CITY OF SCOTTSDALE DESERT GREENBELT
PIMA ROAD THREE BASINS PROJECT

TRACT 21 DRAINAGE IMPROVEMENTS

DRAINAGE DESIGN REPORT

The Desert Greenbelt

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SECTION 1: INTRODUCTION

1.1 Purpose of Report

The following report provides technical documentation of the hydrology and hydraulic analyses performed in the design of the channel and culvert improvements for the portion of the Pima Road Three Basins (PR3B) Project referred to as the Tract 21 Channel. The purpose of the Tract 21 drainage improvements is to provide a channel for collection and conveyance of stormwater runoff along the Arizona Department of Transportation's Loop 101L Pima Freeway Section 9A, from the future Union Hills Drive overpass to the Pima/Princess Interchange.

1.2 Project Location

Figure 1.1 is a vicinity map showing the project location with respect to the surrounding area. The project is generally located in northeast Scottsdale and is split between Section 36, Township 4 North, Range 4 East, and Section 31 Township 4 North, Range 5 East. As stated previously, the channel improvements will be constructed along the northerly side of the ADOT Loop 101L Pima Freeway Section 9A, from the future Union Hills Drive overpass to the Pima/Princess Interchange. A culvert is also designed to extend southeasterly under the Pima/Princess roadway where it will discharge to another channel that will parallel ADOT Loop 101L Pima Freeway Section 9B, conveying the runoff to an existing culvert at Bell Road. The channel from Pima/Princess to Bell Road is not part of this contract and will be designed by others. It is the intent of the City of Scottsdale, however, to construct both legs of this overall system at the same time, ultimately providing a positive conveyance system all the way to the USBR Basin No. 4 at WestWorld of Scottsdale.

CAPACITY

1.3 Previous Studies

During the course of the PR3B Project, there have been several design reports and memorandums addressing various proposed design scenarios for the conveyance of the Tract 21 drainage. The latest of those is a design memorandum dated 7 April 1998 by Pentacore entitled; *Pima Road Three Basins Project Tract 21 Drainage Design Memorandum.* In that memorandum, two options for directing the the collected runoff in the Tract 21 channel were analyzed and presented. The recommended option, refined and finalized, is presented in this report and on the construction drawings.

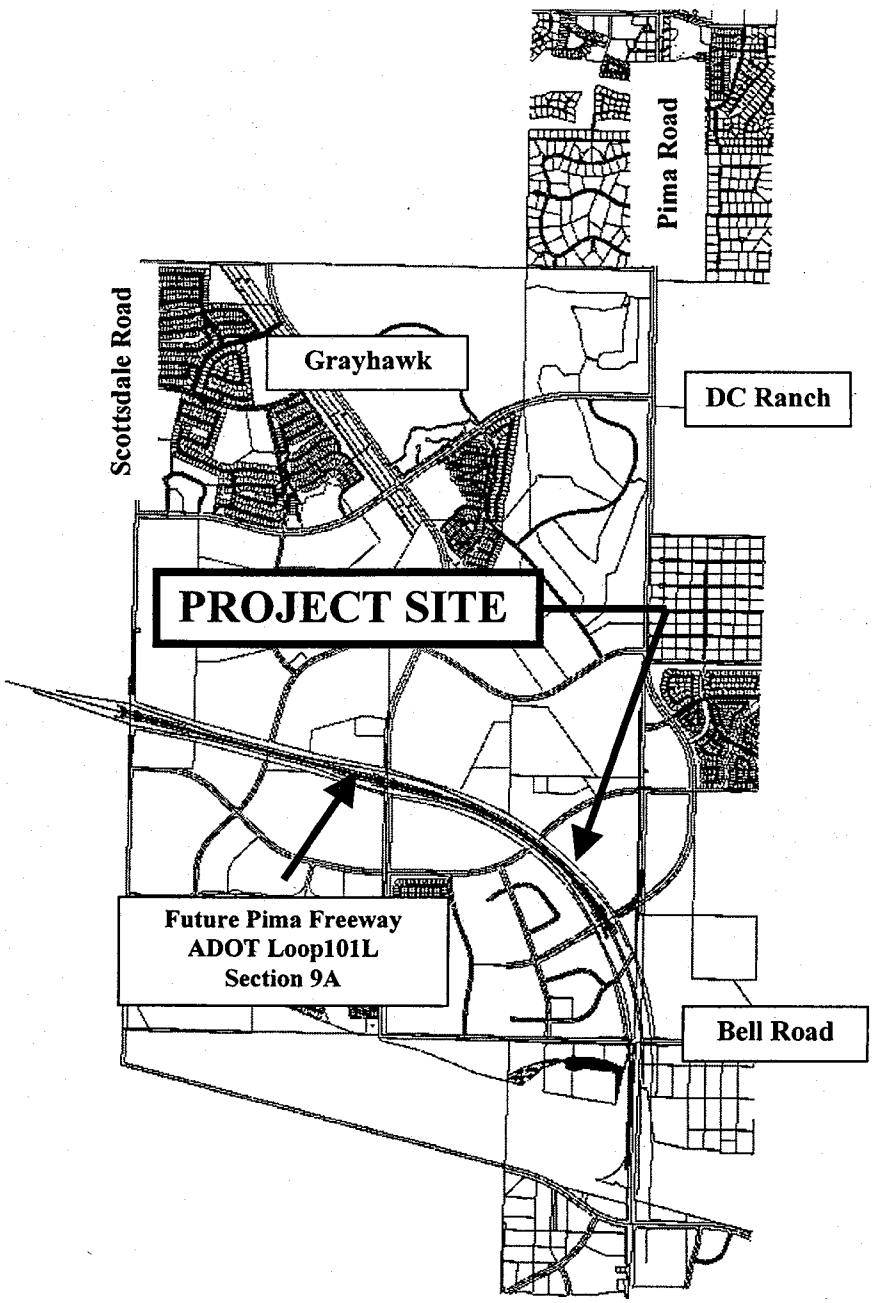

FIGURE 1.1

Vicinity Map

The basis for the watershed hydrology including mapping, methodology and modeling parameters, is presented in the Watershed Hydrology and Concept Design Report, November 1997 [Stantec, 1997], by Stantec Consulting, Inc., which is herein referred to as the WH&CD Report. Two other reports by Stantec Consulting, Inc. entitled; Desert Greenbelt Pima Road Three Basins Project, Ultimate Condition Design Hydrology Report, March 1999, herein referred to as the Ultimate Hydrology Report, [Stantec-Ultimate, 1999] and Desert Greenbelt Pima Road Three Basins Project, Interim Condition Design Hydrology Report, March 1999, herein referred to as the Interim Hydrology Report [Stantec-Interim, 1999] document the design hydrology for the other improvements of the PR3B project and are included as references to give the reader an overview of the watershed hydrology on a whole.

1.4 Project Design Assumptions

The drainage design presented in this report reflects the following assumptions and constraints regarding the condition of the watershed and proposed PR3B facilities:

1. The new PMF dike proposed for construction along the new Union Hills Drive alignment is considered in-place and all runoff north and easterly of that dike is assumed to be conveyed southwesterly to the Pima Freeway East Basin as indicated in the Ultimate Hydrology Report, [Ultimate Report, 1999].
2. It is assumed that the channel segment from Pima/Princess to Bell Road will be constructed concurrently with this project. No provisions for an interim condition without this other leg of the drainage system are made.
3. This design assumes that an agreement exists between the City of Scottsdale and US Bureau of Reclamation that allows for the re-direction of runoff from the area drained by the Tract 21 Channel out of USBR Basin No. 3 (TPC Desert Course) and into USBR Basin No. 4 (WestWorld).
4. As agreed to by the City of Scottsdale, retention requirements will be enforced over the area tributary to the Tract 21 Channel as required to maintain the post-development peak discharges at pre-development magnitudes. Accordingly, the design considers existing conditions for the watershed area tributary to the channel.

1.5 Project Mapping

Topographic base mapping with 1-foot contour intervals and compiled at a scale of 1-inch = 100-feet is used for the hydrology analysis was obtained from the City of Scottsdale. The mapping is based on 1993 photography. Other planimetric data showing existing property boundaries, streets, and right-of-way were also obtained from Scottsdale.

SECTION 2: HYDROLOGY

2.1 General

Hydrology modeling is accomplished using the U.S. Army Corps of Engineer's (USACOE) HEC-1 Flood Hydrograph Package computer model, September 1990 version 4.0.1E, as implemented by Dodson and Associates, Inc. the 100-year, 6-hour, 100-year, 24-hour, and 50-year, 24-hour storms are modeled for this watershed. All storms are temporally distributed using the HEC-1 hypothetical option. Point precipitation values are obtained from the NOAA Atlas II with point rainfall depth-duration-frequency data developed using the PREFRE program. Depth-area reduction factors for the 6- and 24-hour storms are accomplished automatically through HEC-1 via the PH record and the area coded in the BA record for each subbasin. Rainfall losses are estimated by use of NRCS (SCS) curve number estimations with an allowance for impervious by weighting of the CN values. Subbasin rainfall/runoff characteristics are approximated by use of the kinematic wave methodology and channel routes are accomplished using the Muskingum-Cunge method.

2.2 Modeling Parameters

The watershed area tributary to the Tract 21 Channel is essentially Subbasins SCN6A and S54 of the WH&CD Report [Stantec, 1997]. As shown on Plate 1, the watershed area for this study is delineated into five subbasins (T21A through T21E) with five points of concentration (CPA through CPE) are identified along the proposed channel for estimating design discharges.

A rainfall loss CN value of 74 was established by the WH&CD Report for the Tract 21 watershed. Inspection of SCS soils maps for that area indicate the site to be predominantly on soils classified by the NRCS as HSG Type B, and the vegetative cover for the area is estimated to be "poor." The City of Scottsdale's Design Standards Manual prescribes a CN value of 77 for these conditions, therefore this higher value is used to model the rainfall losses. Slight curve number adjustments are also made for Subbasins T21D and T21E to account for the impervious portion of the ADOT Pima Freeway 9A improvements that are projected to discharge to the channel at Pima/Princess. The documentation of those adjustments is provided in the HEC-1 input code as comment records.

For each of the subbasins, the basin area plus overland and main channel flow path geometry and slopes are measured from the project mapping. The WH&CD Report establishes a kinematic overland element roughness coefficient of 0.13 with overland flow lengths of 300 feet and slopes of 1.5 percent.

These values appear reasonable and are used without exception in the UK records for this study. Channel routing geometries, lengths and slopes are obtained from the construction drawings. For the purpose of model stability, no channel routing is performed for the reach of CPA to CPB and CPD to CPE. The channel lengths are insignificant and routings will have no impact on the runoff hydrographs.

2.3 HEC-1 Model Results

The HEC-1 results for each subbasin and point of concentration are summarized in Table 2.1.

TABLE 2.1

Summary of HEC-1 model peak discharges

HEC-1 Operation (1)	Description (2)	Basin Area, in sq. miles (3)	Peak Discharge, in cfs 50-yr, 24-hr (4)	100-yr, 6-hr (5)	100-yr, 24-hr (6)
SUBA	Subbasin A	0.0072	10	10	13
SUBB	Subbasin B	0.0178	24	22	32
CPB	Concentration Point B	0.0250	34	31	45
SUBC	Subbasin C	0.0490	65	59	88
CPC	Concentration Point C	0.0740	96	89	131
SUBD	Subbasin D	0.0406	57	52	74
CPD	Concentration Point D	0.1146	143	139	198
SUBE	Subbasin E	0.0380	56	52	73
CPE	Concentration Point E	0.1526	199	191	271

Output for each of the three HEC-1 models are provided in Appendices A through C and a diskette containing the input and output files is supplied in a pocket at the back of this report.

Per agreement with the City of Scottsdale and Flood Control District of Maricopa County, the design discharge for the Tract 21 Channel was set to be the more conservative of either the 50-year, 24-hour storm or the 100-year, 6-hour storm. According to Table 2.1, the 50-year, 24-hour storm appears to be the controlling storm. Accordingly, the Tract 21 drainage improvements are designed using the 50-year, 24-hour peak discharges.

SECTION 3: HYDRAULICS

3.1 General

The peak discharges estimated in Section 2 of this report are proposed to be intercepted along the northerly boundary of the Pima Freeway Section 9A and conveyed easterly within the Tract 21 Channel. The channel is designed with two separate reaches, each having a different geometry and lining. The upper reach is a triangular in shape and will remain as an earthen seeded with a native, non-irrigated grass mix. The lower reach is a fully shotcrete lined, trapezoidal shaped channel. The channel design also includes small, armored or shotcrete lined sloping drop sections to minimize the channel depth and maintain subcritical flow. The collected runoff is designed to be conveyed under Pima/Princess Road using an eight-foot by four-foot reinforced concrete box culvert. The channel continuing downstream of the box will be designed by others, but for the design and hydraulic analysis purposes of this report, that channel is assumed to be shotcrete lined and of the same geometry and slope as the reach of the Tract 21 Channel just upstream of the box.

The hydraulic modeling of the channel and box is accomplished using the U.S. Army Corps of Engineer's HEC-RAS computer program, version 2.2, September 1998. The mixed flow regime (simultaneous supercritical and subcritical analysis) is invoked to provide a comprehensive analysis of the channel and culvert, and the box culvert is modeled using the culvert analysis algorithm.

3.2 Design Discharges

The channel and culvert are designed to intercept and convey runoff from a 50-year, 24-hour storm. The 100-year, 24-hour storm flows are also modeled to identify a maximum water surface elevation for checking the inundation limits.

Runoff from the tributary area will enter the Tract 21 Channel at wash and overland locations all along the length of the channel. The majority of the runoff will enter the channel at its intersection with the washes, while other, overland flows will spill to the channel over the sides. Spillways are provided at each major wash and are armored to protect against scour. The design discharges are coded into the HEC-RAS model in a manner that will conservatively represent the peak discharges calculated by HEC-1 modeling.

3.3 Parameter Estimation

Manning's n values are estimated for each channel lining using guidance from the Flood Control District of Maricopa County's *Drainage Design Manual for Maricopa County, Volume II – Hydraulics*, dated January 28, 1996 [FCDMC, 1996] and engineering judgment. Table 3.1 summarizes Manning's n values for the proposed channel linings and reinforced concrete box culvert. A complete listing of roughness values for each cross section is provided in Appendix D. It should be noted that "dummy" values of 0.03 were coded for the right and left overbanks, but since the design flows never exceed the channel, these values have no meaning.

Expansion and contraction coefficients are used to estimate headlosses that will occur at the drop locations and at the inlet and outlet of the culvert. Normal values of C&E values of 0.1 and 0.3 are used for normal sections. C&E values of 0.3 and 0.5 are used at the culvert and drop locations. A complete listing of C&E values for each cross section is provided in Appendix D.

TABLE 3.1

Summary of Manning's n values used in hydraulic modeling

Overland Flow Element (1)	Manning's n Range of Values (2)
Shotcrete lined channel with gun finish	0.022
Earthen channel seeded w/ native grass mix (non-irrigated)	0.025
Loose rock rip rap, D_{50} = 12"	0.035
Reinforced concrete box culvert	0.015

3.4 Cross Section Description

All cross sections are based on the proposed channel and box culvert improvements as indicated on the construction documents for this project entitled; "Desert Greenbelt Pima Road Three Basins, Schedule C – Tract 21 Drainage." Pertinent half-sized copies of those drawings are included in Appendix E for reference. The thalweg for cross sections reflecting proposed channel improvements is set at the

3.6 Erosion Control

Loose rock rip rap is used to control erosion in the earthen channel section at wash intersections/junctions and through the sloping face drop at river station 12070 to 12090. The design peak discharge spilling down the face of the drop is only 10 cfs and the maximum velocity is estimated at approximately 7 feet-per-second (fps). Using Figure 165 of the USBR publication entitled; *Hydraulic Design of Stilling Basins and Energy Dissipators, Engineering Monograph No. 25,* May 1984 [USBR, 1984], which is supplied as a reference in Appendix D, yields a maximum stone size of approximately 7 inches. Based on this size and considering the potential for hydraulic jumps to occur at the base of the drop, a rip rap gradation with a D_{50} = 12-inches is selected for protection of these areas. Other rip rap is placed at the transition of the washes to the spillways to mitigate scour and head-cutting.

3.6 HEC-RAS Model Results

Table 3.2 summarizes the HEC-RAS modeling results for the 50-year, 24-hour storm, including calculation of the freeboard requirements per the FCDMC Hydraulics Manual. A full printout of the HEC-RAS detailed output for the 50-year, 24-hour design storm is provided in Appendix F. Table 3.3 summarizes a comparison of the design discharges, water surface elevations, and channel velocities between the 100-year, 24-hour and 50-year, 24-hour models. Digital project files that include both models are included on the diskette supplied in a pocket at the back of this report.

TABLE 3.2

Summary of HEC-RAS results for the 50-yr, 24-hr storm.

River Station (1)	Design Q (cfs) (2)	Minimum Elevation (ft) (3)	Water Surface Elevation (ft) (4)	Critical W.S. Elevation (ft) (5)	Energy Gradeline Elevation (ft) (6)	Channel Velocity (ft/s) (8)	Freeboard (ft) (9)	Channel Froude Number (10)
12350	10	1606.50	1607.31	1607.31	1607.52	3.7	1.0	1.02
12110	10	1604.12	1605.13	1604.94	1605.22	2.5	1.0	0.61
12090	10	1604.00	1604.82	1604.82	1605.03	3.7	1.0	1.01
12085.*	10	1603.38	1603.97	1604.20	1604.77	7.2	1.0	2.33
12080.*	10	1602.75	1603.36	1603.57	1604.06	6.7	1.0	2.14
12075.*	10	1602.12	1602.72	1602.94	1603.46	6.9	1.0	2.22
12070	22	1601.50	1603.09	1602.63	1603.17	2.2	1.0	0.43
12020	22	1601.35	1603.06		1603.12	1.9	1.0	0.36

TABLE 3.2

Summary of HEC-RAS results for the 50-yr, 24-hr storm.

River Station (1)	Design Q (cfs) (2)	Minimum Elevation (ft) (3)	Water Surface Elevation (ft) (4)	Critical W.S. Elevation (ft) (5)	Energy Gradeline Elevation (ft) (6)	Channel Velocity (ft/s) (8)	Freeboard (ft) (9)	Channel Froude Number (10)
12015	34	1601.33	1602.91		1603.09	3.4	1.0	0.67
11755	34	1599.92	1601.39		1601.63	3.9	1.0	0.81
11750	34	1599.90	1601.25	1601.25	1601.59	4.7	1.0	1.01
11745.*	34	1599.43	1600.28	1600.63	1601.43	8.6	1.0	2.07
11740.*	34	1598.95	1599.56	1599.99	1601.12	10.0	1.0	2.54
11735.*	34	1598.47	1598.93	1599.37	1600.72	10.8	1.0	2.97
11730	65	1598.00	1598.68	1599.17	1600.41	10.6	1.0	2.38
11720.*	65	1597.95	1599.38	1599.12	1599.69	4.5	1.0	0.72
11700.*	65	1597.85	1599.32		1599.61	4.3	1.0	0.69
11680	65	1597.75	1599.26		1599.54	4.2	1.0	0.66
11260	96	1595.65	1597.30		1597.78	5.6	1.0	0.85
11230	96	1595.50	1597.14		1597.63	5.6	1.0	0.85
11070	96	1594.70	1596.61		1596.95	4.7	1.0	0.67
11030	96	1594.50	1596.54		1596.82	4.3	1.0	0.59
10950	120	1594.10	1596.04		1596.54	5.7	1.0	0.81
10840	120	1593.55	1595.42		1595.97	5.9	1.0	0.86
10790	120	1593.30	1595.14		1595.71	6.0	1.0	0.88
10550	120	1592.10	1594.07		1594.55	5.6	1.0	0.78
10450	120	1591.60	1593.30	1593.30	1594.00	6.7	1.0	1.00
10440.*	120	1590.50	1591.57	1592.20	1593.70	11.7	1.0	2.16
10430.*	120	1589.40	1590.35	1591.10	1593.17	13.5	1.0	2.62
10420.*	120	1588.30	1589.18	1590.00	1592.50	14.6	1.0	2.93
10410.*	120	1587.20	1588.05	1588.90	1591.69	15.3	1.1	3.13
10400.*	120	1586.10	1589.31	1587.80	1589.44	2.9	1.0	0.34
10390	199	1585.00	1589.27		1589.43	3.2	1.1	0.33
10364.*	199	1584.87	1589.26		1589.41	3.2	1.1	0.32
10338.*	199	1584.74	1589.24		1589.40	3.1	1.2	0.31
10312	199	1584.61	1589.23		1589.38	3.1	1.2	0.30
10302	199	1584.56	1588.68	1587.23	1589.25	6.0	1.2	0.52
10187.5	Culvert							
10072	199	1583.41	1586.00	1586.08	1587.43	9.6	1.0	0.52
10050	199	1583.30	1584.94	1585.59	1587.03	11.6	1.0	1.77
10000	199	1583.05	1585.53	1585.35	1586.26	6.9	1.0	0.88
9850	199	1582.30	1584.78	1584.59	1585.51	6.9	1.0	0.88

TABLE 3.3

Comparison of HEC-RAS results for the 50- and 100-yr, 24-hr storms.

River Station	Minimum Elevation (ft)	Discharge 50-yr (cfs)	Discharge 100-yr (cfs)	Δ	Water Surface Elevation 50-yr (ft)	Water Surface Elevation 100-yr (ft)	Δ	Channel Velocity 50-yr (ft/s)	Channel Velocity 100-yr (ft/s)	Δ
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
12350	1606.50	10	13	3	1607.31	1607.4	0.09	3.7	3.9	0.2
12110	1604.12	10	13	3	1605.13	1605.23	0.10	2.5	2.6	0.2
12090	1604.00	10	13	3	1604.82	1604.91	0.09	3.7	3.9	0.2
12085.*	1603.38	10	13	3	1603.97	1604.05	0.08	7.2	7.2	0.0
12080.*	1602.75	10	13	3	1603.36	1603.42	0.06	6.7	7.2	0.5
12075.*	1602.12	10	13	3	1602.72	1602.78	0.06	6.9	7.4	0.5
12070	1601.50	22	29	7	1603.09	1603.29	0.20	2.2	2.3	0.1
12020	1601.35	22	29	7	1603.06	1603.26	0.20	1.9	2.0	0.1
12015	1601.33	34	45	11	1602.91	1603.09	0.18	3.4	3.6	0.3
11755	1599.92	34	45	11	1601.39	1601.55	0.16	3.9	4.2	0.3
11750	1599.90	34	45	11	1601.25	1601.40	0.15	4.7	5.0	0.3
11745.*	1599.43	34	45	11	1600.28	1600.42	0.14	8.6	8.9	0.3
11740.*	1598.95	34	45	11	1599.56	1599.69	0.13	10.0	10.5	0.5
11735.*	1598.47	34	45	11	1598.93	1599.03	0.10	10.8	11.3	0.6
11730	1598.00	65	88	23	1598.68	1598.86	0.18	10.6	11.0	0.5
11720.*	1597.95	65	88	23	1599.38	1599.68	0.30	4.5	4.8	0.3
11700.*	1597.85	65	88	23	1599.32	1599.62	0.30	4.3	4.7	0.3
11680	1597.75	65	88	23	1599.26	1599.57	0.31	4.2	4.5	0.3
11260	1595.65	96	131	35	1597.30	1597.63	0.33	5.6	6.0	0.4
11230	1595.50	96	131	35	1597.14	1597.49	0.35	5.6	6.0	0.4
11070	1594.70	96	131	35	1596.61	1597.02	0.41	4.7	5.0	0.3
11030	1594.50	96	131	35	1596.54	1596.97	0.43	4.3	4.5	0.3
10950	1594.10	120	164	44	1596.04	1596.41	0.37	5.7	6.2	0.5
10840	1593.55	120	164	44	1595.42	1595.77	0.35	5.9	6.5	0.6
10790	1593.30	120	164	44	1595.14	1595.50	0.36	6.0	6.6	0.6
10550	1592.10	120	164	44	1594.07	1594.43	0.36	5.6	6.1	0.6
10450	1591.60	120	164	44	1593.30	1593.65	0.35	6.7	7.2	0.6
10440.*	1590.50	120	164	44	1591.57	1591.84	0.27	11.7	12.2	0.5
10430.*	1589.40	120	164	44	1590.35	1590.59	0.24	13.5	14.1	0.6
10420.*	1588.30	120	164	44	1589.18	1589.40	0.22	14.6	15.5	0.8
10410.*	1587.20	120	164	44	1588.05	1588.25	0.20	15.3	16.2	0.9
10400.*	1586.10	120	164	44	1589.31	1590.58	1.27	2.9	2.5	-0.4
10390	1585.00	199	271	72	1589.27	1590.53	1.26	3.2	3.0	-0.2
10364.*	1584.87	199	271	72	1589.26	1590.52	1.26	3.2	3.0	-0.2
10338.*	1584.74	199	271	72	1589.24	1590.51	1.27	3.1	3.0	-0.2
10312	1584.61	199	271	72	1589.23	1590.50	1.27	3.1	3.0	-0.1

TABLE 3.3

Comparison of HEC-RAS results for the 50- and 100-yr, 24-hr storms.

River Station	Minimum Elevation	Discharge			Water Surface Elevation			Channel Velocity		
	(ft)	50-yr (cfs)	100-yr (cfs)	Δ	50-yr (ft)	100-yr (ft)	Δ	50-yr (ft/s)	100-yr (ft/s)	Δ
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
10302	1584.56	199	271	72	1588.68	1589.84	1.16	6.0	6.4	0.4
10072	1583.41	199	271	72	1586.00	1586.67	0.67	9.6	10.4	0.8
10050	1583.30	199	271	72	1584.94	1585.22	0.28	11.6	13.0	1.4
10000	1583.05	199	271	72	1585.53	1585.98	0.45	6.9	7.5	0.6
9850	1582.30	199	271	72	1584.78	1585.23	0.45	6.9	7.5	0.6

Water surface profiles plotted from the HEC-RAS models for the 50- and 100-year, 24-hour storms are provided in Appendix G.

SECTION 4: REFERENCES

4.1 List of References

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Appendix A

HEC-1 Ouput for 50-Year, 24-Hour Storm

```
1****************************************                                    ****************************************
*                                      *                                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *   U.S. ARMY CORPS OF ENGINEERS       *
*             MAY  1991                *                                    *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.0.1E             *                                    *         609 SECOND STREET            *
*     Lahey F77L-EM/32 version 5.01    *                                    *      DAVIS, CALIFORNIA 95616         *
*       Dodson & Associates, Inc.      *                                    *          (916) 551-1748              *
* RUN DATE  01/14/99  TIME  10:51:01   *                                    *                                      *
****************************************                                    ****************************************

                                        X     X  XXXXXXX   XXXXX           X
                                        X     X  X        X     X         XX
                                        X     X  X        X               X
                                        XXXXXXX  XXXX     X        XXXXX  X
                                        X     X  X        X               X
                                        X     X  X        X     X         X
                                        X     X  XXXXXXX   XXXXX         XXX

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                HEC-1 INPUT                                                    PAGE  1

      LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

        1           ID    TRACT 21 DRAINAGE CHANNEL
        2           ID    by Pentacore AZ                                  File: t215024.ih1
        3           ID        Project:  5009.0001                          Date: 01-14-99  wso
        4           ID
        5           ID    50-year, 24-hour storm
        6           ID
        7           ID        Ultimate condition hydrology assumes that onsite retention will be
        8           ID          provided within watershed upon development with peak discharges
        9           ID          maintained to pre-development conditions.
       10           ID
       11           ID        Includes tributary area from ADOT Loop 101 Pima Freeway as provided
       12           ID          by Premier Engineering.
       13           ID
       14           ID        Curve Numbers for subbasins T21D an T21E are adjusted to reflect
       15           ID          increased imperviousness due to existing Pima Rd pavement and
       16           ID          future ADOT improvements.
       17           ID
       18           ID
                    *DIAGRAM
       19           IT       5                    720
       20           IO       3
                    *
                    *
                    *

       21           KK    T21A     SUBBASIN T21A
       22           KM         RUNOFF FROM SUBBASIN T21A AT CPA
       23           BA  0.0072
                    *
                    *  50-year precipitation, 24-hour storm duration
                    *
       24           PH                     .68    1.32    2.23    2.49    2.66    2.98    3.37    3.76
       25           LS              77
       26           UK     300   0.015    0.13     100
       27           RK     520   0.015   0.045            TRAP       4       5
                    *
                    *
                    *   ROUTE SUBBASIN T21A (CPA) TO CPB --- TOO SHORT TO ROUTE
                    *
                    *

       28           KK    T21B     SUBBASIN T21B
       29           KM         RUNOFF FROM SUBBASIN T21B
       30           BA  0.0178
       31           LS              77
       32           UK     300   0.015    0.13     100
       33           RK    1380   0.013   0.045            TRAP       4       5
                    *

       34           KK     CPB
       35           KM    COMBINE RUNOFF FROM SUBBASINS T21A AND T21B AT CPB
       36           HC       2
                    *
1                                                HEC-1 INPUT                                                    PAGE  2

      LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
```

```
 37          KK  CPBCPC
 38          KM    ROUTE HYDROGRAPH AT CPB TO CPC
 39          RD     650   0.009   0.025            TRAP       8      1.5
             *

 40          KK    T21C     SUBBASIN T21C
 41          KM         RUNOFF FROM SUBBASIN T21C
 42          BA  0.0490
 43          LS              77
 44          UK     300   0.015    0.13     100
 45          RK    2040   0.017   0.045            TRAP       3       5
             *

 46          KK     CPC
 47          KM    COMBINE ROUTED RUNOFF FROM CPB WITH SUBBASIN T21C AT CPC
 48          HC       2
             *

 49          KK  CPCCPD
 50          KM    ROUTE HYDROGRAPH AT CPC TO CPD
 51          RD     710   0.009   0.025            TRAP       8      1.5
             *

 52          KK    T21D     SUBBASIN T21D
 53          KM         RUNOFF FROM SUBBASIN T21D
 54          KM    CN adjusted to reflect ADOT improvements per the following:
 55          KM       97.1% @ 77 and 2.9% @ 98
 56          BA  0.0406
 57          LS            77.6
 58          UK     300   0.015    0.13     100
 59          RK    2320   0.015   0.045            TRAP       5       10
             *

 60          KK     CPD
 61          KM    COMBINE ROUTED RUNOFF FROM CPC WITH SUBBASIN T21D AT CPD
 62          HC       2
             *
             *
             *   ROUTE HYDROGRAPH AT CPD TO CPE --- TOO SHORT TO ROUTE
             *
             *

 63          KK    T21E     SUBBASIN T21E
 64          KM         RUNOFF FROM SUBBASIN T21E
 65          KM    CN adjusted to reflect ADOT imprvmnts and Pima Rd per the following:
 66          KM       89.6% @ 77 and 10.4% @ 98
 67          BA  0.0380
 68          LS            79.2
 69          UK     300   0.015    0.13     100
 70          RK    2990   0.014   0.045            TRAP       5       10
             *
1                                          HEC-1 INPUT                                          PAGE  3

       LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 71          KK     CPE
 72          KM    COMBINE ROUTED RUNOFF FROM CPD WITH SUBBASIN T21E AT CPE
 73          HC       2
             *
 74          ZZ
1
            SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   21        T21A
               .
               .
   28          .        T21B
               .           .
               .           .
   34        CPB............
              V
              V
   37      CPBCPC
               .
               .
   40          .        T21C
               .           .
               .           .
   46        CPC............
              V
              V
   49      CPCCPD
               .
               .
   52          .        T21D
               .           .
               .           .
   60        CPD............
               .
```

```
                .
  63            .        T21E
                .          .
                .          .
  71         CPE............

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                         *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)     *
*              MAY   1991                 *
*           VERSION 4.0.1E                *
*     Lahey F77L-EM/32 version 5.01       *
*       Dodson & Associates, Inc.         *
*  RUN DATE  01/14/99  TIME  10:51:01     *
*****************************************

                                                    ****************************************
                                                    *                                      *
                                                    *    U.S. ARMY CORPS OF ENGINEERS      *
                                                    *    HYDROLOGIC ENGINEERING CENTER     *
                                                    *          609 SECOND STREET           *
                                                    *        DAVIS, CALIFORNIA 95616       *
                                                    *           (916) 551-1748             *
                                                    *                                      *
                                                    ****************************************


                         TRACT 21 DRAINAGE CHANNEL
                         by Pentacore AZ                          File: t215024.DAT
                             Project:  5009.0001                  Date: 01-14-99  wso

                         50-year, 24-hour storm

                             Ultimate condition hydrology assumes that onsite retention will be
                               provided within watershed upon development with peak discharges
                               maintained to pre-development conditions.

                             Includes tributary area from ADOT Loop 101 Pima Freeway as provided
                               by Premier Engineering.

                             Curve Numbers for subbasins T21D an T21E are adjusted to reflect
                               increased imperviousness due to existing Pima Rd pavement and
                               future ADOT improvements.


  20 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           3  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1    0  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ         720  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      3    0  ENDING DATE
                      NDTIME        1155  ENDING TIME
                       ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL    0.08 HOURS
                       TOTAL TIME BASE   59.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  21 KK     *     T21A   *          SUBBASIN T21A
            *            *
            **************
                                RUNOFF FROM SUBBASIN T21A AT CPA

               SUBBASIN RUNOFF DATA

  23 BA          SUBBASIN CHARACTERISTICS
                       TAREA        0.01  SUBBASIN AREA

                 PRECIPITATION DATA

  24 PH                                 DEPTHS FOR   0-PERCENT HYPOTHETICAL STORM
                 ..... HYDRO-35 ......   ............... TP-40 ...............   ........... TP-49 ...........
                 5-MIN  15-MIN  60-MIN    2-HR    3-HR    6-HR   12-HR   24-HR   2-DAY   4-DAY   7-DAY  10-DAY
                  0.68    1.32    2.23    2.49    2.66    2.98    3.37    3.76    0.00    0.00    0.00    0.00

                                                  STORM AREA =     0.01

  25 LS          SCS LOSS RATE
                       STRTL        0.60  INITIAL ABSTRACTION
                      CRVNBR       77.00  CURVE NUMBER
```

```
                    RTIMP        0.00  PERCENT IMPERVIOUS AREA

                KINEMATIC WAVE
 26 UK            OVERLAND-FLOW ELEMENT NO. 1
                        L        300.  OVERLAND FLOW LENGTH
                        S      0.0150  SLOPE
                        N       0.130  ROUGHNESS COEFFICIENT
                       PA       100.0  PERCENT OF SUBBASIN
                    DXMIN           5  MINIMUM NUMBER OF DX INTERVALS

                KINEMATIC WAVE
 27 RK            MAIN CHANNEL
                        L        520.  CHANNEL LENGTH
                        S      0.0150  SLOPE
                        N       0.045  CHANNEL ROUGHNESS COEFFICIENT
                       CA        0.01  CONTRIBUTING AREA
                    SHAPE        TRAP  CHANNEL SHAPE
                       WD        4.00  BOTTOM WIDTH OR DIAMETER
                        Z        5.00  SIDE SLOPE
                   NDXMIN           2  MINIMUM NUMBER OF DX INTERVALS
                   RUPSTQ          NO  ROUTE UPSTREAM HYDROGRAPH

                                                    ***
                                  COMPUTED KINEMATIC PARAMETERS
                                       VARIABLE TIME STEP
                                     (DT SHOWN IS A MINIMUM)

                 ELEMENT    ALPHA       M         DT        DX       PEAK    TIME TO     VOLUME    MAXIMUM
                                                                              PEAK                  CELERITY
                                                (MIN)      (FT)     (CFS)     (MIN)       (IN)      (FPS)

                 PLANE1      1.40      1.67      2.65     60.00     10.46    731.91      1.62       0.40
                 MAIN        1.35      1.35      0.96    173.33     10.20    734.29      1.62       3.33

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00  EXCESS=0.6245E+00 OUTFLOW=0.6218E+00 BASIN STORAGE=0.8278E-04 PERCENT ERROR=   0.4

                                  INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

                 MAIN        1.35      1.35      5.00               10.04    735.00      1.62

     ***            ***            ***            ***            ***

                     HYDROGRAPH AT STATION     T21A

   TOTAL RAINFALL =    3.76, TOTAL LOSS =    2.13, TOTAL EXCESS =    1.63

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+     10.      12.25        1.          0.          0.          0.
                       (INCHES)     1.411       1.617       1.618       1.618
                        (AC-FT)       1.          1.          1.          1.

                       CUMULATIVE AREA =    0.01 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
 28 KK      *     T21B   *          SUBBASIN T21B
            *            *
            **************
                              RUNOFF FROM SUBBASIN T21B

               SUBBASIN RUNOFF DATA

 30 BA          SUBBASIN CHARACTERISTICS
                     TAREA        0.02  SUBBASIN AREA

                PRECIPITATION DATA

 24 PH                            DEPTHS FOR   0-PERCENT HYPOTHETICAL STORM
                ..... HYDRO-35 .....   ............... TP-40 ...............   ........... TP-49 ...........
                5-MIN  15-MIN  60-MIN    2-HR    3-HR    6-HR   12-HR   24-HR   2-DAY   4-DAY   7-DAY  10-DAY
                 0.68    1.32    2.23    2.49    2.66    2.98    3.37    3.76    0.00    0.00    0.00    0.00

                                                STORM AREA =    0.02

 31 LS          SCS LOSS RATE
                     STRTL        0.60  INITIAL ABSTRACTION
                    CRVNBR       77.00  CURVE NUMBER
                     RTIMP        0.00  PERCENT IMPERVIOUS AREA

                KINEMATIC WAVE
 32 UK            OVERLAND-FLOW ELEMENT NO. 1
                        L        300.  OVERLAND FLOW LENGTH
                        S      0.0150  SLOPE
```

```
                    N       0.130  ROUGHNESS COEFFICIENT
                   PA       100.0  PERCENT OF SUBBASIN
                DXMIN           5  MINIMUM NUMBER OF DX INTERVALS

            KINEMATIC WAVE
 33 RK        MAIN CHANNEL
                    L       1380.  CHANNEL LENGTH
                    S      0.0130  SLOPE
                    N       0.045  CHANNEL ROUGHNESS COEFFICIENT
                   CA        0.02  CONTRIBUTING AREA
                SHAPE        TRAP  CHANNEL SHAPE
                   WD        4.00  BOTTOM WIDTH OR DIAMETER
                    Z        5.00  SIDE SLOPE
              NDXMIN           2  MINIMUM NUMBER OF DX INTERVALS
              RUPSTQ          NO  ROUTE UPSTREAM HYDROGRAPH

                                                    ***
                          COMPUTED KINEMATIC PARAMETERS
                               VARIABLE TIME STEP
                            (DT SHOWN IS A MINIMUM)

          ELEMENT    ALPHA       M        DT        DX       PEAK    TIME TO      VOLUME    MAXIMUM
                                                                       PEAK                   CELERITY
                                           (MIN)      (FT)     (CFS)    (MIN)       (IN)      (FPS)

          PLANE1      1.40      1.67      2.65     60.00     25.86   731.91       1.62       0.40
          MAIN        1.26      1.35      2.08    460.00     24.22   736.22       1.62       3.92

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00  EXCESS=0.1544E+01 OUTFLOW=0.1536E+01 BASIN STORAGE=0.2144E-03 PERCENT ERROR=   0.5

                                INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

          MAIN        1.26      1.35      5.00               23.87   735.00       1.62

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION     T21B

   TOTAL RAINFALL =    3.76, TOTAL LOSS =    2.13, TOTAL EXCESS =    1.63

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+     24.     12.25          3.          1.          0.          0.
                       (INCHES)     1.408       1.616       1.617       1.617
                        (AC-FT)        1.          2.          2.          2.

                       CUMULATIVE AREA =    0.02 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
 34 KK      *      CPB   *
            *            *
            **************
                    COMBINE RUNOFF FROM SUBBASINS T21A AND T21B AT CPB

 36 HC          HYDROGRAPH COMBINATION
                     ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                    ***

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION      CPB

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+     34.     12.25          4.          1.          0.          0.
                       (INCHES)     1.408       1.616       1.618       1.618
                        (AC-FT)        2.          2.          2.          2.

                       CUMULATIVE AREA =    0.02 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
 37 KK      *    CPBCPC  *
            *            *
```

```
**************
                ROUTE HYDROGRAPH AT CPB TO CPC

            HYDROGRAPH ROUTING DATA

 39 RD        MUSKINGUM-CUNGE CHANNEL ROUTING
                      L        650.  CHANNEL LENGTH
                      S     0.0090  SLOPE
                      N      0.025  CHANNEL ROUGHNESS COEFFICIENT
                     CA       0.00  CONTRIBUTING AREA
                  SHAPE       TRAP  CHANNEL SHAPE
                     WD       8.00  BOTTOM WIDTH OR DIAMETER
                      Z       1.50  SIDE SLOPE

                                                  ***
                         COMPUTED MUSKINGUM-CUNGE PARAMETERS
                              COMPUTATION TIME STEP
          ELEMENT    ALPHA      M        DT        DX       PEAK    TIME TO     VOLUME    MAXIMUM
                                                                      PEAK                  CELERITY
                                          (MIN)     (FT)     (CFS)    (MIN)       (IN)      (FPS)

            MAIN      1.72     1.44      2.17    325.00     33.17   737.58      1.62      4.99

                                   INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

            MAIN      1.72     1.44      5.00               31.40   740.00      1.62

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2157E+01 EXCESS=0.0000E+00 OUTFLOW=0.2157E+01 BASIN STORAGE=0.4212E-03 PERCENT ERROR=   0.0

     ***          ***          ***          ***          ***

                HYDROGRAPH AT STATION   CPBCPC

 PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR      24-HR      72-HR    59.92-HR
+   (CFS)      (HR)
                          (CFS)
+     31.     12.33          4.         1.         0.         0.
                       (INCHES)      1.406      1.615      1.617      1.617
                        (AC-FT)         2.         2.         2.         2.

                       CUMULATIVE AREA =    0.02 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
 40 KK      *     T21C   *          SUBBASIN T21C
            *            *
            **************
                            RUNOFF FROM SUBBASIN T21C

            SUBBASIN RUNOFF DATA

 42 BA        SUBBASIN CHARACTERISTICS
                   TAREA        0.05  SUBBASIN AREA

              PRECIPITATION DATA

 24 PH                          DEPTHS FOR   0-PERCENT HYPOTHETICAL STORM
              ..... HYDRO-35 .....   ............... TP-40 ...............   ........... TP-49 ...........
              5-MIN  15-MIN  60-MIN    2-HR    3-HR    6-HR   12-HR   24-HR   2-DAY   4-DAY   7-DAY  10-DAY
               0.68    1.32    2.23    2.49    2.66    2.98    3.37    3.76    0.00    0.00    0.00    0.00

                                                STORM AREA =    0.05

 43 LS        SCS LOSS RATE
                   STRTL        0.60  INITIAL ABSTRACTION
                  CRVNBR       77.00  CURVE NUMBER
                   RTIMP        0.00  PERCENT IMPERVIOUS AREA

              KINEMATIC WAVE
 44 UK          OVERLAND-FLOW ELEMENT NO. 1
                      L        300.  OVERLAND FLOW LENGTH
                      S      0.0150  SLOPE
                      N       0.130  ROUGHNESS COEFFICIENT
                     PA       100.0  PERCENT OF SUBBASIN
                  DXMIN           5  MINIMUM NUMBER OF DX INTERVALS

              KINEMATIC WAVE
 45 RK          MAIN CHANNEL
                      L       2040.  CHANNEL LENGTH
                      S      0.0170  SLOPE
                      N       0.045  CHANNEL ROUGHNESS COEFFICIENT
                     CA        0.05  CONTRIBUTING AREA
                  SHAPE        TRAP  CHANNEL SHAPE
```

```
                WD        3.00  BOTTOM WIDTH OR DIAMETER
                 Z        5.00  SIDE SLOPE
            NDXMIN           2  MINIMUM NUMBER OF DX INTERVALS
            RUPSTQ          NO  ROUTE UPSTREAM HYDROGRAPH

                                                  ***
                          COMPUTED KINEMATIC PARAMETERS
                               VARIABLE TIME STEP
                             (DT SHOWN IS A MINIMUM)

          ELEMENT    ALPHA       M         DT        DX       PEAK    TIME TO     VOLUME    MAXIMUM
                                                                        PEAK                  CELERITY
                                           (MIN)      (FT)     (CFS)    (MIN)       (IN)      (FPS)

          PLANE1      1.40      1.67       2.65     60.00     71.17   731.91       1.62       0.40
          MAIN        1.48      1.34       2.04    680.00     66.20   736.47       1.62       5.65

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00  EXCESS=0.4250E+01 OUTFLOW=0.4229E+01 BASIN STORAGE=0.5898E-03 PERCENT ERROR=   0.5

                                INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

          MAIN        1.48      1.34       5.00               65.07   735.00       1.62

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION     T21C

   TOTAL RAINFALL =    3.76, TOTAL LOSS =    2.13, TOTAL EXCESS =    1.63

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+     65.      12.25                7.          2.          1.          1.
                       (INCHES)    1.408       1.617       1.618       1.618
                        (AC-FT)      4.          4.          4.          4.

                       CUMULATIVE AREA =    0.05 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  46 KK     *     CPC    *
            *            *
            **************
                        COMBINE ROUTED RUNOFF FROM CPB WITH SUBBASIN T21C AT CPC

  48 HC          HYDROGRAPH COMBINATION
                      ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                  ***

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION     CPC

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+     96.      12.25               11.          3.          1.          1.
                       (INCHES)    1.408       1.616       1.618       1.618
                        (AC-FT)      6.          6.          6.          6.

                       CUMULATIVE AREA =    0.07 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  49 KK     *   CPCCPD   *
            *            *
            **************
                        ROUTE HYDROGRAPH AT CPC TO CPD

              HYDROGRAPH ROUTING DATA

  51 RD          MUSKINGUM-CUNGE CHANNEL ROUTING
                            L       710.  CHANNEL LENGTH
                            S     0.0090  SLOPE
                            N      0.025  CHANNEL ROUGHNESS COEFFICIENT
                           CA       0.00  CONTRIBUTING AREA
                        SHAPE       TRAP  CHANNEL SHAPE
```

```
                WD        8.00  BOTTOM WIDTH OR DIAMETER
                 Z        1.50  SIDE SLOPE

                                                  ***
                        COMPUTED MUSKINGUM-CUNGE PARAMETERS
                              COMPUTATION TIME STEP
        ELEMENT    ALPHA       M         DT        DX       PEAK    TIME TO     VOLUME    MAXIMUM
                                                                      PEAK                  CELERITY
                                         (MIN)      (FT)     (CFS)    (MIN)       (IN)      (FPS)

          MAIN      1.72      1.44       1.72    355.00     95.24    737.85      1.62       6.86

                                 INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

          MAIN      1.72      1.44       5.00               92.08    740.00      1.62

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.6383E+01 EXCESS=0.0000E+00 OUTFLOW=0.6383E+01 BASIN STORAGE=0.4570E-03 PERCENT ERROR=   0.0

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION   CPCCPD

  PEAK FLOW     TIME                     MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                         (CFS)
+     92.      12.33                11.          3.          1.          1.
                      (INCHES)    1.407       1.617       1.618       1.618
                       (AC-FT)       6.          6.          6.          6.

                      CUMULATIVE AREA =    0.07 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
  52 KK   *     T21D   *          SUBBASIN T21D
          *            *
          **************
                              RUNOFF FROM SUBBASIN T21D
                         CN adjusted to reflect ADOT improvements per the following:
                            97.1% @ 77 and 2.9% @ 98

             SUBBASIN RUNOFF DATA

  56 BA        SUBBASIN CHARACTERISTICS
                     TAREA        0.04  SUBBASIN AREA

               PRECIPITATION DATA

  24 PH                            DEPTHS FOR   0-PERCENT HYPOTHETICAL STORM
               ..... HYDRO-35 .....   ............... TP-40 ...............   ........... TP-49 ...........
               5-MIN  15-MIN  60-MIN    2-HR    3-HR    6-HR   12-HR   24-HR   2-DAY   4-DAY   7-DAY  10-DAY
                0.68    1.32    2.23    2.49    2.66    2.98    3.37    3.76    0.00    0.00    0.00    0.00

                                                STORM AREA =    0.04

  57 LS        SCS LOSS RATE
                     STRTL        0.58  INITIAL ABSTRACTION
                    CRVNBR       77.60  CURVE NUMBER
                     RTIMP        0.00  PERCENT IMPERVIOUS AREA

               KINEMATIC WAVE
  58 UK          OVERLAND-FLOW ELEMENT NO. 1
                         L        300.  OVERLAND FLOW LENGTH
                         S      0.0150  SLOPE
                         N       0.130  ROUGHNESS COEFFICIENT
                        PA       100.0  PERCENT OF SUBBASIN
                     DXMIN           5  MINIMUM NUMBER OF DX INTERVALS

               KINEMATIC WAVE
  59 RK          MAIN CHANNEL
                         L       2320.  CHANNEL LENGTH
                         S      0.0150  SLOPE
                         N       0.045  CHANNEL ROUGHNESS COEFFICIENT
                        CA        0.04  CONTRIBUTING AREA
                     SHAPE        TRAP  CHANNEL SHAPE
                        WD        5.00  BOTTOM WIDTH OR DIAMETER
                         Z        1.00  SIDE SLOPE
                    NDXMIN           2  MINIMUM NUMBER OF DX INTERVALS
                    RUPSTQ          NO  ROUTE UPSTREAM HYDROGRAPH

                                                  ***
                              COMPUTED KINEMATIC PARAMETERS
                                   VARIABLE TIME STEP
                                (DT SHOWN IS A MINIMUM)
```

```
                ELEMENT    ALPHA      M        DT        DX       PEAK    TIME TO      VOLUME    MAXIMUM
                                                                          PEAK                   CELERITY
                                                (MIN)     (FT)     (CFS)    (MIN)       (IN)      (FPS)

               PLANE1       1.40     1.67      2.50     60.00     61.19   731.01       1.66       0.41
               MAIN         1.51     1.42      2.02    773.33     57.00   736.39       1.66       6.74

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00  EXCESS=0.3613E+01 OUTFLOW=0.3595E+01 BASIN STORAGE=0.5595E-03 PERCENT ERROR=   0.5

                                        INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

               MAIN         1.51     1.42      5.00                56.73   735.00       1.66

     ***            ***            ***            ***            ***

                      HYDROGRAPH AT STATION     T21D

    TOTAL RAINFALL =    3.76, TOTAL LOSS =    2.09, TOTAL EXCESS =    1.67

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                         (CFS)
+     57.      12.25                6.          2.          1.          1.
                       (INCHES)   1.448       1.661       1.662       1.662
                        (AC-FT)     3.          4.          4.          4.

                       CUMULATIVE AREA =    0.04 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  60 KK     *      CPD   *
            *            *
            **************
                        COMBINE ROUTED RUNOFF FROM CPC WITH SUBBASIN T21D AT CPD

  62 HC          HYDROGRAPH COMBINATION
                      ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

     ***            ***            ***            ***            ***

                      HYDROGRAPH AT STATION      CPD

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                         (CFS)
+    143.      12.25                18.          5.          2.          2.
                       (INCHES)   1.421       1.632       1.633       1.633
                        (AC-FT)     9.         10.         10.         10.

                       CUMULATIVE AREA =    0.11 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  63 KK     *      T21E  *          SUBBASIN T21E
            *            *
            **************
                             RUNOFF FROM SUBBASIN T21E
                        CN adjusted to reflect ADOT imprvmnts and Pima Rd per the following:
                           89.6% @ 77 and 10.4% @ 98

              SUBBASIN RUNOFF DATA

  67 BA         SUBBASIN CHARACTERISTICS
                      TAREA        0.04  SUBBASIN AREA

                PRECIPITATION DATA

  24 PH                             DEPTHS FOR   0-PERCENT HYPOTHETICAL STORM
                ..... HYDRO-35 .....   ............... TP-40 ...............   ........... TP-49 ...........
                5-MIN  15-MIN  60-MIN    2-HR    3-HR    6-HR   12-HR   24-HR   2-DAY   4-DAY   7-DAY  10-DAY
                 0.68    1.32    2.23    2.49    2.66    2.98    3.37    3.76    0.00    0.00    0.00    0.00

                                                STORM AREA =    0.04

  68 LS         SCS LOSS RATE
```

```
                    STRTL        0.53  INITIAL ABSTRACTION
                   CRVNBR       79.20  CURVE NUMBER
                    RTIMP        0.00  PERCENT IMPERVIOUS AREA

                KINEMATIC WAVE
 69 UK            OVERLAND-FLOW ELEMENT NO. 1
                        L        300.  OVERLAND FLOW LENGTH
                        S      0.0150  SLOPE
                        N       0.130  ROUGHNESS COEFFICIENT
                       PA       100.0  PERCENT OF SUBBASIN
                    DXMIN           5  MINIMUM NUMBER OF DX INTERVALS

                KINEMATIC WAVE
 70 RK            MAIN CHANNEL
                        L       2990.  CHANNEL LENGTH
                        S      0.0140  SLOPE
                        N       0.045  CHANNEL ROUGHNESS COEFFICIENT
                       CA        0.04  CONTRIBUTING AREA
                    SHAPE        TRAP  CHANNEL SHAPE
                       WD        5.00  BOTTOM WIDTH OR DIAMETER
                        Z        1.00  SIDE SLOPE
                   NDXMIN           2  MINIMUM NUMBER OF DX INTERVALS
                   RUPSTQ          NO  ROUTE UPSTREAM HYDROGRAPH

                                                        ***
                                  COMPUTED KINEMATIC PARAMETERS
                                       VARIABLE TIME STEP
                                     (DT SHOWN IS A MINIMUM)

                 ELEMENT    ALPHA       M        DT        DX       PEAK    TIME TO     VOLUME    MAXIMUM
                                                                             PEAK                  CELERITY
                                                (MIN)      (FT)     (CFS)     (MIN)      (IN)      (FPS)

                 PLANE1      1.40      1.67      2.38     60.00     63.76    730.47      1.78      0.43
                 MAIN        1.46      1.42      2.64    996.67     56.78    737.01      1.78      6.52

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00  EXCESS=0.3618E+01 OUTFLOW=0.3598E+01 BASIN STORAGE=0.5274E-03 PERCENT ERROR=   0.5

                                  INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

                 MAIN        1.46      1.42      5.00               55.56    735.00      1.77

     ***          ***          ***          ***          ***

                     HYDROGRAPH AT STATION     T21E

   TOTAL RAINFALL =    3.76, TOTAL LOSS =    1.97, TOTAL EXCESS =    1.79

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+     56.     12.25                 6.          2.          1.          1.
                        (INCHES)  1.548       1.773       1.774       1.774
                         (AC-FT)     3.          4.          4.          4.

                        CUMULATIVE AREA =    0.04 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
 71 KK      *      CPE   *
            *            *
            **************
                     COMBINE ROUTED RUNOFF FROM CPD WITH SUBBASIN T21E AT CPE

 73 HC          HYDROGRAPH COMBINATION
                    ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                        ***

     ***          ***          ***          ***          ***

                     HYDROGRAPH AT STATION      CPE

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+    199.     12.25                24.          7.          3.          3.
                        (INCHES)  1.453       1.667       1.668       1.668
                         (AC-FT)    12.         14.         14.         14.

                        CUMULATIVE AREA =    0.15 SQ MI

1
                                                RUNOFF SUMMARY
```

FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	T21A	10.	12.25	1.	0.	0.	0.01		
+	HYDROGRAPH AT	T21B	24.	12.25	3.	1.	0.	0.02		
+	2 COMBINED AT	CPB	34.	12.25	4.	1.	0.	0.02		
+	ROUTED TO	CPBCPC	31.	12.33	4.	1.	0.	0.02		
+	HYDROGRAPH AT	T21C	65.	12.25	7.	2.	1.	0.05		
+	2 COMBINED AT	CPC	96.	12.25	11.	3.	1.	0.07		
+	ROUTED TO	CPCCPD	92.	12.33	11.	3.	1.	0.07		
+	HYDROGRAPH AT	T21D	57.	12.25	6.	2.	1.	0.04		
+	2 COMBINED AT	CPD	143.	12.25	18.	5.	2.	0.11		
+	HYDROGRAPH AT	T21E	56.	12.25	6.	2.	1.	0.04		
+	2 COMBINED AT	CPE	199.	12.25	24.	7.	3.	0.15		

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
T21A	MANE	0.96	10.20	734.29	1.62	5.00	10.04	735.00	1.62

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.6245E+00 OUTFLOW=0.6218E+00 BASIN STORAGE=0.8278E-04 PERCENT ERROR= 0.4

T21B	MANE	2.08	24.22	736.22	1.62	5.00	23.87	735.00	1.62

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.1544E+01 OUTFLOW=0.1536E+01 BASIN STORAGE=0.2144E-03 PERCENT ERROR= 0.5

CPBCPC	MANE	2.17	33.17	737.58	1.62	5.00	31.40	740.00	1.62

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2157E+01 EXCESS=0.0000E+00 OUTFLOW=0.2157E+01 BASIN STORAGE=0.4212E-03 PERCENT ERROR= 0.0

T21C	MANE	2.04	66.20	736.47	1.62	5.00	65.07	735.00	1.62

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.4250E+01 OUTFLOW=0.4229E+01 BASIN STORAGE=0.5898E-03 PERCENT ERROR= 0.5

CPCCPD	MANE	1.72	95.24	737.85	1.62	5.00	92.08	740.00	1.62

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.6383E+01 EXCESS=0.0000E+00 OUTFLOW=0.6383E+01 BASIN STORAGE=0.4570E-03 PERCENT ERROR= 0.0

T21D	MANE	2.02	57.00	736.39	1.66	5.00	56.73	735.00	1.66

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.3613E+01 OUTFLOW=0.3595E+01 BASIN STORAGE=0.5595E-03 PERCENT ERROR= 0.5

T21E	MANE	2.64	56.78	737.01	1.78	5.00	55.56	735.00	1.77

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.3618E+01 OUTFLOW=0.3598E+01 BASIN STORAGE=0.5274E-03 PERCENT ERROR= 0.5

*** NORMAL END OF HEC-1 ***

Appendix B

HEC-1 Ouput for 100-Year, 6-Hour Storm

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             MAY  1991                 *
*           VERSION 4.0.1E              *
*     Lahey F77L-EM/32 version 5.01     *
*       Dodson & Associates, Inc.       *
*  RUN DATE  01/14/99  TIME  10:31:35   *
*****************************************
```

```
*****************************************
*                                       *
*   U.S. ARMY CORPS OF ENGINEERS        *
*   HYDROLOGIC ENGINEERING CENTER       *
*         609 SECOND STREET             *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X    X         XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X    X          X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                          HEC-1 INPUT                                                    PAGE  1

      LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

        1           ID    TRACT 21 DRAINAGE CHANNEL
        2           ID    by Pentacore AZ                                    File: t211006.ih1
        3           ID        Project:  5009.0001                            Date: 01-11-99  wso
        4           ID
        5           ID    100-year, 6-hour storm
        6           ID
        7           ID        Ultimate condition hydrology assumes that onsite retention will be
        8           ID          provided within watershed upon development with peak discharges
        9           ID          maintained to pre-development conditions.
       10           ID
       11           ID        Includes tributary area from ADOT Loop 101 Pima Freeway as provided
       12           ID          by Premier Engineering.
       13           ID
       14           ID        Curve Numbers for subbasins T21D an T21E are adjusted to reflect
       15           ID          increased imperviousness due to existing Pima Rd pavement and
       16           ID          future ADOT improvements.
       17           ID
       18           ID
                    *DIAGRAM
       19           IT       5                    720
       20           IO       3
                    *
                    *
                    *

       21           KK    T21A     SUBBASIN T21A
       22           KM         RUNOFF FROM SUBBASIN T21A AT CPA
       23           BA  0.0072
                    *
                    *  100-year precipitation, 6-hour storm duration
                    *
       24           PH                     .84    1.53    2.46    2.75    2.94    3.31
       25           LS              77
       26           UK     300   0.015    0.13     100
       27           RK     520   0.015   0.045            TRAP       4       5
                    *
                    *
                    *   ROUTE SUBBASIN T21A (CPA) TO CPB --- TOO SHORT TO ROUTE
                    *
                    *

       28           KK    T21B     SUBBASIN T21B
       29           KM         RUNOFF FROM SUBBASIN T21B
       30           BA  0.0178
       31           LS              77
       32           UK     300   0.015    0.13     100
       33           RK    1380   0.013   0.045            TRAP       4       5
                    *

       34           KK     CPB
       35           KM    COMBINE RUNOFF FROM SUBBASINS T21A AND T21B AT CPB
       36           HC       2
                    *
1                                          HEC-1 INPUT                                                    PAGE  2

      LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
```

```
 37          KK  CPBCPC
 38          KM    ROUTE HYDROGRAPH AT CPB TO CPC
 39          RD     650   0.009   0.025            TRAP       8      1.5
             *

 40          KK    T21C     SUBBASIN T21C
 41          KM         RUNOFF FROM SUBBASIN T21C
 42          BA  0.0490
 43          LS              77
 44          UK     300   0.015    0.13     100
 45          RK    2040   0.017   0.045            TRAP       3       5
             *

 46          KK     CPC
 47          KM    COMBINE ROUTED RUNOFF FROM CPB WITH SUBBASIN T21C AT CPC
 48          HC       2
             *

 49          KK  CPCCPD
 50          KM    ROUTE HYDROGRAPH AT CPC TO CPD
 51          RD     710   0.009   0.025            TRAP       8      1.5
             *

 52          KK    T21D     SUBBASIN T21D
 53          KM         RUNOFF FROM SUBBASIN T21D
 54          KM    CN adjusted to reflect ADOT improvements per the following:
 55          KM       97.1% @ 77 and 2.9% @ 98
 56          BA  0.0406
 57          LS            77.6
 58          UK     300   0.015    0.13     100
 59          RK    2320   0.015   0.045            TRAP       5       10
             *

 60          KK     CPD
 61          KM    COMBINE ROUTED RUNOFF FROM CPC WITH SUBBASIN T21D AT CPD
 62          HC       2
             *
             *
             *   ROUTE HYDROGRAPH AT CPD TO CPE --- TOO SHORT TO ROUTE
             *
             *

 63          KK    T21E     SUBBASIN T21E
 64          KM         RUNOFF FROM SUBBASIN T21E
 65          KM    CN adjusted to reflect ADOT imprvmnts and Pima Rd per the following:
 66          KM       89.6% @ 77 and 10.4% @ 98
 67          BA  0.0380
 68          LS            79.2
 69          UK     300   0.015    0.13     100
 70          RK    2990   0.014   0.045            TRAP       5       10
             *
1                                          HEC-1 INPUT                                          PAGE  3

       LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 71          KK     CPE
 72          KM    COMBINE ROUTED RUNOFF FROM CPD WITH SUBBASIN T21E AT CPE
 73          HC       2
             *
 74          ZZ
1
             SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   21        T21A
             .
             .
   28        .        T21B
             .          .
             .          .
   34      CPB...........
             V
             V
   37    CPBCPC
             .
             .
   40        .        T21C
             .          .
             .          .
   46      CPC...........
             V
             V
   49    CPCCPD
             .
             .
   52        .        T21D
             .          .
             .          .
   60      CPD...........
             .
```

```
                .
  63            .        T21E
                .          .
                .          .
  71         CPE............

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              MAY   1991               *
*           VERSION 4.0.1E              *
*     Lahey F77L-EM/32 version 5.01     *
*       Dodson & Associates, Inc.       *
*  RUN DATE  01/14/99  TIME  10:31:35   *
*****************************************

*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
```

TRACT 21 DRAINAGE CHANNEL
by Pentacore AZ
Project: 5009.0001

File: t21006.IH1
Date: 01-11-99 wso

100-year, 6-hour storm

Ultimate condition hydrology assumes that onsite retention will be provided within watershed upon development with peak discharges maintained to pre-development conditions.

Includes tributary area from ADOT Loop 101 Pima Freeway as provided by Premier Engineering.

Curve Numbers for subbasins T21D an T21E are adjusted to reflect increased imperviousness due to existing Pima Rd pavement and future ADOT improvements.

```
 20 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          3  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        720  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      3    0  ENDING DATE
                     NDTIME       1155  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL    0.08 HOURS
                      TOTAL TIME BASE   59.92 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
 21 KK    *     T21A   *          SUBBASIN T21A
          *            *
          **************
                              RUNOFF FROM SUBBASIN T21A AT CPA

             SUBBASIN RUNOFF DATA

 23 BA          SUBBASIN CHARACTERISTICS
                      TAREA        0.01  SUBBASIN AREA

                PRECIPITATION DATA

 24 PH                              DEPTHS FOR   0-PERCENT HYPOTHETICAL STORM
                ..... HYDRO-35 .....   ............... TP-40 ...............   ........... TP-49 ...........
                5-MIN  15-MIN  60-MIN    2-HR    3-HR    6-HR   12-HR   24-HR   2-DAY   4-DAY   7-DAY  10-DAY
                 0.84    1.53    2.46    2.75    2.94    3.31    0.00    0.00    0.00    0.00    0.00    0.00

                                                STORM AREA =     0.01

 25 LS          SCS LOSS RATE
                      STRTL        0.60  INITIAL ABSTRACTION
                     CRVNBR       77.00  CURVE NUMBER
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                RTIMP        0.00  PERCENT IMPERVIOUS AREA

            KINEMATIC WAVE
 26 UK        OVERLAND-FLOW ELEMENT NO. 1
                   L        300.  OVERLAND FLOW LENGTH
                   S      0.0150  SLOPE
                   N       0.130  ROUGHNESS COEFFICIENT
                  PA       100.0  PERCENT OF SUBBASIN
               DXMIN           5  MINIMUM NUMBER OF DX INTERVALS

            KINEMATIC WAVE
 27 RK        MAIN CHANNEL
                   L        520.  CHANNEL LENGTH
                   S      0.0150  SLOPE
                   N       0.045  CHANNEL ROUGHNESS COEFFICIENT
                  CA        0.01  CONTRIBUTING AREA
               SHAPE        TRAP  CHANNEL SHAPE
                  WD        4.00  BOTTOM WIDTH OR DIAMETER
                   Z        5.00  SIDE SLOPE
              NDXMIN           2  MINIMUM NUMBER OF DX INTERVALS
              RUPSTQ          NO  ROUTE UPSTREAM HYDROGRAPH

                                                  ***
                              COMPUTED KINEMATIC PARAMETERS
                                   VARIABLE TIME STEP
                                (DT SHOWN IS A MINIMUM)

              ELEMENT    ALPHA       M         DT        DX       PEAK    TIME TO     VOLUME    MAXIMUM
                                                                           PEAK                  CELERITY
                                                (MIN)      (FT)     (CFS)    (MIN)       (IN)      (FPS)

              PLANE1      1.40      1.67       2.64     60.00      9.94   193.21       1.28      0.39
              MAIN        1.35      1.35       0.97    173.33      9.65   195.18       1.28      3.28

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00  EXCESS=0.4957E+00 OUTFLOW=0.4919E+00 BASIN STORAGE=0.5027E-04 PERCENT ERROR=   0.7

                                   INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

              MAIN        1.35      1.35       5.00                 9.63   195.00       1.28

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION     T21A

   TOTAL RAINFALL =    3.31, TOTAL LOSS =    2.02, TOTAL EXCESS =    1.29

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+     10.       3.25                1.          0.          0.          0.
                       (INCHES)   1.267       1.275       1.276       1.276
                        (AC-FT)      0.          0.          0.          0.

                       CUMULATIVE AREA =    0.01 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

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          *            *
 28 KK    *     T21B   *          SUBBASIN T21B
          *            *
          **************
                              RUNOFF FROM SUBBASIN T21B

            SUBBASIN RUNOFF DATA

 30 BA        SUBBASIN CHARACTERISTICS
                  TAREA        0.02  SUBBASIN AREA

              PRECIPITATION DATA

 24 PH                              DEPTHS FOR   0-PERCENT HYPOTHETICAL STORM
              ..... HYDRO-35 .....  ............... TP-40 ...............  ........... TP-49 ...........
              5-MIN  15-MIN  60-MIN    2-HR    3-HR    6-HR   12-HR   24-HR   2-DAY   4-DAY   7-DAY  10-DAY
               0.84    1.53    2.46    2.75    2.94    3.31    0.00    0.00    0.00    0.00    0.00    0.00

                                                STORM AREA =    0.02

 31 LS        SCS LOSS RATE
                  STRTL        0.60  INITIAL ABSTRACTION
                 CRVNBR       77.00  CURVE NUMBER
                  RTIMP        0.00  PERCENT IMPERVIOUS AREA

              KINEMATIC WAVE
 32 UK        OVERLAND-FLOW ELEMENT NO. 1
                   L        300.  OVERLAND FLOW LENGTH
                   S      0.0150  SLOPE
```

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                    N       0.130  ROUGHNESS COEFFICIENT
                   PA       100.0  PERCENT OF SUBBASIN
                DXMIN           5  MINIMUM NUMBER OF DX INTERVALS

            KINEMATIC WAVE
 33 RK        MAIN CHANNEL
                    L      1380.  CHANNEL LENGTH
                    S     0.0130  SLOPE
                    N      0.045  CHANNEL ROUGHNESS COEFFICIENT
                   CA       0.02  CONTRIBUTING AREA
                SHAPE       TRAP  CHANNEL SHAPE
                   WD       4.00  BOTTOM WIDTH OR DIAMETER
                    Z       5.00  SIDE SLOPE
               NDXMIN          2  MINIMUM NUMBER OF DX INTERVALS
               RUPSTQ         NO  ROUTE UPSTREAM HYDROGRAPH

                                                   ***
                              COMPUTED KINEMATIC PARAMETERS
                                   VARIABLE TIME STEP
                                (DT SHOWN IS A MINIMUM)

          ELEMENT    ALPHA       M         DT        DX       PEAK    TIME TO     VOLUME    MAXIMUM
                                                                        PEAK                  CELERITY
                                             (MIN)      (FT)     (CFS)    (MIN)       (IN)      (FPS)

          PLANE1      1.40      1.67       2.64     60.00     24.58   193.21      1.28      0.39
          MAIN        1.26      1.35       2.14    460.00     22.79   197.33      1.28      3.86

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00  EXCESS=0.1225E+01 OUTFLOW=0.1215E+01 BASIN STORAGE=0.1296E-03 PERCENT ERROR=   0.8

                                   INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

          MAIN        1.26      1.35       5.00               21.68   195.00      1.28

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION     T21B

   TOTAL RAINFALL =    3.31, TOTAL LOSS =    2.02, TOTAL EXCESS =    1.29

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+     22.       3.25          2.          1.          0.          0.
                       (INCHES)     1.272       1.281       1.282       1.282
                        (AC-FT)        1.          1.          1.          1.

                       CUMULATIVE AREA =    0.02 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
 34 KK      *     CPB    *
            *            *
            **************
                    COMBINE RUNOFF FROM SUBBASINS T21A AND T21B AT CPB

 36 HC          HYDROGRAPH COMBINATION
                     ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                   ***

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION     CPB

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+     31.       3.25          3.          1.          0.          0.
                       (INCHES)     1.270       1.280       1.280       1.280
                        (AC-FT)        2.          2.          2.          2.

                       CUMULATIVE AREA =    0.02 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

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            *            *
 37 KK      *   CPBCPC   *
            *            *
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                ROUTE HYDROGRAPH AT CPB TO CPC

          HYDROGRAPH ROUTING DATA

 39 RD      MUSKINGUM-CUNGE CHANNEL ROUTING
                    L        650.  CHANNEL LENGTH
                    S      0.0090  SLOPE
                    N       0.025  CHANNEL ROUGHNESS COEFFICIENT
                   CA        0.00  CONTRIBUTING AREA
                SHAPE        TRAP  CHANNEL SHAPE
                   WD        8.00  BOTTOM WIDTH OR DIAMETER
                    Z        1.50  SIDE SLOPE

                                                   ***
                          COMPUTED MUSKINGUM-CUNGE PARAMETERS
                                COMPUTATION TIME STEP
          ELEMENT    ALPHA      M        DT        DX       PEAK    TIME TO     VOLUME    MAXIMUM
                                                                      PEAK                  CELERITY
                                          (MIN)     (FT)     (CFS)    (MIN)      (IN)      (FPS)

            MAIN      1.72      1.44      1.75    325.00     31.05   197.75      1.28      4.87

                                     INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

            MAIN      1.72      1.44      5.00               30.17   200.00      1.28

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1706E+01 EXCESS=0.0000E+00 OUTFLOW=0.1706E+01 BASIN STORAGE=0.4208E-03 PERCENT ERROR=   0.0


   ***          ***          ***          ***          ***

                HYDROGRAPH AT STATION   CPBCPC

 PEAK FLOW     TIME                     MAXIMUM AVERAGE FLOW
                                  6-HR      24-HR      72-HR     59.92-HR
+   (CFS)      (HR)
                     (CFS)
+     30.      3.33                3.         1.         0.          0.
                (INCHES)        1.270      1.279      1.279       1.279
                 (AC-FT)           2.         2.         2.          2.

                CUMULATIVE AREA =    0.02 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


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*            *
 40 KK      *     T21C   *          SUBBASIN T21C
*            *
**************
                         RUNOFF FROM SUBBASIN T21C

          SUBBASIN RUNOFF DATA

 42 BA      SUBBASIN CHARACTERISTICS
                 TAREA        0.05  SUBBASIN AREA

            PRECIPITATION DATA

 24 PH                        DEPTHS FOR   0-PERCENT HYPOTHETICAL STORM
            ..... HYDRO-35 .....   ............... TP-40 ...............   ........... TP-49 ...........
            5-MIN  15-MIN  60-MIN    2-HR    3-HR    6-HR   12-HR   24-HR   2-DAY   4-DAY   7-DAY  10-DAY
             0.84    1.53    2.46    2.75    2.94    3.31    0.00    0.00    0.00    0.00    0.00    0.00

                                          STORM AREA =    0.05

 43 LS      SCS LOSS RATE
                 STRTL        0.60  INITIAL ABSTRACTION
                CRVNBR       77.00  CURVE NUMBER
                 RTIMP        0.00  PERCENT IMPERVIOUS AREA

            KINEMATIC WAVE
 44 UK        OVERLAND-FLOW ELEMENT NO. 1
                    L        300.  OVERLAND FLOW LENGTH
                    S      0.0150  SLOPE
                    N       0.130  ROUGHNESS COEFFICIENT
                   PA       100.0  PERCENT OF SUBBASIN
                DXMIN           5  MINIMUM NUMBER OF DX INTERVALS

            KINEMATIC WAVE
 45 RK        MAIN CHANNEL
                    L       2040.  CHANNEL LENGTH
                    S      0.0170  SLOPE
                    N       0.045  CHANNEL ROUGHNESS COEFFICIENT
                   CA        0.05  CONTRIBUTING AREA
                SHAPE        TRAP  CHANNEL SHAPE
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```
                WD        3.00  BOTTOM WIDTH OR DIAMETER
                 Z        5.00  SIDE SLOPE
            NDXMIN           2  MINIMUM NUMBER OF DX INTERVALS
            RUPSTQ          NO  ROUTE UPSTREAM HYDROGRAPH

                                                  ***
                          COMPUTED KINEMATIC PARAMETERS
                               VARIABLE TIME STEP
                             (DT SHOWN IS A MINIMUM)

          ELEMENT    ALPHA       M        DT        DX       PEAK    TIME TO     VOLUME    MAXIMUM
                                                                       PEAK                  CELERITY
                                           (MIN)      (FT)     (CFS)    (MIN)       (IN)      (FPS)

          PLANE1      1.40      1.67      2.64     60.00     67.63   193.21      1.28      0.39
          MAIN        1.48      1.34      2.18    680.00     62.56   197.65      1.28      5.57

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00  EXCESS=0.3373E+01 OUTFLOW=0.3344E+01 BASIN STORAGE=0.3557E-03 PERCENT ERROR=   0.8

                                INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

          MAIN        1.48      1.34      5.00              59.26   200.00      1.28

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION     T21C

   TOTAL RAINFALL =    3.31, TOTAL LOSS =    2.02, TOTAL EXCESS =    1.29

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+     59.       3.33         7.          2.          1.          1.
                       (INCHES)     1.272       1.281       1.282       1.282
                        (AC-FT)        3.          3.          3.          3.

                       CUMULATIVE AREA =    0.05 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
  46 KK     *      CPC   *
            *            *
            **************
                       COMBINE ROUTED RUNOFF FROM CPB WITH SUBBASIN T21C AT CPC

  48 HC          HYDROGRAPH COMBINATION
                      ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                  ***

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION      CPC

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+     89.       3.33        10.          3.          1.          1.
                       (INCHES)     1.271       1.281       1.281       1.281
                        (AC-FT)        5.          5.          5.          5.

                       CUMULATIVE AREA =    0.07 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
  49 KK     *    CPCCPD  *
            *            *
            **************
                       ROUTE HYDROGRAPH AT CPC TO CPD

              HYDROGRAPH ROUTING DATA

  51 RD          MUSKINGUM-CUNGE CHANNEL ROUTING
                           L        710.  CHANNEL LENGTH
                           S     0.0090  SLOPE
                           N      0.025  CHANNEL ROUGHNESS COEFFICIENT
                          CA       0.00  CONTRIBUTING AREA
                       SHAPE       TRAP  CHANNEL SHAPE
```

```
                WD        8.00  BOTTOM WIDTH OR DIAMETER
                 Z        1.50  SIDE SLOPE

                                                  ***
                          COMPUTED MUSKINGUM-CUNGE PARAMETERS
                                COMPUTATION TIME STEP
        ELEMENT    ALPHA       M        DT        DX       PEAK    TIME TO     VOLUME    MAXIMUM
                                                                     PEAK                  CELERITY
                                          (MIN)     (FT)     (CFS)   (MIN)       (IN)      (FPS)

          MAIN      1.72      1.44       1.76    355.00     88.48   199.07      1.28       6.72

                                 INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

          MAIN      1.72      1.44       5.00               88.15   200.00      1.28

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.5053E+01 EXCESS=0.0000E+00 OUTFLOW=0.5053E+01 BASIN STORAGE=0.4574E-03 PERCENT ERROR=   0.0


   ***          ***          ***          ***          ***

                HYDROGRAPH AT STATION   CPCCPD

 PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)      (HR)
                     (CFS)
+     88.      3.33                10.          3.          1.          1.
                  (INCHES)       1.272       1.282       1.282       1.282
                   (AC-FT)          5.          5.          5.          5.

                 CUMULATIVE AREA =    0.07 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
 52 KK    *     T21D   *          SUBBASIN T21D
          *            *
          **************
                          RUNOFF FROM SUBBASIN T21D
                     CN adjusted to reflect ADOT improvements per the following:
                        97.1% @ 77 and 2.9% @ 98

            SUBBASIN RUNOFF DATA

 56 BA        SUBBASIN CHARACTERISTICS
                   TAREA        0.04  SUBBASIN AREA

              PRECIPITATION DATA

 24 PH                          DEPTHS FOR   0-PERCENT HYPOTHETICAL STORM
              ..... HYDRO-35 .....   ............... TP-40 ...............   ........... TP-49 ...........
              5-MIN  15-MIN  60-MIN    2-HR    3-HR    6-HR   12-HR   24-HR   2-DAY   4-DAY   7-DAY  10-DAY
               0.84    1.53    2.46    2.75    2.94    3.31    0.00    0.00    0.00    0.00    0.00    0.00

                                          STORM AREA =    0.04

 57 LS        SCS LOSS RATE
                  STRTL        0.58  INITIAL ABSTRACTION
                 CRVNBR       77.60  CURVE NUMBER
                  RTIMP        0.00  PERCENT IMPERVIOUS AREA

              KINEMATIC WAVE
 58 UK          OVERLAND-FLOW ELEMENT NO. 1
                      L        300.  OVERLAND FLOW LENGTH
                      S      0.0150  SLOPE
                      N       0.130  ROUGHNESS COEFFICIENT
                     PA       100.0  PERCENT OF SUBBASIN
                  DXMIN           5  MINIMUM NUMBER OF DX INTERVALS

              KINEMATIC WAVE
 59 RK          MAIN CHANNEL
                      L       2320.  CHANNEL LENGTH
                      S      0.0150  SLOPE
                      N       0.045  CHANNEL ROUGHNESS COEFFICIENT
                     CA        0.04  CONTRIBUTING AREA
                  SHAPE        TRAP  CHANNEL SHAPE
                     WD        5.00  BOTTOM WIDTH OR DIAMETER
                      Z        1.00  SIDE SLOPE
                 NDXMIN           2  MINIMUM NUMBER OF DX INTERVALS
                 RUPSTQ          NO  ROUTE UPSTREAM HYDROGRAPH

                                                  ***
                          COMPUTED KINEMATIC PARAMETERS
                               VARIABLE TIME STEP
                             (DT SHOWN IS A MINIMUM)
```

```
                ELEMENT    ALPHA      M        DT        DX       PEAK    TIME TO     VOLUME    MAXIMUM
                                                                          PEAK                  CELERITY
                                                (MIN)      (FT)     (CFS)    (MIN)      (IN)      (FPS)

                PLANE1      1.40     1.67      2.59     60.00     58.73   192.85      1.32      0.40
                MAIN        1.51     1.42      2.02    773.33     54.40   196.60      1.32      6.63

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00  EXCESS=0.2877E+01 OUTFLOW=0.2851E+01 BASIN STORAGE=0.3028E-03 PERCENT ERROR=   0.9

                                    INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

                MAIN        1.51     1.42      5.00                52.17   195.00      1.31

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION     T21D

   TOTAL RAINFALL =    3.31, TOTAL LOSS =    1.98, TOTAL EXCESS =    1.33

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+     52.       3.25                 6.          1.          1.          1.
                        (INCHES)   1.304       1.314       1.314       1.314
                         (AC-FT)     3.          3.          3.          3.

                        CUMULATIVE AREA =    0.04 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  60 KK     *     CPD    *
            *            *
            **************
                        COMBINE ROUTED RUNOFF FROM CPC WITH SUBBASIN T21D AT CPD

  62 HC          HYDROGRAPH COMBINATION
                      ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                  ***

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION     CPD

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+    139.       3.33                16.          4.          2.          2.
                        (INCHES)   1.284       1.293       1.294       1.294
                         (AC-FT)     8.          8.          8.          8.

                        CUMULATIVE AREA =    0.11 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  63 KK     *    T21E    *          SUBBASIN T21E
            *            *
            **************
                             RUNOFF FROM SUBBASIN T21E
                        CN adjusted to reflect ADOT imprvmnts and Pima Rd per the following:
                           89.6% @ 77 and 10.4% @ 98

              SUBBASIN RUNOFF DATA

  67 BA          SUBBASIN CHARACTERISTICS
                      TAREA        0.04  SUBBASIN AREA

                 PRECIPITATION DATA

  24 PH                             DEPTHS FOR   0-PERCENT HYPOTHETICAL STORM
                 ..... HYDRO-35 .....   ............... TP-40 ...............   ........... TP-49 ...........
                 5-MIN  15-MIN  60-MIN    2-HR    3-HR    6-HR   12-HR   24-HR   2-DAY   4-DAY   7-DAY  10-DAY
                  0.84    1.53    2.46    2.75    2.94    3.31    0.00    0.00    0.00    0.00    0.00    0.00

                                                STORM AREA =    0.04

  68 LS          SCS LOSS RATE
```

```
                    STRTL        0.53  INITIAL ABSTRACTION
                   CRVNBR       79.20  CURVE NUMBER
                    RTIMP        0.00  PERCENT IMPERVIOUS AREA

                KINEMATIC WAVE
 69 UK            OVERLAND-FLOW ELEMENT NO. 1
                        L        300.  OVERLAND FLOW LENGTH
                        S      0.0150  SLOPE
                        N       0.130  ROUGHNESS COEFFICIENT
                       PA       100.0  PERCENT OF SUBBASIN
                    DXMIN           5  MINIMUM NUMBER OF DX INTERVALS

                KINEMATIC WAVE
 70 RK            MAIN CHANNEL
                        L       2990.  CHANNEL LENGTH
                        S      0.0140  SLOPE
                        N       0.045  CHANNEL ROUGHNESS COEFFICIENT
                       CA        0.04  CONTRIBUTING AREA
                    SHAPE        TRAP  CHANNEL SHAPE
                       WD        5.00  BOTTOM WIDTH OR DIAMETER
                        Z        1.00  SIDE SLOPE
                   NDXMIN           2  MINIMUM NUMBER OF DX INTERVALS
                   RUPSTQ          NO  ROUTE UPSTREAM HYDROGRAPH

                                                        ***
                                   COMPUTED KINEMATIC PARAMETERS
                                        VARIABLE TIME STEP
                                      (DT SHOWN IS A MINIMUM)

                 ELEMENT    ALPHA       M        DT        DX       PEAK    TIME TO     VOLUME    MAXIMUM
                                                                             PEAK                  CELERITY
                                                (MIN)      (FT)     (CFS)     (MIN)       (IN)      (FPS)

                 PLANE1      1.40      1.67      2.63     60.00     62.45    194.02      1.42      0.42
                 MAIN        1.46      1.42      2.59    996.67     54.45    198.33      1.42      6.41

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00  EXCESS=0.2904E+01 OUTFLOW=0.2876E+01 BASIN STORAGE=0.2574E-03 PERCENT ERROR=   1.0

                                   INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

                 MAIN        1.46      1.42      5.00               51.89    200.00      1.42

     ***          ***          ***          ***          ***

                     HYDROGRAPH AT STATION     T21E

   TOTAL RAINFALL =    3.31, TOTAL LOSS =    1.88, TOTAL EXCESS =    1.43

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+     52.       3.33                 6.          1.          1.          1.
                        (INCHES)   1.407       1.418       1.418       1.418
                         (AC-FT)     3.          3.          3.          3.

                        CUMULATIVE AREA =    0.04 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
 71 KK      *      CPE   *
            *            *
            **************
                     COMBINE ROUTED RUNOFF FROM CPD WITH SUBBASIN T21E AT CPE

 73 HC          HYDROGRAPH COMBINATION
                     ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                        ***

     ***          ***          ***          ***          ***

                     HYDROGRAPH AT STATION     CPE

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+    191.       3.33                22.          5.          2.          2.
                        (INCHES)   1.314       1.324       1.325       1.325
                         (AC-FT)    11.         11.         11.         11.

                        CUMULATIVE AREA =    0.15 SQ MI

1
                                                RUNOFF SUMMARY
```

FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	T21A	10.	3.25	1.	0.	0.	0.01		
+	HYDROGRAPH AT	T21B	22.	3.25	2.	1.	0.	0.02		
+	2 COMBINED AT	CPB	31.	3.25	3.	1.	0.	0.02		
+	ROUTED TO	CPBCPC	30.	3.33	3.	1.	0.	0.02		
+	HYDROGRAPH AT	T21C	59.	3.33	7.	2.	1.	0.05		
+	2 COMBINED AT	CPC	89.	3.33	10.	3.	1.	0.07		
+	ROUTED TO	CPCCPD	88.	3.33	10.	3.	1.	0.07		
+	HYDROGRAPH AT	T21D	52.	3.25	6.	1.	1.	0.04		
+	2 COMBINED AT	CPD	139.	3.33	16.	4.	2.	0.11		
+	HYDROGRAPH AT	T21E	52.	3.33	6.	1.	1.	0.04		
+	2 COMBINED AT	CPE	191.	3.33	22.	5.	2.	0.15		

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
T21A	MANE	0.97	9.65	195.18	1.28	5.00	9.63	195.00	1.28

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.4957E+00 OUTFLOW=0.4919E+00 BASIN STORAGE=0.5027E-04 PERCENT ERROR= 0.7

T21B	MANE	2.14	22.79	197.33	1.28	5.00	21.68	195.00	1.28

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.1225E+01 OUTFLOW=0.1215E+01 BASIN STORAGE=0.1296E-03 PERCENT ERROR= 0.8

CPBCPC	MANE	1.75	31.05	197.75	1.28	5.00	30.17	200.00	1.28

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1706E+01 EXCESS=0.0000E+00 OUTFLOW=0.1706E+01 BASIN STORAGE=0.4208E-03 PERCENT ERROR= 0.0

T21C	MANE	2.18	62.56	197.65	1.28	5.00	59.26	200.00	1.28

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.3373E+01 OUTFLOW=0.3344E+01 BASIN STORAGE=0.3557E-03 PERCENT ERROR= 0.8

CPCCPD	MANE	1.76	88.48	199.07	1.28	5.00	88.15	200.00	1.28

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.5053E+01 EXCESS=0.0000E+00 OUTFLOW=0.5053E+01 BASIN STORAGE=0.4574E-03 PERCENT ERROR= 0.0

T21D	MANE	2.02	54.40	196.60	1.32	5.00	52.17	195.00	1.31

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.2877E+01 OUTFLOW=0.2851E+01 BASIN STORAGE=0.3028E-03 PERCENT ERROR= 0.9

T21E	MANE	2.59	54.45	198.33	1.42	5.00	51.89	200.00	1.42

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.2904E+01 OUTFLOW=0.2876E+01 BASIN STORAGE=0.2574E-03 PERCENT ERROR= 1.0

*** NORMAL END OF HEC-1 ***

Appendix C

HEC-1 Ouput for 100-Year, 24-Hour Storm

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              MAY  1991               *
*            VERSION 4.0.1E            *
*     Lahey F77L-EM/32 version 5.01    *
*       Dodson & Associates, Inc.      *
*  RUN DATE  01/14/99  TIME  10:48:55  *
****************************************
```

```
****************************************
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 551-1748             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X       X     X        XX
X     X  X       X               X
XXXXXXX  XXXX    X        XXXXX  X
X     X  X       X               X
X     X  X       X   X           X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                          HEC-1 INPUT                                                    PAGE  1

      LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

        1           ID    TRACT 21 DRAINAGE CHANNEL
        2           ID    by Pentacore AZ                                    File: t2110024.ih1
        3           ID        Project:  5009.0001                            Date: 01-14-99  wso
        4           ID
        5           ID    100-year, 24-hour storm
        6           ID
        7           ID        Ultimate condition hydrology assumes that onsite retention will be
        8           ID          provided within watershed upon development with peak discharges
        9           ID          maintained to pre-development conditions.
       10           ID
       11           ID        Includes tributary area from ADOT Loop 101 Pima Freeway as provided
       12           ID          by Premier Engineering.
       13           ID
       14           ID        Curve Numbers for subbasins T21D an T21E are adjusted to reflect
       15           ID          increased imperviousness due to existing Pima Rd pavement and
       16           ID          future ADOT improvements.
       17           ID
       18           ID
                    *DIAGRAM
       19           IT       5                    720
       20           IO       3
                    *
                    *
                    *

       21           KK    T21A     SUBBASIN T21A
       22           KM         RUNOFF FROM SUBBASIN T21A AT CPA
       23           BA  0.0072
                    *
                    *  100-year precipitation, 24-hour storm duration
                    *
       24           PH                     .84    1.53    2.46    2.75    2.94    3.31    3.74    4.17
       25           LS              77
       26           UK     300   0.015    0.13     100
       27           RK     520   0.015   0.045            TRAP       4       5
                    *
                    *
                    *   ROUTE SUBBASIN T21A (CPA) TO CPB --- TOO SHORT TO ROUTE
                    *
                    *

       28           KK    T21B     SUBBASIN T21B
       29           KM         RUNOFF FROM SUBBASIN T21B
       30           BA  0.0178
       31           LS              77
       32           UK     300   0.015    0.13     100
       33           RK    1380   0.013   0.045            TRAP       4       5
                    *

       34           KK     CPB
       35           KM    COMBINE RUNOFF FROM SUBBASINS T21A AND T21B AT CPB
       36           HC       2
                    *
1                                          HEC-1 INPUT                                                    PAGE  2

      LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
```

```
 37          KK  CPBCPC
 38          KM    ROUTE HYDROGRAPH AT CPB TO CPC
 39          RD     650   0.009   0.025            TRAP       8     1.5
             *

 40          KK    T21C     SUBBASIN T21C
 41          KM         RUNOFF FROM SUBBASIN T21C
 42          BA  0.0490
 43          LS              77
 44          UK     300   0.015    0.13     100
 45          RK    2040   0.017   0.045            TRAP       3       5
             *

 46          KK     CPC
 47          KM    COMBINE ROUTED RUNOFF FROM CPB WITH SUBBASIN T21C AT CPC
 48          HC       2
             *

 49          KK  CPCCPD
 50          KM    ROUTE HYDROGRAPH AT CPC TO CPD
 51          RD     710   0.009   0.025            TRAP       8     1.5
             *

 52          KK    T21D     SUBBASIN T21D
 53          KM         RUNOFF FROM SUBBASIN T21D
 54          KM    CN adjusted to reflect ADOT improvements per the following:
 55          KM       97.1% @ 77 and 2.9% @ 98
 56          BA  0.0406
 57          LS            77.6
 58          UK     300   0.015    0.13     100
 59          RK    2320   0.015   0.045            TRAP       5       10
             *

 60          KK     CPD
 61          KM    COMBINE ROUTED RUNOFF FROM CPC WITH SUBBASIN T21D AT CPD
 62          HC       2
             *
             *
             *   ROUTE HYDROGRAPH AT CPD TO CPE --- TOO SHORT TO ROUTE
             *
             *

 63          KK    T21E     SUBBASIN T21E
 64          KM         RUNOFF FROM SUBBASIN T21E
 65          KM    CN adjusted to reflect ADOT imprvmnts and Pima Rd per the following:
 66          KM       89.6% @ 77 and 10.4% @ 98
 67          BA  0.0380
 68          LS            79.2
 69          UK     300   0.015    0.13     100
 70          RK    2990   0.014   0.045            TRAP       5       10
             *
1                                          HEC-1 INPUT                                          PAGE  3
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 71          KK     CPE
 72          KM    COMBINE ROUTED RUNOFF FROM CPD WITH SUBBASIN T21E AT CPE
 73          HC       2
             *
 74          ZZ
1
            SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  21       T21A
             .
             .
  28         .        T21B
             .          .
             .          .
  34       CPB............
             V
             V
  37     CPBCPC
             .
             .
  40         .        T21C
             .          .
             .          .
  46       CPC............
             V
             V
  49     CPCCPD
             .
             .
  52         .        T21D
             .          .
             .          .
  60       CPD............
             .
```

```
                .
  63            .        T21E
                .          .
                .          .
  71         CPE............

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              MAY   1991               *
 *           VERSION 4.0.1E              *
 *     Lahey F77L-EM/32 version 5.01     *
 *       Dodson & Associates, Inc.       *
 *  RUN DATE  01/14/99  TIME  10:48:55   *
 *****************************************

                                                    ***************************************
                                                    *                                     *
                                                    *    U.S. ARMY CORPS OF ENGINEERS     *
                                                    *    HYDROLOGIC ENGINEERING CENTER    *
                                                    *          609 SECOND STREET          *
                                                    *       DAVIS, CALIFORNIA 95616       *
                                                    *           (916) 551-1748            *
                                                    *                                     *
                                                    ***************************************

                          TRACT 21 DRAINAGE CHANNEL
                          by Pentacore AZ                          File: t2110024.DAT
                              Project:  5009.0001                  Date: 01-14-99  wso

                          100-year, 24-hour storm

                              Ultimate condition hydrology assumes that onsite retention will be
                                provided within watershed upon development with peak discharges
                                maintained to pre-development conditions.

                              Includes tributary area from ADOT Loop 101 Pima Freeway as provided
                                by Premier Engineering.

                              Curve Numbers for subbasins T21D an T21E are adjusted to reflect
                                increased imperviousness due to existing Pima Rd pavement and
                                future ADOT improvements.


  20 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           3  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1    0  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ         720  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      3    0  ENDING DATE
                      NDTIME        1155  ENDING TIME
                       ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL    0.08 HOURS
                       TOTAL TIME BASE   59.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
  21 KK     *     T21A   *          SUBBASIN T21A
            *            *
            **************
                                RUNOFF FROM SUBBASIN T21A AT CPA

               SUBBASIN RUNOFF DATA

  23 BA          SUBBASIN CHARACTERISTICS
                       TAREA        0.01  SUBBASIN AREA

                 PRECIPITATION DATA

  24 PH                                 DEPTHS FOR   0-PERCENT HYPOTHETICAL STORM
                 ..... HYDRO-35 .....   ............... TP-40 ...............   ........... TP-49 ...........
                 5-MIN  15-MIN  60-MIN    2-HR    3-HR    6-HR   12-HR   24-HR   2-DAY   4-DAY   7-DAY  10-DAY
                  0.84    1.53    2.46    2.75    2.94    3.31    3.74    4.17    0.00    0.00    0.00    0.00

                                                STORM AREA =    0.01

  25 LS          SCS LOSS RATE
                       STRTL        0.60  INITIAL ABSTRACTION
                      CRVNBR       77.00  CURVE NUMBER
```

```
                RTIMP        0.00  PERCENT IMPERVIOUS AREA

            KINEMATIC WAVE
 26 UK        OVERLAND-FLOW ELEMENT NO. 1
                   L         300.  OVERLAND FLOW LENGTH
                   S      0.0150  SLOPE
                   N       0.130  ROUGHNESS COEFFICIENT
                  PA       100.0  PERCENT OF SUBBASIN
              DXMIN           5  MINIMUM NUMBER OF DX INTERVALS

            KINEMATIC WAVE
 27 RK        MAIN CHANNEL
                   L         520.  CHANNEL LENGTH
                   S      0.0150  SLOPE
                   N       0.045  CHANNEL ROUGHNESS COEFFICIENT
                  CA        0.01  CONTRIBUTING AREA
               SHAPE        TRAP  CHANNEL SHAPE
                  WD        4.00  BOTTOM WIDTH OR DIAMETER
                   Z        5.00  SIDE SLOPE
              NDXMIN           2  MINIMUM NUMBER OF DX INTERVALS
              RUPSTQ          NO  ROUTE UPSTREAM HYDROGRAPH

                                                  ***
                              COMPUTED KINEMATIC PARAMETERS
                                   VARIABLE TIME STEP
                                (DT SHOWN IS A MINIMUM)

              ELEMENT    ALPHA       M        DT        DX      PEAK    TIME TO     VOLUME    MAXIMUM
                                                                          PEAK                  CELERITY
                                                (MIN)      (FT)    (CFS)     (MIN)      (IN)      (FPS)

              PLANE1      1.40     1.67      2.24     60.00    14.15    730.08      1.94      0.45
              MAIN        1.35     1.35      0.96    173.33    13.78    732.22      1.94      3.62

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00  EXCESS=0.7471E+00 OUTFLOW=0.7441E+00 BASIN STORAGE=0.8452E-04 PERCENT ERROR=   0.4

                                   INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

              MAIN        1.35     1.35      5.00              13.07    730.00      1.93

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION     T21A

   TOTAL RAINFALL =    4.17, TOTAL LOSS =    2.22, TOTAL EXCESS =    1.95

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+     13.      12.17                1.          0.          0.          0.
                       (INCHES)   1.695       1.932       1.933       1.933
                        (AC-FT)     1.          1.          1.          1.

                       CUMULATIVE AREA =    0.01 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
 28 KK    *     T21B   *          SUBBASIN T21B
          *            *
          **************
                            RUNOFF FROM SUBBASIN T21B

            SUBBASIN RUNOFF DATA

 30 BA        SUBBASIN CHARACTERISTICS
                  TAREA        0.02  SUBBASIN AREA

              PRECIPITATION DATA

 24 PH                          DEPTHS FOR   0-PERCENT HYPOTHETICAL STORM
              ..... HYDRO-35 .....   ............... TP-40 ...............   ........... TP-49 ...........
              5-MIN  15-MIN  60-MIN    2-HR    3-HR    6-HR   12-HR   24-HR   2-DAY   4-DAY   7-DAY  10-DAY
               0.84    1.53    2.46    2.75    2.94    3.31    3.74    4.17    0.00    0.00    0.00    0.00

                                                STORM AREA =    0.02

 31 LS        SCS LOSS RATE
                  STRTL        0.60  INITIAL ABSTRACTION
                 CRVNBR       77.00  CURVE NUMBER
                  RTIMP        0.00  PERCENT IMPERVIOUS AREA

              KINEMATIC WAVE
 32 UK        OVERLAND-FLOW ELEMENT NO. 1
                   L         300.  OVERLAND FLOW LENGTH
                   S      0.0150  SLOPE
```

```
                    N       0.130  ROUGHNESS COEFFICIENT
                   PA       100.0  PERCENT OF SUBBASIN
                DXMIN           5  MINIMUM NUMBER OF DX INTERVALS

            KINEMATIC WAVE
 33 RK        MAIN CHANNEL
                    L       1380.  CHANNEL LENGTH
                    S      0.0130  SLOPE
                    N       0.045  CHANNEL ROUGHNESS COEFFICIENT
                   CA        0.02  CONTRIBUTING AREA
                SHAPE        TRAP  CHANNEL SHAPE
                   WD        4.00  BOTTOM WIDTH OR DIAMETER
                    Z        5.00  SIDE SLOPE
               NDXMIN           2  MINIMUM NUMBER OF DX INTERVALS
               RUPSTQ          NO  ROUTE UPSTREAM HYDROGRAPH

                                                   ***
                              COMPUTED KINEMATIC PARAMETERS
                                   VARIABLE TIME STEP
                                (DT SHOWN IS A MINIMUM)

                ELEMENT    ALPHA       M         DT        DX       PEAK    TIME TO      VOLUME    MAXIMUM
                                                                             PEAK                   CELERITY
                                                (MIN)      (FT)     (CFS)     (MIN)       (IN)      (FPS)

                PLANE1      1.40      1.67       2.24     60.00     34.98    730.08       1.94       0.45
                MAIN        1.26      1.35       1.94    460.00     32.54    734.45       1.94       4.24

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00  EXCESS=0.1847E+01 OUTFLOW=0.1838E+01 BASIN STORAGE=0.2190E-03 PERCENT ERROR=   0.5

                                        INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

                MAIN        1.26      1.35       5.00                32.07    735.00       1.94

     ***          ***          ***          ***          ***

                     HYDROGRAPH AT STATION     T21B

   TOTAL RAINFALL =    4.17, TOTAL LOSS =    2.22, TOTAL EXCESS =    1.95

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+     32.     12.25          3.          1.          0.          0.
                       (INCHES)      1.697       1.936       1.937       1.937
                        (AC-FT)         2.          2.          2.          2.

                       CUMULATIVE AREA =    0.02 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
 34 KK      *     CPB    *
            *            *
            **************
                     COMBINE RUNOFF FROM SUBBASINS T21A AND T21B AT CPB

 36 HC          HYDROGRAPH COMBINATION
                     ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                   ***

     ***          ***          ***          ***          ***

                     HYDROGRAPH AT STATION     CPB

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+     45.     12.25          5.          1.          1.          1.
                       (INCHES)      1.696       1.935       1.936       1.936
                        (AC-FT)         2.          3.          3.          3.

                       CUMULATIVE AREA =    0.02 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
 37 KK      *   CPBCPC   *
            *            *
```

```
**************
                ROUTE HYDROGRAPH AT CPB TO CPC

            HYDROGRAPH ROUTING DATA

 39 RD        MUSKINGUM-CUNGE CHANNEL ROUTING
                      L        650.  CHANNEL LENGTH
                      S     0.0090  SLOPE
                      N      0.025  CHANNEL ROUGHNESS COEFFICIENT
                     CA       0.00  CONTRIBUTING AREA
                  SHAPE       TRAP  CHANNEL SHAPE
                     WD       8.00  BOTTOM WIDTH OR DIAMETER
                      Z       1.50  SIDE SLOPE

                                                  ***
                         COMPUTED MUSKINGUM-CUNGE PARAMETERS
                              COMPUTATION TIME STEP
          ELEMENT    ALPHA      M        DT        DX       PEAK    TIME TO     VOLUME    MAXIMUM
                                                                      PEAK                  CELERITY
                                          (MIN)      (FT)     (CFS)    (MIN)       (IN)      (FPS)

           MAIN       1.72     1.44       1.99    325.00     42.88   735.81      1.94      5.43

                                   INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

           MAIN       1.72     1.44       5.00               42.64   735.00      1.93

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2581E+01 EXCESS=0.0000E+00 OUTFLOW=0.2581E+01 BASIN STORAGE=0.4225E-03 PERCENT ERROR=   0.0


     ***          ***          ***          ***          ***

                HYDROGRAPH AT STATION   CPBCPC

  PEAK FLOW     TIME                     MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+     43.      12.25                 5.          1.          1.          1.
                        (INCHES)  1.695       1.934       1.935       1.935
                         (AC-FT)     2.          3.          3.          3.

                       CUMULATIVE AREA =    0.02 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


**************
*            *
 40 KK      *      T21C  *          SUBBASIN T21C
*            *
**************
                         RUNOFF FROM SUBBASIN T21C

            SUBBASIN RUNOFF DATA

 42 BA        SUBBASIN CHARACTERISTICS
                   TAREA        0.05  SUBBASIN AREA

              PRECIPITATION DATA

 24 PH                          DEPTHS FOR   0-PERCENT HYPOTHETICAL STORM
              ..... HYDRO-35 .....   ............... TP-40 ...............   ........... TP-49 ...........
              5-MIN  15-MIN  60-MIN    2-HR    3-HR    6-HR   12-HR   24-HR   2-DAY   4-DAY   7-DAY  10-DAY
               0.84    1.53    2.46    2.75    2.94    3.31    3.74    4.17    0.00    0.00    0.00    0.00

                                          STORM AREA =    0.05

 43 LS        SCS LOSS RATE
                   STRTL        0.60  INITIAL ABSTRACTION
                  CRVNBR       77.00  CURVE NUMBER
                   RTIMP        0.00  PERCENT IMPERVIOUS AREA

              KINEMATIC WAVE
 44 UK          OVERLAND-FLOW ELEMENT NO. 1
                      L        300.  OVERLAND FLOW LENGTH
                      S      0.0150  SLOPE
                      N       0.130  ROUGHNESS COEFFICIENT
                     PA       100.0  PERCENT OF SUBBASIN
                  DXMIN           5  MINIMUM NUMBER OF DX INTERVALS

              KINEMATIC WAVE
 45 RK          MAIN CHANNEL
                      L       2040.  CHANNEL LENGTH
                      S      0.0170  SLOPE
                      N       0.045  CHANNEL ROUGHNESS COEFFICIENT
                     CA        0.05  CONTRIBUTING AREA
                  SHAPE        TRAP  CHANNEL SHAPE
```

```
                WD        3.00  BOTTOM WIDTH OR DIAMETER
                 Z        5.00  SIDE SLOPE
            NDXMIN           2  MINIMUM NUMBER OF DX INTERVALS
            RUPSTQ          NO  ROUTE UPSTREAM HYDROGRAPH

                                                  ***
                          COMPUTED KINEMATIC PARAMETERS
                               VARIABLE TIME STEP
                             (DT SHOWN IS A MINIMUM)

          ELEMENT    ALPHA       M         DT        DX       PEAK    TIME TO     VOLUME    MAXIMUM
                                                                        PEAK                  CELERITY
                                           (MIN)      (FT)     (CFS)    (MIN)       (IN)      (FPS)

          PLANE1      1.40      1.67       2.25     60.00     96.26   730.08       1.94       0.45
          MAIN        1.48      1.34       1.89    680.00     89.04   734.76       1.94       6.09

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00  EXCESS=0.5084E+01 OUTFLOW=0.5062E+01 BASIN STORAGE=0.6018E-03 PERCENT ERROR=   0.4

                                INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

          MAIN        1.48      1.34       5.00                88.43   735.00       1.94

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION     T21C

    TOTAL RAINFALL =    4.17, TOTAL LOSS =    2.22, TOTAL EXCESS =    1.95

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+     88.      12.25        9.          3.          1.          1.
                       (INCHES)     1.699       1.938       1.939       1.939
                        (AC-FT)       4.          5.          5.          5.

                       CUMULATIVE AREA =    0.05 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
  46 KK     *     CPC    *
            *            *
            **************
                    COMBINE ROUTED RUNOFF FROM CPB WITH SUBBASIN T21C AT CPC

  48 HC          HYDROGRAPH COMBINATION
                      ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                  ***

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION     CPC

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+    131.      12.25       14.          4.          2.          2.
                       (INCHES)     1.698       1.936       1.938       1.938
                        (AC-FT)       7.          8.          8.          8.

                       CUMULATIVE AREA =    0.07 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
  49 KK     *   CPCCPD   *
            *            *
            **************
                    ROUTE HYDROGRAPH AT CPC TO CPD

               HYDROGRAPH ROUTING DATA

  51 RD          MUSKINGUM-CUNGE CHANNEL ROUTING
                           L        710.  CHANNEL LENGTH
                           S     0.0090  SLOPE
                           N      0.025  CHANNEL ROUGHNESS COEFFICIENT
                          CA       0.00  CONTRIBUTING AREA
                       SHAPE       TRAP  CHANNEL SHAPE
```

```
                WD        8.00  BOTTOM WIDTH OR DIAMETER
                 Z        1.50  SIDE SLOPE

                                                  ***
                        COMPUTED MUSKINGUM-CUNGE PARAMETERS
                              COMPUTATION TIME STEP
        ELEMENT    ALPHA       M         DT        DX       PEAK    TIME TO     VOLUME    MAXIMUM
                                                                      PEAK                  CELERITY
                                                (MIN)      (FT)     (CFS)     (MIN)       (IN)      (FPS)

          MAIN      1.72      1.44       1.57    355.00    128.93    736.67      1.94      7.55


                              INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL


          MAIN      1.72      1.44       5.00              123.17    735.00      1.94

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.7651E+01 EXCESS=0.0000E+00 OUTFLOW=0.7650E+01 BASIN STORAGE=0.4564E-03 PERCENT ERROR=   0.0


   ***          ***          ***          ***          ***

                 HYDROGRAPH AT STATION   CPCCPD

 PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                              6-HR       24-HR       72-HR     59.92-HR
+   (CFS)      (HR)
                 (CFS)
+    123.     12.25            14.          4.          2.          2.
            (INCHES)         1.699       1.938       1.940       1.940
             (AC-FT)            7.          8.          8.          8.

            CUMULATIVE AREA =    0.07 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
 52 KK    *     T21D   *          SUBBASIN T21D
          *            *
          **************
                          RUNOFF FROM SUBBASIN T21D
                     CN adjusted to reflect ADOT improvements per the following:
                        97.1% @ 77 and 2.9% @ 98

            SUBBASIN RUNOFF DATA

 56 BA        SUBBASIN CHARACTERISTICS
                TAREA        0.04  SUBBASIN AREA

              PRECIPITATION DATA

 24 PH                          DEPTHS FOR   0-PERCENT HYPOTHETICAL STORM
            ..... HYDRO-35 .....   ............... TP-40 ...............   ........... TP-49 ...........
            5-MIN  15-MIN  60-MIN    2-HR    3-HR    6-HR   12-HR   24-HR   2-DAY   4-DAY   7-DAY  10-DAY
             0.84    1.53    2.46    2.75    2.94    3.31    3.74    4.17    0.00    0.00    0.00    0.00

                                              STORM AREA =    0.04

 57 LS        SCS LOSS RATE
                STRTL        0.58  INITIAL ABSTRACTION
               CRVNBR       77.60  CURVE NUMBER
                RTIMP        0.00  PERCENT IMPERVIOUS AREA

              KINEMATIC WAVE
 58 UK          OVERLAND-FLOW ELEMENT NO. 1
                    L        300.  OVERLAND FLOW LENGTH
                    S      0.0150  SLOPE
                    N       0.130  ROUGHNESS COEFFICIENT
                   PA       100.0  PERCENT OF SUBBASIN
                DXMIN           5  MINIMUM NUMBER OF DX INTERVALS

              KINEMATIC WAVE
 59 RK          MAIN CHANNEL
                    L       2320.  CHANNEL LENGTH
                    S      0.0150  SLOPE
                    N       0.045  CHANNEL ROUGHNESS COEFFICIENT
                   CA        0.04  CONTRIBUTING AREA
                SHAPE        TRAP  CHANNEL SHAPE
                   WD        5.00  BOTTOM WIDTH OR DIAMETER
                    Z        1.00  SIDE SLOPE
               NDXMIN           2  MINIMUM NUMBER OF DX INTERVALS
               RUPSTQ          NO  ROUTE UPSTREAM HYDROGRAPH

                                                  ***
                        COMPUTED KINEMATIC PARAMETERS
                              VARIABLE TIME STEP
                           (DT SHOWN IS A MINIMUM)
```

```
                ELEMENT    ALPHA      M        DT        DX       PEAK    TIME TO     VOLUME    MAXIMUM
                                                                          PEAK                  CELERITY
                                                (MIN)      (FT)     (CFS)    (MIN)      (IN)      (FPS)

                PLANE1      1.40      1.67      2.25     60.00     80.59   731.33      1.98      0.46
                MAIN        1.51      1.42      1.84    773.33     75.62   733.30      1.98      7.30

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00  EXCESS=0.4313E+01 OUTFLOW=0.4296E+01 BASIN STORAGE=0.5050E-03 PERCENT ERROR=   0.4

                                        INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

                MAIN        1.51      1.42      5.00                74.37   735.00      1.98

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION     T21D

   TOTAL RAINFALL =    4.17, TOTAL LOSS =    2.18, TOTAL EXCESS =    1.99

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                         (CFS)
+     74.      12.25                8.          2.          1.          1.
                       (INCHES)   1.739       1.982       1.984       1.984
                        (AC-FT)     4.          4.          4.          4.

                       CUMULATIVE AREA =    0.04 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  60 KK     *      CPD   *
            *            *
            **************
                        COMBINE ROUTED RUNOFF FROM CPC WITH SUBBASIN T21D AT CPD

  62 HC          HYDROGRAPH COMBINATION
                      ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                  ***

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION     CPD

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                         (CFS)
+    198.      12.25                21.         6.          2.          2.
                       (INCHES)   1.713       1.954       1.955       1.955
                        (AC-FT)    10.         12.         12.         12.

                       CUMULATIVE AREA =    0.11 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  63 KK     *      T21E  *          SUBBASIN T21E
            *            *
            **************
                             RUNOFF FROM SUBBASIN T21E
                        CN adjusted to reflect ADOT imprvmnts and Pima Rd per the following:
                           89.6% @ 77 and 10.4% @ 98

              SUBBASIN RUNOFF DATA

  67 BA         SUBBASIN CHARACTERISTICS
                      TAREA        0.04  SUBBASIN AREA

                PRECIPITATION DATA

  24 PH                            DEPTHS FOR   0-PERCENT HYPOTHETICAL STORM
                ..... HYDRO-35 .....   ............... TP-40 ...............   ........... TP-49 ...........
                5-MIN  15-MIN  60-MIN    2-HR    3-HR    6-HR   12-HR   24-HR   2-DAY   4-DAY   7-DAY  10-DAY
                 0.84    1.53    2.46    2.75    2.94    3.31    3.74    4.17    0.00    0.00    0.00    0.00

                                                STORM AREA =    0.04

  68 LS         SCS LOSS RATE
```

```
                    STRTL        0.53  INITIAL ABSTRACTION
                   CRVNBR       79.20  CURVE NUMBER
                    RTIMP        0.00  PERCENT IMPERVIOUS AREA

                KINEMATIC WAVE
 69 UK            OVERLAND-FLOW ELEMENT NO. 1
                        L        300.  OVERLAND FLOW LENGTH
                        S      0.0150  SLOPE
                        N       0.130  ROUGHNESS COEFFICIENT
                       PA       100.0  PERCENT OF SUBBASIN
                    DXMIN           5  MINIMUM NUMBER OF DX INTERVALS

                KINEMATIC WAVE
 70 RK            MAIN CHANNEL
                        L       2990.  CHANNEL LENGTH
                        S      0.0140  SLOPE
                        N       0.045  CHANNEL ROUGHNESS COEFFICIENT
                       CA        0.04  CONTRIBUTING AREA
                    SHAPE        TRAP  CHANNEL SHAPE
                       WD        5.00  BOTTOM WIDTH OR DIAMETER
                        Z        1.00  SIDE SLOPE
                   NDXMIN           2  MINIMUM NUMBER OF DX INTERVALS
                   RUPSTQ          NO  ROUTE UPSTREAM HYDROGRAPH

                                                        ***
                                  COMPUTED KINEMATIC PARAMETERS
                                       VARIABLE TIME STEP
                                     (DT SHOWN IS A MINIMUM)

                 ELEMENT    ALPHA       M         DT        DX       PEAK    TIME TO     VOLUME    MAXIMUM
                                                                              PEAK                  CELERITY
                                                  (MIN)      (FT)     (CFS)    (MIN)       (IN)      (FPS)

                 PLANE1      1.40      1.67       2.18     60.00     83.41   730.42       2.11       0.47
                 MAIN        1.46      1.42       2.41    996.67     73.25   733.53       2.11       7.04

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00  EXCESS=0.4293E+01 OUTFLOW=0.4274E+01 BASIN STORAGE=0.5399E-03 PERCENT ERROR=   0.4

                                  INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

                 MAIN        1.46      1.42       5.00               73.07   735.00       2.11

     ***          ***          ***          ***          ***

                     HYDROGRAPH AT STATION     T21E

   TOTAL RAINFALL =    4.17, TOTAL LOSS =    2.05, TOTAL EXCESS =    2.12

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+     73.      12.25        8.          2.          1.          1.
                       (INCHES)     1.851       2.107       2.108       2.108
                        (AC-FT)       4.          4.          4.          4.

                       CUMULATIVE AREA =    0.04 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
 71 KK      *     CPE    *
            *            *
            **************
                     COMBINE ROUTED RUNOFF FROM CPD WITH SUBBASIN T21E AT CPE

 73 HC          HYDROGRAPH COMBINATION
                    ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                        ***

     ***          ***          ***          ***          ***

                     HYDROGRAPH AT STATION     CPE

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     59.92-HR
+   (CFS)       (HR)
                          (CFS)
+    271.      12.25       29.          8.          3.          3.
                       (INCHES)     1.747       1.992       1.993       1.993
                        (AC-FT)      14.         16.         16.         16.

                       CUMULATIVE AREA =    0.15 SQ MI

1
                                                RUNOFF SUMMARY
```

FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	T21A	13.	12.17	1.	0.	0.	0.01		
+	HYDROGRAPH AT	T21B	32.	12.25	3.	1.	0.	0.02		
+	2 COMBINED AT	CPB	45.	12.25	5.	1.	1.	0.02		
+	ROUTED TO	CPBCPC	43.	12.25	5.	1.	1.	0.02		
+	HYDROGRAPH AT	T21C	88.	12.25	9.	3.	1.	0.05		
+	2 COMBINED AT	CPC	131.	12.25	14.	4.	2.	0.07		
+	ROUTED TO	CPCCPD	123.	12.25	14.	4.	2.	0.07		
+	HYDROGRAPH AT	T21D	74.	12.25	8.	2.	1.	0.04		
+	2 COMBINED AT	CPD	198.	12.25	21.	6.	2.	0.11		
+	HYDROGRAPH AT	T21E	73.	12.25	8.	2.	1.	0.04		
+	2 COMBINED AT	CPE	271.	12.25	29.	8.	3.	0.15		

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
T21A	MANE	0.96	13.78	732.22	1.94	5.00	13.07	730.00	1.93

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.7471E+00 OUTFLOW=0.7441E+00 BASIN STORAGE=0.8452E-04 PERCENT ERROR= 0.4

T21B	MANE	1.94	32.54	734.45	1.94	5.00	32.07	735.00	1.94

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.1847E+01 OUTFLOW=0.1838E+01 BASIN STORAGE=0.2190E-03 PERCENT ERROR= 0.5

CPBCPC	MANE	1.99	42.88	735.81	1.94	5.00	42.64	735.00	1.93

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2581E+01 EXCESS=0.0000E+00 OUTFLOW=0.2581E+01 BASIN STORAGE=0.4225E-03 PERCENT ERROR= 0.0

T21C	MANE	1.89	89.04	734.76	1.94	5.00	88.43	735.00	1.94

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.5084E+01 OUTFLOW=0.5062E+01 BASIN STORAGE=0.6018E-03 PERCENT ERROR= 0.4

CPCCPD	MANE	1.57	128.93	736.67	1.94	5.00	123.17	735.00	1.94

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.7651E+01 EXCESS=0.0000E+00 OUTFLOW=0.7650E+01 BASIN STORAGE=0.4564E-03 PERCENT ERROR= 0.0

T21D	MANE	1.84	75.62	733.30	1.98	5.00	74.37	735.00	1.98

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.4313E+01 OUTFLOW=0.4296E+01 BASIN STORAGE=0.5050E-03 PERCENT ERROR= 0.4

T21E	MANE	2.41	73.25	733.53	2.11	5.00	73.07	735.00	2.11

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.4293E+01 OUTFLOW=0.4274E+01 BASIN STORAGE=0.5399E-03 PERCENT ERROR= 0.4

*** NORMAL END OF HEC-1 ***

Appendix D

Hydraulic Analyses Reference Data

Edit Manning's n or k Values

River: Tract 21 Channel

Reach: Reach 1

☑ Edit Interpolated XS's

Selected Area Global Edits

Add Constant | Multiply Factor | Set Values

	River Sta	Frctn (n/K)	n #1	n #2	n #3	n #4
1	12350	n	.03	.025	.03	
2	12110	n	.03	.025	.03	
3	12090	n	.03	.035	.03	
4	12085.*	n	.03	.035	.03	.03
5	12080.*	n	.03	.035	.03	.03
6	12075.*	n	.03	.035	.03	.03
7	12070	n	.03	.035	.03	
8	12020	n	.03	.025	.03	
9	12015	n	.03	.025	.03	
10	11755	n	.03	.025	.03	
11	11750	n	.03	.022	.03	
12	11745.*	n	.03	.022	.03	.03
13	11740.*	n	.03	.022	.03	.03
14	11735.*	n	.03	.022	.03	.03
15	11730	n	.03	.022	.03	
16	11720.*	n	.03	.022	.03	
17	11700.*	n	.03	.022	.03	
18	11680	n	.03	.022	.03	
19	11260	n	.03	.022	.03	
20	11230	n	.03	.022	.03	
21	11070	n	.03	.022	.03	
22	11030	n	.03	.022	.03	
23	10950	n	.03	.022	.03	
24	10840	n	.03	.022	.03	
25	10790	n	.03	.022	.03	
26	10550	n	.03	.022	.03	
27	10450	n	.03	.022	.03	
28	10440.*	n	.03	.022	.03	.03
29	10430.*	n	.03	.022	.03	.03
30	10420.*	n	.03	.022	.03	.03
31	10410.*	n	.03	.022	.03	.03
32	10400.*	n	.03	.022	.03	.03
33	10390	n	.03	.022	.03	
34	10364.*	n	.03	.022	.03	
35	10338.*	n	.03	.022	.03	
36	10312	n	.03	.022	.03	
37	10302	n	.03	.015	.03	
38	10187.5	Culvert				
39	10072	n	.03	.015	.03	
40	10050	n	.03	.022	.03	
41	10000	n	.03	.022	.03	
42	9850	n	.03	.022	.03	

OK | Cancel | Help

Edit Contraction/Expansion Coefficients

River: Tract 21 Channel ☑ Edit Interpolated XS's

Reach: Reach 1

Selected Area Global Edits

Add Constant | Multiply Factor | Set Values

	River Sta	Contraction	Expansion
1	12350	.1	.3
2	12110	.1	.3
3	12090	.1	.3
4	12085.*	.1	.3
5	12080.*	.1	.3
6	12075.*	.1	.3
7	12070	.3	.5
8	12020	.1	.3
9	12015	.1	.3
10	11755	.1	.3
11	11750	.1	.3
12	11745.*	.1	.3
13	11740.*	.1	.3
14	11735.*	.1	.3
15	11730	.3	.5
16	11720.*	.3	.5
17	11700.*	.3	.5
18	11680	.1	.3
19	11260	.1	.3
20	11230	.1	.3
21	11070	.1	.3
22	11030	.1	.3
23	10950	.1	.3
24	10840	.1	.3
25	10790	.1	.3
26	10550	.1	.3
27	10450	.1	.3
28	10440.*	.1	.3
29	10430.*	.1	.3
30	10420.*	.1	.3
31	10410.*	.1	.3
32	10400.*	.1	.3
33	10390	.3	.5
34	10364.*	.3	.5
35	10338.*	.3	.5
36	10312	.3	.5
37	10302	.3	.5
38	10187.5	Culvert	
39	10072	.3	.5
40	10050	.1	.3
41	10000	.1	.3
42	9850	.1	.3

OK | Cancel | Help

HEC-RAS Station	Plan Station
12350	1100
12110	1340
12090	1360
12070	1380
12020	1430
12015	1435
11755	1695
11750	1700
11745	1705
11740	1710
11735	1715
11730	1720
11720	1730
11700	1750
11680	1770
11260	2190
11230	2220
11070	2380
11030	2420
10950	2500
10840	2610
10790	2660
10550	2900
10450	3000
10440	3010
10430	3020
10420	3030
10410	3040
10400	3050
10390	3060
10377	3073
10364	3086
10351	3099
10338	3112
10325	3125
10312	3138
10302	3148
10187.5	3262.5
10072	3378
10050	3400
10000	3450
9850	3600

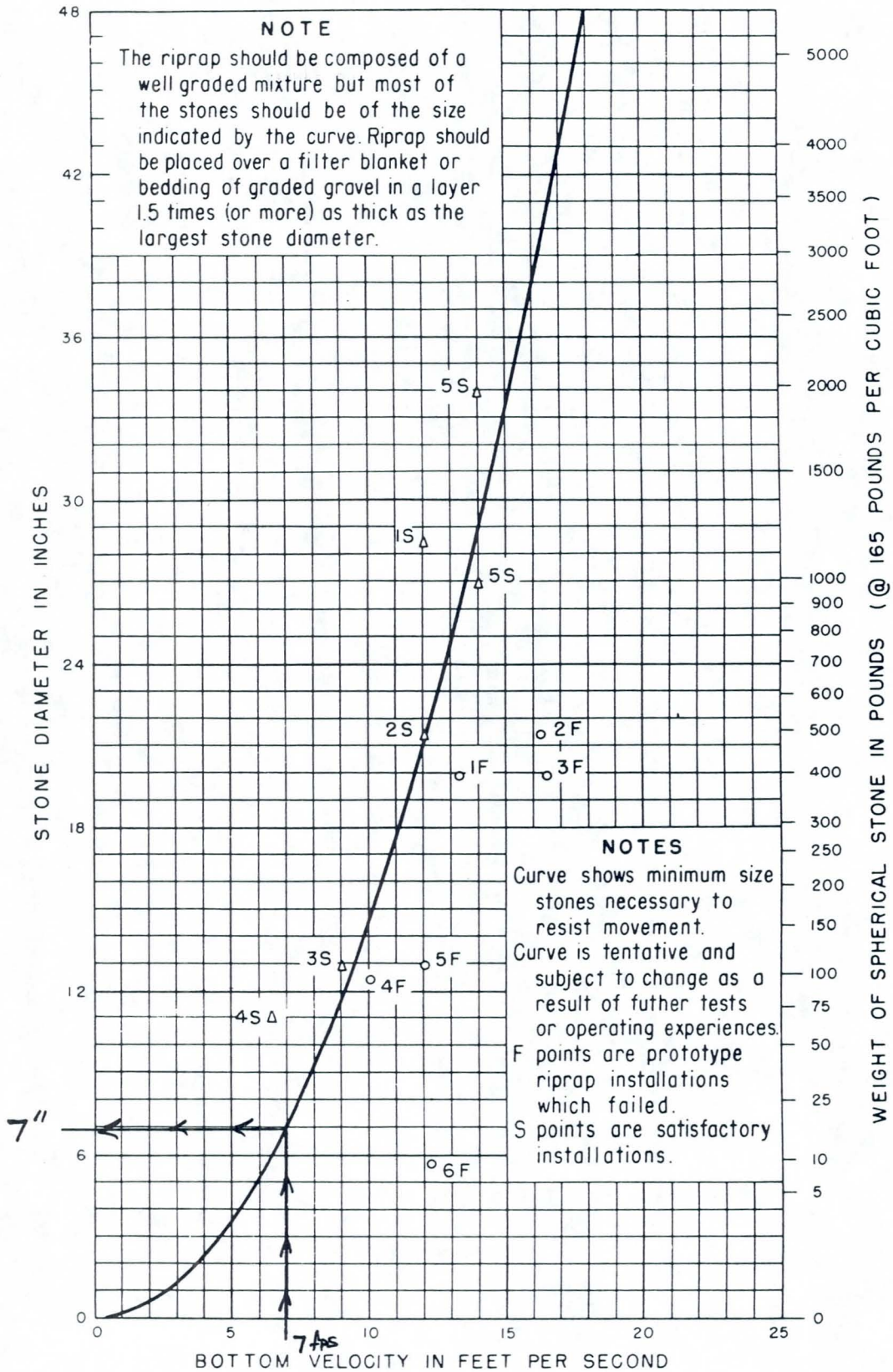
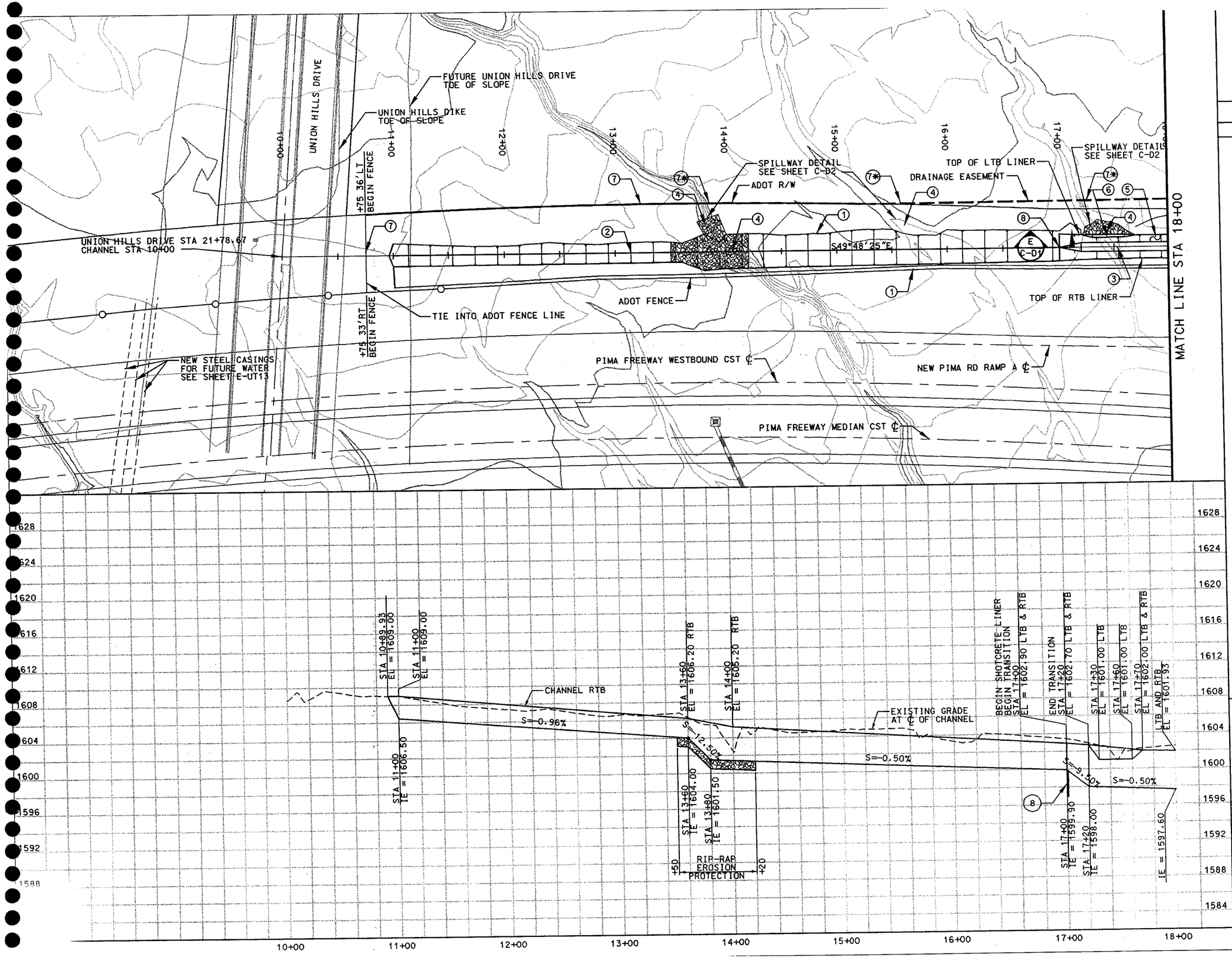


FIGURE 165.—*Curve to determine maximum stone size in riprap mixture.*

Appendix E

Schedule C - Tract 21 Drainage Construction Drawings



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Civil Engineering · Construction Administration
Land Surveying · Planning · ADA Consulting
2255 No. 44th St., SUITE 255 Phoenix, AZ 85008
TELEPHONE (602) 681-9272 FAX (602) 681-9339

CONSTRUCTION NOTES:

DESCRIPTION	Unit	Quan.
① GRADE CHANNEL TO LIMITS SHOWN PER DETAIL (B/C-D1) (C/C-D1) — CUT	CY	1,105
FILL	CY	204
② CONSTRUCT NATURAL V-DITCH CHANNEL PER DETAIL (B/C-D1)		
③ CONSTRUCT SHOTCRETE CHANNEL LINING PER DETAIL (C/C-D1)	SF	2,445
④ PROVIDE RIP-RAP EROSION PROTECTION PER DETAIL SHEET C-D2	CY	240
⑤ INSTALL WEEP HOLES PER DETAIL (D/C-D1) AT 20' O.C.	EA	10
⑥ CONSTRUCT SPILLWAY PER DETAIL SHEET C-D2		
⑦ CONSTRUCT CHAIN LINK FENCE PER ADOT STD DETAIL C-12.20 * PROVIDE UNHINGED GATE SECTION WHEN SPANNING WASHES UPSTREAM OF SPILLWAY	LF	800
⑧ CONSTRUCT 2' TOE DOWN PER DETAIL (E/C-D3)		

40 0 40 80

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT (OUTSIDE MARICOPA COUNTY)

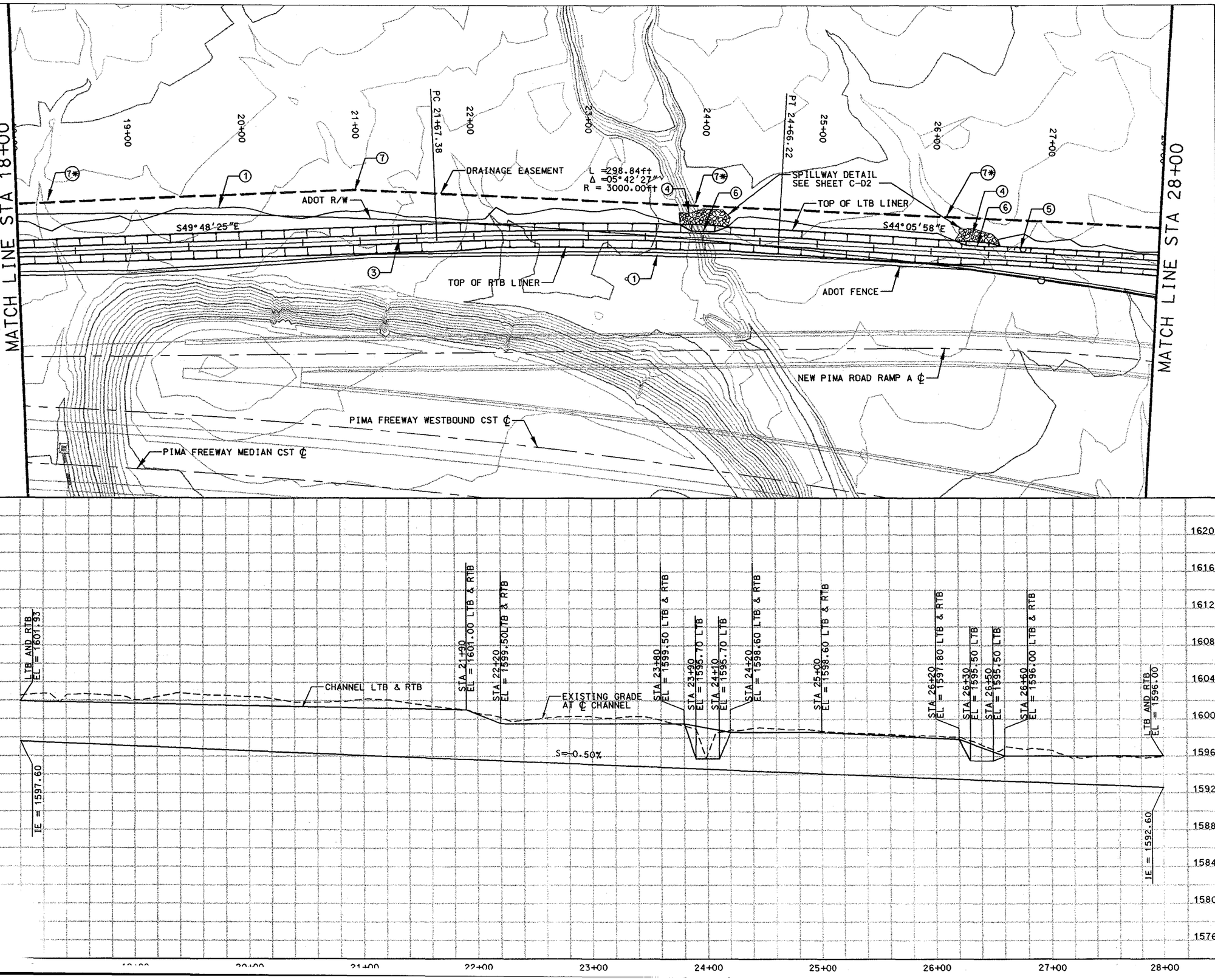
NOT FOR CONSTRUCTION

DATE	REVISION	BY
ENGINEER		

TRANSPORTATION DEPARTMENT
TRANSPORTATION PLANNING
3939 CIVIC CENTER BLVD.
SCOTTSDALE, ARIZONA 85251

PROJECT TITLE: DESERT GREENBELT PIMA ROAD 3 BASINS SCHEDULE C – TRACT 21 DRAINAGE PLAN AND PROFILE

SCALE	DESIGNED BY	DATE	BID NO.	SHT.
HORIZ. 1"=40' VERT. 1"=5'	WSO	03/17/99		C-C1
	DRAWN BY TJC	AS-BUILT	PROJECT NO. 5009.0001	OF



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CONSTRUCTION NOTES:

DESCRIPTION		Unit	Quan.
① GRADE CHANNEL TO LIMITS SHOWN PER DETAIL (C / C-D1)	CUT	CY	3,414
	FILL	CY	26
③ CONSTRUCT SHOTCRETE CHANNEL LINING PER DETAIL (C / C-D1)		SF	29,731
④ PROVIDE RIP-RAP EROSION PROTECTION PER DETAIL SHEET C-D2		CY	55
⑤ INSTALL WEEP HOLES PER DETAIL (E / C-D2) AT 20' O.C.		EA	100
⑥ INSTALL SPILLWAY PER DETAIL SHEET C-D2			
⑦ CONSTRUCT CHAIN LINK FENCE PER ADOT STD DETAIL C-12.20 * PROVIDE UNHINGED GATE SECTION WHEN SPANNING WASHES UPSTREAM OF SPILLWAY		LF	1,004

40 0 40 80

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1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

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DATE	REVISION	BY

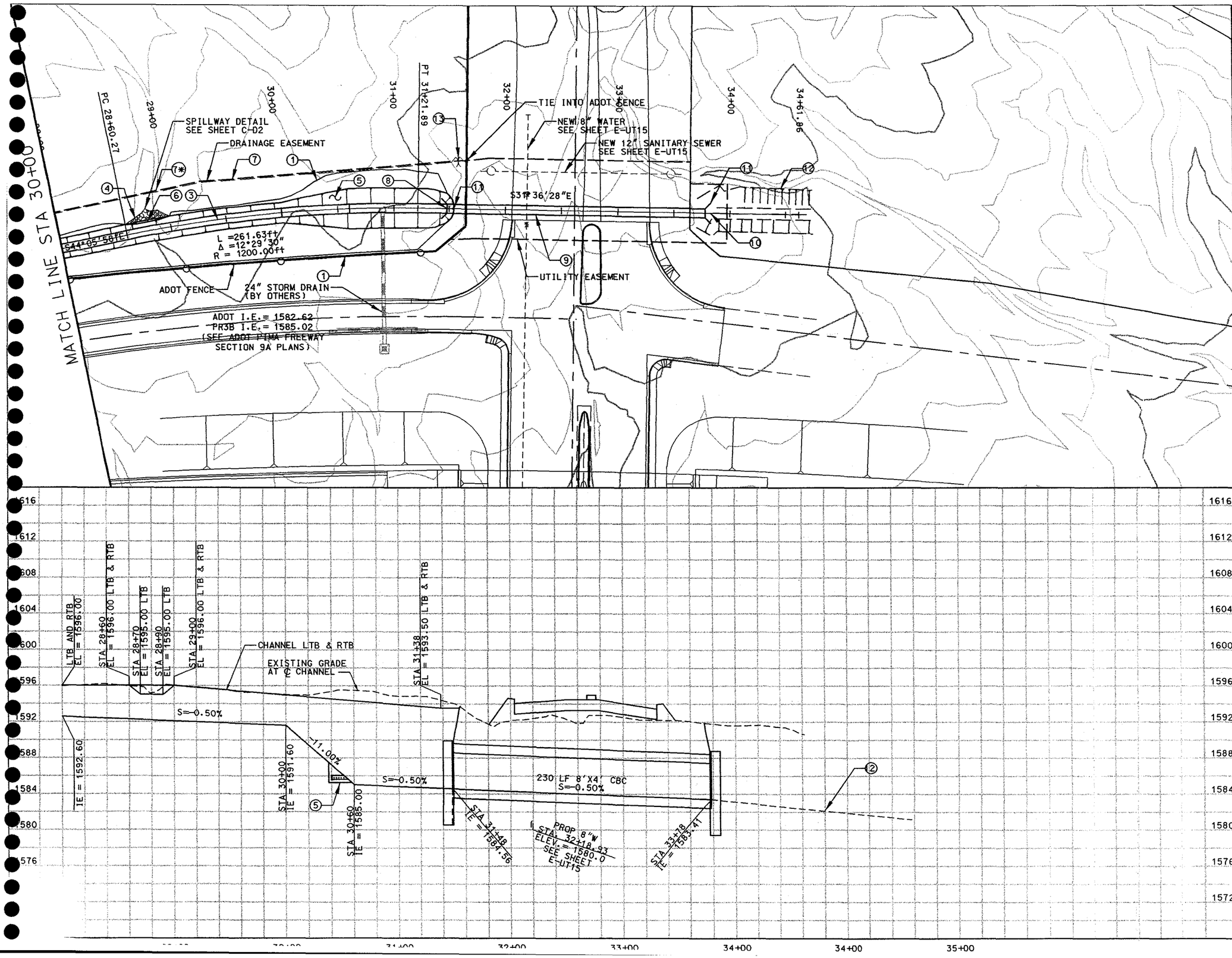
ENGINEER

CITY OF SCOTTSDALE ARIZONA

TRANSPORTATION DEPARTMENT
TRANSPORTATION PLANNING
3939 CIVIC CENTER BLVD.
SCOTTSDALE, ARIZONA 85251

PROJECT TITLE DESERT GREENBELT PIMA ROAD 3 BASINS
SCHEDULE C – TRACT 21 DRAINAGE
PLAN AND PROFILE

SCALE	DESIGNED BY	DATE	BID NO.	SHT.
HORIZ. 1"=40'	WSO	03/17/99		C-C2
VERT. 1"=5'	DRAWN BY TJC	AS-BUILT	PROJECT NO. 5009.0001	OF



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TELEPHONE (602) 681-9272 FAX (602) 681-9339

CONSTRUCTION NOTES:

DESCRIPTION	Unit	Quan.
① GRADE CHANNEL TO LIMITS SHOWN PER DETAIL (C / C-D1) — CUT	CY	1,751
FILL	CY	81
③ CONSTRUCT SHOTCRETE CHANNEL LINING PER DETAIL (C / C-D1)	SF	2,758
④ PROVIDE RIP-RAP EROSION PROTECTION PER DETAIL SHEET C-D2	CY	11
⑤ INSTALL WEEP HOLES PER DETAIL (E / C-D1) AT 20' O.C.	EA	35
⑥ INSTALL SPILLWAY PER DETAIL SEE SHEET C-D2		
⑦ CONSTRUCT CHAIN LINK FENCE PER ADOT STD DETAIL C-12.20 * PROVIDE UNHINGED GATE SECTION WHEN SPANNING WASHES UPSTREAM OF SPILLWAY	LF	372
⑧ CONSTRUCT HEADWALL AND WINGWALLS PER DETAIL (1 / C-D3)	EA	1
⑨ CONSTRUCT 8'X4' CBC PER ADOT STD DRAWING B-02.10 AND DETAIL (1 / C-D3)	LF	230
⑩ CONSTRUCT HEADWALL AND WINGWALL PER ADOT STD DRAWING B-08.10 TYPE A. L =10'	EA	1
⑪ CONSTRUCT HANDRAIL PER COS STD DETAIL 2508 AND DETAIL SHEET C-D3	LF	29
⑫ CONTINUATION OF CHANNEL BY OTHERS		
⑬ INSTALL 12' DOUBLE SWING GATE	EA	1

40 0 40 80

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

NOT FOR CONSTRUCTION

DATE	REVISION	BY

ENGINEER

CITY OF SCOTTSDALE ARIZONA

TRANSPORTATION DEPARTMENT
TRANSPORTATION PLANNING
3939 CIVIC CENTER BLVD.
SCOTTSDALE, ARIZONA 85251

PROJECT TITLE: DESERT GREENBELT PIMA ROAD 3 BASINS
SCHEDULE C – TRACT 21 DRAINAGE
PLAN AND PROFILE

SCALE	DESIGNED BY	DATE	BID NO.	SHT.
HORIZ. 1"=40'	WSO	03/17/99		C-C3
VERT. 1"=5'	DRAWN BY	AS-BUILT	PROJECT NO. 5008.0001	OF

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Land Surveying · Planning · ADA Consulting
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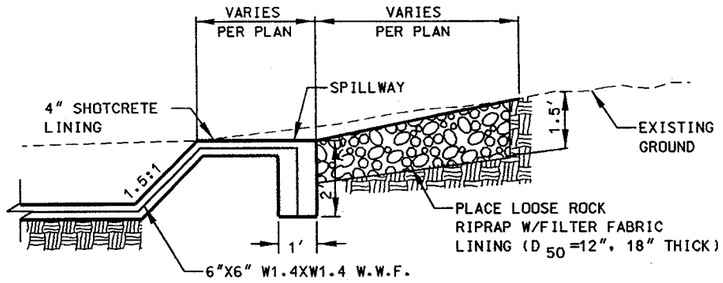
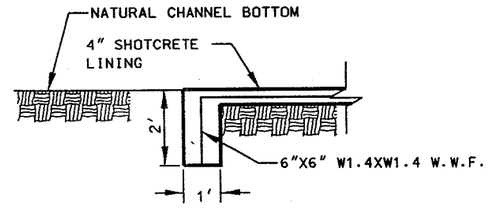
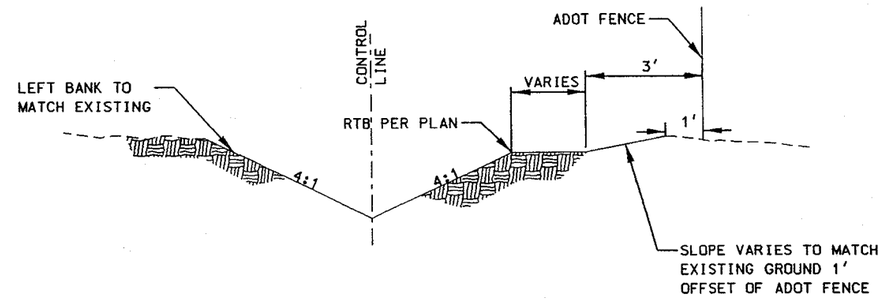


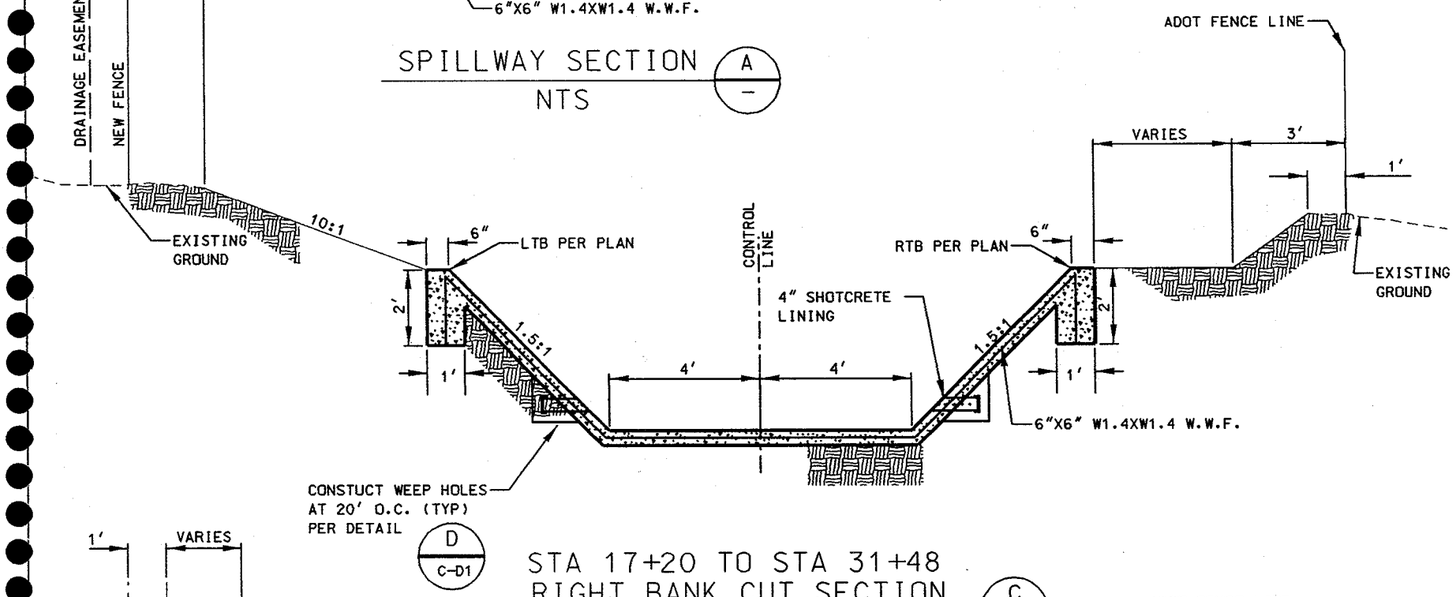
SPILLWAY SECTION (A / –)
NTS



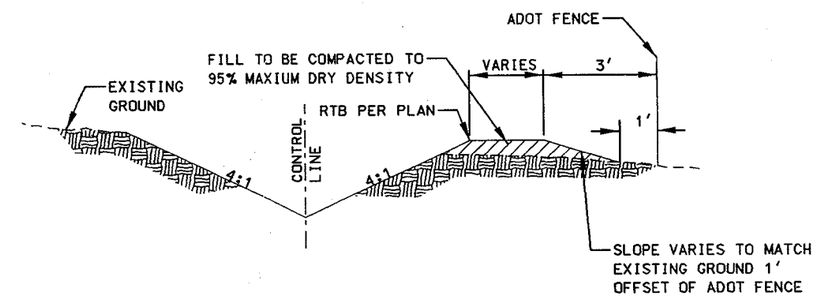
TOE DOWN SECTION STA 17+00 (E / –)
NTS



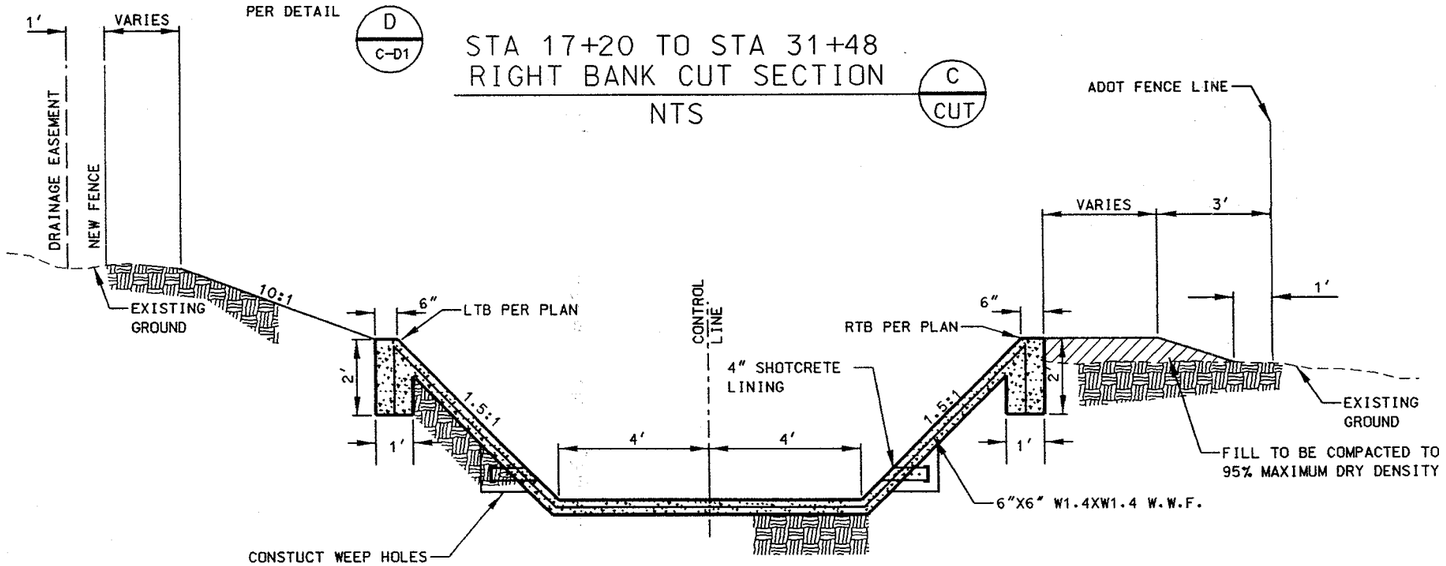
STA 11+00 TO STA 17+00
RIGHT BANK CUT SECTION (B / CUT)
NTS



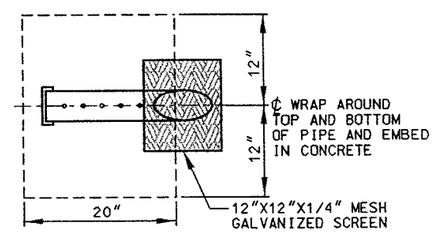
STA 17+20 TO STA 31+48
RIGHT BANK CUT SECTION (C / CUT)
NTS

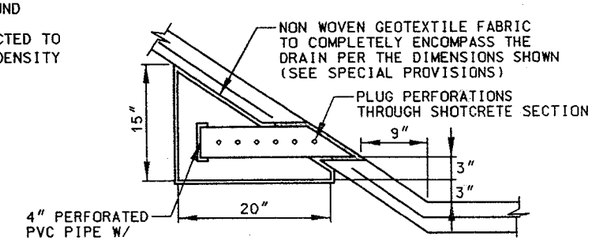


STA 11+00 TO STA 17+00
RIGHT BANK FILL SECTION (B / FILL)
NTS



STA 17+20 TO STA 31+48
RIGHT BANK FILL SECTION (C / FILL)
NTS





WEEP HOLES (D / –)
NTS

NOT FOR CONSTRUCTION

DATE	REVISION	BY
ENGINEER		

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TRANSPORTATION PLANNING
3939 CIVIC CENTER BLVD.
SCOTTSDALE, ARIZONA 8525

PROJECT TITLE DESERT GREENBELT PIMA ROAD 3 BASINS
SCHEDULE C – TRACT 21 DRAINAGE
TYPICAL SECTIONS

SCALE	DESIGNED BY	DATE	BID NO.	SHT C-D1
HORIZ. NTS	WSO	03/17/99		
VERT. NTS	DRAWN BY JEB	AS-BUILT	PROJECT NO. 5009.0001	OF

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Civil Engineering · Construction Administration
Land Surveying · Planning · ADA Consulting
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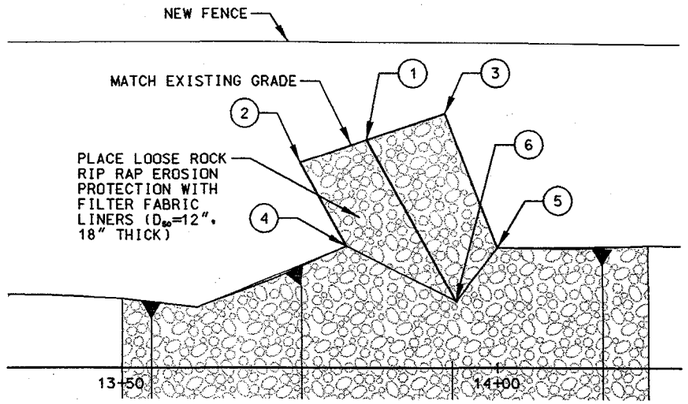
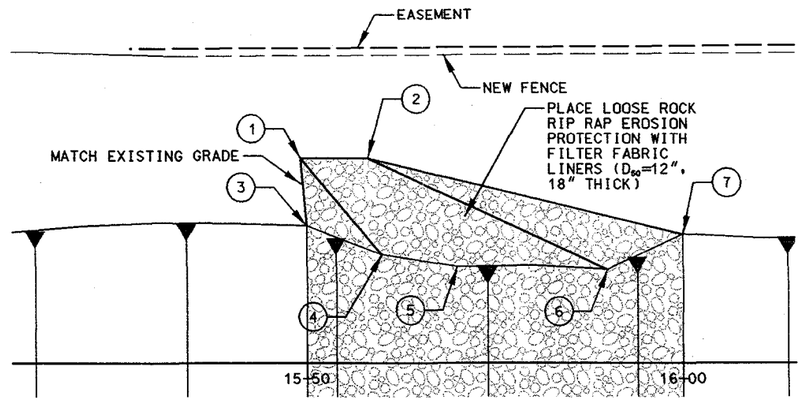
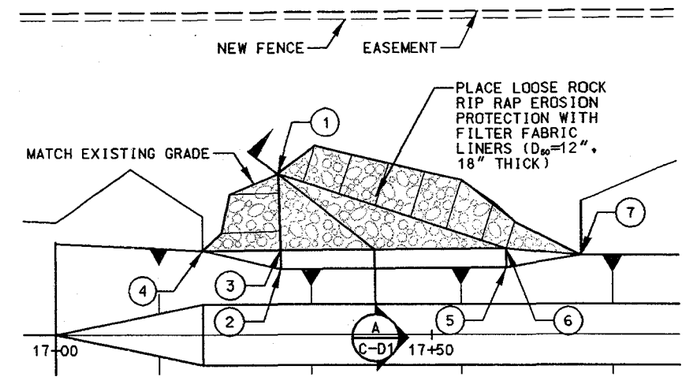
TELEPHONE (602) 681-9272 FAX (602) 681-9339



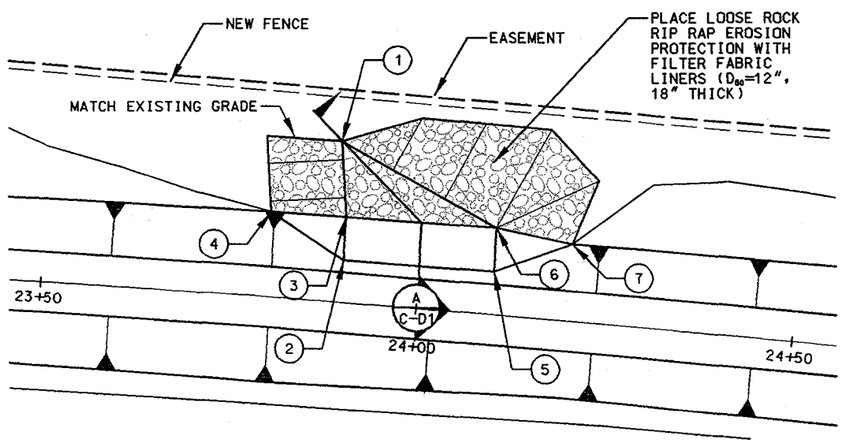
PT NO.	STA	OFFSET	ELEV
1	13+82.73	30.00 LT	1602.54
2	13+73.87	27.04 LT	1605.53
3	13+93.06	33.45 LT	1605.57
4	13+80.00	16.05 LT	1605.51
5	14+00.00	15.80 LT	1605.35
6	13+94.50	8.71 LT	1602.49



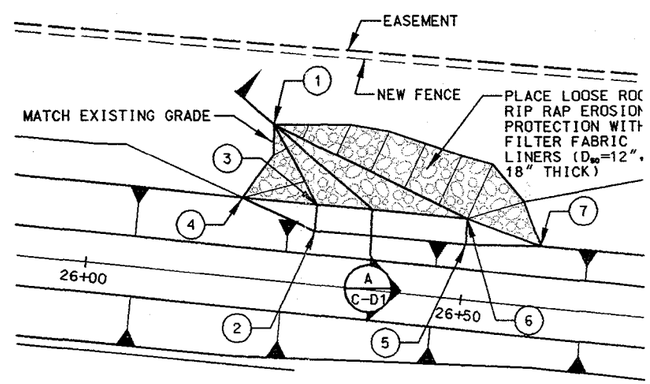
PT NO.	STA	OFFSET	ELEV
1	15+49.19	27.00 LT	1604.00
2	15+58.19	27.00 LT	1604.00
3	15+50.00	18.07 LT	1605.17
4	15+60.00	14.32 LT	1604.18
5	15+70.00	12.68 LT	1603.72
6	15+90.00	12.29 LT	1603.52
7	16+00.00	16.99 LT	1604.65



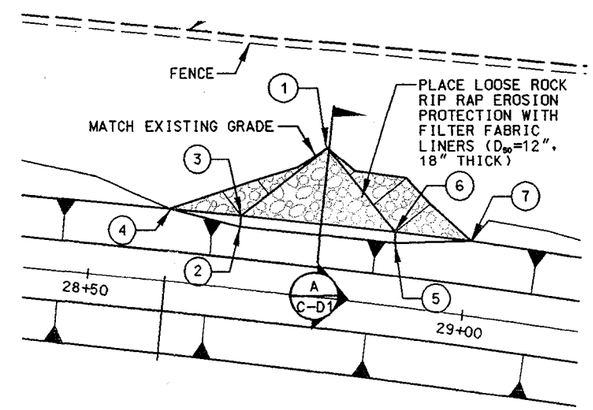
PT NO.	STA	OFFSET	ELEV
1	17+29.69	21.12 LT	1601.60
2	17+30.00	8.57 LT	1601.00
3	17+30.00	11.12 LT	1601.00
4	17+20.00	11.05 LT	1602.70
5	17+60.00	8.80 LT	1601.00
6	17+60.00	11.35 LT	1601.00
7	17+70.00	10.37 LT	1602.00



PT NO.	STA	OFFSET	ELEV
1	23+88.81	21.27 LT	1596.21
2	23+90.00	5.58 LT	1595.70
3	23+90.00	11.27 LT	1595.70
4	23+80.00	11.20 LT	1599.50
5	24+10.00	5.72 LT	1595.70
6	24+10.00	11.42 LT	1595.70
7	24+20.00	10.15 LT	1598.60



PT NO.	STA	OFFSET	ELEV
1	26+23.18	20.47 LT	1596.77
2	26+30.00	7.07 LT	1595.50
3	26+30.00	10.52 LT	1595.50
4	26+20.00	10.45 LT	1597.80
5	26+50.00	7.23 LT	1595.50
6	26+50.00	10.67 LT	1595.50
7	26+60.00	8.05 LT	1596.00



PT NO.	STA	OFFSET	ELEV
1	28+79.92	19.66 LT	1595.44
2	28+70.00	8.12 LT	1595.00
3	28+70.00	9.63 LT	1595.00
4	28+60.27	9.51 LT	1595.97
5	28+90.00	8.28 LT	1595.00
6	28+90.00	9.78 LT	1595.00
7	29+00.00	9.85 LT	1596.00

NOT FOR CONSTRUCTION

DATE	REVISION	BY
ENGINEER		

TRANSPORTATION DEPARTMENT
TRANSPORTATION PLANNING
3939 CIVIC CENTER BLVD.
SCOTTSDALE, ARIZONA 85251

PROJECT TITLE DESERT GREENBELT PIMA ROAD 3 BASINS
SCHEDULE C – TRACT 21 DRAINAGE
SPILLWAY DETAILS

SCALE	DESIGNED BY	DATE	BID NO.	SHT. C-D2
HORIZ. 1"=10'	WSO	03/17/99		
VERT. NTS	DRAWN BY JEB	AS-BUILT	PROJECT NO. 5009.0001	OF

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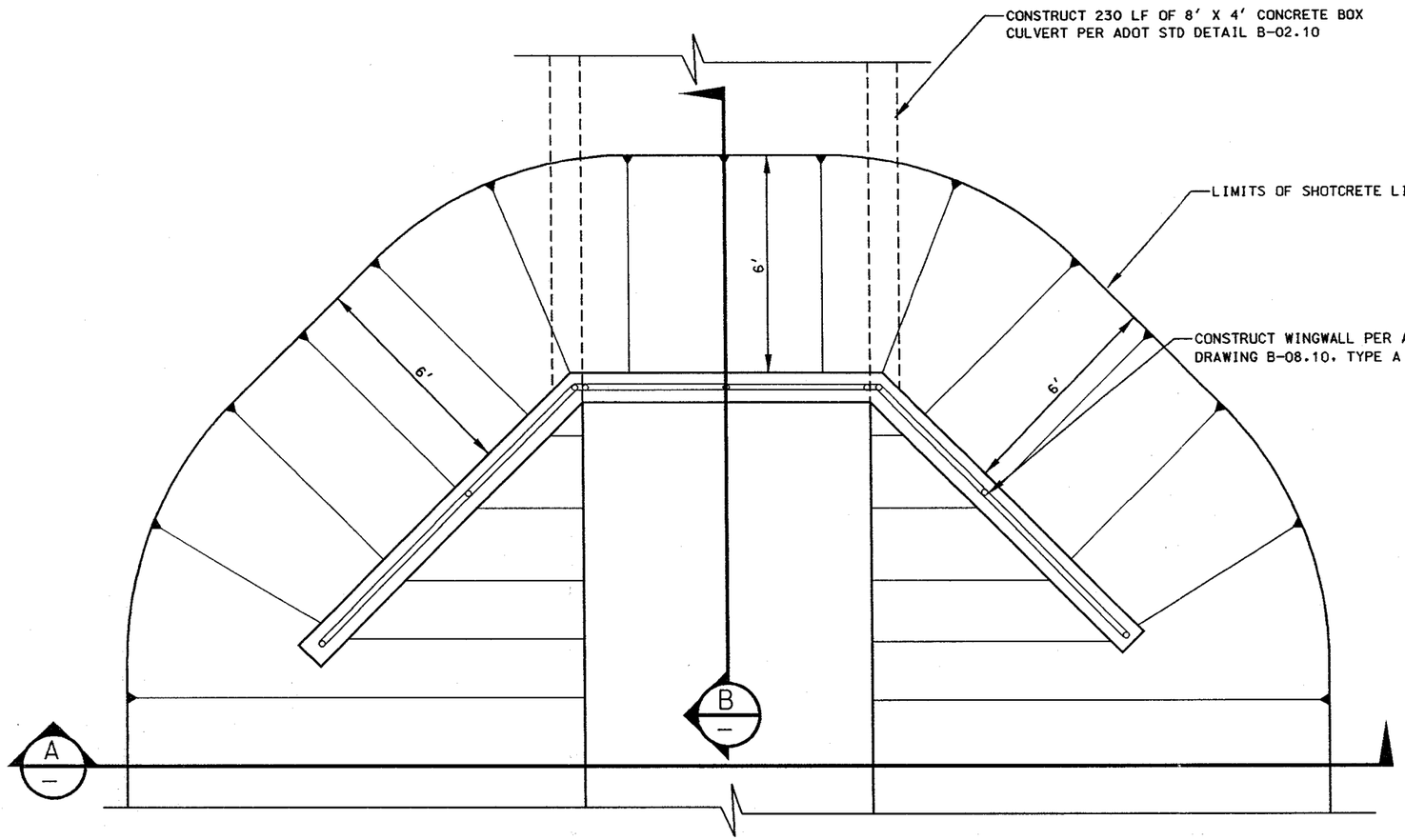
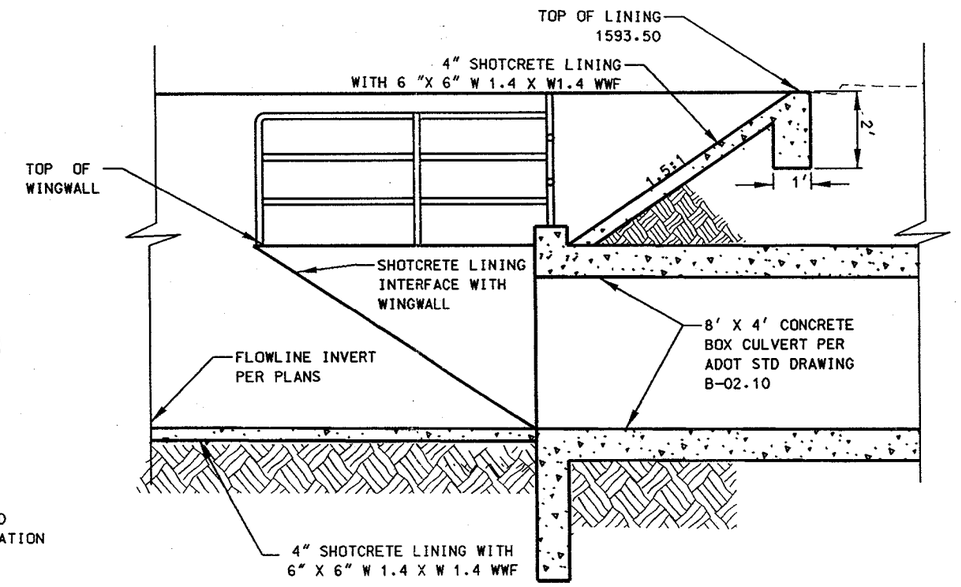
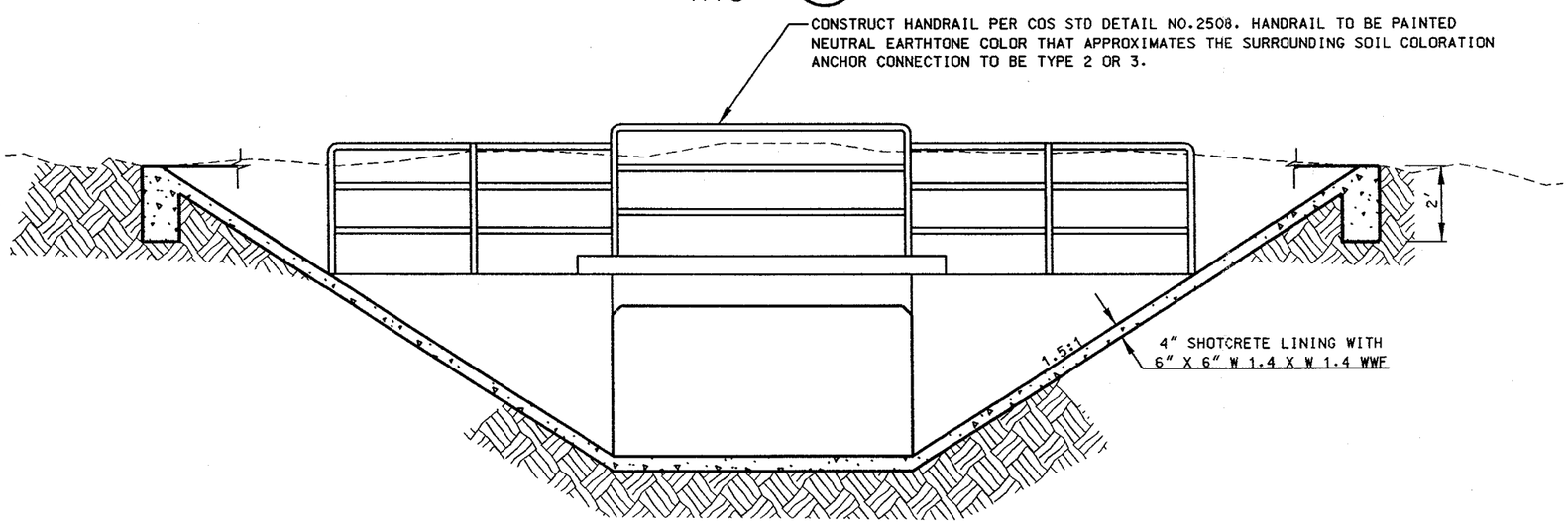
TELEPHONE (602) 681-9272 FAX (602) 681-9339



DETAIL 1
NTS



SECTION B
NTS



SECTION A
NTS

NOT FOR CONSTRUCTION

DATE	REVISION	BY

ENGINEER

CITY OF SCOTTSDALE ARIZONA

TRANSPORTATION DEPARTMENT
TRANSPORTATION PLANNING
3939 CIVIC CENTER BLVD.
SCOTTSDALE, ARIZONA 85251

PROJECT TITLE DESERT GREENBELT PIMA ROAD 3 BASIN
SCHEDULE C-TRACT 21 DRAINAGE
CHANNEL STANDARD DETAILS

SCALE	DESIGNED BY	DATE	BID NO.	SHT. C-D3
HORIZ.	JEB	03/17/99		
VERT.	DRAWN BY JEB	AS-BUILT	PROJECT NO. 5009.0001	OF

Appendix F

HEC-RAS Output for the 50-year, 24-hour storm

```
                    HEC-RAS September 1998 Version 2.2
                      U.S. Army Corp of Engineers
                     Hydrologic Engineering Center
                       609 Second Street, Suite D
                      Davis, California 95616-4687
                            (916) 756-1104

          X     X  XXXXXX    XXXX        XXXX       XX      XXXX
          X     X  X        X    X       X   X     X  X    X
          X     X  X        X            X   X    X    X   X
          XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
          X     X  X        X            X  X     X    X        X
          X     X  X        X    X       X   X    X    X        X
          X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: PR3B Project - Tract 21 Channel
Project File : T21CHNNL.prj
Run Date and Time: 5/22/99 12:14:12 PM

Project in English units

Project Description:
Pima Road Three Basins Project - Tract 21 Drainage Channel and Pima/Princess TI Culvert
Pentacore Arizona --- Project No. 5009.0001
River Station 10000
equals Channel Construction STA 34+50

PLAN DATA

Plan Title: PR3B-Tract21 Drainage Channel 50yrDsgn
Plan File : p:\0007\TRACT21\engr\hydraulics\RAS\T21CHNNL.p01

Geometry Title: PR3B-Tract21 Drng Chnnl Geom - 8' x4' rcb
Geometry File : p:\0007\TRACT21\engr\hydraulics\RAS\T21CHNNL.g01

Flow Title : PR3B-Tract21 Flow Data (50yr,24hr)
Flow File : p:\0007\TRACT21\engr\hydraulics\RAS\T21CHNNL.f01

Plan Description:
Pima Road Three Basins - Tract 21 Channel
Pentacore AZ --- Job No.
5009.0001
100% Channel Design - 8'x4' RCB at Pima-Princess
50yr,24hr Design
Discharges

Plan Summary Information:

Number of:	Cross Sections	= 41	Mulitple Openings	=	0
	Culverts	= 1	Inline Weirs	=	0
	Bridges	= 0			

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculaton tolerance = 0.01
Maximum number of interations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Mixed Flow

FLOW DATA

Flow Title: PR3B-Tract21 Flow Data (50yr,24hr)
Flow File : p:\0007\TRACT21\engr\hydraulics\RAS\T21CHNNL.f01

Flow Data (cfs)

River	Reach	RS	PF 1
Tract 21 Channel	Reach 1	12350	10
Tract 21 Channel	Reach 1	12070	22
Tract 21 Channel	Reach 1	12015	34
Tract 21 Channel	Reach 1	11730	65
Tract 21 Channel	Reach 1	11260	96
Tract 21 Channel	Reach 1	11030	120
Tract 21 Channel	Reach 1	10390	199
Tract 21 Channel	Reach 1	10312	199

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Tract 21 Channel	Reach 1	PF 1	Critical	Normal S = .005

GEOMETRY DATA

Geometry Title: PR3B-Tract21 Drng Chnnl Geom - 8' x4' rcb
Geometry File : p:\0007\TRACT21\engr\hydraulics\RAS\T21CHNNL.g01

CROSS SECTION RIVER: Tract 21 Channel
REACH: Reach 1 RS: 12350

INPUT
Description: Channel STA 11+00. Upstream limit of channel. West end of earthen bottom "vee" collector section.

Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9962	1609.2	9990	1609	10000	1606.5	10010	1608.8	10029	1608.8

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9962	.03	9990	.025	10010	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9990	10010	260	260	260	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1607.52	Element			
Vel Head (ft)	0.21	Wt. n-Val.		0.025	
W.S. Elev (ft)	1607.31	Reach Len. (ft)	260.00	260.00	260.00
Crit W.S. (ft)	1607.31	Flow Area (sq ft)		2.72	
E.G. Slope (ft/ft)	0.013271	Area (sq ft)		2.72	
Q Total (cfs)	10.00	Flow (cfs)		10.00	
Top Width (ft)	6.74	Top Width (ft)		6.74	
Vel Total (ft/s)	3.67	Avg. Vel. (ft/s)		3.67	
Max Chl Dpth (ft)	0.81	Hydr. Depth (ft)		0.40	
Conv. Total (cfs)	86.8	Conv. (cfs)		86.8	
Length Wtd. (ft)	260.00	Wetted Per. (ft)		6.93	
Min Ch El (ft)	1606.50	Shear (lb/sq ft)		0.33	
Alpha	1.00	Stream Power (lb/ft s)		1.19	
Frctn Loss (ft)	1.85	Cum Volume (acre-ft)		1.08	
C & E Loss (ft)	0.03	Cum SA (acres)		0.70	

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Tract 21 Channel
REACH: Reach 1 RS: 12110

INPUT
Description: Channel STA 13+40. East end of shallow earthen collector and 20-ft upstream of transition to larger earthen "vee" section.

Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9955	1606.4	9991.2	1606.32	10000	1604.12	10008.8	1606.32	10020	1606.4

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9955	.03	9991.2	.025	10008.8	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9991.2	10008.8	20	20	20	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1605.22	Element			
Vel Head (ft)	0.09	Wt. n-Val.		0.025	
W.S. Elev (ft)	1605.13	Reach Len. (ft)	20.00	20.00	20.00
Crit W.S. (ft)	1604.94	Flow Area (sq ft)		4.07	
E.G. Slope (ft/ft)	0.004419	Area (sq ft)		4.07	
Q Total (cfs)	10.00	Flow (cfs)		10.00	
Top Width (ft)	8.07	Top Width (ft)		8.07	
Vel Total (ft/s)	2.45	Avg. Vel. (ft/s)		2.45	
Max Chl Dpth (ft)	1.01	Hydr. Depth (ft)		0.50	
Conv. Total (cfs)	150.4	Conv. (cfs)		150.4	
Length Wtd. (ft)	20.00	Wetted Per. (ft)		8.32	
Min Ch El (ft)	1604.12	Shear (lb/sq ft)		0.14	
Alpha	1.00	Stream Power (lb/ft s)		0.33	
Frctn Loss (ft)	0.18	Cum Volume (acre-ft)		1.06	

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  C & E Loss (ft)              0.01   Cum SA (acres)                        0.66

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less
         than 0.7 or greater than 1.4.  This may indicate the need for additional cross sections.
Note:    Hydraulic jump has occurred between this cross section and the previous upstream section.

CROSS SECTION          RIVER: Tract 21 Channel
REACH: Reach 1            RS: 12090

INPUT
Description: Channel STA 13+60.  East end of shallow earthen collector and
             upstream end of transition to larger earthen "vee" section.
             Riprap is used through transition.
Station Elevation Data     num=       5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9955  1606.3  9991.2  1606.2   10000    1604 10008.8  1606.2   10020  1606.2

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9955     .03  9991.2    .035 10008.8     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        9991.2 10008.8                 5       5       5             .1       .3

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)            1605.03   Element                   Left OB    Channel   Right OB
  Vel Head (ft)                0.21   Wt. n-Val.                            0.035
  W.S. Elev (ft)            1604.82   Reach Len. (ft)              5.00      5.00       5.00
  Crit W.S. (ft)            1604.82   Flow Area (sq ft)                      2.71
  E.G. Slope (ft/ft)       0.025632   Area (sq ft)                           2.71
  Q Total (cfs)               10.00   Flow (cfs)                            10.00
  Top Width (ft)               6.59   Top Width (ft)                         6.59
  Vel Total (ft/s)             3.69   Avg. Vel. (ft/s)                       3.69
  Max Chl Dpth (ft)            0.82   Hydr. Depth (ft)                       0.41
  Conv. Total (cfs)            62.5   Conv. (cfs)                            62.5
  Length Wtd. (ft)             5.00   Wetted Per. (ft)                       6.79
  Min Ch El (ft)            1604.00   Shear (lb/sq ft)                       0.64
  Alpha                        1.00   Stream Power (lb/ft s)                 2.36
  Frctn Loss (ft)              0.13   Cum Volume (acre-ft)                   1.05
  C & E Loss (ft)              0.00   Cum SA (acres)                         0.66

Warning: The energy equation could not be balanced within the specified number of iterations.  The
         program used critical depth for the water surface and continued on with the calculations.
Warning: During the standard step iterations, when the assumed water surface was set equal to
         critical depth, the calculated water surface came back below critical depth.  This indicates
         that there is not a valid subcritical answer.  The program defaulted to critical depth.

CROSS SECTION          RIVER: Tract 21 Channel
REACH: Reach 1            RS: 12085.*

INPUT
Description:
Station Elevation Data     num=       5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9960 1606.12  9989.4 1606.02   10000 1603.38 10010.8 1606.07   10020 1606.07

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
    9960     .03  9989.4    .035 10010.8     .03   10020     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        9989.4 10010.8                 5       5       5             .1       .3

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)            1604.77   Element                   Left OB    Channel   Right OB
  Vel Head (ft)                0.80   Wt. n-Val.                            0.035
  W.S. Elev (ft)            1603.97   Reach Len. (ft)              5.00      5.00       5.00
  Crit W.S. (ft)            1604.20   Flow Area (sq ft)                      1.39
  E.G. Slope (ft/ft)       0.152227   Area (sq ft)                           1.39
  Q Total (cfs)               10.00   Flow (cfs)                            10.00
  Top Width (ft)               4.73   Top Width (ft)                         4.73
  Vel Total (ft/s)             7.18   Avg. Vel. (ft/s)                       7.18
  Max Chl Dpth (ft)            0.59   Hydr. Depth (ft)                       0.29
  Conv. Total (cfs)            25.6   Conv. (cfs)                            25.6
  Length Wtd. (ft)             5.00   Wetted Per. (ft)                       4.87
  Min Ch El (ft)            1603.38   Shear (lb/sq ft)                       2.71
  Alpha                        1.00   Stream Power (lb/ft s)                19.51
  Frctn Loss (ft)              0.25   Cum Volume (acre-ft)                   1.05
  C & E Loss (ft)              0.05   Cum SA (acres)                         0.66

Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for
         additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less
         than 0.7 or greater than 1.4.  This may indicate the need for additional cross sections.
Note:    Program found supercritical flow starting at this cross section.

CROSS SECTION          RIVER: Tract 21 Channel
REACH: Reach 1            RS: 12080.*

INPUT
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Description:
Station Elevation Data     num=       5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9965 1605.95  9987.6 1605.85   10000 1602.75 10012.8 1605.95   10020 1605.95

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
    9965     .03  9987.6    .035 10012.8     .03   10020     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        9987.6 10012.8                 5       5       5             .1       .3

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)            1604.06   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.70   Wt. n-Val.                            0.035
  W.S. Elev (ft)            1603.36   Reach Len. (ft)              5.00      5.00       5.00
  Crit W.S. (ft)            1603.57   Flow Area (sq ft)                      1.49
  E.G. Slope (ft/ft)       0.126989   Area (sq ft)                           1.49
  Q Total (cfs)               10.00   Flow (cfs)                            10.00
  Top Width (ft)               4.88   Top Width (ft)                         4.88
  Vel Total (ft/s)             6.72   Avg. Vel. (ft/s)                       6.72
  Max Chl Dpth (ft)            0.61   Hydr. Depth (ft)                       0.31
  Conv. Total (cfs)            28.1   Conv. (cfs)                            28.1
  Length Wtd. (ft)             5.00   Wetted Per. (ft)                       5.03
  Min Ch El (ft)            1602.75   Shear (lb/sq ft)                       2.35
  Alpha                        1.00   Stream Power (lb/ft s)                15.76
  Frctn Loss (ft)              0.69   Cum Volume (acre-ft)                   1.05
  C & E Loss (ft)              0.03   Cum SA (acres)                         0.65


CROSS SECTION          RIVER: Tract 21 Channel
REACH: Reach 1            RS: 12075.*

INPUT
Description:
Station Elevation Data     num=       5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9970 1605.78  9985.8 1605.68   10000 1602.12 10014.8 1605.82   10020 1605.82

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
    9970     .03  9985.8    .035 10014.8     .03   10020     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        9985.8 10014.8                 5       5       5             .1       .3

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)            1603.46   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.74   Wt. n-Val.                            0.035
  W.S. Elev (ft)            1602.72   Reach Len. (ft)              5.00      5.00       5.00
  Crit W.S. (ft)            1602.94   Flow Area (sq ft)                      1.45
  E.G. Slope (ft/ft)       0.136919   Area (sq ft)                           1.45
  Q Total (cfs)               10.00   Flow (cfs)                            10.00
  Top Width (ft)               4.81   Top Width (ft)                         4.81
  Vel Total (ft/s)             6.91   Avg. Vel. (ft/s)                       6.91
  Max Chl Dpth (ft)            0.60   Hydr. Depth (ft)                       0.30
  Conv. Total (cfs)            27.0   Conv. (cfs)                            27.0
  Length Wtd. (ft)             5.00   Wetted Per. (ft)                       4.96
  Min Ch El (ft)            1602.12   Shear (lb/sq ft)                       2.50
  Alpha                        1.00   Stream Power (lb/ft s)                17.25
  Frctn Loss (ft)              0.64   Cum Volume (acre-ft)                   1.05
  C & E Loss (ft)              0.00   Cum SA (acres)                         0.65


CROSS SECTION          RIVER: Tract 21 Channel
REACH: Reach 1            RS: 12070

INPUT
Description: Channel STA 13+80. Downstream end of transition and upstream end
             of larger earthen "vee" section.  Riprap is used through
             transition and modeled.
Station Elevation Data     num=       5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9975  1605.6     9984  1605.5   10000  1601.5 10016.8  1605.7   10020  1605.7

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9975     .03     9984    .035 10016.8     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          9984 10016.8                20      20      20             .3       .5

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)            1603.17   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.07   Wt. n-Val.                            0.035
  W.S. Elev (ft)            1603.09   Reach Len. (ft)             20.00     20.00      20.00
  Crit W.S. (ft)            1602.63   Flow Area (sq ft)                     10.16
  E.G. Slope (ft/ft)       0.003668   Area (sq ft)                          10.16
  Q Total (cfs)               22.00   Flow (cfs)                            22.00
  Top Width (ft)              12.75   Top Width (ft)                        12.75
  Vel Total (ft/s)             2.17   Avg. Vel. (ft/s)                       2.17
  Max Chl Dpth (ft)            1.59   Hydr. Depth (ft)                       0.80
```

Conv. Total (cfs)	363.3	Conv. (cfs)	363.3
Length Wtd. (ft)	20.00	Wetted Per. (ft)	13.14
Min Ch El (ft)	1601.50	Shear (lb/sq ft)	0.18
Alpha	1.00	Stream Power (lb/ft s)	0.38
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	1.05
C & E Loss (ft)	0.01	Cum SA (acres)	0.65

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

CROSS SECTION RIVER: Tract 21 Channel
REACH: Reach 1 RS: 12020

INPUT
Description: Channel STA 14+30. End of riprap lining 50-ft downstream of toe of transition. Larger earthen "vee" section.
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9970	1605.5	9985.4	1605	10000	1601.35	10013.8	1604.8	10019	1604.8

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9970	.03	9985.4	.025	10013.8	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9985.4	10013.8	5	5	5	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1603.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.		0.025	
W.S. Elev (ft)	1603.06	Reach Len. (ft)	5.00	5.00	5.00
Crit W.S. (ft)		Flow Area (sq ft)		11.73	
E.G. Slope (ft/ft)	0.001276	Area (sq ft)		11.73	
Q Total (cfs)	22.00	Flow (cfs)		22.00	
Top Width (ft)	13.70	Top Width (ft)		13.70	
Vel Total (ft/s)	1.88	Avg. Vel. (ft/s)		1.88	
Max Chl Dpth (ft)	1.71	Hydr. Depth (ft)		0.86	
Conv. Total (cfs)	615.9	Conv. (cfs)		615.9	
Length Wtd. (ft)	5.00	Wetted Per. (ft)		14.12	
Min Ch El (ft)	1601.35	Shear (lb/sq ft)		0.07	
Alpha	1.00	Stream Power (lb/ft s)		0.12	
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)		1.05	
C & E Loss (ft)	0.01	Cum SA (acres)		0.65	

CROSS SECTION RIVER: Tract 21 Channel
REACH: Reach 1 RS: 12015

INPUT
Description: Channel STA 14+35. Larger earthen "vee" section. No riprap.
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9970	1605.5	9985.4	1604.98	10000	1601.33	10013.8	1604.78	10019	1604.8

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9970	.03	9985.4	.025	10013.8	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9985.4	10013.8	260	260	260	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1603.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.18	Wt. n-Val.		0.025	
W.S. Elev (ft)	1602.91	Reach Len. (ft)	260.00	260.00	260.00
Crit W.S. (ft)		Flow Area (sq ft)		10.02	
E.G. Slope (ft/ft)	0.004632	Area (sq ft)		10.02	
Q Total (cfs)	34.00	Flow (cfs)		34.00	
Top Width (ft)	12.66	Top Width (ft)		12.66	
Vel Total (ft/s)	3.39	Avg. Vel. (ft/s)		3.39	
Max Chl Dpth (ft)	1.58	Hydr. Depth (ft)		0.79	
Conv. Total (cfs)	499.6	Conv. (cfs)		499.6	
Length Wtd. (ft)	260.00	Wetted Per. (ft)		13.05	
Min Ch El (ft)	1601.33	Shear (lb/sq ft)		0.22	
Alpha	1.00	Stream Power (lb/ft s)		0.75	
Frctn Loss (ft)	1.46	Cum Volume (acre-ft)		1.05	
C & E Loss (ft)	0.01	Cum SA (acres)		0.65	

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Tract 21 Channel
REACH: Reach 1 RS: 11755

INPUT
Description: Channel STA 16+95. Larger earthen "vee" section. Just upstream of shotcrete transition.
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9970	1603.7	9988	1602.92	10000	1599.92	10012	1602.92	10017	1602.92

```
Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9970     .03    9988    .025   10012     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          9988   10012                 5       5       5             .1       .3

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)            1601.63   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.24   Wt. n-Val.                            0.025
  W.S. Elev (ft)            1601.39   Reach Len. (ft)              5.00      5.00       5.00
  Crit W.S. (ft)                      Flow Area (sq ft)                      8.66
  E.G. Slope (ft/ft)       0.006849   Area (sq ft)                           8.66
  Q Total (cfs)               34.00   Flow (cfs)                            34.00
  Top Width (ft)              11.77   Top Width (ft)                        11.77
  Vel Total (ft/s)             3.93   Avg. Vel. (ft/s)                       3.93
  Max Chl Dpth (ft)            1.47   Hydr. Depth (ft)                       0.74
  Conv. Total (cfs)           410.8   Conv. (cfs)                           410.8
  Length Wtd. (ft)             5.00   Wetted Per. (ft)                      12.13
  Min Ch El (ft)            1599.92   Shear (lb/sq ft)                       0.31
  Alpha                        1.00   Stream Power (lb/ft s)                 1.20
  Frctn Loss (ft)              0.04   Cum Volume (acre-ft)                   0.99
  C & E Loss (ft)              0.01   Cum SA (acres)                         0.57


CROSS SECTION          RIVER: Tract 21 Channel
REACH: Reach 1            RS: 11750

INPUT
Description: Channel STA 17+00.  Upstream end transition from "vee" channel to
             trapezoidal section.  Upstream edge of shotcrete lining.
Station Elevation Data     num=       5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9970  1603.7    9988  1602.9   10000  1599.9   10012  1602.9   10017  1602.9

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9970     .03    9988    .022   10012     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          9988   10012                 5       5       5             .1       .3

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)            1601.59   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.34   Wt. n-Val.                            0.022
  W.S. Elev (ft)            1601.25   Reach Len. (ft)              5.00      5.00       5.00
  Crit W.S. (ft)            1601.25   Flow Area (sq ft)                      7.25
  E.G. Slope (ft/ft)       0.008500   Area (sq ft)                           7.25
  Q Total (cfs)               34.00   Flow (cfs)                            34.00
  Top Width (ft)              10.77   Top Width (ft)                        10.77
  Vel Total (ft/s)             4.69   Avg. Vel. (ft/s)                       4.69
  Max Chl Dpth (ft)            1.35   Hydr. Depth (ft)                       0.67
  Conv. Total (cfs)           368.8   Conv. (cfs)                           368.8
  Length Wtd. (ft)             5.00   Wetted Per. (ft)                      11.10
  Min Ch El (ft)            1599.90   Shear (lb/sq ft)                       0.35
  Alpha                        1.00   Stream Power (lb/ft s)                 1.62
  Frctn Loss (ft)              0.04   Cum Volume (acre-ft)                   0.99
  C & E Loss (ft)              0.00   Cum SA (acres)                         0.57


Warning: The energy equation could not be balanced within the specified number of iterations.  The
         program used critical depth for the water surface and continued on with the calculations.
Warning: During the standard step iterations, when the assumed water surface was set equal to
         critical depth, the calculated water surface came back below critical depth.  This indicates
         that there is not a valid subcritical answer.  The program defaulted to critical depth.

CROSS SECTION          RIVER: Tract 21 Channel
REACH: Reach 1            RS: 11745.*

INPUT
Description:
Station Elevation Data     num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  9973.5 1603.57 9988.24 1602.85    9999 1599.43   10000 1599.43   10001 1599.43
10011.76 1602.8510016.75 1602.85

Manning's n Values          num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
  9973.5     .03 9988.24    .02210011.76     .0310016.75     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9988.2410011.76                 5       5       5             .1       .3

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)            1601.43   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                1.16   Wt. n-Val.                            0.022
  W.S. Elev (ft)            1600.28   Reach Len. (ft)              5.00      5.00       5.00
  Crit W.S. (ft)            1600.63   Flow Area (sq ft)                      3.94
  E.G. Slope (ft/ft)       0.039152   Area (sq ft)                           3.94
  Q Total (cfs)               34.00   Flow (cfs)                            34.00
  Top Width (ft)               7.32   Top Width (ft)                         7.32
```

Vel Total (ft/s)	8.64	Avg. Vel. (ft/s)	8.64
Max Chl Dpth (ft)	0.85	Hydr. Depth (ft)	0.54
Conv. Total (cfs)	171.8	Conv. (cfs)	171.8
Length Wtd. (ft)	5.00	Wetted Per. (ft)	7.58
Min Ch El (ft)	1599.43	Shear (lb/sq ft)	1.27
Alpha	1.00	Stream Power (lb/ft s)	10.96
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	0.99
C & E Loss (ft)	0.08	Cum SA (acres)	0.57

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Note: Program found supercritical flow starting at this cross section.

CROSS SECTION RIVER: Tract 21 Channel
REACH: Reach 1 RS: 11740.*

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9977	1603.45	9988.47	1602.8	9998	1598.95	10000	1598.95	10002	1598.95
10011.53	1602.8	10016.5	1602.8						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9977	.03	9988.47	.02	210011.53	.03	10016.5	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9988.47	10011.53	5	5	5	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1601.12	Element			
Vel Head (ft)	1.56	Wt. n-Val.		0.022	
W.S. Elev (ft)	1599.56	Reach Len. (ft)	5.00	5.00	5.00
Crit W.S. (ft)	1599.99	Flow Area (sq ft)		3.39	
E.G. Slope (ft/ft)	0.060896	Area (sq ft)		3.39	
Q Total (cfs)	34.00	Flow (cfs)		34.00	
Top Width (ft)	7.04	Top Width (ft)		7.04	
Vel Total (ft/s)	10.02	Avg. Vel. (ft/s)		10.02	
Max Chl Dpth (ft)	0.61	Hydr. Depth (ft)		0.48	
Conv. Total (cfs)	137.8	Conv. (cfs)		137.8	
Length Wtd. (ft)	5.00	Wetted Per. (ft)		7.28	
Min Ch El (ft)	1598.95	Shear (lb/sq ft)		1.77	
Alpha	1.00	Stream Power (lb/ft s)		17.75	
Frctn Loss (ft)	0.24	Cum Volume (acre-ft)		0.99	
C & E Loss (ft)	0.04	Cum SA (acres)		0.57	

CROSS SECTION RIVER: Tract 21 Channel
REACH: Reach 1 RS: 11735.*

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9980.5	1603.32	9988.71	1602.75	9997	1598.47	10000	1598.47	10003	1598.47
10011.29	1602.75	10016.25	1602.75						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9980.5	.03	9988.71	.02	210011.29	.03	10016.25	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9988.71	10011.29	5	5	5	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1600.72	Element			
Vel Head (ft)	1.80	Wt. n-Val.		0.022	
W.S. Elev (ft)	1598.93	Reach Len. (ft)	5.00	5.00	5.00
Crit W.S. (ft)	1599.37	Flow Area (sq ft)		3.16	
E.G. Slope (ft/ft)	0.087390	Area (sq ft)		3.16	
Q Total (cfs)	34.00	Flow (cfs)		34.00	
Top Width (ft)	7.78	Top Width (ft)		7.78	
Vel Total (ft/s)	10.75	Avg. Vel. (ft/s)		10.75	
Max Chl Dpth (ft)	0.46	Hydr. Depth (ft)		0.41	
Conv. Total (cfs)	115.0	Conv. (cfs)		115.0	
Length Wtd. (ft)	5.00	Wetted Per. (ft)		8.00	
Min Ch El (ft)	1598.47	Shear (lb/sq ft)		2.16	
Alpha	1.00	Stream Power (lb/ft s)		23.19	
Frctn Loss (ft)	0.36	Cum Volume (acre-ft)		0.99	
C & E Loss (ft)	0.02	Cum SA (acres)		0.57	

CROSS SECTION RIVER: Tract 21 Channel
REACH: Reach 1 RS: 11730

INPUT
Description: Channel STA 17+20. East end of transition from "vee" to trapezoidal section and toe of vertical transition. Shotcrete lining used.

```
Station Elevation Data     num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9984  1603.2 9988.95  1602.7    9996    1598   10000    1598   10004    1598
10011.05  1602.7   10016  1602.7

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9984     .03 9988.95    .02210011.05     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9988.9510011.05               10      10      10             .3       .5

CROSS SECTION OUTPUT     Profile #PF 1

  E.G. Elev (ft)            1600.41   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                1.73   Wt. n-Val.                            0.022
  W.S. Elev (ft)            1598.68   Reach Len. (ft)              10.00     10.00     10.00
  Crit W.S. (ft)            1599.17   Flow Area (sq ft)                       6.16
  E.G. Slope (ft/ft)       0.049480   Area (sq ft)                            6.16
  Q Total (cfs)               65.00   Flow (cfs)                             65.00
  Top Width (ft)              10.05   Top Width (ft)                         10.05
  Vel Total (ft/s)            10.55   Avg. Vel. (ft/s)                       10.55
  Max Chl Dpth (ft)            0.68   Hydr. Depth (ft)                        0.61
  Conv. Total (cfs)           292.2   Conv. (cfs)                            292.2
  Length Wtd. (ft)            10.00   Wetted Per. (ft)                       10.46
  Min Ch El (ft)            1598.00   Shear (lb/sq ft)                        1.82
  Alpha                        1.00   Stream Power (lb/ft s)                 19.20
  Frctn Loss (ft)              0.29   Cum Volume (acre-ft)                    0.99
  C & E Loss (ft)              0.02   Cum SA (acres)                          0.57


Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less
         than 0.7 or greater than 1.4.  This may indicate the need for additional cross sections.

CROSS SECTION           RIVER: Tract 21 Channel
REACH: Reach 1            RS: 11720.*

INPUT
Description:
Station Elevation Data     num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  9983.6  1603.1 9989.08 1602.56    9996 1597.95   10000 1597.95   10004 1597.95
10010.92 1602.56 10016.2 1602.56

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  9983.6     .03 9989.08    .02210010.92     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9989.0810010.92               20      20      20             .3       .5

CROSS SECTION OUTPUT     Profile #PF 1

  E.G. Elev (ft)            1599.69   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.32   Wt. n-Val.                            0.022
  W.S. Elev (ft)            1599.37   Reach Len. (ft)              20.00     20.00     20.00
  Crit W.S. (ft)            1599.12   Flow Area (sq ft)                      14.43
  E.G. Slope (ft/ft)       0.003927   Area (sq ft)                           14.43
  Q Total (cfs)               65.00   Flow (cfs)                             65.00
  Top Width (ft)              12.27   Top Width (ft)                         12.27
  Vel Total (ft/s)             4.51   Avg. Vel. (ft/s)                        4.51
  Max Chl Dpth (ft)            1.42   Hydr. Depth (ft)                        1.18
  Conv. Total (cfs)          1037.3   Conv. (cfs)                           1037.3
  Length Wtd. (ft)            20.00   Wetted Per. (ft)                       13.13
  Min Ch El (ft)            1597.95   Shear (lb/sq ft)                        0.27
  Alpha                        1.00   Stream Power (lb/ft s)                  1.21
  Frctn Loss (ft)              0.08   Cum Volume (acre-ft)                    0.99
  C & E Loss (ft)              0.01   Cum SA (acres)                          0.57


Note:    Hydraulic jump has occurred between this cross section and the previous upstream section.

CROSS SECTION           RIVER: Tract 21 Channel
REACH: Reach 1            RS: 11700.*

INPUT
Description:
Station Elevation Data     num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  9982.8  1602.9 9989.35 1602.28    9996 1597.85   10000 1597.85   10004 1597.85
10010.65 1602.28 10016.6 1602.28

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  9982.8     .03 9989.35    .02210010.65     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9989.3510010.65               20      20      20             .3       .5

CROSS SECTION OUTPUT     Profile #PF 1

  E.G. Elev (ft)            1599.60   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.30   Wt. n-Val.                            0.022
  W.S. Elev (ft)            1599.31   Reach Len. (ft)              20.00     20.00     20.00
  Crit W.S. (ft)                      Flow Area (sq ft)                      14.84
```

E.G. Slope (ft/ft)	0.003621	Area (sq ft)	14.84
Q Total (cfs)	65.00	Flow (cfs)	65.00
Top Width (ft)	12.37	Top Width (ft)	12.37
Vel Total (ft/s)	4.38	Avg. Vel. (ft/s)	4.38
Max Chl Dpth (ft)	1.46	Hydr. Depth (ft)	1.20
Conv. Total (cfs)	1080.2	Conv. (cfs)	1080.2
Length Wtd. (ft)	20.00	Wetted Per. (ft)	13.25
Min Ch El (ft)	1597.85	Shear (lb/sq ft)	0.25
Alpha	1.00	Stream Power (lb/ft s)	1.11
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	0.98
C & E Loss (ft)	0.01	Cum SA (acres)	0.56

```
CROSS SECTION          RIVER: Tract 21 Channel
REACH: Reach 1            RS: 11680

INPUT
Description: Channel STA 17+70.  Shotcrete lined trapezoidal channel.
Station Elevation Data     num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9982  1602.7 9989.62    1602    9996 1597.75   10000 1597.75   10004 1597.75
10010.38    1602   10017    1602

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9982     .03 9989.62    .02210010.38     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9989.6210010.38               420     420     420             .1       .3

CROSS SECTION OUTPUT    Profile #PF 1
```

E.G. Elev (ft)	1599.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.		0.022	
W.S. Elev (ft)	1599.25	Reach Len. (ft)	420.00	420.00	420.00
Crit W.S. (ft)		Flow Area (sq ft)		15.34	
E.G. Slope (ft/ft)	0.003286	Area (sq ft)		15.34	
Q Total (cfs)	65.00	Flow (cfs)		65.00	
Top Width (ft)	12.49	Top Width (ft)		12.49	
Vel Total (ft/s)	4.24	Avg. Vel. (ft/s)		4.24	
Max Chl Dpth (ft)	1.50	Hydr. Depth (ft)		1.23	
Conv. Total (cfs)	1133.9	Conv. (cfs)		1133.9	
Length Wtd. (ft)	420.00	Wetted Per. (ft)		13.40	
Min Ch El (ft)	1597.75	Shear (lb/sq ft)		0.23	
Alpha	1.00	Stream Power (lb/ft s)		1.00	
Frctn Loss (ft)	1.72	Cum Volume (acre-ft)		0.97	
C & E Loss (ft)	0.02	Cum SA (acres)		0.55	

```
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
         section.  This may indicate the need for additional cross sections.

CROSS SECTION          RIVER: Tract 21 Channel
REACH: Reach 1            RS: 11260

INPUT
Description: Channel STA 21+90.  Shotcrete lined trapezoidal section.
Station Elevation Data     num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9979  1601.2 9987.98    1601    9996 1595.65   10000 1595.65   10004 1595.65
10012.02    1601   10014    1601

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9979     .03 9987.98    .02210012.02     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9987.9810012.02                30      30      30             .1       .3

CROSS SECTION OUTPUT    Profile #PF 1
```

E.G. Elev (ft)	1597.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.47	Wt. n-Val.		0.022	
W.S. Elev (ft)	1597.32	Reach Len. (ft)	30.00	30.00	30.00
Crit W.S. (ft)		Flow Area (sq ft)		17.52	
E.G. Slope (ft/ft)	0.004887	Area (sq ft)		17.52	
Q Total (cfs)	96.00	Flow (cfs)		96.00	
Top Width (ft)	13.00	Top Width (ft)		13.00	
Vel Total (ft/s)	5.48	Avg. Vel. (ft/s)		5.48	
Max Chl Dpth (ft)	1.67	Hydr. Depth (ft)		1.35	
Conv. Total (cfs)	1373.2	Conv. (cfs)		1373.2	
Length Wtd. (ft)	30.00	Wetted Per. (ft)		14.01	
Min Ch El (ft)	1595.65	Shear (lb/sq ft)		0.38	
Alpha	1.00	Stream Power (lb/ft s)		2.09	
Frctn Loss (ft)	0.15	Cum Volume (acre-ft)		0.81	
C & E Loss (ft)	0.00	Cum SA (acres)		0.43	

```
CROSS SECTION          RIVER: Tract 21 Channel
REACH: Reach 1            RS: 11230

INPUT
Description: Channel STA 22+20.  Shotcrete lined trapezoidal section.
Station Elevation Data     num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

```
    9976    1601    9990  1599.5    9996  1595.5   10000  1595.5   10004  1595.5
   10010  1599.5   10014  1599.5   10016  1599.5

Manning's n Values          num=        3
     Sta   n Val      Sta   n Val      Sta   n Val
    9976     .03     9990    .022    10010     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          9990   10010               160     160     160             .1       .3

CROSS SECTION OUTPUT     Profile #PF 1

  E.G. Elev (ft)            1597.64   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.46   Wt. n-Val.                            0.022
  W.S. Elev (ft)            1597.17   Reach Len. (ft)            160.00     160.00    160.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     17.59
  E.G. Slope (ft/ft)       0.004834   Area (sq ft)                          17.59
  Q Total (cfs)               96.00   Flow (cfs)                            96.00
  Top Width (ft)              13.02   Top Width (ft)                        13.02
  Vel Total (ft/s)             5.46   Avg. Vel. (ft/s)                       5.46
  Max Chl Dpth (ft)            1.67   Hydr. Depth (ft)                       1.35
  Conv. Total (cfs)          1380.8   Conv. (cfs)                          1380.8
  Length Wtd. (ft)           160.00   Wetted Per. (ft)                      14.03
  Min Ch El (ft)            1595.50   Shear (lb/sq ft)                       0.38
  Alpha                        1.00   Stream Power (lb/ft s)                 2.06
  Frctn Loss (ft)              0.49   Cum Volume (acre-ft)                   0.80
  C & E Loss (ft)              0.06   Cum SA (acres)                         0.42


Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less
         than 0.7 or greater than 1.4.  This may indicate the need for additional cross sections.

CROSS SECTION           RIVER: Tract 21 Channel
REACH: Reach 1            RS: 11070

INPUT
Description: Channel STA 23+80.  Shotcrete lined trapezoidal channel.
Station Elevation Data     num=        7
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
    9977  1599.7  9989.25  1599.5    9996  1594.7   10000  1594.7   10004  1594.7
10010.75  1599.5    10015  1599.5

Manning's n Values          num=        3
     Sta   n Val      Sta   n Val      Sta   n Val
    9977     .03  9989.25    .02210010.75     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9989.2510010.75               40      40      40             .1       .3

CROSS SECTION OUTPUT     Profile #PF 1

  E.G. Elev (ft)            1597.08   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.27   Wt. n-Val.                            0.022
  W.S. Elev (ft)            1596.82   Reach Len. (ft)             40.00      40.00     40.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     23.24
  E.G. Slope (ft/ft)       0.002144   Area (sq ft)                          23.24
  Q Total (cfs)               96.00   Flow (cfs)                            96.00
  Top Width (ft)              13.95   Top Width (ft)                        13.95
  Vel Total (ft/s)             4.13   Avg. Vel. (ft/s)                       4.13
  Max Chl Dpth (ft)            2.12   Hydr. Depth (ft)                       1.67
  Conv. Total (cfs)          2073.3   Conv. (cfs)                          2073.3
  Length Wtd. (ft)            40.00   Wetted Per. (ft)                      15.30
  Min Ch El (ft)            1594.70   Shear (lb/sq ft)                       0.20
  Alpha                        1.00   Stream Power (lb/ft s)                 0.84
  Frctn Loss (ft)              0.13   Cum Volume (acre-ft)                   0.73
  C & E Loss (ft)              0.03   Cum SA (acres)                         0.37


CROSS SECTION           RIVER: Tract 21 Channel
REACH: Reach 1            RS: 11030

INPUT
Description: Channel STA 24+20.  Shotcrete lined trapezoidal channel.
Station Elevation Data     num=        7
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
    9982  1599.2  9989.85  1598.6    9996  1594.5   10000  1594.5   10004  1594.5
10010.15  1598.6    10014  1598.6

Manning's n Values          num=        3
     Sta   n Val      Sta   n Val      Sta   n Val
    9982     .03  9989.85    .02210010.15     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9989.8510010.15               80      80      80             .1       .3

CROSS SECTION OUTPUT     Profile #PF 1

  E.G. Elev (ft)            1596.92   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.53   Wt. n-Val.                            0.022
  W.S. Elev (ft)            1596.39   Reach Len. (ft)             80.00      80.00     80.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     20.47
  E.G. Slope (ft/ft)       0.004892   Area (sq ft)                          20.47
  Q Total (cfs)              120.00   Flow (cfs)                           120.00
  Top Width (ft)              13.67   Top Width (ft)                        13.67
  Vel Total (ft/s)             5.86   Avg. Vel. (ft/s)                       5.86
```

Max Chl Dpth (ft)	1.89	Hydr. Depth (ft)	1.50
Conv. Total (cfs)	1715.8	Conv. (cfs)	1715.8
Length Wtd. (ft)	80.00	Wetted Per. (ft)	14.81
Min Ch El (ft)	1594.50	Shear (lb/sq ft)	0.42
Alpha	1.00	Stream Power (lb/ft s)	2.47
Frctn Loss (ft)	0.37	Cum Volume (acre-ft)	0.71
C & E Loss (ft)	0.01	Cum SA (acres)	0.36

CROSS SECTION RIVER: Tract 21 Channel
REACH: Reach 1 RS: 10950

INPUT
Description: Channel STA 25+00. Shotcrete lined trapezoidal channel.
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9986	1598.9	9989.25	1598.6	9996	1594.1	10000	1594.1	10004	1594.1
10010.75	1598.6	10013	1598.6						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9986	.03	9989.25	.02	10010.75	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9989.25	10010.75	120	120	120	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1596.54	Element			
Vel Head (ft)	0.50	Wt. n-Val.		0.022	
W.S. Elev (ft)	1596.04	Reach Len. (ft)	120.00	120.00	120.00
Crit W.S. (ft)		Flow Area (sq ft)		21.21	
E.G. Slope (ft/ft)	0.004425	Area (sq ft)		21.21	
Q Total (cfs)	120.00	Flow (cfs)		120.00	
Top Width (ft)	13.83	Top Width (ft)		13.83	
Vel Total (ft/s)	5.66	Avg. Vel. (ft/s)		5.66	
Max Chl Dpth (ft)	1.94	Hydr. Depth (ft)		1.53	
Conv. Total (cfs)	1804.0	Conv. (cfs)		1804.0	
Length Wtd. (ft)	120.00	Wetted Per. (ft)		15.01	
Min Ch El (ft)	1594.10	Shear (lb/sq ft)		0.39	
Alpha	1.00	Stream Power (lb/ft s)		2.21	
Frctn Loss (ft)	0.57	Cum Volume (acre-ft)		0.67	
C & E Loss (ft)	0.00	Cum SA (acres)		0.33	

CROSS SECTION RIVER: Tract 21 Channel
REACH: Reach 1 RS: 10840

INPUT
Description: Channel STA 26+10. Shotcrete lined trapezoidal channel.
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9986	1598	9989.63	1597.8	9996	1593.55	10000	1593.55	10004	1593.55
10010.38	1597.8	10012	1597.8						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9986	.03	9989.63	.02	10010.38	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9989.63	10010.38	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1595.97	Element			
Vel Head (ft)	0.55	Wt. n-Val.		0.022	
W.S. Elev (ft)	1595.42	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)		Flow Area (sq ft)		20.25	
E.G. Slope (ft/ft)	0.005050	Area (sq ft)		20.25	
Q Total (cfs)	120.00	Flow (cfs)		120.00	
Top Width (ft)	13.62	Top Width (ft)		13.62	
Vel Total (ft/s)	5.93	Avg. Vel. (ft/s)		5.93	
Max Chl Dpth (ft)	1.87	Hydr. Depth (ft)		1.49	
Conv. Total (cfs)	1688.6	Conv. (cfs)		1688.6	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		14.75	
Min Ch El (ft)	1593.55	Shear (lb/sq ft)		0.43	
Alpha	1.00	Stream Power (lb/ft s)		2.56	
Frctn Loss (ft)	0.26	Cum Volume (acre-ft)		0.61	
C & E Loss (ft)	0.00	Cum SA (acres)		0.30	

CROSS SECTION RIVER: Tract 21 Channel
REACH: Reach 1 RS: 10790

INPUT
Description: Channel STA 26+60. Shotcrete lined trapezoidal channel.
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9970	1598	9991.95	1596	9996	1593.3	10000	1593.3	10004	1593.3
10008.05	1596	10013	1596						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9970	.03	9991.95	.02	10008.05	.03

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      9991.9510008.05               240     240     240            .1        .3

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)            1595.71   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.57   Wt. n-Val.                            0.022
  W.S. Elev (ft)            1595.14   Reach Len. (ft)             240.00    240.00     240.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     19.86
  E.G. Slope (ft/ft)       0.005332   Area (sq ft)                          19.86
  Q Total (cfs)              120.00   Flow (cfs)                           120.00
  Top Width (ft)              13.53   Top Width (ft)                        13.53
  Vel Total (ft/s)             6.04   Avg. Vel. (ft/s)                       6.04
  Max Chl Dpth (ft)            1.84   Hydr. Depth (ft)                       1.47
  Conv. Total (cfs)          1643.3   Conv. (cfs)                          1643.3
  Length Wtd. (ft)           240.00   Wetted Per. (ft)                      14.65
  Min Ch El (ft)            1593.30   Shear (lb/sq ft)                       0.45
  Alpha                        1.00   Stream Power (lb/ft s)                 2.73
  Frctn Loss (ft)              1.14   Cum Volume (acre-ft)                   0.59
  C & E Loss (ft)              0.03   Cum SA (acres)                         0.28


Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
         section.  This may indicate the need for additional cross sections.

CROSS SECTION           RIVER: Tract 21 Channel
REACH: Reach 1             RS: 10550

INPUT
Description: Channel STA 29+00.  Shotcrete lined trapezoidal channel.
Station Elevation Data     num=        7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9985  1596.5 9990.15    1596    9996  1592.1   10000  1592.1   10004  1592.1
10009.85    1596   10035    1596

Manning's n Values         num=        3
     Sta   n Val     Sta   n Val     Sta   n Val
    9985     .03 9990.15    .02210009.85     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      9990.1510009.85               100     100     100            .1        .3

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)            1594.55   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.48   Wt. n-Val.                            0.022
  W.S. Elev (ft)            1594.07   Reach Len. (ft)             100.00    100.00     100.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     21.64
  E.G. Slope (ft/ft)       0.004181   Area (sq ft)                          21.64
  Q Total (cfs)              120.00   Flow (cfs)                           120.00
  Top Width (ft)              13.92   Top Width (ft)                        13.92
  Vel Total (ft/s)             5.55   Avg. Vel. (ft/s)                       5.55
  Max Chl Dpth (ft)            1.97   Hydr. Depth (ft)                       1.55
  Conv. Total (cfs)          1855.8   Conv. (cfs)                          1855.8
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                      15.12
  Min Ch El (ft)            1592.10   Shear (lb/sq ft)                       0.37
  Alpha                        1.00   Stream Power (lb/ft s)                 2.07
  Frctn Loss (ft)              0.54   Cum Volume (acre-ft)                   0.47
  C & E Loss (ft)              0.02   Cum SA (acres)                         0.21


CROSS SECTION           RIVER: Tract 21 Channel
REACH: Reach 1             RS: 10450

INPUT
Description: Channel STA 30+00.  Shotcrete lined trapezoidal channel.  Upstream
             end of vertical transition to culvert grade.
Station Elevation Data     num=        7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9988  1595.3  9990.9    1595    9996  1591.6   10000  1591.6   10004  1591.6
 10009.1    1595   10039    1595

Manning's n Values         num=        3
     Sta   n Val     Sta   n Val     Sta   n Val
    9988     .03  9990.9    .022 10009.1     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9990.9 10009.1               10      10      10            .1        .3

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)            1594.00   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.69   Wt. n-Val.                            0.022
  W.S. Elev (ft)            1593.30   Reach Len. (ft)              10.00     10.00      10.00
  Crit W.S. (ft)            1593.30   Flow Area (sq ft)                     17.98
  E.G. Slope (ft/ft)       0.007094   Area (sq ft)                          17.98
  Q Total (cfs)              120.00   Flow (cfs)                           120.00
  Top Width (ft)              13.11   Top Width (ft)                        13.11
  Vel Total (ft/s)             6.68   Avg. Vel. (ft/s)                       6.68
  Max Chl Dpth (ft)            1.70   Hydr. Depth (ft)                       1.37
  Conv. Total (cfs)          1424.7   Conv. (cfs)                          1424.7
  Length Wtd. (ft)           10.00   Wetted Per. (ft)                      14.14
  Min Ch El (ft)            1591.60   Shear (lb/sq ft)                       0.56
  Alpha                        1.00   Stream Power (lb/ft s)                 3.76
  Frctn Loss (ft)              0.07   Cum Volume (acre-ft)                   0.43
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C & E Loss (ft)              0.00   Cum SA (acres)                    0.17

Warning: The energy equation could not be balanced within the specified number of iterations.  The
         program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
         section.  This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to
         critical depth, the calculated water surface came back below critical depth.  This indicates
         that there is not a valid subcritical answer.  The program defaulted to critical depth.

CROSS SECTION          RIVER: Tract 21 Channel
REACH: Reach 1            RS: 10440.*

INPUT
Description:
Station Elevation Data    num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9984.33 1595.45 9989.45 1594.87    9996  1590.5   10000  1590.5   10004  1590.5
10010.55 1594.87   10039 1594.87

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9984.33     .03 9989.45    .02210010.55     .03   10039     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9989.4510010.55               10      10      10             .1       .3

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)            1593.70   Element                   Left OB    Channel   Right OB
  Vel Head (ft)                2.13   Wt. n-Val.                           0.022
  W.S. Elev (ft)            1591.57   Reach Len. (ft)             10.00     10.00      10.00
  Crit W.S. (ft)            1592.20   Flow Area (sq ft)                     10.24
  E.G. Slope (ft/ft)       0.036535   Area (sq ft)                          10.24
  Q Total (cfs)              120.00   Flow (cfs)                           120.00
  Top Width (ft)              11.20   Top Width (ft)                        11.20
  Vel Total (ft/s)            11.72   Avg. Vel. (ft/s)                      11.72
  Max Chl Dpth (ft)            1.07   Hydr. Depth (ft)                       0.91
  Conv. Total (cfs)           627.8   Conv. (cfs)                           627.8
  Length Wtd. (ft)            10.00   Wetted Per. (ft)                      11.84
  Min Ch El (ft)            1590.50   Shear (lb/sq ft)                       1.97
  Alpha                        1.00   Stream Power (lb/ft s)                23.11
  Frctn Loss (ft)              0.14   Cum Volume (acre-ft)                   0.43
  C & E Loss (ft)              0.15   Cum SA (acres)                         0.17

Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for
         additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less
         than 0.7 or greater than 1.4.  This may indicate the need for additional cross sections.
Note:    Program found supercritical flow starting at this cross section.

CROSS SECTION          RIVER: Tract 21 Channel
REACH: Reach 1            RS: 10430.*

INPUT
Description:
Station Elevation Data    num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9980.67  1595.6    9988 1594.73    9996  1589.4   10000  1589.4   10004  1589.4
   10012 1594.73   10039 1594.73

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9980.67     .03    9988    .022   10012     .03   10039     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          9988   10012               10      10      10             .1       .3

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)            1593.17   Element                   Left OB    Channel   Right OB
  Vel Head (ft)                2.82   Wt. n-Val.                           0.022
  W.S. Elev (ft)            1590.35   Reach Len. (ft)             10.00     10.00      10.00
  Crit W.S. (ft)            1591.10   Flow Area (sq ft)                      8.90
  E.G. Slope (ft/ft)       0.055446   Area (sq ft)                           8.90
  Q Total (cfs)              120.00   Flow (cfs)                           120.00
  Top Width (ft)              10.84   Top Width (ft)                        10.84
  Vel Total (ft/s)            13.48   Avg. Vel. (ft/s)                      13.48
  Max Chl Dpth (ft)            0.95   Hydr. Depth (ft)                       0.82
  Conv. Total (cfs)           509.6   Conv. (cfs)                           509.6
  Length Wtd. (ft)            10.00   Wetted Per. (ft)                      11.41
  Min Ch El (ft)            1589.40   Shear (lb/sq ft)                       2.70
  Alpha                        1.00   Stream Power (lb/ft s)                36.41
  Frctn Loss (ft)              0.45   Cum Volume (acre-ft)                   0.42
  C & E Loss (ft)              0.07   Cum SA (acres)                         0.17

Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for
         additional cross sections.

CROSS SECTION          RIVER: Tract 21 Channel
REACH: Reach 1            RS: 10420.*
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INPUT
Description:
Station Elevation Data     num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9977 1595.75 9986.55  1594.6    9996  1588.3   10000  1588.3   10004  1588.3
10013.45  1594.6   10039  1594.6

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
    9977     .03 9986.55    .02210013.45     .03   10039     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9986.5510013.45               10      10      10             .1       .3

CROSS SECTION OUTPUT     Profile #PF 1

  E.G. Elev (ft)            1592.50   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                3.32   Wt. n-Val.                            0.022
  W.S. Elev (ft)            1589.18   Reach Len. (ft)              10.00     10.00      10.00
  Crit W.S. (ft)            1590.00   Flow Area (sq ft)                       8.21
  E.G. Slope (ft/ft)       0.070699   Area (sq ft)                            8.21
  Q Total (cfs)              120.00   Flow (cfs)                            120.00
  Top Width (ft)              10.64   Top Width (ft)                         10.64
  Vel Total (ft/s)            14.62   Avg. Vel. (ft/s)                       14.62
  Max Chl Dpth (ft)            0.88   Hydr. Depth (ft)                        0.77
  Conv. Total (cfs)           451.3   Conv. (cfs)                           451.3
  Length Wtd. (ft)            10.00   Wetted Per. (ft)                       11.18
  Min Ch El (ft)            1588.30   Shear (lb/sq ft)                        3.24
  Alpha                        1.00   Stream Power (lb/ft s)                 47.39
  Frctn Loss (ft)              0.62   Cum Volume (acre-ft)                    0.42
  C & E Loss (ft)              0.05   Cum SA (acres)                          0.17


CROSS SECTION            RIVER: Tract 21 Channel
REACH: Reach 1             RS: 10410.*

INPUT
Description:
Station Elevation Data     num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9973.33  1595.9  9985.1 1594.47    9996  1587.2   10000  1587.2   10004  1587.2
 10014.9 1594.47   10039 1594.47

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9973.33     .03  9985.1    .022 10014.9     .03   10039     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        9985.1 10014.9               10      10      10             .1       .3

CROSS SECTION OUTPUT     Profile #PF 1

  E.G. Elev (ft)            1591.69   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                3.64   Wt. n-Val.                            0.022
  W.S. Elev (ft)            1588.05   Reach Len. (ft)              10.00     10.00      10.00
  Crit W.S. (ft)            1588.90   Flow Area (sq ft)                       7.83
  E.G. Slope (ft/ft)       0.081371   Area (sq ft)                            7.83
  Q Total (cfs)              120.00   Flow (cfs)                            120.00
  Top Width (ft)              10.54   Top Width (ft)                         10.54
  Vel Total (ft/s)            15.32   Avg. Vel. (ft/s)                       15.32
  Max Chl Dpth (ft)            0.85   Hydr. Depth (ft)                        0.74
  Conv. Total (cfs)           420.7   Conv. (cfs)                           420.7
  Length Wtd. (ft)            10.00   Wetted Per. (ft)                       11.05
  Min Ch El (ft)            1587.20   Shear (lb/sq ft)                        3.60
  Alpha                        1.00   Stream Power (lb/ft s)                 55.18
  Frctn Loss (ft)              0.76   Cum Volume (acre-ft)                    0.42
  C & E Loss (ft)              0.03   Cum SA (acres)                          0.16


CROSS SECTION            RIVER: Tract 21 Channel
REACH: Reach 1             RS: 10400.*

INPUT
Description:
Station Elevation Data     num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9969.67 1596.05 9983.65 1594.33    9996  1586.1   10000  1586.1   10004  1586.1
10016.35 1594.33   10039 1594.33

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9969.67     .03 9983.65    .02210016.35     .03   10039     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9983.6510016.35               10      10      10             .1       .3

CROSS SECTION OUTPUT     Profile #PF 1

  E.G. Elev (ft)            1589.44   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.13   Wt. n-Val.                            0.022
  W.S. Elev (ft)            1589.31   Reach Len. (ft)              10.00     10.00      10.00
  Crit W.S. (ft)            1587.80   Flow Area (sq ft)                      41.14
  E.G. Slope (ft/ft)       0.000693   Area (sq ft)                           41.14
  Q Total (cfs)              120.00   Flow (cfs)                            120.00
  Top Width (ft)              17.63   Top Width (ft)                         17.63
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Vel Total (ft/s)	2.92	Avg. Vel. (ft/s)	2.92
Max Chl Dpth (ft)	3.21	Hydr. Depth (ft)	2.33
Conv. Total (cfs)	4558.8	Conv. (cfs)	4558.8
Length Wtd. (ft)	10.00	Wetted Per. (ft)	19.58
Min Ch El (ft)	1586.10	Shear (lb/sq ft)	0.09
Alpha	1.00	Stream Power (lb/ft s)	0.27
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.41
C & E Loss (ft)	0.00	Cum SA (acres)	0.16

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

CROSS SECTION RIVER: Tract 21 Channel
REACH: Reach 1 RS: 10390

INPUT
Description: Channel STA 30+60. Shotcrete lined trapezoidal channel.
Downstream toe of vertical transition to culvert grade.
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9966	1596.2	9982.2	1594.2	9996	1585	10000	1585	10004	1585
10017.8	1594.2	10039	1594.2						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9966	.03	9982.2	.022	10017.8	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9982.2	10017.8	26	26	26	.3	.5

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1589.43	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.		0.022	
W.S. Elev (ft)	1589.27	Reach Len. (ft)	26.00	26.00	26.00
Crit W.S. (ft)		Flow Area (sq ft)		61.50	
E.G. Slope (ft/ft)	0.000633	Area (sq ft)		61.50	
Q Total (cfs)	199.00	Flow (cfs)		199.00	
Top Width (ft)	20.81	Top Width (ft)		20.81	
Vel Total (ft/s)	3.24	Avg. Vel. (ft/s)		3.24	
Max Chl Dpth (ft)	4.27	Hydr. Depth (ft)		2.96	
Conv. Total (cfs)	7912.6	Conv. (cfs)		7912.6	
Length Wtd. (ft)	26.00	Wetted Per. (ft)		23.39	
Min Ch El (ft)	1585.00	Shear (lb/sq ft)		0.10	
Alpha	1.00	Stream Power (lb/ft s)		0.34	
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)		0.40	
C & E Loss (ft)	0.00	Cum SA (acres)		0.16	

CROSS SECTION RIVER: Tract 21 Channel
REACH: Reach 1 RS: 10364.*

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9967.33	1595.63	9982.35	1593.97	9996	1584.87	10000	1584.87	10004	1584.87
10016.31	1593.97	10038	1593.97						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9967.33	.03	9982.35	.022	10016.31	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9982.35	10016.31	26	26	26	.3	.5

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1589.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.		0.022	
W.S. Elev (ft)	1589.26	Reach Len. (ft)	26.00	26.00	26.00
Crit W.S. (ft)		Flow Area (sq ft)		62.54	
E.G. Slope (ft/ft)	0.000595	Area (sq ft)		62.54	
Q Total (cfs)	199.00	Flow (cfs)		199.00	
Top Width (ft)	20.51	Top Width (ft)		20.51	
Vel Total (ft/s)	3.18	Avg. Vel. (ft/s)		3.18	
Max Chl Dpth (ft)	4.39	Hydr. Depth (ft)		3.05	
Conv. Total (cfs)	8161.1	Conv. (cfs)		8161.1	
Length Wtd. (ft)	26.00	Wetted Per. (ft)		23.29	
Min Ch El (ft)	1584.87	Shear (lb/sq ft)		0.10	
Alpha	1.00	Stream Power (lb/ft s)		0.32	
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)		0.36	
C & E Loss (ft)	0.00	Cum SA (acres)		0.14	

CROSS SECTION RIVER: Tract 21 Channel
REACH: Reach 1 RS: 10338.*

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9968.67	1595.07	9982.51	1593.73	9996	1584.74	10000	1584.74	10004	1584.74

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10014.83 1593.73   10037 1593.73

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9968.67     .03 9982.51    .02210014.83     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      9982.5110014.83                26      26      26             .3       .5

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)            1589.40   Element                   Left OB    Channel   Right OB
  Vel Head (ft)                0.15   Wt. n-Val.                            0.022
  W.S. Elev (ft)            1589.24   Reach Len. (ft)             26.00     26.00     26.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     63.47
  E.G. Slope (ft/ft)       0.000562   Area (sq ft)                          63.47
  Q Total (cfs)              199.00   Flow (cfs)                           199.00
  Top Width (ft)              20.18   Top Width (ft)                        20.18
  Vel Total (ft/s)             3.14   Avg. Vel. (ft/s)                       3.14
  Max Chl Dpth (ft)            4.50   Hydr. Depth (ft)                       3.14
  Conv. Total (cfs)          8391.9   Conv. (cfs)                          8391.9
  Length Wtd. (ft)            26.00   Wetted Per. (ft)                      23.17
  Min Ch El (ft)            1584.74   Shear (lb/sq ft)                       0.10
  Alpha                        1.00   Stream Power (lb/ft s)                 0.30
  Frctn Loss (ft)              0.01   Cum Volume (acre-ft)                   0.33
  C & E Loss (ft)              0.00   Cum SA (acres)                         0.13


CROSS SECTION          RIVER: Tract 21 Channel
REACH: Reach 1           RS: 10312

INPUT
Description: Channel STA 31+38.  Culvert Section #4.  Shotcrete lined
             trapezoidal channel just upstream of the upstream headwall.
Station Elevation Data     num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9970  1594.5 9982.66  1593.5    9996 1584.61   10000 1584.61   10004 1584.61
10013.34  1593.5   10036  1593.5

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9970     .03 9982.66    .02210013.34     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      9982.6610013.34                10      10      10             .3       .5

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)            1589.38   Element                   Left OB    Channel   Right OB
  Vel Head (ft)                0.15   Wt. n-Val.                            0.022
  W.S. Elev (ft)            1589.23   Reach Len. (ft)             10.00     10.00     10.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     64.22
  E.G. Slope (ft/ft)       0.000537   Area (sq ft)                          64.22
  Q Total (cfs)              199.00   Flow (cfs)                           199.00
  Top Width (ft)              19.79   Top Width (ft)                        19.79
  Vel Total (ft/s)             3.10   Avg. Vel. (ft/s)                       3.10
  Max Chl Dpth (ft)            4.62   Hydr. Depth (ft)                       3.24
  Conv. Total (cfs)          8590.6   Conv. (cfs)                          8590.6
  Length Wtd. (ft)            10.00   Wetted Per. (ft)                      23.04
  Min Ch El (ft)            1584.61   Shear (lb/sq ft)                       0.09
  Alpha                        1.00   Stream Power (lb/ft s)                 0.29
  Frctn Loss (ft)              0.01   Cum Volume (acre-ft)                   0.29
  C & E Loss (ft)              0.12   Cum SA (acres)                         0.12


Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less
         than 0.7 or greater than 1.4.  This may indicate the need for additional cross sections.

CROSS SECTION          RIVER: Tract 21 Channel
REACH: Reach 1           RS: 10302

INPUT
Description: Channel STA 31+48.  Culvert Section #3.  Upstream face of 8x4 RCB.
Station Elevation Data     num=       5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9995.99  1593.5    9996 1584.56   10000 1584.56   10004 1584.5610004.01  1593.5

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9995.99     .03 9995.99    .01510004.01     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      9995.9910004.01               230     230     230             .3       .5

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)            1589.25   Element                   Left OB    Channel   Right OB
  Vel Head (ft)                0.56   Wt. n-Val.                            0.015
  W.S. Elev (ft)            1588.68   Reach Len. (ft)            230.00    230.00    230.00
  Crit W.S. (ft)            1587.23   Flow Area (sq ft)                     32.99
  E.G. Slope (ft/ft)       0.001483   Area (sq ft)                          32.99
  Q Total (cfs)              199.00   Flow (cfs)                           199.00
  Top Width (ft)               8.01   Top Width (ft)                         8.01
  Vel Total (ft/s)             6.03   Avg. Vel. (ft/s)                       6.03
  Max Chl Dpth (ft)            4.12   Hydr. Depth (ft)                       4.12
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  Conv. Total (cfs)          5168.3   Conv. (cfs)                          5168.3
  Length Wtd. (ft)           230.00   Wetted Per. (ft)                     16.59
  Min Ch El (ft)            1584.56   Shear (lb/sq ft)                      0.18
  Alpha                        1.00   Stream Power (lb/ft s)                1.11
  Frctn Loss (ft)                     Cum Volume (acre-ft)                  0.28
  C & E Loss (ft)                     Cum SA (acres)                        0.12


CULVERT                 RIVER: Tract 21 Channel
REACH: Reach 1            RS: 10187.5

INPUT
Description: Channel STA 32+62.5.  8'x4' RCB (Std ADOT Config)
Distance from Upstream XS =       0
Deck/Roadway Width        =     230
Weir Coefficient          =     2.6
Bridge Deck/Roadway Skew  =
Upstream  Deck/Roadway Coordinates
    num=        2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    9980  1594.5           10020  1594.5

Upstream Bridge Cross Section Data
Station Elevation Data    num=       5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9995.99  1593.5    9996 1584.56   10000 1584.56   10004 1584.5610004.01  1593.5

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9995.99     .03 9995.99    .01510004.01     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
       9995.9910004.01             .3       .5

Downstream  Deck/Roadway Coordinates
    num=        2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    9980    1594           10020    1594

Downstream Bridge Cross Section Data
Station Elevation Data    num=       5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9995.99  1591.5    9996 1583.41   10000 1583.41   10004 1583.4110004.01  1591.5

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9995.99     .03 9995.99    .01510004.01     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
       9995.9910004.01             .3       .5

Upstream Embankment side slope              =      46 horiz. to 1.0 vertical
Downstream Embankment side slope            =      16 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  1

Culvert Name     Shape      Rise    Span
Culvert #1         Box       4       8
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    n Value   Entrance Loss Coef   Exit Loss Coef
                  0     230       .015                   .5                1
Upstream   Elevation =  1584.56
           Centerline Station =  10000
Downstream Elevation =  1583.41
           Centerline Station =  10000

CULVERT OUTPUT    Profile #PF 1
Culvert ID : Culvert #1

  Culv Q (cfs)            199.00   Culv Vel In (ft/s)        9.29
  # Barrels                    1   Culv Vel Out (ft/s)       9.51
  Q Barrel (cfs)          199.00   Culv Inv El Up (ft)    1584.56
  E.G. US. (ft)          1589.25   Culv Inv El Dn (ft)    1583.41
  W.S. US. (ft)          1588.68   Culv Frctn Ls (ft)        1.15
  Delta EG (ft)             1.82   Culv Ext Lss (ft)         0.00
  Delta WS (ft)             2.68   Culv Ent Lss (ft)         0.67
  E.G. IC (ft)           1588.89   Q Weir (cfs)
  E.G. OC (ft)           1589.25   Weir Sta Lft (ft)
  Culvert Control         Outlet   Weir Sta Rgt (ft)
  Culv WS In (ft)        1587.24   Weir Submerg
  Culv WS Out (ft)       1586.02   Weir Max Depth (ft)
  Culv Nml Depth (ft)       2.61   Weir Avg Depth (ft)
  Culv Crt Depth (ft)       2.68   Wr Flw Area (sq ft)
  Culv Ful Lngh (ft)               Min Top Rd (ft)        1594.50


Note:    During supercritical analysis, the culvert direct step method went to normal depth.  The
         program then assumed normal depth at the outlet.
```

Note: The flow in the culvert is entirely supercritical.

CROSS SECTION RIVER: Tract 21 Channel
REACH: Reach 1 RS: 10072

INPUT
Description: Channel STA 33+78. Culvert Section #2. Downstream face of 8x4 RCB.
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9995.99	1591.5	9996	1583.41	10000	1583.41	10004	1583.41	10004.01	1591.5

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9995.99	.03	9995.99	.01	10004.01	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9995.99	10004.01	22	22	22	.3	.5

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1587.43	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.43	Wt. n-Val.		0.015	
W.S. Elev (ft)	1586.00	Reach Len. (ft)	22.00	22.00	22.00
Crit W.S. (ft)	1586.08	Flow Area (sq ft)		20.71	
E.G. Slope (ft/ft)	0.004980	Area (sq ft)		20.71	
Q Total (cfs)	199.00	Flow (cfs)		199.00	
Top Width (ft)	8.01	Top Width (ft)		8.01	
Vel Total (ft/s)	9.61	Avg. Vel. (ft/s)		9.61	
Max Chl Dpth (ft)	2.59	Hydr. Depth (ft)		2.59	
Conv. Total (cfs)	2819.8	Conv. (cfs)		2819.8	
Length Wtd. (ft)	22.00	Wetted Per. (ft)		12.85	
Min Ch El (ft)	1583.41	Shear (lb/sq ft)		0.50	
Alpha	1.00	Stream Power (lb/ft s)		4.81	
Frctn Loss (ft)		Cum Volume (acre-ft)		0.14	
C & E Loss (ft)		Cum SA (acres)		0.07	

CROSS SECTION RIVER: Tract 21 Channel
REACH: Reach 1 RS: 10050

INPUT
Description: Channel STA 34+00. Culvert Section #1. Future shotcrete lined trapezoidal channel. Section will be constructed with different contract.
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9983.7	1591.5	9996	1583.3	10000	1583.3	10004	1583.3	10016.3	1591.5

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9983.7	.03	9983.7	.022	10016.3	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9983.7	10016.3	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1587.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.08	Wt. n-Val.		0.022	
W.S. Elev (ft)	1584.94	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	1585.59	Flow Area (sq ft)		17.18	
E.G. Slope (ft/ft)	0.022218	Area (sq ft)		17.18	
Q Total (cfs)	199.00	Flow (cfs)		199.00	
Top Width (ft)	12.93	Top Width (ft)		12.93	
Vel Total (ft/s)	11.58	Avg. Vel. (ft/s)		11.58	
Max Chl Dpth (ft)	1.64	Hydr. Depth (ft)		1.33	
Conv. Total (cfs)	1335.1	Conv. (cfs)		1335.1	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		13.92	
Min Ch El (ft)	1583.30	Shear (lb/sq ft)		1.71	
Alpha	1.00	Stream Power (lb/ft s)		19.83	
Frctn Loss (ft)	0.20	Cum Volume (acre-ft)		0.13	
C & E Loss (ft)	0.20	Cum SA (acres)		0.07	

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Tract 21 Channel
REACH: Reach 1 RS: 10000

INPUT
Description: Channel STA 34+50. Future shotcrete lined trapezoidal channel. Section will be constructed with different contract.
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9984.08	1591	9996	1583.05	10000	1583.05	10004	1583.05	10015.92	1591

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9984.08	.03	9984.08	.02	10015.92	.03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

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      9984.0810015.92              150     150     150             .1       .3

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)            1586.26  Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.73  Wt. n-Val.                            0.022
  W.S. Elev (ft)            1585.53  Reach Len. (ft)             150.00    150.00     150.00
  Crit W.S. (ft)            1585.35  Flow Area (sq ft)                      29.07
  E.G. Slope (ft/ft)       0.005002  Area (sq ft)                           29.07
  Q Total (cfs)              199.00  Flow (cfs)                            199.00
  Top Width (ft)              15.44  Top Width (ft)                         15.44
  Vel Total (ft/s)             6.85  Avg. Vel. (ft/s)                        6.85
  Max Chl Dpth (ft)            2.48  Hydr. Depth (ft)                        1.88
  Conv. Total (cfs)          2813.8  Conv. (cfs)                           2813.8
  Length Wtd. (ft)           150.00  Wetted Per. (ft)                       16.94
  Min Ch El (ft)            1583.05  Shear (lb/sq ft)                        0.54
  Alpha                        1.00  Stream Power (lb/ft s)                  3.67
  Frctn Loss (ft)              0.75  Cum Volume (acre-ft)                    0.10
  C & E Loss (ft)              0.00  Cum SA (acres)                          0.05


Note:    Hydraulic jump has occurred between this cross section and the previous upstream section.

CROSS SECTION          RIVER: Tract 21 Channel
REACH: Reach 1            RS: 9850

INPUT
Description: Channel STA 34+50.  Future shotcrete lined trapezoidal channel.
             Section will be constructed with different contract.
Station Elevation Data     num=       5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  9988.5  1587.3    9996  1582.3   10000  1582.3   10004  1582.3 10011.5  1587.3

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  9988.5     .03  9988.5    .022 10011.5     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        9988.5 10011.5                 0       0       0              .1       .3

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)            1585.51  Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.73  Wt. n-Val.                            0.022
  W.S. Elev (ft)            1584.78  Reach Len. (ft)
  Crit W.S. (ft)            1584.59  Flow Area (sq ft)                      29.07
  E.G. Slope (ft/ft)       0.005001  Area (sq ft)                           29.07
  Q Total (cfs)              199.00  Flow (cfs)                            199.00
  Top Width (ft)              15.44  Top Width (ft)                         15.44
  Vel Total (ft/s)             6.85  Avg. Vel. (ft/s)                        6.85
  Max Chl Dpth (ft)            2.48  Hydr. Depth (ft)                        1.88
  Conv. Total (cfs)          2814.1  Conv. (cfs)                           2814.1
  Length Wtd. (ft)                   Wetted Per. (ft)                       16.94
  Min Ch El (ft)            1582.30  Shear (lb/sq ft)                        0.54
  Alpha                        1.00  Stream Power (lb/ft s)                  3.67
  Frctn Loss (ft)                    Cum Volume (acre-ft)
  C & E Loss (ft)                    Cum SA (acres)


SUMMARY OF MANNING'S N VALUES

River:Tract 21 Channel

     Reach          River Sta.       n1       n2       n3       n4

 Reach 1             12350            .03      .025     .03
 Reach 1             12110            .03      .025     .03
 Reach 1             12090            .03      .035     .03
 Reach 1             12085.*          .03      .035     .03      .03
 Reach 1             12080.*          .03      .035     .03      .03
 Reach 1             12075.*          .03      .035     .03      .03
 Reach 1             12070            .03      .035     .03
 Reach 1             12020            .03      .025     .03
 Reach 1             12015            .03      .025     .03
 Reach 1             11755            .03      .025     .03
 Reach 1             11750            .03      .022     .03
 Reach 1             11745.*          .03      .022     .03      .03
 Reach 1             11740.*          .03      .022     .03      .03
 Reach 1             11735.*          .03      .022     .03      .03
 Reach 1             11730            .03      .022     .03
 Reach 1             11720.*          .03      .022     .03
 Reach 1             11700.*          .03      .022     .03
 Reach 1             11680            .03      .022     .03
 Reach 1             11260            .03      .022     .03
 Reach 1             11230            .03      .022     .03
 Reach 1             11070            .03      .022     .03
 Reach 1             11030            .03      .022     .03
 Reach 1             10950            .03      .022     .03
 Reach 1             10840            .03      .022     .03
 Reach 1             10790            .03      .022     .03
 Reach 1             10550            .03      .022     .03
 Reach 1             10450            .03      .022     .03
 Reach 1             10440.*          .03      .022     .03      .03
```

Reach 1	10430.*	.03	.022	.03	.03
Reach 1	10420.*	.03	.022	.03	.03
Reach 1	10410.*	.03	.022	.03	.03
Reach 1	10400.*	.03	.022	.03	.03
Reach 1	10390	.03	.022	.03	
Reach 1	10364.*	.03	.022	.03	
Reach 1	10338.*	.03	.022	.03	
Reach 1	10312	.03	.022	.03	
Reach 1	10302	.03	.015	.03	
Reach 1	10187.5	Culvert			
Reach 1	10072	.03	.015	.03	
Reach 1	10050	.03	.022	.03	
Reach 1	10000	.03	.022	.03	
Reach 1	9850	.03	.022	.03	

SUMMARY OF REACH LENGTHS

River: Tract 21 Channel

Reach	River Sta.	Left	Channel	Right
Reach 1	12350	260	260	260
Reach 1	12110	20	20	20
Reach 1	12090	5	5	5
Reach 1	12085.*	5	5	5
Reach 1	12080.*	5	5	5
Reach 1	12075.*	5	5	5
Reach 1	12070	20	20	20
Reach 1	12020	5	5	5
Reach 1	12015	260	260	260
Reach 1	11755	5	5	5
Reach 1	11750	5	5	5
Reach 1	11745.*	5	5	5
Reach 1	11740.*	5	5	5
Reach 1	11735.*	5	5	5
Reach 1	11730	10	10	10
Reach 1	11720.*	20	20	20
Reach 1	11700.*	20	20	20
Reach 1	11680	420	420	420
Reach 1	11260	30	30	30
Reach 1	11230	160	160	160
Reach 1	11070	40	40	40
Reach 1	11030	80	80	80
Reach 1	10950	120	120	120
Reach 1	10840	50	50	50
Reach 1	10790	240	240	240
Reach 1	10550	100	100	100
Reach 1	10450	10	10	10
Reach 1	10440.*	10	10	10
Reach 1	10430.*	10	10	10
Reach 1	10420.*	10	10	10
Reach 1	10410.*	10	10	10
Reach 1	10400.*	10	10	10
Reach 1	10390	26	26	26
Reach 1	10364.*	26	26	26
Reach 1	10338.*	26	26	26
Reach 1	10312	10	10	10
Reach 1	10302	230	230	230
Reach 1	10187.5	Culvert		
Reach 1	10072	22	22	22
Reach 1	10050	50	50	50
Reach 1	10000	150	150	150
Reach 1	9850	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Tract 21 Channel

Reach	River Sta.	Contr.	Expan.
Reach 1	12350	.1	.3
Reach 1	12110	.1	.3
Reach 1	12090	.1	.3
Reach 1	12085.*	.1	.3
Reach 1	12080.*	.1	.3
Reach 1	12075.*	.1	.3
Reach 1	12070	.3	.5
Reach 1	12020	.1	.3
Reach 1	12015	.1	.3
Reach 1	11755	.1	.3
Reach 1	11750	.1	.3
Reach 1	11745.*	.1	.3
Reach 1	11740.*	.1	.3
Reach 1	11735.*	.1	.3
Reach 1	11730	.3	.5
Reach 1	11720.*	.3	.5
Reach 1	11700.*	.3	.5
Reach 1	11680	.1	.3
Reach 1	11260	.1	.3

Reach 1	11230	.1	.3
Reach 1	11070	.1	.3
Reach 1	11030	.1	.3
Reach 1	10950	.1	.3
Reach 1	10840	.1	.3
Reach 1	10790	.1	.3
Reach 1	10550	.1	.3
Reach 1	10450	.1	.3
Reach 1	10440.*	.1	.3
Reach 1	10430.*	.1	.3
Reach 1	10420.*	.1	.3
Reach 1	10410.*	.1	.3
Reach 1	10400.*	.1	.3
Reach 1	10390	.3	.5
Reach 1	10364.*	.3	.5
Reach 1	10338.*	.3	.5
Reach 1	10312	.3	.5
Reach 1	10302	.3	.5
Reach 1	10187.5	Culvert	
Reach 1	10072	.3	.5
Reach 1	10050	.1	.3
Reach 1	10000	.1	.3
Reach 1	9850	.1	.3

Profile Output Table - Standard Table 1

Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach 1	12350	10.00	1606.50	1607.31	1607.31	1607.52	0.013271	3.67	2.72	6.74	1.02
Reach 1	12110	10.00	1604.12	1605.13	1604.94	1605.22	0.004419	2.45	4.07	8.07	0.61
Reach 1	12090	10.00	1604.00	1604.82	1604.82	1605.03	0.025632	3.69	2.71	6.59	1.01
Reach 1	12085.*	10.00	1603.38	1603.97	1604.20	1604.77	0.152227	7.18	1.39	4.73	2.33
Reach 1	12080.*	10.00	1602.75	1603.36	1603.57	1604.06	0.126989	6.72	1.49	4.88	2.14
Reach 1	12075.*	10.00	1602.12	1602.72	1602.94	1603.46	0.136919	6.91	1.45	4.81	2.22
Reach 1	12070	22.00	1601.50	1603.09	1602.63	1603.17	0.003668	2.17	10.16	12.75	0.43
Reach 1	12020	22.00	1601.35	1603.06		1603.12	0.001276	1.88	11.73	13.70	0.36
Reach 1	12015	34.00	1601.33	1602.91		1603.09	0.004632	3.39	10.02	12.66	0.67
Reach 1	11755	34.00	1599.92	1601.39		1601.63	0.006849	3.93	8.66	11.77	0.81
Reach 1	11750	34.00	1599.90	1601.25	1601.25	1601.59	0.008500	4.69	7.25	10.77	1.01
Reach 1	11745.*	34.00	1599.43	1600.28	1600.63	1601.43	0.039152	8.64	3.94	7.32	2.07
Reach 1	11740.*	34.00	1598.95	1599.56	1599.99	1601.12	0.060896	10.02	3.39	7.04	2.54
Reach 1	11735.*	34.00	1598.47	1598.93	1599.37	1600.72	0.087390	10.75	3.16	7.78	2.97
Reach 1	11730	65.00	1598.00	1598.68	1599.17	1600.41	0.049480	10.55	6.16	10.05	2.38
Reach 1	11720.*	65.00	1597.95	1599.37	1599.12	1599.69	0.003927	4.51	14.43	12.27	0.73
Reach 1	11700.*	65.00	1597.85	1599.31		1599.60	0.003621	4.38	14.84	12.37	0.71
Reach 1	11680	65.00	1597.75	1599.25		1599.53	0.003286	4.24	15.34	12.49	0.67
Reach 1	11260	96.00	1595.65	1597.32		1597.78	0.004887	5.48	17.52	13.00	0.83
Reach 1	11230	96.00	1595.50	1597.17		1597.64	0.004834	5.46	17.59	13.02	0.83
Reach 1	11070	96.00	1594.70	1596.82		1597.08	0.002144	4.13	23.24	13.95	0.56
Reach 1	11030	120.00	1594.50	1596.39		1596.92	0.004892	5.86	20.47	13.67	0.84
Reach 1	10950	120.00	1594.10	1596.04		1596.54	0.004425	5.66	21.21	13.83	0.81
Reach 1	10840	120.00	1593.55	1595.42		1595.97	0.005050	5.93	20.25	13.62	0.86
Reach 1	10790	120.00	1593.30	1595.14		1595.71	0.005332	6.04	19.86	13.53	0.88
Reach 1	10550	120.00	1592.10	1594.07		1594.55	0.004181	5.55	21.64	13.92	0.78
Reach 1	10450	120.00	1591.60	1593.30	1593.30	1594.00	0.007094	6.68	17.98	13.11	1.00
Reach 1	10440.*	120.00	1590.50	1591.57	1592.20	1593.70	0.036535	11.72	10.24	11.20	2.16
Reach 1	10430.*	120.00	1589.40	1590.35	1591.10	1593.17	0.055446	13.48	8.90	10.84	2.62
Reach 1	10420.*	120.00	1588.30	1589.18	1590.00	1592.50	0.070699	14.62	8.21	10.64	2.93
Reach 1	10410.*	120.00	1587.20	1588.05	1588.90	1591.69	0.081371	15.32	7.83	10.54	3.13
Reach 1	10400.*	120.00	1586.10	1589.31	1587.80	1589.44	0.000693	2.92	41.14	17.63	0.34
Reach 1	10390	199.00	1585.00	1589.27		1589.43	0.000633	3.24	61.50	20.81	0.33
Reach 1	10364.*	199.00	1584.87	1589.26		1589.41	0.000595	3.18	62.54	20.51	0.32
Reach 1	10338.*	199.00	1584.74	1589.24		1589.40	0.000562	3.14	63.47	20.18	0.31
Reach 1	10312	199.00	1584.61	1589.23		1589.38	0.000537	3.10	64.22	19.79	0.30
Reach 1	10302	199.00	1584.56	1588.68	1587.23	1589.25	0.001483	6.03	32.99	8.01	0.52
Reach 1	10187.5	Culvert									
Reach 1	10072	199.00	1583.41	1586.00	1586.08	1587.43	0.004980	9.61	20.71	8.01	0.52
Reach 1	10050	199.00	1583.30	1584.94	1585.59	1587.03	0.022218	11.58	17.18	12.93	1.77
Reach 1	10000	199.00	1583.05	1585.53	1585.35	1586.26	0.005002	6.85	29.07	15.44	0.88
Reach 1	9850	199.00	1582.30	1584.78	1584.59	1585.51	0.005001	6.85	29.07	15.44	0.88

Profile Output Table - Standard Table 2

Reach	River Sta	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
Reach 1	12350	1607.52	1607.31	0.21	1.85	0.03		10.00		6.74
Reach 1	12110	1605.22	1605.13	0.09	0.18	0.01		10.00		8.07
Reach 1	12090	1605.03	1604.82	0.21	0.13	0.00		10.00		6.59
Reach 1	12085.*	1604.77	1603.97	0.80	0.25	0.05		10.00		4.73
Reach 1	12080.*	1604.06	1603.36	0.70	0.69	0.03		10.00		4.88
Reach 1	12075.*	1603.46	1602.72	0.74	0.64	0.00		10.00		4.81
Reach 1	12070	1603.17	1603.09	0.07	0.04	0.01		22.00		12.75
Reach 1	12020	1603.12	1603.06	0.05	0.01	0.01		22.00		13.70
Reach 1	12015	1603.09	1602.91	0.18	1.46	0.01		34.00		12.66
Reach 1	11755	1601.63	1601.39	0.24	0.04	0.01		34.00		11.77
Reach 1	11750	1601.59	1601.25	0.34	0.04	0.00		34.00		10.77
Reach 1	11745.*	1601.43	1600.28	1.16	0.08	0.08		34.00		7.32
Reach 1	11740.*	1601.12	1599.56	1.56	0.24	0.04		34.00		7.04
Reach 1	11735.*	1600.72	1598.93	1.80	0.36	0.02		34.00		7.78
Reach 1	11730	1600.41	1598.68	1.73	0.29	0.02		65.00		10.05
Reach 1	11720.*	1599.69	1599.37	0.32	0.08	0.01		65.00		12.27

Reach 1	11700.*	1599.60	1599.31	0.30	0.07	0.01	65.00	12.37
Reach 1	11680	1599.53	1599.25	0.28	1.72	0.02	65.00	12.49
Reach 1	11260	1597.78	1597.32	0.47	0.15	0.00	96.00	13.00
Reach 1	11230	1597.64	1597.17	0.46	0.49	0.06	96.00	13.02
Reach 1	11070	1597.08	1596.82	0.27	0.13	0.03	96.00	13.95
Reach 1	11030	1596.92	1596.39	0.53	0.37	0.01	120.00	13.67
Reach 1	10950	1596.54	1596.04	0.50	0.57	0.00	120.00	13.83
Reach 1	10840	1595.97	1595.42	0.55	0.26	0.00	120.00	13.62
Reach 1	10790	1595.71	1595.14	0.57	1.14	0.03	120.00	13.53
Reach 1	10550	1594.55	1594.07	0.48	0.54	0.02	120.00	13.92
Reach 1	10450	1594.00	1593.30	0.69	0.07	0.00	120.00	13.11
Reach 1	10440.*	1593.70	1591.57	2.13	0.14	0.15	120.00	11.20
Reach 1	10430.*	1593.17	1590.35	2.82	0.45	0.07	120.00	10.84
Reach 1	10420.*	1592.50	1589.18	3.32	0.62	0.05	120.00	10.64
Reach 1	10410.*	1591.69	1588.05	3.64	0.76	0.03	120.00	10.54
Reach 1	10400.*	1589.44	1589.31	0.13	0.01	0.00	120.00	17.63
Reach 1	10390	1589.43	1589.27	0.16	0.02	0.00	199.00	20.81
Reach 1	10364.*	1589.41	1589.26	0.16	0.02	0.00	199.00	20.51
Reach 1	10338.*	1589.40	1589.24	0.15	0.01	0.00	199.00	20.18
Reach 1	10312	1589.38	1589.23	0.15	0.01	0.12	199.00	19.79
Reach 1	10302	1589.25	1588.68	0.56			199.00	8.01
Reach 1	10187.5	Culvert						
Reach 1	10072	1587.43	1586.00	1.43			199.00	8.01
Reach 1	10050	1587.03	1584.94	2.08	0.20	0.20	199.00	12.93
Reach 1	10000	1586.26	1585.53	0.73	0.75	0.00	199.00	15.44
Reach 1	9850	1585.51	1584.78	0.73			199.00	15.44

Profile Output Table - Four XS Culvert

Reach	River Sta	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
Reach 1	10312	1589.38	1589.23	0.15	0.01	0.12		199.00		19.79
Reach 1	10302	1589.25	1588.68	0.56				199.00		8.01
Reach 1	10187.5	Culvert								
Reach 1	10072	1587.43	1586.00	1.43				199.00		8.01
Reach 1	10050	1587.03	1584.94	2.08	0.20	0.20		199.00		12.93

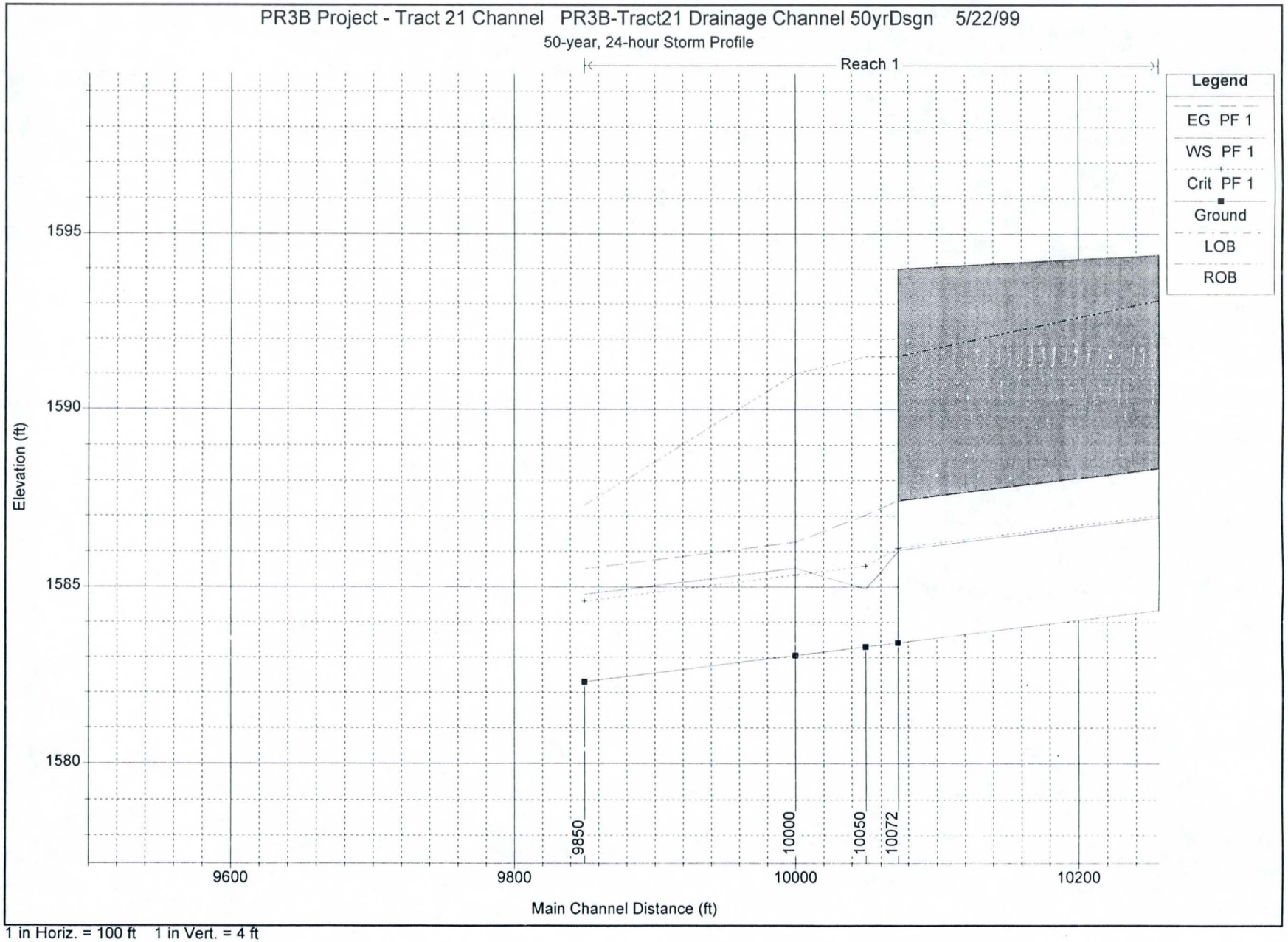
Profile Output Table - Culvert Only

Reach	River Sta	E.G. US. (ft)	W.S. US. (ft)	E.G. IC (ft)	E.G. OC (ft)	Min Top Rd (ft)	Culv Q (cfs)	Q Weir (cfs)	Delta WS (ft)	Culv Vel In (ft/s)	Culv Vel Out (ft/s)
Reach 1	10187.5	Culvert #1	1589.25	1588.68	1588.89	1589.25	1594.50	199.00		2.68	9.29

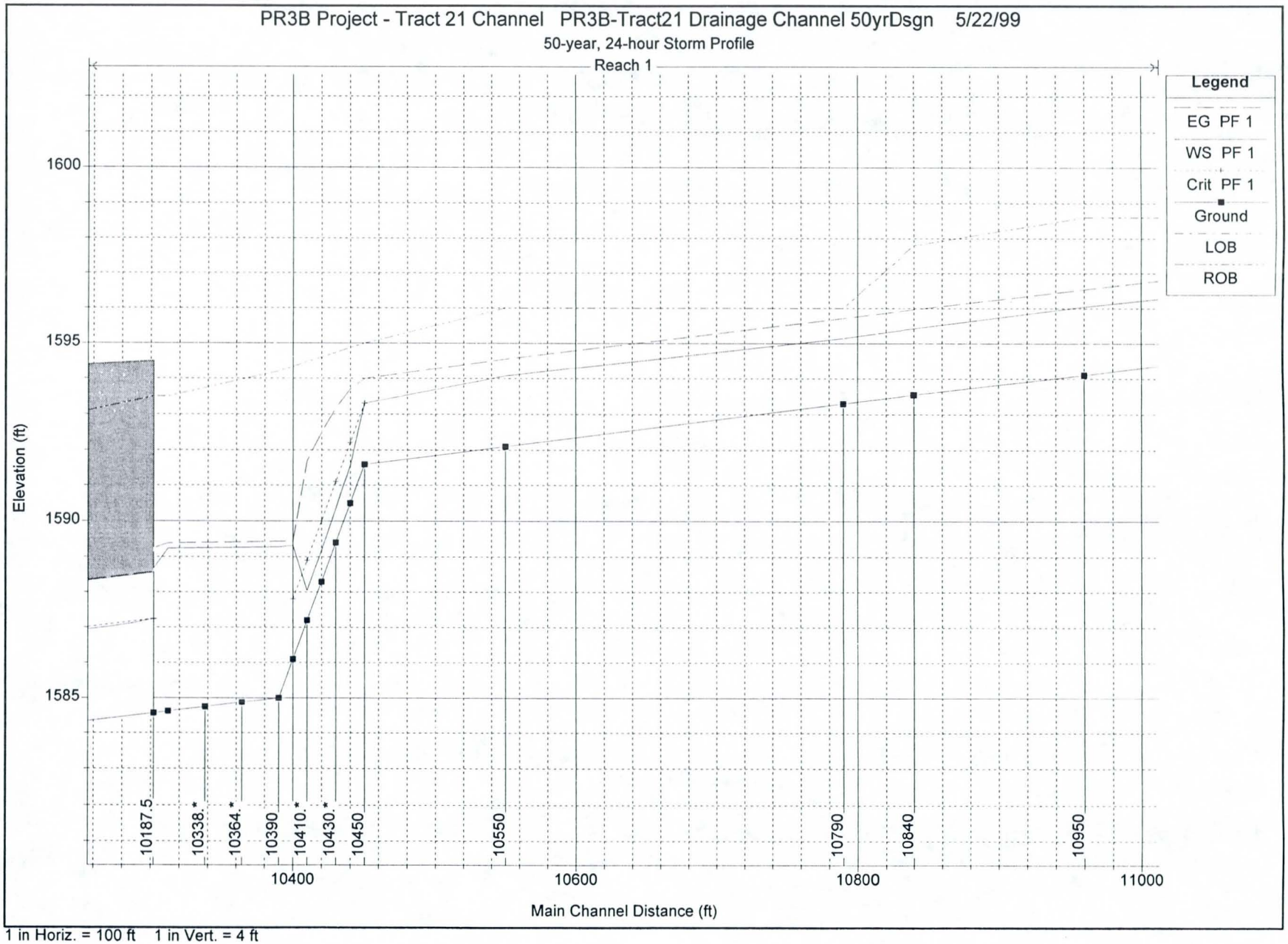
9.51

Appendix G

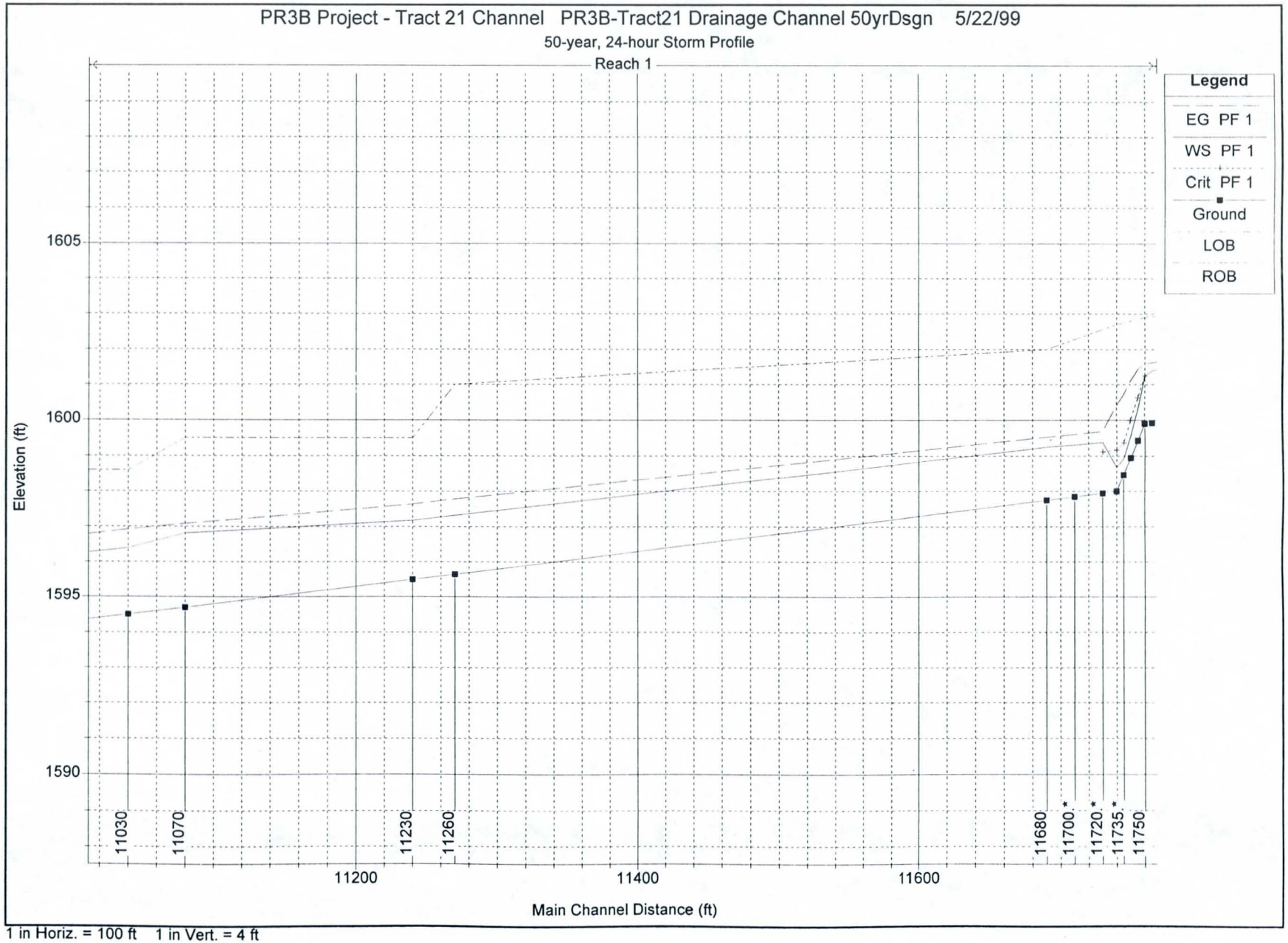
HEC-RAS Water Surface Profiles



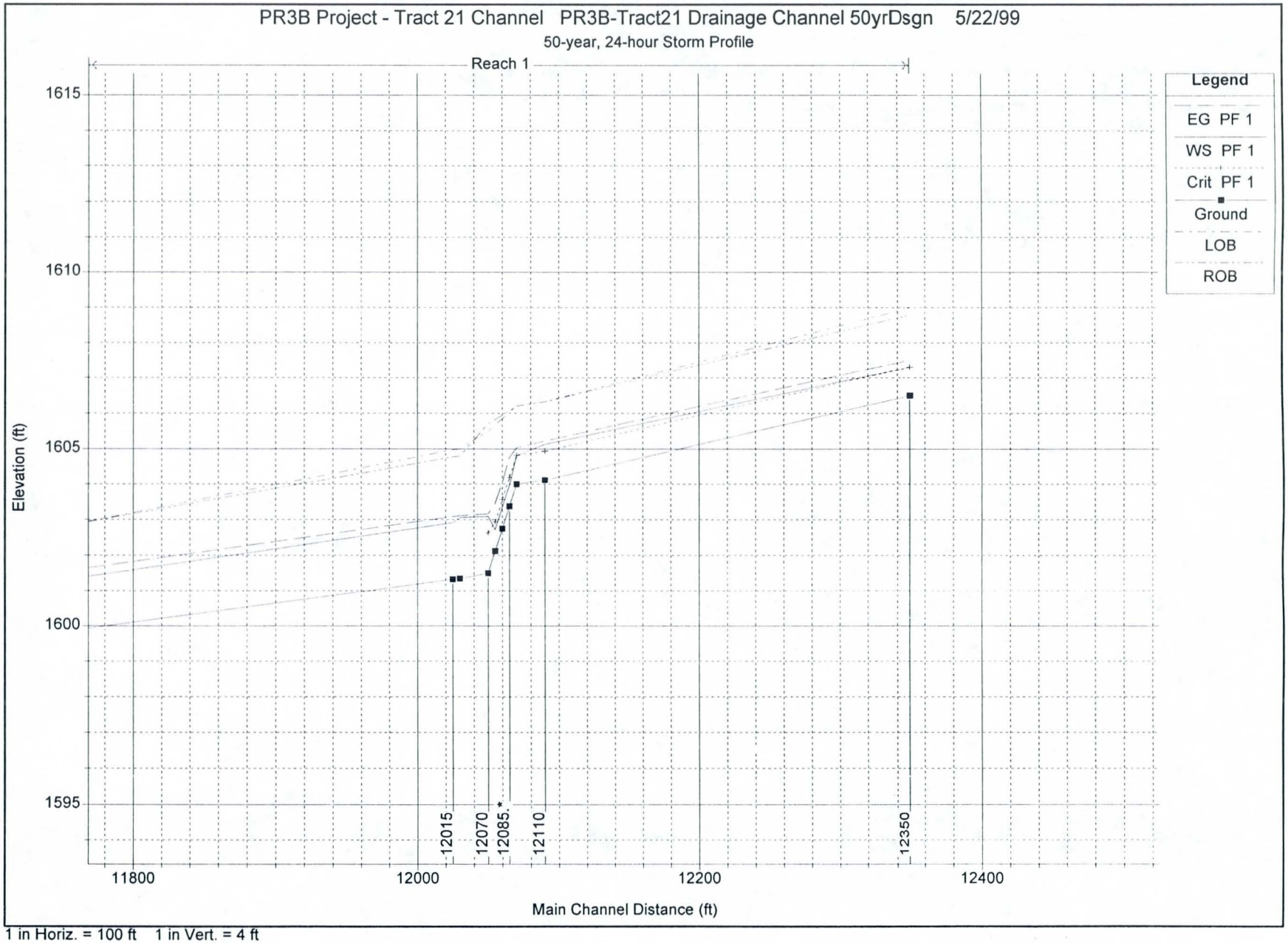
1 in Horiz. = 100 ft 1 in Vert. = 4 ft



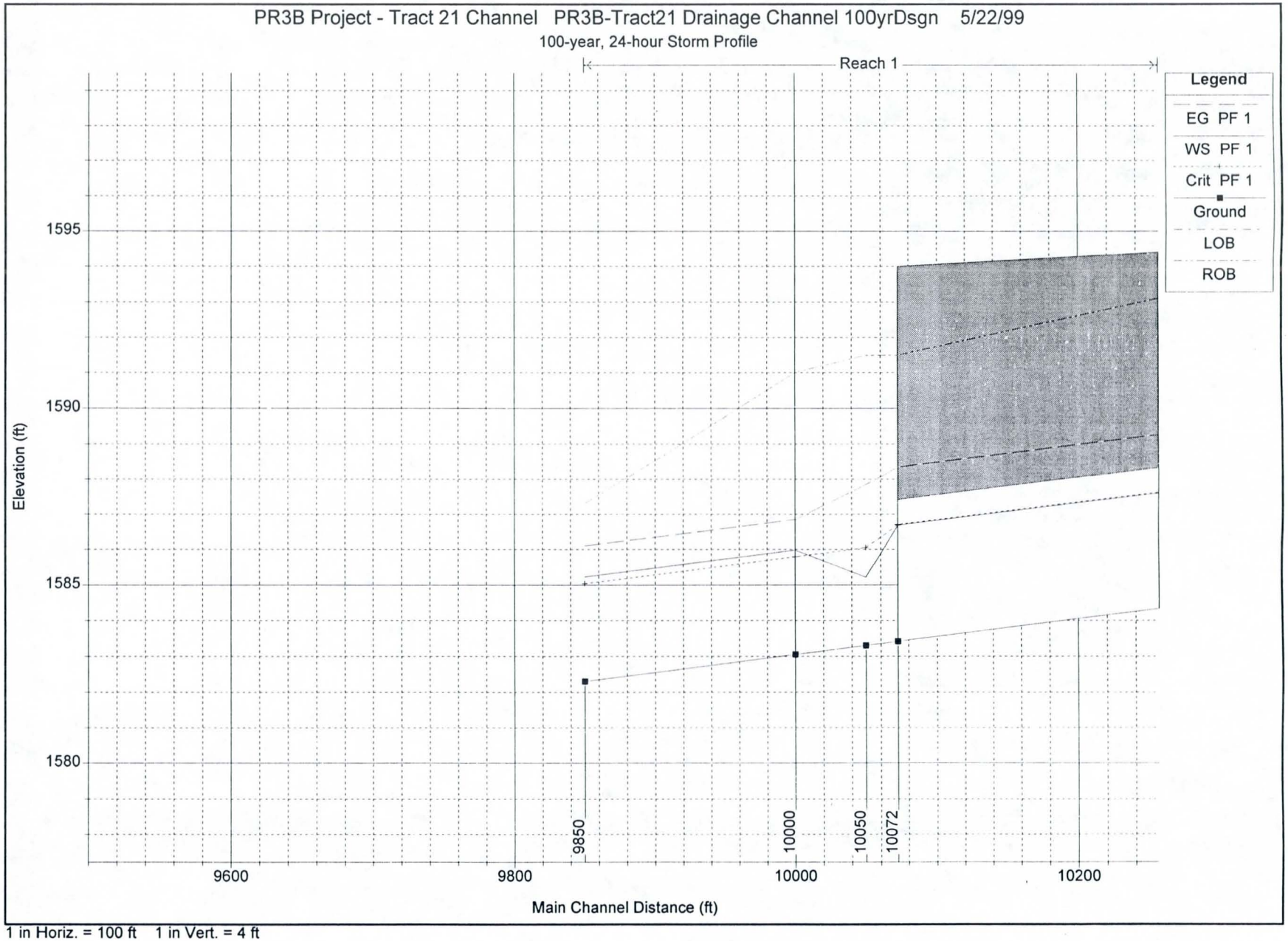
1 in Horiz. = 100 ft 1 in Vert. = 4 ft



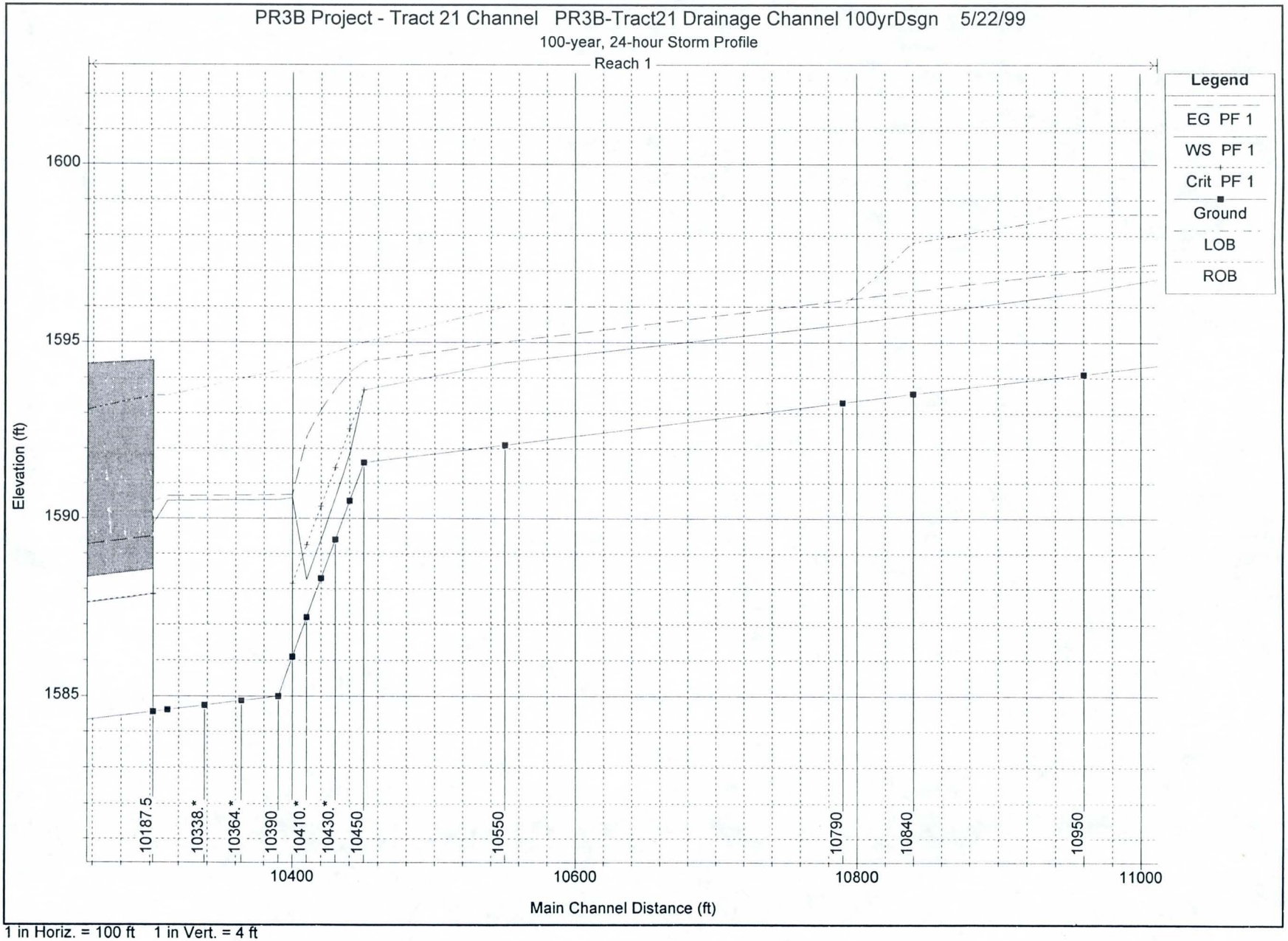
1 in Horiz. = 100 ft 1 in Vert. = 4 ft



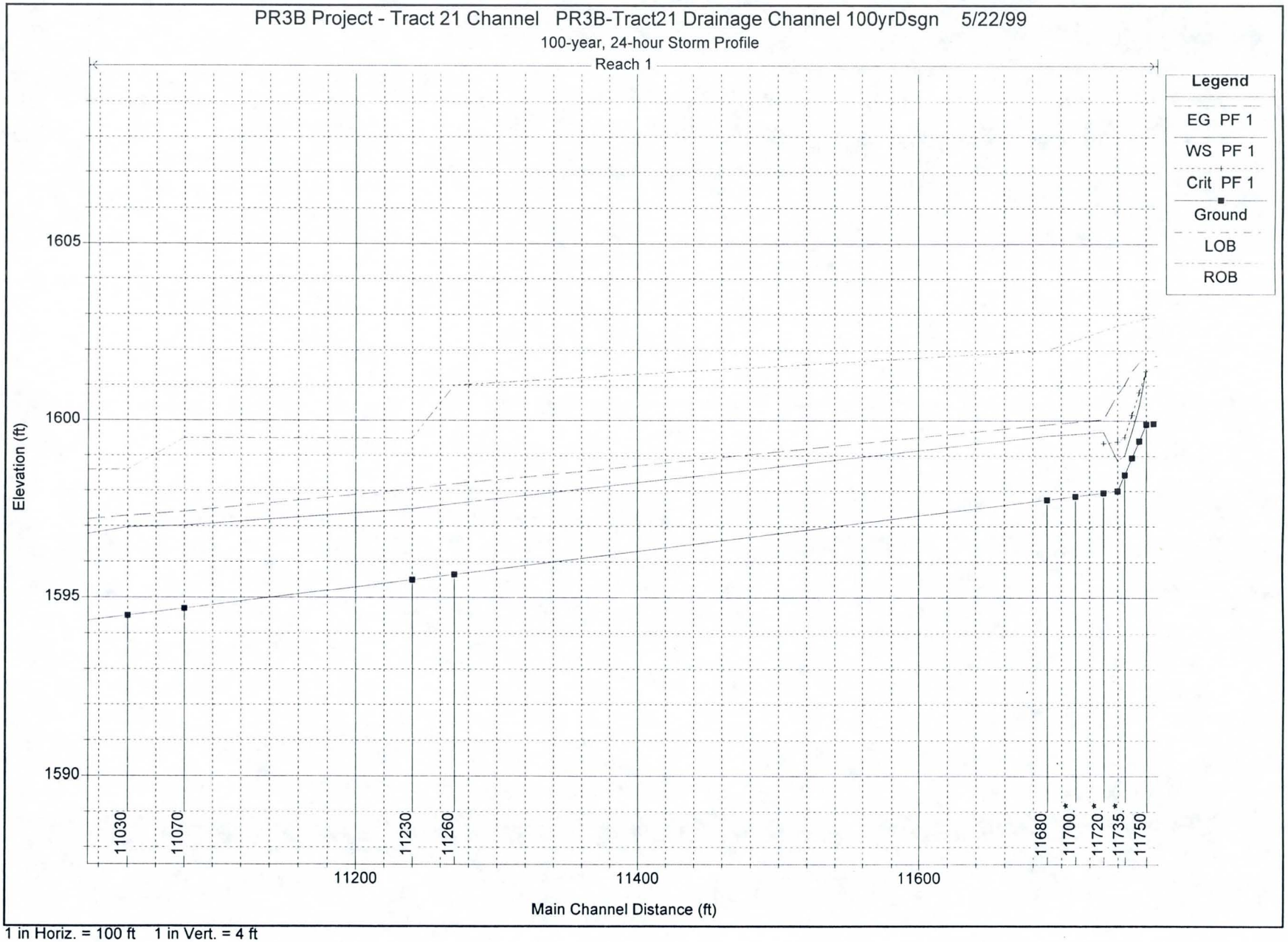
1 in Horiz. = 100 ft 1 in Vert. = 4 ft



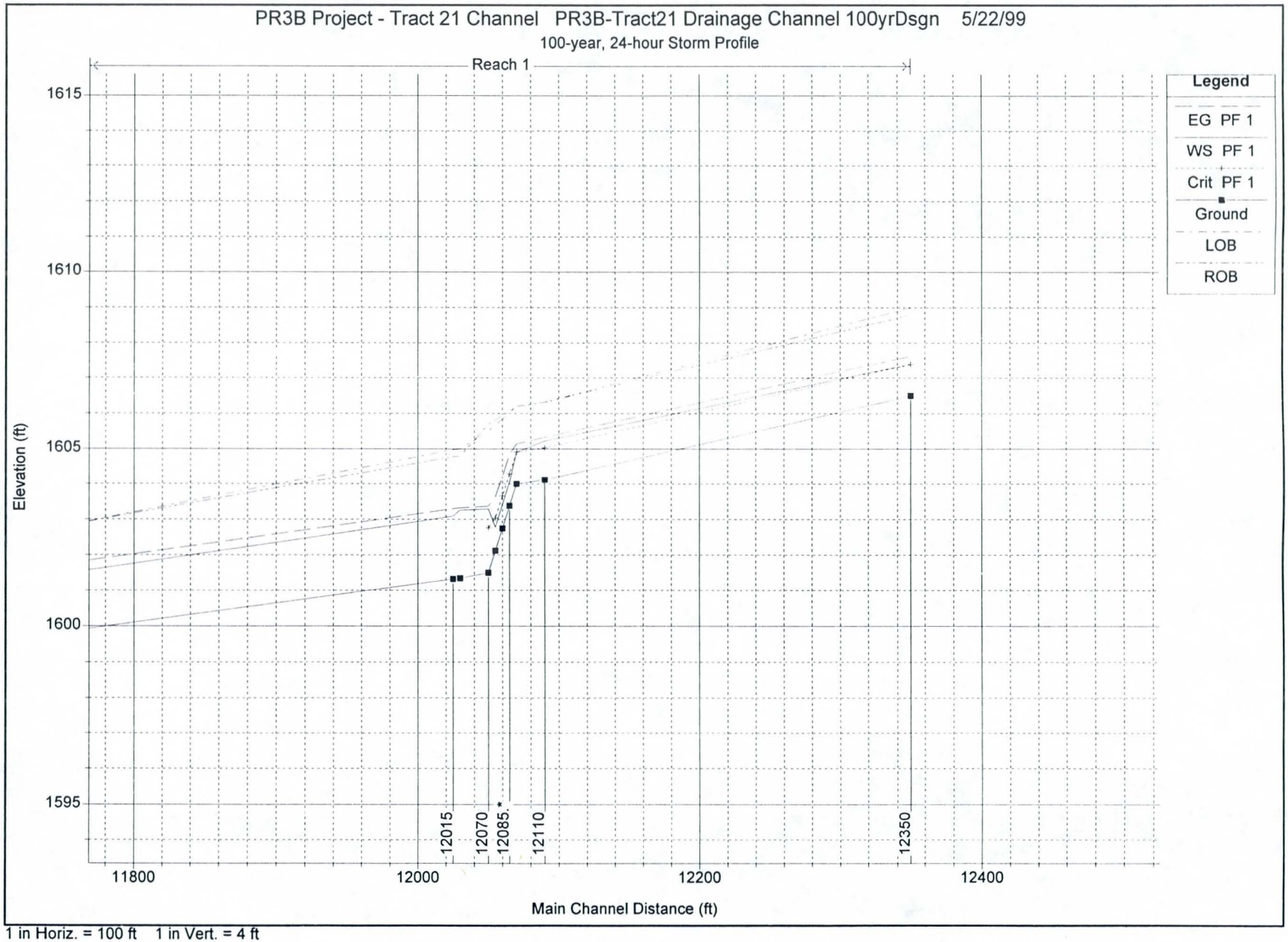
1 in Horiz. = 100 ft 1 in Vert. = 4 ft



1 in Horiz. = 100 ft 1 in Vert. = 4 ft



1 in Horiz. = 100 ft 1 in Vert. = 4 ft



1 in Horiz. = 100 ft 1 in Vert. = 4 ft

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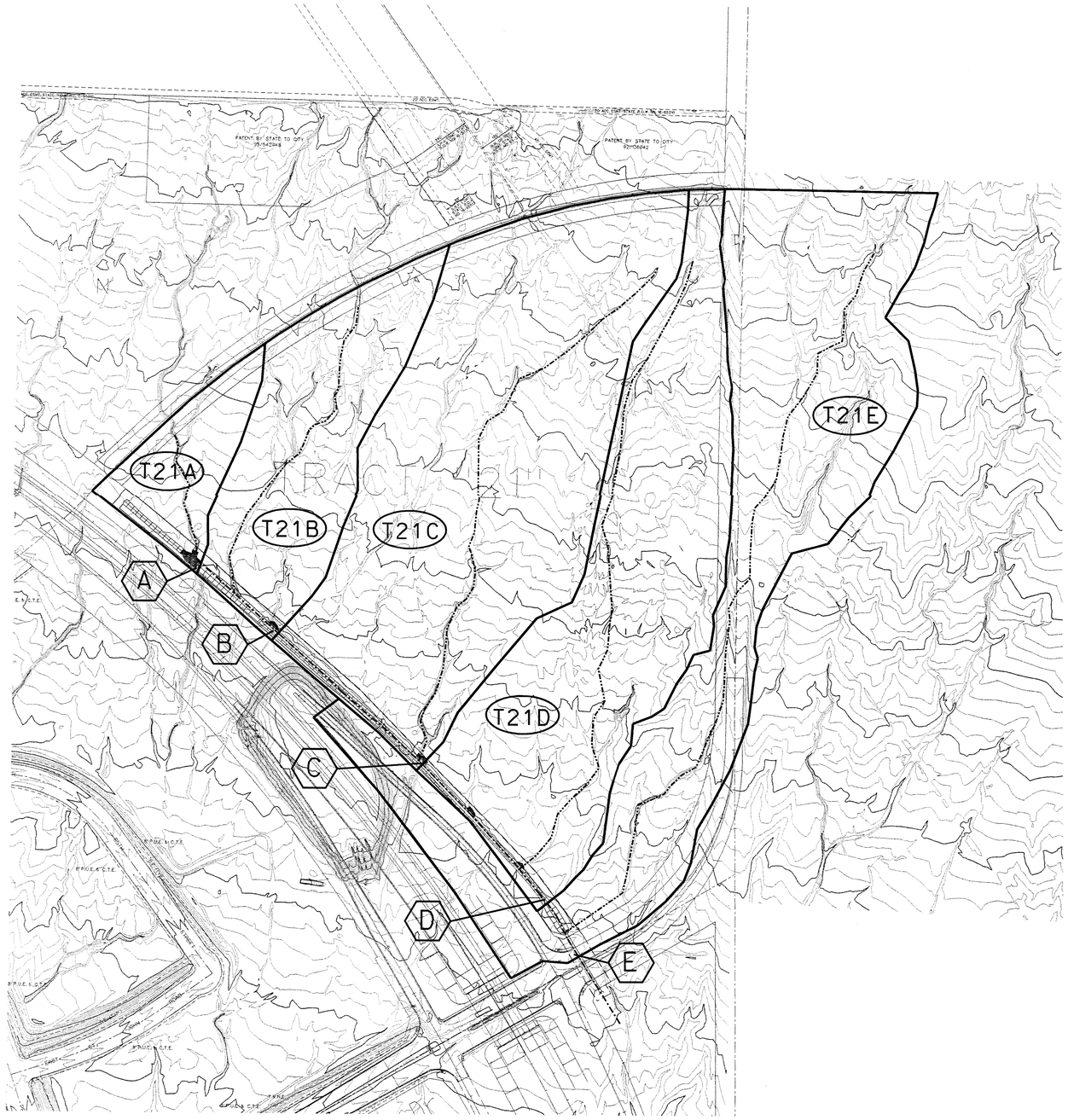

LEGEND

- Subbasin Boundary
- RK Record Flowpath
- Routing Flowpath
- (T21E) Subbasin Identifier
- (E) Concentration Point Identifier

200 0 200 400

CITY OF SCOTTSDALE ARIZONA

TRANSPORTATION DEPARTMENT

TRANSPORTATION PLANNING

3939 CIVIC CENTER BLVD.
SCOTTSDALE, ARIZONA 85251

PLATE 1

TRACT 21
DRAINAGE IMPROVEMENTS
WATERSHED MAP