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FINAL DRAINAGE REPORT FOR AUSTIN BLUFFS STORM SEWER OUTFALL MEADOW RIDGE DRIVE TO COTTONWOOD CREEK

September 1998

Prepared For:

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DRAINAGE REPORT STATEMENT

ENGINEER'S STATEMENT:
The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

______________________ 1-14-99
Kyle R. Campbell, Colorado P.E. #29794 Date
For and On Behalf of JR Engineering, Ltd.

DEVELOPER'S STATEMENT:
I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: LP47, LLC dba La Plata Investments

By: ______________________
Bob Ingels

Title: ______________________

Address: 7150 Campus Drive, Suite 365

Colorado Springs, CO 80920

CITY OF COLORADO SPRINGS ONLY:
Filed in accordance with Section 15-3-906 of the Code of the City of Colorado Springs, 1980, as amended.

______________________ Jan 15, 1999
City Engineer Date

Conditions:

FINAL DRAINAGE REPORT FOR AUSTIN BLUFFS STORM SEWER OUTFALL MEADOW RIDGE DRIVE TO COTTONWOOD CREEK

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APPENDIX

FINAL DRAINAGE REPORT FOR AUSTIN BLUFFS STORM SEWER OUTFALL MEADOW RIDGE DRIVE TO COTTONWOOD CREEK

PURPOSE

The purpose of this report is to outline facilities and present hydraulic analysis to demonstrate that the proposed facilities can safely convey developed condition flows from the existing box culvert under Meadow Ridge Drive to the proposed outfall at Cottonwood Creek.

GENERAL DESCRIPTION

Austin Bluffs storm sewer outfall is located in the east half of Section 2, Township 13 South, Range 66 West of the Sixth Principal Meridian in the City of Colorado Springs, County of El Paso, State of Colorado. The site is bounded to the south by Woodmen Road and Cottonwood Creek, to the north by Meadow Ridge Drive, to the east by Austin Bluffs Parkway Pilot Road, and to the west by a natural channel tributary to Cottonwood Creek, and unplatted lands.

The proposed construction consists of approximately 1,800 L.F. of 6' high by 11' wide cast inplace reinforced concrete box culvert (RCB), a 52.5' long reinforced concrete energy dissipater, and a 64' long reinforced concrete baffled chute drop structure. The proposed facilities are intended to intercept runoff at the existing outlet of the 6' x 10' RCB under Meadow Ridge Drive, and convey that runoff and that from the Austin Bluffs Pilot Road storm drain inlets +/-1917-feet south to Cottonwood Creek. The proposed discharge point is between the existing natural channel on the west and Austin Bluffs Pilot Road on the east.

The soils within the project area and the tributary watershed are predominately "Blakeland Soils," Map Symbol 8, belonging to Hydrologic Soil Group B. The watershed also contains a small area Map Symbol 83, "Stapleton Sandy Loam Soils," Hydrologic Soil Group B.

EXISTING CONDITIONS

Presently, drainage from Sub-Basins G1 through G5 and a portion of Sub-Basins G6 discharges through an existing 6' x 10' RCB under Meadow Ridge Drive. The existing culvert discharges through a short section of concrete channel to the existing natural channel tributary to Cottonwood Creek. Existing storm inlets near the junction of Meadow Ridge Drive and Austin Bluffs Parkway also discharge to the existing natural channel.

The Preliminary/Final Drainage Report Austin Bluffs Parkway from Woodmen Road north to Meadow Ridge provides for inlets along Austin Bluffs Parkway, which temporarily discharge to the existing natural drainage way.

PROPOSED DRAINAGE CONDITIONS

The proposed project will intercept the discharge from the 6' x 10' box culvert under Meadow Ridge Drive, as well as flow from the existing 4-foot drainage inlets in Meadow Ridge Drive, and flows from inlets serving Austin Bluffs Parkway and Fairfax at Briargate Filing No. 6. It is also anticipated that future developed flows from Sub-Basin 8A will be directed to the proposed 6' x 11' RCB from the west. The exact location of the future connection point(s) is not known at this time. Future inlet(s) for the widening of the southerly portions of Austin Bluffs Parkway should also be connected to the proposed reinforced concrete box culvert.

At Station 13+56 a combination manhole/sump inlet is proposed to intercept the flowby from the adjacent Austin Bluffs inlets. At such time as the widening of Austin Bluffs Parkway is completed with additional inlets constructed to the south, this inlet can be abandoned.

It is proposed that future grading concepts adjacent to the project corridor reflect the possibility of plugged condition and/or flows in excess of the design condition. In these conditions it is proposed that overflow will be routed down Austin Bluffs Parkway. Developed condition grading should provide relief above the street elevation.

Grading proposed with this project will direct surface drainage from the project area into the existing gutter and swale along Austin Bluffs Parkway.

HYDROLOGY

The Cottonwood Creek Drainage Basin has been studied by URS Consultants, "Cottonwood Creek Drainage Basin Planning Study," dated June 6, 1994, and the Draft "Cottonwood Creek Drainage Basin Planning Study," dated May 1996, by Ayres Associates.

Sub-Basins G1 through G8 as defined in the above referenced Studies contribute runoff to the project facilities. Only portions of Basins G7 and G8 are tributary to the proposed facilities. Calculations indicating the adjustments to Basins G7A and G8A tributary areas are included in the Appendix of this report.

HEC-1 modeling done to generate the design flow data for the proposed facilities is consistent with the modeling done by Ayres Associates in preparation of the draft "Cottonwood Creek Basin Planning Study," dated May 1996.

It should be noted that a detention basin was proposed in Basin G8, in the drainage basin planning study. The referenced letter report prepared by JR Engineering, Ltd., November 1, 1996, using flow data from the above studies concluded that the deletion of the detention pond created little additional impact on water velocity or flood levels in Cottonwood Creek downstream of the confluence. As a result, direct conveyance alternatives from Meadow Ridge Drive to the confluence with Cottonwood Creek were investigated resulting in the facilities proposed in this report.

It should be noted that additional connections to the box culvert may be required to serve Basin 8A in the developed condition to include potential future inlets along the ultimate section of Austin Bluffs Parkway. The location of these facilities has not been determined. Since the flows are minor and included in the total Q_{100} = 1651 cfs, these additions in the future should not have a significant impact on the function of the proposed facilities.

The HEC-1 Analysis Points 12C, 12CP, and 12CQ are indicated on the Drainage Basin and the Plan and Profile sheets included in the Appendix of this report.

It is proposed that at Analysis Point 12CP, a combination access manhole/sump inlet be provided to pick up an estimated 90% of the flowby Q_{100} = 39 cfs. This flow was temporarily directed to the existing natural channel in referenced Drainage Report for Austin Bluffs Parkway.

The attached HEC-1 analysis indicates a combined developed condition flow at Meadow Ridge Drive Analysis Point 12C of Q_{100} = 1484 cfs (including Sub-Basins G5 and G6), Q_{100} = 1527 cfs at Analysis Point 12CP and Q_{100} = 1651 cfs at the confluence with Cottonwood Creek Analysis Point 12CQ. At this time the location of junction points of the storm sewer(s) serving Sub-Basin G8A in the developed condition are unknown, thus the flow rate of Q_{100} = 1651 cfs was used for design from Analysis Point 12CP to the outfall.

HYDRAULICS – BOX CULVERT

Profile of the proposed alignment dictated an average slope of greater than 3% over the +/-1,800 L.F. of box culvert with a +/-40-foot drop from the top of slope above Cottonwood Creek to the channel bottom.

Analysis of various types of conveyances resulted in selection of a 6'R x 11'S cast inplace reinforced concrete box section to be designed to function as an open channel supporting supercritical flow. In order to facilitate this concept:

1. The RCB free board capacity must be signicificant enough to insure the water surface does not contact the top of the RCB for any substantial distance.

2. Allowances must be made for junction and bend losses to maintain supercritical flow through these transitions.

3. The duration of high flow velocity intervals should be short term to minimize abrasion of the concrete surfaces.

The capacity of the 6' R x 11' S box culvert section was evaluated with Mannings equation using Flow Master version 5.10 (data sheets are included in the Appendix). Also included in the Appendix is a table titled "Box Culvert Open Channel Hydraulics Summary," which tabulates the results of the Flow Master channel analysis for each section of the box culvert channel. In regards to capacity at Q_{100} = 1651 cfs, the maximum flow depth is 4.40'. At flow depth of 5.8', channel capacity is 2390 cfs, for 739 cfs or 45% theoretical reserve capacity. This indicates that it is unlikely that conditions would occur during a 100-year event that could sustain full depth flow. Note that Q_{100} flow depths are less than half of the critical depth for the box culvert tangent sections. Thus, it appears supercritical flow can be maintained during the 100-year event in the tangent sections.

To compensate for energy loss at bends and known junctions, inclined drops are provided to prevent a raise in the water surface. Losses were estimated using formulas for miter bends. Copies of the calculations and the formula source are included in the Appendix. Note that where the channel slopes are 6% or greater, the combined channel depth and junction or bend loss is less than the 6' box culvert height.

Junction losses calculated in accordance with methods outlined in the Publication "Hydraulic Analysis Of Junctions" Bureau Of Engineering, City of Los Angeles, Office Standard 115 Storm Drain Design Division, 1968, Page 19, Case E. The calculations demonstrate that water levels generated by the indicated junctions and future anticipated junctions are well below the six foot RCB height. The junction loss calculations are included in the Appendix.

To determine the likely duration and frequency of flow producing high velocities HEC-1 runs were made for 2, 10, and 100-year frequency storms. The Colorado Springs Drainage Criteria Manual indicates that concrete pipe requires additional protection for velocities over 18 fps. 15 fps was used in the following evaluation. Using Flow Master, the following channel flow conditions were defined:

Q	Channel Slope	Depth	Velocities
69 cfs	0.06	0.42 ft	15 fps
124 cfs	0.03	0.75 ft	15 fps

Reviewing the HEC-1 analysis for 2, 5, and 100-year frequency storms, the following time intervals can be determined for the above flow conditions:

1. A 2-year frequency storm will reach flows 69 cfs or greater for 55 minutes, 124 cfs or greater for 35 minutes.

2. A 10-year frequency storm will reach flows 69 cfs or greater for 1 hour 25 minutes, 124 cfs or greater for 1 hour 5 minutes.

3. A 100-year frequency storm will reach flows of 69 cfs or greater for 2 hours 35 minutes, 124 cfs or greater for 1 hour 30 minutes.

The table titled "Box Culvert Open Channel Hydraulics Summary" included in the Appendix of this report tabulates peak velocities from 32.5 to 42.5 fps for a 100-year frequency storm, 26.4 to 35.2 fps for a 10-year frequency storm, 19.9 to 26.2 fps for a 2-year frequency storm. Recognizing that these time intervals and velocities are theoretical, directly connected inlets on Austin Bluffs Parkway and Fairfax Filing No. 6 may produce flows that reach 18 fps in localized high intensity storms. However, the bottom line is that the duration of flows producing velocities greater than 15 fps will be relatively short and of low frequency.

HYDRAULICS – ENERGY DISSIPATER AND BAFFLED CHUTE DROP STRUCTURE

The purpose of the energy dissipater is to provide a transition from the 11-foot width of the RCB to the 32-foot width of the Baffled Chute Drop Structure. The invert of energy dissipater is 2.5 feet below the invert of the RCB and has an inside height of 8.5-feet. This is intended to minimize the potential for water levels rising in the RCB to full depth flow.

The dissipater provides for a width expansion ratio of 5:1. Two rows of baffles are intended to reduce velocity and spread the flow out over the width of the dissipater. Velocity can be calculated for the two extremes. The first assuming full depth flow:

$$V = Q/A$$

$$V = 1651 \text{ cfs}/(8.5')(32') = 6.1 \text{ fps}$$

The second assuming critical depth for a channel 32-foot wide with a slope of S = 0.002, n = 0.013, Q = 1651 cfs, then $V_{crit.}$ = 11.7 fps, $d_{crit.}$ = 4.36 ft. Actual water velocity would be between these extremes.

At the Baffled Drop Chute Structures the bottom of the channel rises1-foot above the dissipater channel bottom and at this point drop at the 4:1 slope of the proposed Baffled Chute Drop to the Cottonwood Creek Channel. Two low flow channels allow drainage of the dissipater channel. The first row of baffles in the chute are located at the same elevation as the dissipater outlet invert, 1-foot below the chute inlet crest. Seven rows of baffles space 9.25-feet apart are proposed in the Baffled Drop Chute Structure. The design of the Baffled Drop Chute Structure follows the guidelines given in the U.S. Department of Interior Bureau of Reclamation, Technical Publication "Design of Small Dams." Calculations are included in the Appendix of this report.

FLOOD PLAIN STATEMENT

The construction of the proposed outfall into Cottonwood Creek lies within the Cottonwood Creek 100-year flood limits and thus requires a Floodplain Development Permit.

RECOMMENDATIONS

As a result of this study, our analysis indicates that the installation of the proposed facilities can safely convey the 100-year storm event without adversely affecting the surrounding properties. Design analysis of the proposed facilities are included in the Appendix of this report.

Developed condition finish grade of the properties along Austin Bluffs Parkway between Woodmen Road and Meadow Ridge Drive should reflect the possibility of a plugged flow condition or storms in excess of the design frequency and provide relief above possible flood levels.

It is recommended that proposed facilities be constructed as outlined in this report and that future development be addressed as outlined in the section "Proposed Drainage Conditions" of this report.

CONSTRUCTION COST

Preliminary construction cost estimates for the proposed reinforced concrete box culvert, energy dissipater, baffled drop chute structure, and related items predict the cost in the order of $850,000.

It should be noted that these facilities are not consistent with the adopted Drainage Basin Study. The project will have to be presented to the Drainage Board to determine whether or not it can be included in the basin fee.

MAINTENANCE

It is anticipated upon completion of construction of the facilities with approval and acceptance by the City of Colorado Springs, the City of Colorado Springs will take over maintenance of the facilities.

Maintenance of the facilities should include regular inspection of the facilities. Routine items should include correction of any erosion at the outfall to Cottonwood Creek and removal of any debris in or upstream of the facilities. Maintenance should also include inspection of the concrete surfaces with attention to critical areas, and immediate repair to any problem areas.

PREPARED BY:

John R Bessette

John R. Bessette, P.E.
Project Engineer
Land Development
For and On Behalf of JR Engineering, Ltd.

/vb/871712/final drainage

REFERENCES

1. "Cottonwood Creek Drainage Basin Planning Study," prepared by URS Consultants, June 6, 1994.

2. "Cottonwood Creek Drainage Basin Planning Study," prepared by Ayres Associates, May 1996.

3. "Preliminary/Final Drainage Report for Austin Bluffs Parkway from Woodmen Road north to Meadow Ridge," prepared by JR Engineering, Ltd., July 1997.

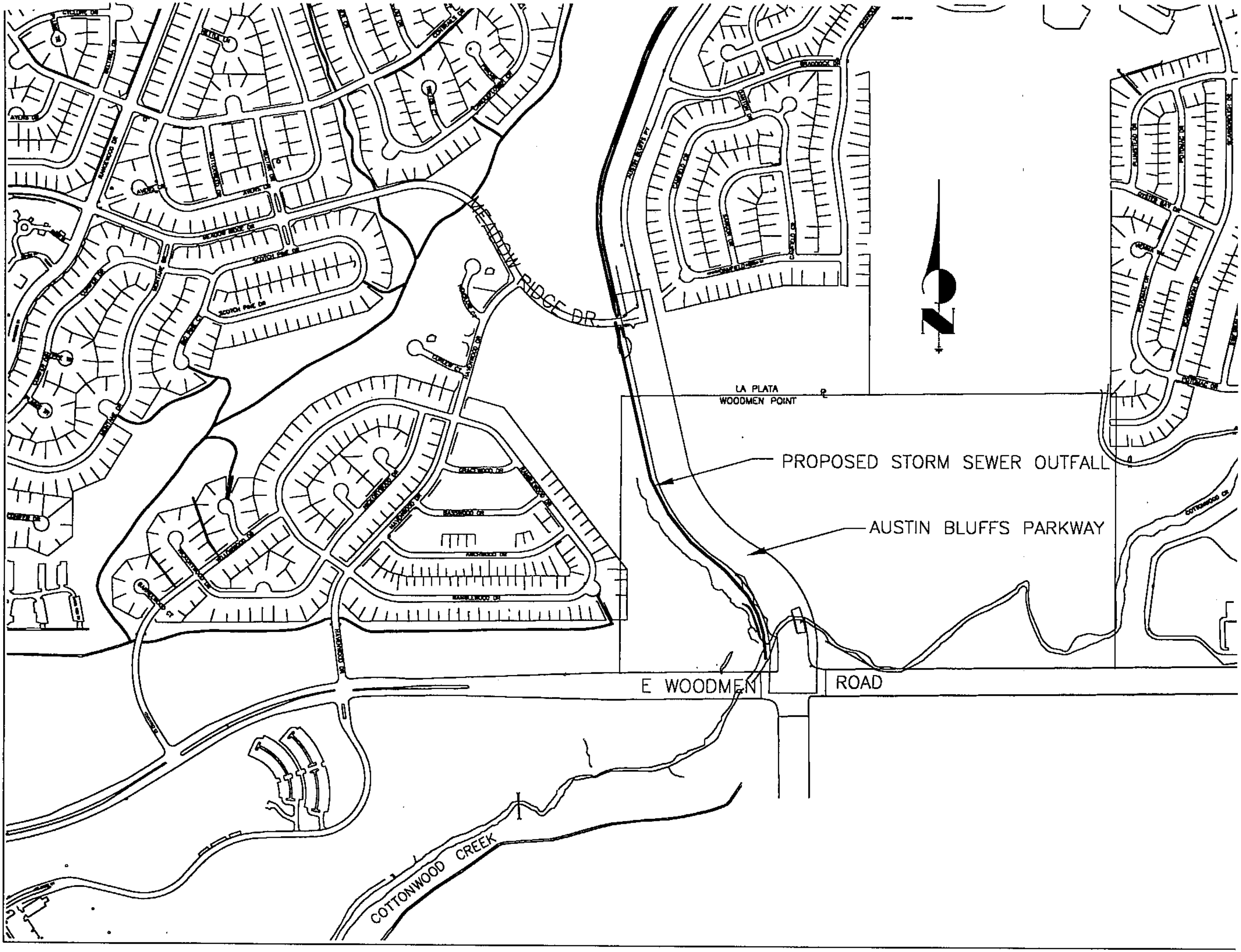
4. "Letter Report Subject Detention Facility Requirements at Austin Bluffs Parkway Tributary to Cottonwood Creek," prepared by JR Engineering, Ltd., November 1996.

5. "Final Drainage Report for Fairfax at Briargate Filing No. 6," prepared by JR Engineering, Ltd., May 1997.

6. Reference Book Titled "Design of Small Dams," U.S. Department of Interior Bureau of Reclamation, Tech. Publication.

APPENDIX

VICINITY MAP



MEADOW RIDGE DR.
LA PLATA
WOODMEN POINT
PROPOSED STORM SEWER OUTFALL
AUSTIN BLUFFS PARKWAY
E WOODMEN
ROAD
COTTONWOOD CREEK
N

FLOODPLAIN MAP

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 528 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

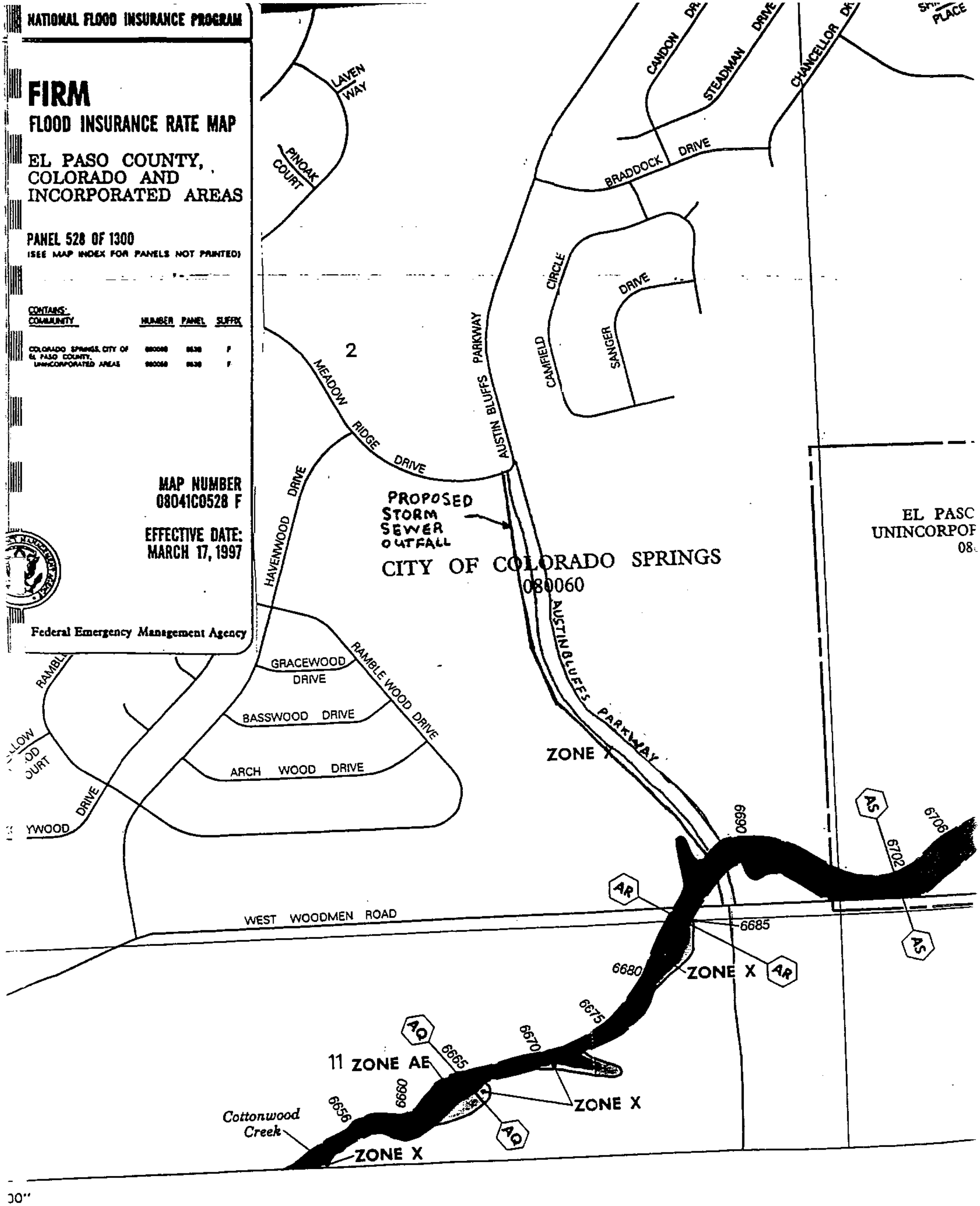
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0528	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0528	F

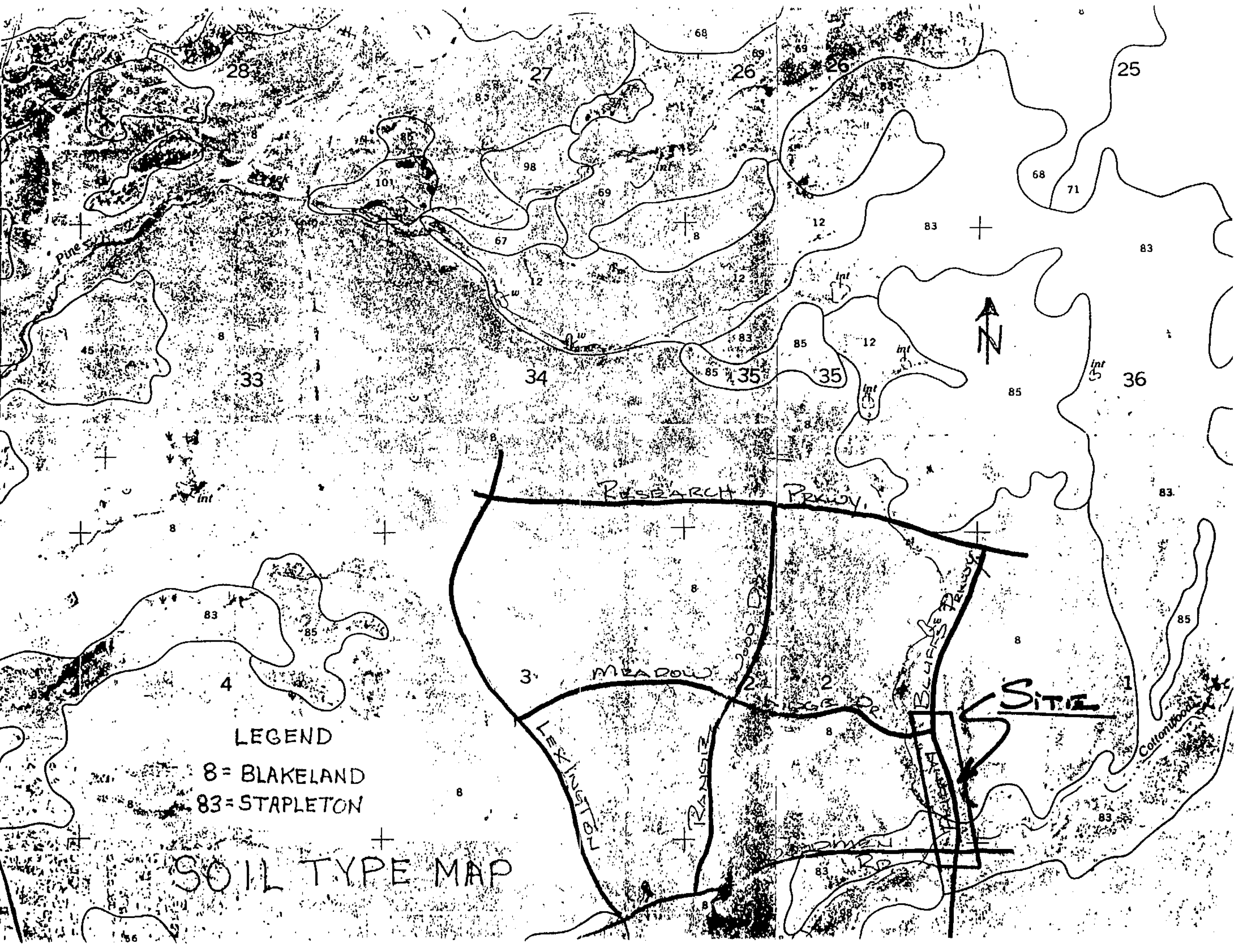
MAP NUMBER
08041C0528 F

EFFECTIVE DATE:
MARCH 17, 1997

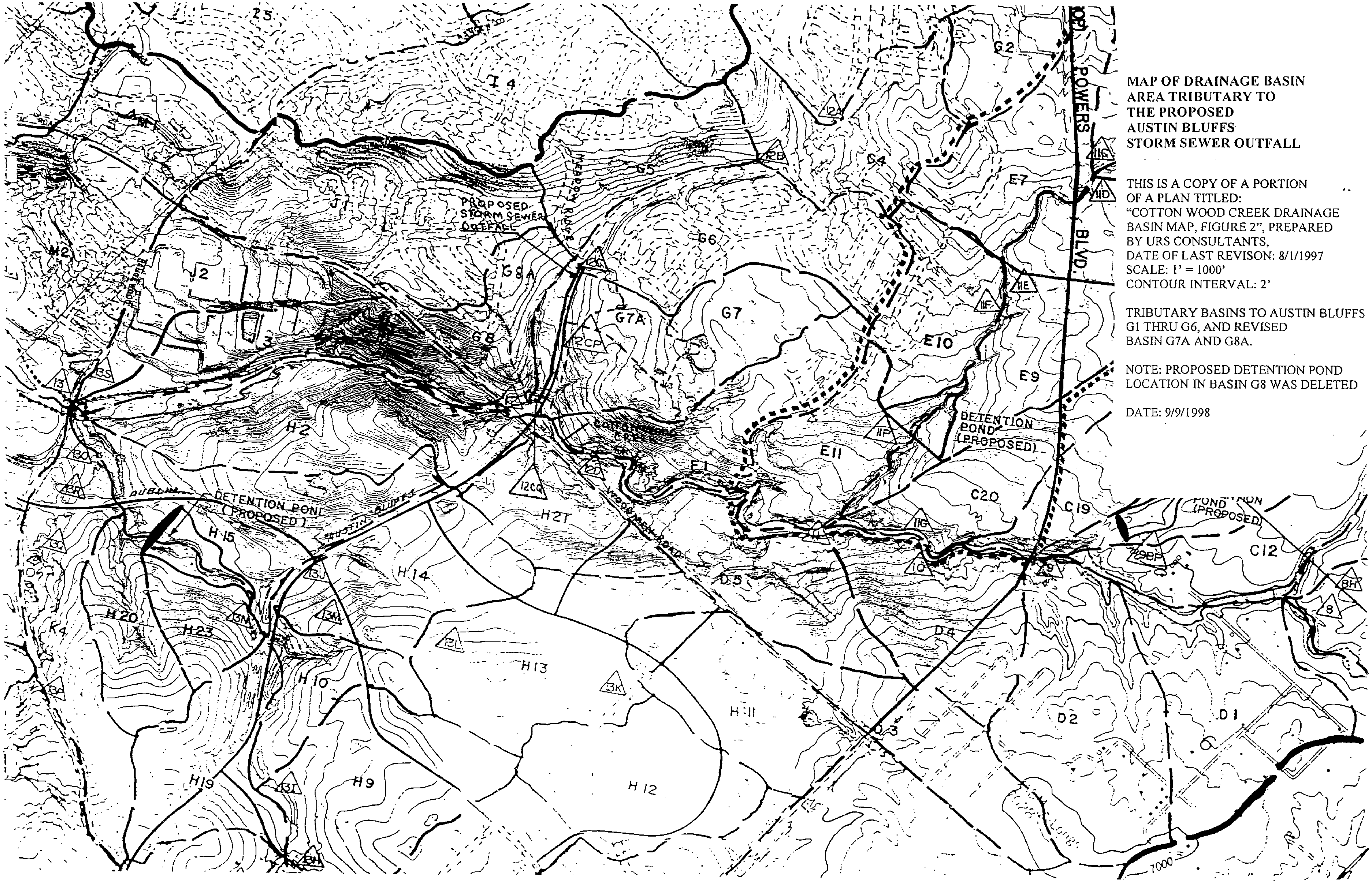
Federal Emergency Management Agency



S.C.S. SOIL MAP


SOIL TYPE MAP
LEGEND
8 = BLAKELAND
83 = STAPLETON
RESEARCH PRKWY.
MEADOW RIDGE DR.
LEXINGTON
SITE
Pine
Cottonwood

MAP OF DRAINAGE BASINS TRIBUTARY TO AUSTIN BLUFFS STORM SEWER OUTFALL



MAP OF DRAINAGE BASIN AREA TRIBUTARY TO THE PROPOSED AUSTIN BLUFFS STORM SEWER OUTFALL

THIS IS A COPY OF A PORTION OF A PLAN TITLED:
"COTTON WOOD CREEK DRAINAGE BASIN MAP, FIGURE 2", PREPARED BY URS CONSULTANTS,
DATE OF LAST REVISON: 8/1/1997
SCALE: 1' = 1000'
CONTOUR INTERVAL: 2'

TRIBUTARY BASINS TO AUSTIN BLUFFS G1 THRU G6, AND REVISED BASIN G7A AND G8A.

NOTE: PROPOSED DETENTION POND LOCATION IN BASIN G8 WAS DELETED

DATE: 9/9/1998

HYDROLOGIC CALCULATIONS

DRAINAGE BASIN AREA ADJUSTMENTS

HEC-1 2-Year Frequency Storm
HEC-1 10-Year Frequency Storm
HEC-1 100-Year Frequency Storm

DRAINAGE BASIN AREA ADJUSTMENTS

HEC-1 ANALYSIS:

Adjust Area G-7 and G-8 from previous study and HEC-1 analysis.

Area G-7 reduced to G-7A
Area = 18.8 AC = 0.0294 sq. mi.
C_N = 88

G-7A Time of Concentration
Basin G Fairfax Filing No. 6 Drainage Report $T_C = 9.2$ min.
Basin G to inlet on falls
Church Road 450 ft at 3.11%

$$V = 35(0.0311)^{1/2} = 6.2 \text{ fps}$$

$$T_T = \frac{450'}{6.2 \text{ fps}} = 73 \text{ sec}$$

From inlet new storm drain
600 L.F. +/- 36" dia S.D.
Assume 25 fps $T_T = \frac{600}{25} = 24$ sec.

$$\text{Total } T_C = \frac{(9.2 + (73+24)/60)}{60} = .018 \text{ hrs}$$

Area G-8 Reduced to G-8A
Area = 41.32 Ac = 0.0645 Ac
C_N: Use previous C_N: 80.1
T_T: Use previous T_T: 0.17 hr

HEC-1 ANALYSIS
2-YEAR FREQUENCY STORM

HEC1 S/N: 1343000062 HMVersion: 6.33 Data File: X:\870000.ALL\871571\HYDRO\HEC1\ABSD\ABSD2.DAT

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              MAY  1991               *
*            VERSION 4.0.1E            *
*                                      *
* RUN DATE  08/26/1998  TIME  09:55:29 *
*                                      *
****************************************
```

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*****************************************
*                                       *
*     U.S. ARMY CORPS OF ENGINEERS      *
*     HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
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```
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
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::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::
:::                                    :::
:::  Full Microcomputer Implementation :::
:::               by                   :::
:::        Haestad Methods, Inc.       :::
:::                                    :::
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::::::::::::::::::::::::::::::::::::::::::
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37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

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

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

  1           ID     A PORTION OF COTTONWOOD CREEK AYERS DBPS MODEL REVISED TO PROVIDE
  2           ID     A DESIGN PEAK FLOW RATE FOR A STORM DRAIN OUTFALL LINE TO BE CONSTRUCTED
  3           ID     ADJACENT TO AUSTIN BLUFFS PARKWAY BETWEEN MEADOW RIDGE DRIVE AND
  4           ID     COTTONWOOD CREEK. REVISED BY JR ENGINEERING, VANCE FOSSINGER ON 8-05-97
  5           ID     100 YR 24 HR STORM
  6           ID
  7           ID     MODEL IS PRELIMINARY
  8           ID
  9           ID     COTTONWOOD CREEK DBPS AYRES PROJECT NO. 34-0330.00
 10           ID     FUTURE CONDITIONS - INPUT FILE 100FDREV.INP
 11           ID     CN AND LAGS REVISED BASED UPON SEPTEMBER 4TH, 1996 MEETING WITH
 12           ID     CITY OF COLORADO SPRINGS ENGINEERING STAFF
 13           ID     2 YEAR 24 HOUR STORM
              *DIAGRAM
 14           IT        5 01SEP89     800     300
 15           IO        5

 16           KK       G1
 17           KM      RUNOFF FROM  G1
 18           BA    0.180
 19           LS        0     81.7
 20           UD    0.180
 21           IN       15
 22           PB    2.0
 23           PC    .0000   .0005   .0015   .0030   .0045   .0060   .0080   .0100   .0120   .0143
 24           PC    .0165   .0188   .0210   .0233   .0255   .0278   .0320   .0390   .0460   .0530
 25           PC    .0600   .0750   .1000   .4000   .7000   .7250   .7500   .7650   .7800   .7900
 26           PC    .8000   .8100   .8200   .8250   .8300   .8350   .8400   .8450   .8500   .8550
 27           PC    .8600   .8638   .8675   .8713   .8750   .8788   .8825   .8863   .8900   .8938
 28           PC    .8975   .9013   .9050   .9083   .9115   .9148   .9180   .9210   .9240   .9270
 29           PC    .9300   .9325   .9350   .9375   .9400   .9425   .9450   .9475   .9500   .9525
 30           PC    .9550   .9575   .9600   .9625   .9650   .9675   .9700   .9725   .9750   .9775
 31           PC    .9800   .9813   .9825   .9838   .9850   .9863   .9875   .9888   .9900   .9913
 32           PC    .9925   .9938   .9950   .9963   .9975   .9988   1.000

 33           KK  G1-12A
 34           KM      ROUTE G1 TO DESIGN POINT 12A
 35           RD     2400    .023    .013       0    CIRC     5.5

 36           KK       G3
 37           KM      RUNOFF FROM  G3
 38           BA    0.183
 39           LS        0     79.4
 40           UD    0.270

 41           KK      12A
 42           KM      COMBINE G1-12A,G3
 43           HC        2

 44           KK       G2
 45           KM      RUNOFF FROM  G2
 46           BA    0.107
 47           LS        0     75.3
 48           UD    0.150
```

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

 49            KK  G2-12B
 50            KM     ROUTE G2 TO DESIGN POINT 12B
 51            RD    2900     .042     .035       0    TRAP       5       8

 52            KK      G4
 53            KM     RUNOFF FROM  G4
 54            BA   0.132
 55            LS       0    87.0
 56            UD   0.230

 57            KK     12B
 58            KM     COMBINE 12A,G2-12B,G4
 59            HC       3

 60            KK  12B12C
 61            KM     ROUTE 12B TO DESIGN POINT 12C
 62            KO       0
 63            RD    2500     .025     .015       0    TRAP      10       5

 64            KK      G5
 65            KM     RUNOFF FROM  G5
 66            BA   0.118
 67            LS       0    76.3
 68            UD   0.190

 69            KK      G6
 70            KM     RUNOFF FROM  G6
 71            BA   0.139
 72            LS       0    78.1
 73            UD   0.200

 74            KK     12C
 75            KM     COMBINE 12B-12C,G5,G6 FOR TOTAL FLOW AT MEADOW RIDGE
 76            HC       3

 77            KK  12C12F
 78            KM     ROUTE 12C TO DESIGN POINT 12F AT CONFLUENCE W/ COTTONWOOD CREEK
 79            KO       0
 80            RD    1650     .028     .013       0    CIRC       8

 81            KK  G7A
 82            KM     RUNOFF FROM  G7A
 83            BA   0.0294
 84            LS       0    88.0
 85            UD   0.18

 86            KK     12C2
 87            KM     COMBINE 12C12F AND G7A FOR TOTAL FLOW IN AUSTIN BLUFFS TRIBUTARY
 88            KO       2       2     200
 89            HC       2
```

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

KK   G8A
KM     RUNOFF FROM  G8A
BA   0.0645
LS      0     80.1
UD   0.17

KK     12C3
KM     COMBINE 12CC AND G8A FOR TOTAL FLOW IN AUSTIN BLUFFS TRIBUTARY
HC      2
ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

  16            G1
                 V
                 V
  33         G1-12A
                 .
                 .
  36             .          G3
                 .           .
                 .           .
  41            12A...........
                 .
                 .
  44             .          G2
                 .           V
                 .           V
  49             .       G2-12B
                 .           .
                 .           .
  52             .           .          G4
                 .           .           .
                 .           .           .
  57            12B.......................
                 V
                 V
  60         12B12C
                 .
                 .
  64             .          G5
                 .           .
                 .           .
  69             .           .          G6
                 .           .           .
                 .           .           .
  74            12C.......................
                 V
                 V
  77         12C12F
                 .
                 .
  81             .      G7A
                 .           .
                 .           .
  86            12C...........
                 .
                 .
  90             .      G8A
                 .           .
                 .           .
  95            12C...........
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
HEC1 S/N: 1343000062        HMVersion: 6.33    Data File: X:\870000.ALL\871571\HYDRO\HEC1\ABSD\ABSD2.DAT

*****************************************                                       ****************************************
*                                       *                                       *                                      *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                                       *   U.S. ARMY CORPS OF ENGINEERS       *
*            MAY  1991                  *                                       *   HYDROLOGIC ENGINEERING CENTER      *
*          VERSION 4.0.1E               *                                       *         609 SECOND STREET            *
*                                       *                                       *     DAVIS, CALIFORNIA 95616          *
* RUN DATE  08/26/1998  TIME  09:55:29 *                                        *          (916) 756-1104              *
*                                       *                                       *                                      *
*****************************************                                       ****************************************


                      A PORTION OF COTTONWOOD CREEK AYERS DBPS MODEL REVISED TO PROVIDE
                      A DESIGN PEAK FLOW RATE FOR A STORM DRAIN OUTFALL LINE TO BE CONSTRUCTED
                      ADJACENT TO AUSTIN BLUFFS PARKWAY BETWEEN MEADOW RIDGE DRIVE AND
                      COTTONWOOD CREEK. REVISED BY JR ENGINEERING, VANCE FOSSINGER ON 8-05-97
                      100 YR 24 HR STORM

                      MODEL IS PRELIMINARY

                      COTTONWOOD CREEK DBPS AYRES PROJECT NO. 34-0330.00
                      FUTURE CONDITIONS - INPUT FILE 100FDREV.INP
                      CN AND LAGS REVISED BASED UPON SEPTEMBER 4TH, 1996 MEETING WITH
                      CITY OF COLORADO SPRINGS ENGINEERING STAFF
                      2 YEAR 24 HOUR STORM

 15 IO         OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT         HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE     1SEP89  STARTING DATE
                     ITIME       0800  STARTING TIME
                        NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE     2SEP89  ENDING DATE
                    NDTIME       0855  ENDING TIME
                     ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL    0.08 HOURS
                     TOTAL TIME BASE   24.92 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


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

          **************
          *            *
 60 KK    *   12B12C   *
          *            *
          **************

 62 KO         OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE


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

          **************
          *            *
 77 KK    *   12C12F   *
          *            *
          **************

 79 KO         OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE


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

          **************
          *            *
 86 KK    *      12C   *      2
          *            *
          **************

 88 KO         OUTPUT CONTROL VARIABLES
                     IPRNT          2  PRINT CONTROL
                     IPLOT          2  PLOT CONTROL
                     QSCAL       200.  HYDROGRAPH PLOT SCALE

 89 HC         HYDROGRAPH COMBINATION
                     ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

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

                                                HYDROGRAPH AT STATION      12C
                                                   SUM OF  2 HYDROGRAPHS

*************************************************************************************************************************
                              *                              *                              *
  DA MON HRMN  ORD      FLOW  *   DA MON HRMN  ORD     FLOW  *   DA MON HRMN  ORD     FLOW  *   DA MON HRMN  ORD      FLOW
                              *                              *                              *
   1 SEP 0800    1        0.  *    1 SEP 1415   76     293.  *    1 SEP 2030  151      10.  *    2 SEP 0245  226        7.
```

1 SEP 0805	2	0.	*	1 SEP 1420	77	230.	*	1 SEP 2035	152	10.	*	2 SEP 0250	227	7.
1 SEP 0810	3	0.	*	1 SEP 1425	78	168.	*	1 SEP 2040	153	10.	*	2 SEP 0255	228	7.
1 SEP 0815	4	0.	*	1 SEP 1430	79	124.	*	1 SEP 2045	154	10.	*	2 SEP 0300	229	7.
1 SEP 0820	5	0.	*	1 SEP 1435	80	97.	*	1 SEP 2050	155	10.	*	2 SEP 0305	230	7.
1 SEP 0825	6	0.	*	1 SEP 1440	81	79.	*	1 SEP 2055	156	10.	*	2 SEP 0310	231	7.
1 SEP 0830	7	0.	*	1 SEP 1445	82	65.	*	1 SEP 2100	157	10.	*	2 SEP 0315	232	7.
1 SEP 0835	8	0.	*	1 SEP 1450	83	55.	*	1 SEP 2105	158	10.	*	2 SEP 0320	233	7.
1 SEP 0840	9	0.	*	1 SEP 1455	84	48.	*	1 SEP 2110	159	10.	*	2 SEP 0325	234	7.
1 SEP 0845	10	0.	*	1 SEP 1500	85	43.	*	1 SEP 2115	160	10.	*	2 SEP 0330	235	7.
1 SEP 0850	11	0.	*	1 SEP 1505	86	39.	*	1 SEP 2120	161	9.	*	2 SEP 0335	236	7.
1 SEP 0855	12	0.	*	1 SEP 1510	87	37.	*	1 SEP 2125	162	9.	*	2 SEP 0340	237	7.
1 SEP 0900	13	0.	*	1 SEP 1515	88	34.	*	1 SEP 2130	163	9.	*	2 SEP 0345	238	7.
1 SEP 0905	14	0.	*	1 SEP 1520	89	31.	*	1 SEP 2135	164	9.	*	2 SEP 0350	239	7.
1 SEP 0910	15	0.	*	1 SEP 1525	90	29.	*	1 SEP 2140	165	9.	*	2 SEP 0355	240	7.
1 SEP 0915	16	0.	*	1 SEP 1530	91	27.	*	1 SEP 2145	166	9.	*	2 SEP 0400	241	7.
1 SEP 0920	17	0.	*	1 SEP 1535	92	26.	*	1 SEP 2150	167	9.	*	2 SEP 0405	242	7.
1 SEP 0925	18	0.	*	1 SEP 1540	93	25.	*	1 SEP 2155	168	9.	*	2 SEP 0410	243	7.
1 SEP 0930	19	0.	*	1 SEP 1545	94	25.	*	1 SEP 2200	169	9.	*	2 SEP 0415	244	6.
1 SEP 0935	20	0.	*	1 SEP 1550	95	24.	*	1 SEP 2205	170	9.	*	2 SEP 0420	245	6.
1 SEP 0940	21	0.	*	1 SEP 1555	96	24.	*	1 SEP 2210	171	9.	*	2 SEP 0425	246	5.
1 SEP 0945	22	0.	*	1 SEP 1600	97	24.	*	1 SEP 2215	172	8.	*	2 SEP 0430	247	5.
1 SEP 0950	23	0.	*	1 SEP 1605	98	24.	*	1 SEP 2220	173	8.	*	2 SEP 0435	248	4.
1 SEP 0955	24	0.	*	1 SEP 1610	99	23.	*	1 SEP 2225	174	8.	*	2 SEP 0440	249	4.
1 SEP 1000	25	0.	*	1 SEP 1615	100	22.	*	1 SEP 2230	175	8.	*	2 SEP 0445	250	4.
1 SEP 1005	26	0.	*	1 SEP 1620	101	19.	*	1 SEP 2235	176	8.	*	2 SEP 0450	251	4.
1 SEP 1010	27	0.	*	1 SEP 1625	102	17.	*	1 SEP 2240	177	8.	*	2 SEP 0455	252	4.
1 SEP 1015	28	0.	*	1 SEP 1630	103	16.	*	1 SEP 2245	178	8.	*	2 SEP 0500	253	4.
1 SEP 1020	29	0.	*	1 SEP 1635	104	14.	*	1 SEP 2250	179	8.	*	2 SEP 0505	254	4.
1 SEP 1025	30	0.	*	1 SEP 1640	105	14.	*	1 SEP 2255	180	8.	*	2 SEP 0510	255	3.
1 SEP 1030	31	0.	*	1 SEP 1645	106	13.	*	1 SEP 2300	181	8.	*	2 SEP 0515	256	3.
1 SEP 1035	32	0.	*	1 SEP 1650	107	13.	*	1 SEP 2305	182	8.	*	2 SEP 0520	257	3.
1 SEP 1040	33	0.	*	1 SEP 1655	108	13.	*	1 SEP 2310	183	8.	*	2 SEP 0525	258	4.
1 SEP 1045	34	0.	*	1 SEP 1700	109	13.	*	1 SEP 2315	184	8.	*	2 SEP 0530	259	3.
1 SEP 1050	35	0.	*	1 SEP 1705	110	13.	*	1 SEP 2320	185	8.	*	2 SEP 0535	260	3.
1 SEP 1055	36	0.	*	1 SEP 1710	111	12.	*	1 SEP 2325	186	7.	*	2 SEP 0540	261	3.
1 SEP 1100	37	0.	*	1 SEP 1715	112	12.	*	1 SEP 2330	187	7.	*	2 SEP 0545	262	3.
1 SEP 1105	38	0.	*	1 SEP 1720	113	12.	*	1 SEP 2335	188	7.	*	2 SEP 0550	263	3.
1 SEP 1110	39	0.	*	1 SEP 1725	114	13.	*	1 SEP 2340	189	7.	*	2 SEP 0555	264	4.
1 SEP 1115	40	0.	*	1 SEP 1730	115	13.	*	1 SEP 2345	190	7.	*	2 SEP 0600	265	4.
1 SEP 1120	41	0.	*	1 SEP 1735	116	13.	*	1 SEP 2350	191	7.	*	2 SEP 0605	266	3.
1 SEP 1125	42	0.	*	1 SEP 1740	117	13.	*	1 SEP 2355	192	7.	*	2 SEP 0610	267	3.
1 SEP 1130	43	0.	*	1 SEP 1745	118	13.	*	2 SEP 0000	193	7.	*	2 SEP 0615	268	3.
1 SEP 1135	44	0.	*	1 SEP 1750	119	13.	*	2 SEP 0005	194	7.	*	2 SEP 0620	269	3.
1 SEP 1140	45	0.	*	1 SEP 1755	120	13.	*	2 SEP 0010	195	7.	*	2 SEP 0625	270	4.
1 SEP 1145	46	0.	*	1 SEP 1800	121	13.	*	2 SEP 0015	196	7.	*	2 SEP 0630	271	4.
1 SEP 1150	47	0.	*	1 SEP 1805	122	13.	*	2 SEP 0020	197	7.	*	2 SEP 0635	272	3.
1 SEP 1155	48	0.	*	1 SEP 1810	123	12.	*	2 SEP 0025	198	7.	*	2 SEP 0640	273	3.
1 SEP 1200	49	0.	*	1 SEP 1815	124	12.	*	2 SEP 0030	199	7.	*	2 SEP 0645	274	3.
1 SEP 1205	50	0.	*	1 SEP 1820	125	12.	*	2 SEP 0035	200	7.	*	2 SEP 0650	275	4.
1 SEP 1210	51	0.	*	1 SEP 1825	126	11.	*	2 SEP 0040	201	7.	*	2 SEP 0655	276	4.
1 SEP 1215	52	0.	*	1 SEP 1830	127	11.	*	2 SEP 0045	202	7.	*	2 SEP 0700	277	4.
1 SEP 1220	53	0.	*	1 SEP 1835	128	10.	*	2 SEP 0050	203	7.	*	2 SEP 0705	278	4.
1 SEP 1225	54	0.	*	1 SEP 1840	129	10.	*	2 SEP 0055	204	7.	*	2 SEP 0710	279	3.
1 SEP 1230	55	0.	*	1 SEP 1845	130	10.	*	2 SEP 0100	205	7.	*	2 SEP 0715	280	3.
1 SEP 1235	56	0.	*	1 SEP 1850	131	10.	*	2 SEP 0105	206	7.	*	2 SEP 0720	281	4.
1 SEP 1240	57	0.	*	1 SEP 1855	132	10.	*	2 SEP 0110	207	7.	*	2 SEP 0725	282	4.
1 SEP 1245	58	0.	*	1 SEP 1900	133	10.	*	2 SEP 0115	208	7.	*	2 SEP 0730	283	4.
1 SEP 1250	59	0.	*	1 SEP 1905	134	10.	*	2 SEP 0120	209	7.	*	2 SEP 0735	284	4.
1 SEP 1255	60	0.	*	1 SEP 1910	135	10.	*	2 SEP 0125	210	7.	*	2 SEP 0740	285	3.
1 SEP 1300	61	0.	*	1 SEP 1915	136	10.	*	2 SEP 0130	211	7.	*	2 SEP 0745	286	4.
1 SEP 1305	62	0.	*	1 SEP 1920	137	10.	*	2 SEP 0135	212	7.	*	2 SEP 0750	287	4.
1 SEP 1310	63	0.	*	1 SEP 1925	138	10.	*	2 SEP 0140	213	7.	*	2 SEP 0755	288	4.
1 SEP 1315	64	0.	*	1 SEP 1930	139	10.	*	2 SEP 0145	214	7.	*	2 SEP 0800	289	4.
1 SEP 1320	65	0.	*	1 SEP 1935	140	10.	*	2 SEP 0150	215	7.	*	2 SEP 0805	290	3.
1 SEP 1325	66	0.	*	1 SEP 1940	141	10.	*	2 SEP 0155	216	7.	*	2 SEP 0810	291	3.
1 SEP 1330	67	0.	*	1 SEP 1945	142	10.	*	2 SEP 0200	217	7.	*	2 SEP 0815	292	3.
1 SEP 1335	68	0.	*	1 SEP 1950	143	10.	*	2 SEP 0205	218	7.	*	2 SEP 0820	293	2.
1 SEP 1340	69	2.	*	1 SEP 1955	144	10.	*	2 SEP 0210	219	7.	*	2 SEP 0825	294	2.
1 SEP 1345	70	8.	*	1 SEP 2000	145	10.	*	2 SEP 0215	220	7.	*	2 SEP 0830	295	1.
1 SEP 1350	71	34.	*	1 SEP 2005	146	10.	*	2 SEP 0220	221	7.	*	2 SEP 0835	296	1.
1 SEP 1355	72	100.	*	1 SEP 2010	147	10.	*	2 SEP 0225	222	7.	*	2 SEP 0840	297	1.
1 SEP 1400	73	194.	*	1 SEP 2015	148	10.	*	2 SEP 0230	223	7.	*	2 SEP 0845	298	0.
1 SEP 1405	74	284.	*	1 SEP 2020	149	10.	*	2 SEP 0235	224	7.	*	2 SEP 0850	299	0.
1 SEP 1410	75	323.	*	1 SEP 2025	150	10.	*	2 SEP 0240	225	7.	*	2 SEP 0855	300	0.
			*				*				*			

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PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.92-HR
323.	6.17	(CFS)	42.	14.	13.	13.
		(INCHES)	0.443	0.586	0.586	0.586
		(AC-FT)	21.	28.	28.	28.

CUMULATIVE AREA = 0.89 SQ MI

STATION 12C

```
                        (O) OUTFLOW
          0.      400.      0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
DAHRMN PER
 10800   10---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.
 10805   20         .         .         .         .         .         .         .         .         .         .         .         .
 10810   30         .         .         .         .         .         .         .         .         .         .         .         .
 10815   40         .         .         .         .         .         .         .         .         .         .         .         .
 10820   50         .         .         .         .         .         .         .         .         .         .         .         .
 10825   60         .         .         .         .         .         .         .         .         .         .         .         .
 10830   70         .         .         .         .         .         .         .         .         .         .         .         .
 10835   80         .         .         .         .         .         .         .         .         .         .         .         .
 10840   90         .         .         .         .         .         .         .         .         .         .         .         .
 10845  100         .         .         .         .         .         .         .         .         .         .         .         .
 10850  110 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 10855  120         .         .         .         .         .         .         .         .         .         .         .         .
 10900  130         .         .         .         .         .         .         .         .         .         .         .         .
 10905  140         .         .         .         .         .         .         .         .         .         .         .         .
 10910  150         .         .         .         .         .         .         .         .         .         .         .         .
 10915  160         .         .         .         .         .         .         .         .         .         .         .         .
 10920  170         .         .         .         .         .         .         .         .         .         .         .         .
 10925  180         .         .         .         .         .         .         .         .         .         .         .         .
 10930  190         .         .         .         .         .         .         .         .         .         .         .         .
 10935  200         .         .         .         .         .         .         .         .         .         .         .         .
 10940  210 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 10945  220         .         .         .         .         .         .         .         .         .         .         .         .
 10950  230         .         .         .         .         .         .         .         .         .         .         .         .
 10955  240         .         .         .         .         .         .         .         .         .         .         .         .
 11000  250         .         .         .         .         .         .         .         .         .         .         .         .
 11005  260         .         .         .         .         .         .         .         .         .         .         .         .
 11010  270         .         .         .         .         .         .         .         .         .         .         .         .
 11015  280         .         .         .         .         .         .         .         .         .         .         .         .
 11020  290         .         .         .         .         .         .         .         .         .         .         .         .
 11025  300         .         .         .         .         .         .         .         .         .         .         .         .
 11030  310 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 11035  320         .         .         .         .         .         .         .         .         .         .         .         .
 11040  330         .         .         .         .         .         .         .         .         .         .         .         .
 11045  340         .         .         .         .         .         .         .         .         .         .         .         .
 11050  350         .         .         .         .         .         .         .         .         .         .         .         .
 11055  360         .         .         .         .         .         .         .         .         .         .         .         .
 11100  370         .         .         .         .         .         .         .         .         .         .         .         .
 11105  380         .         .         .         .         .         .         .         .         .         .         .         .
 11110  390         .         .         .         .         .         .         .         .         .         .         .         .
 11115  400         .         .         .         .         .         .         .         .         .         .         .         .
 11120  410 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 11125  420         .         .         .         .         .         .         .         .         .         .         .         .
 11130  430         .         .         .         .         .         .         .         .         .         .         .         .
 11135  440         .         .         .         .         .         .         .         .         .         .         .         .
 11140  450         .         .         .         .         .         .         .         .         .         .         .         .
 11145  460         .         .         .         .         .         .         .         .         .         .         .         .
 11150  470         .         .         .         .         .         .         .         .         .         .         .         .
 11155  480         .         .         .         .         .         .         .         .         .         .         .         .
 11200  490         .         .         .         .         .         .         .         .         .         .         .         .
 11205  500         .         .         .         .         .         .         .         .         .         .         .         .
 11210  510 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 11215  520         .         .         .         .         .         .         .         .         .         .         .         .
 11220  530         .         .         .         .         .         .         .         .         .         .         .         .
 11225  540         .         .         .         .         .         .         .         .         .         .         .         .
 11230  550         .         .         .         .         .         .         .         .         .         .         .         .
 11235  560         .         .         .         .         .         .         .         .         .         .         .         .
 11240  570         .         .         .         .         .         .         .         .         .         .         .         .
 11245  580         .         .         .         .         .         .         .         .         .         .         .         .
 11250  590         .         .         .         .         .         .         .         .         .         .         .         .
 11255  600         .         .         .         .         .         .         .         .         .         .         .         .
 11300  610 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 11305  620         .         .         .         .         .         .         .         .         .         .         .         .
 11310  630         .         .         .         .         .         .         .         .         .         .         .         .
 11315  640         .         .         .         .         .         .         .         .         .         .         .         .
 11320  650         .         .         .         .         .         .         .         .         .         .         .         .
 11325  660         .         .         .         .         .         .         .         .         .         .         .         .
 11330  670         .         .         .         .         .         .         .         .         .         .         .         .
 11335  680         .         .         .         .         .         .         .         .         .         .         .         .
 11340  690         .         .         .         .         .         .         .         .         .         .         .         .
 11345  700         .         .         .         .         .         .         .         .         .         .         .         .
 11350  71.O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 11355  72.  O      .         .         .         .         .         .         .         .         .         .         .         .
 11400  73.    O    .         .         .         .         .         .         .         .         .         .         .         .
 11405  74.      O  .         .         .         .         .         .         .         .         .         .         .         .
 11410  75.       O .         .         .         .         .         .         .         .         .         .         .         .
 11415  76.      O  .         .         .         .         .         .         .         .         .         .         .         .
 11420  77.     O   .         .         .         .         .         .         .         .         .         .         .         .
 11425  78.   O     .         .         .         .         .         .         .         .         .         .         .         .
 11430  79.  O      .         .         .         .         .         .         .         .         .         .         .         .
 11435  80. O       .         .         .         .         .         .         .         .         .         .         .         .
 11440  81. O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 11445  82. O       .         .         .         .         .         .         .         .         .         .         .         .
 11450  83.O        .         .         .         .         .         .         .         .         .         .         .         .
 11455  84.O        .         .         .         .         .         .         .         .         .         .         .         .
 11500  85.O        .         .         .         .         .         .         .         .         .         .         .         .
 11505  86.O        .         .         .         .         .         .         .         .         .         .         .         .
 11510  87.O        .         .         .         .         .         .         .         .         .         .         .         .
 11515  88.O        .         .         .         .         .         .         .         .         .         .         .         .
 11520  89.O        .         .         .         .         .         .         .         .         .         .         .         .
 11525  90.O        .         .         .         .         .         .         .         .         .         .         .         .
 11530  91.O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 11535  92.O        .         .         .         .         .         .         .         .         .         .         .         .
 11540  93.O        .         .         .         .         .         .         .         .         .         .         .         .
 11545  94.O        .         .         .         .         .         .         .         .         .         .         .         .
 11550  95.O        .         .         .         .         .         .         .         .         .         .         .         .
 11555  96.O        .         .         .         .         .         .         .         .         .         .         .         .
 11600  97.O        .         .         .         .         .         .         .         .         .         .         .         .
 11605  98.O        .         .         .         .         .         .         .         .         .         .         .         .
 11610  99.O        .         .         .         .         .         .         .         .         .         .         .         .
 11615 100.O        .         .         .         .         .         .         .         .         .         .         .         .
 11620 1010 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 11625 1020         .         .         .         .         .         .         .         .         .         .         .         .
 11630 1030         .         .         .         .         .         .         .         .         .         .         .         .
 11635 1040         .         .         .         .         .         .         .         .         .         .         .         .
 11640 1050         .         .         .         .         .         .         .         .         .         .         .         .
 11645 1060         .         .         .         .         .         .         .         .         .         .         .         .
 11650 1070         .         .         .         .         .         .         .         .         .         .         .         .
 11655 1080         .         .         .         .         .         .         .         .         .         .         .         .
 11700 1090         .         .         .         .         .         .         .         .         .         .         .         .
 11705 1100         .         .         .         .         .         .         .         .         .         .         .         .
 11710 1110 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 11715 1120         .         .         .         .         .         .         .         .         .         .         .         .
 11720 1130         .         .         .         .         .         .         .         .         .         .         .         .
 11725 1140         .         .         .         .         .         .         .         .         .         .         .         .
 11730 1150         .         .         .         .         .         .         .         .         .         .         .
```

11735	1160
11740	1170
11745	1180
11750	1190
11755	1200
11800	1210
11805	1220
11810	1230
11815	1240
11820	1250
11825	1260
11830	1270
11835	1280
11840	1290
11845	1300
11850	1310
11855	1320
11900	1330
11905	1340
11910	1350
11915	1360
11920	1370
11925	1380
11930	1390
11935	1400
11940	1410
11945	1420
11950	1430
11955	1440
12000	1450
12005	1460
12010	1470
12015	1480
12020	1490
12025	1500
12030	1510
12035	1520
12040	1530
12045	1540
12050	1550
12055	1560
12100	1570
12105	1580
12110	1590
12115	1600
12120	1610
12125	1620
12130	1630
12135	1640
12140	1650
12145	1660
12150	1670
12155	1680
12200	1690
12205	1700
12210	1710
12215	1720
12220	1730
12225	1740
12230	1750
12235	1760
12240	1770
12245	1780
12250	1790
12255	1800
12300	1810
12305	1820
12310	1830
12315	1840
12320	1850
12325	1860
12330	1870
12335	1880
12340	1890
12345	1900
12350	1910
12355	1920
20000	1930
20005	1940
20010	1950
20015	1960
20020	1970
20025	1980
20030	1990
20035	2000
20040	2010
20045	2020
20050	2030
20055	2040
20100	2050
20105	2060
20110	2070
20115	2080
20120	2090
20125	2100
20130	2110
20135	2120
20140	2130
20145	2140
20150	2150
20155	2160
20200	2170
20205	2180
20210	2190
20215	2200
20220	2210
20225	2220
20230	2230
20235	2240
20240	2250
20245	2260
20250	2270
20255	2280
20300	2290
20305	2300
20310	2310
20315	2320
20320	2330
20325	2340
20330	2350

20335	2360
20340	2370
20345	2380
20350	2390
20355	2400
20400	2410
20405	2420
20410	2430
20415	2440
20420	2450
20425	2460
20430	2470
20435	2480
20440	2490
20445	2500
20450	2510
20455	2520
20500	2530
20505	2540
20510	2550
20515	2560
20520	2570
20525	2580
20530	2590
20535	2600
20540	2610
20545	2620
20550	2630
20555	2640
20600	2650
20605	2660
20610	2670
20615	2680
20620	2690
20625	2700
20630	2710
20635	2720
20640	2730
20645	2740
20650	2750
20655	2760
20700	2770
20705	2780
20710	2790
20715	2800
20720	2810
20725	2820
20730	2830
20735	2840
20740	2850
20745	2860
20750	2870
20755	2880
20800	2890
20805	2900
20810	2910
20815	2920
20820	2930
20825	2940
20830	2950
20835	2960
20840	2970
20845	2980
20850	2990
20855	3000

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	G1	86.	6.08	9.	3.	3.	0.18		
ROUTED TO	G1-12A	81.	6.08	9.	3.	3.	0.18		
HYDROGRAPH AT	G3	57.	6.17	8.	3.	3.	0.18		
2 COMBINED AT	12A	135.	6.17	17.	6.	6.	0.36		
HYDROGRAPH AT	G2	30.	6.08	3.	1.	1.	0.11		
ROUTED TO	G2-12B	28.	6.25	3.	1.	1.	0.11		
HYDROGRAPH AT	G4	84.	6.08	10.	3.	3.	0.13		
3 COMBINED AT	12B	242.	6.17	31.	10.	10.	0.60		
ROUTED TO	12B12C	239.	6.17	31.	10.	10.	0.60		
HYDROGRAPH AT	G5	33.	6.08	4.	1.	1.	0.12		
HYDROGRAPH AT	G6	45.	6.08	5.	2.	2.	0.14		
3 COMBINED AT	12C	311.	6.17	40.	13.	13.	0.86		
ROUTED TO	12C12F	305.	6.17	40.	13.	13.	0.86		
HYDROGRAPH AT	G7A	22.	6.08	2.	1.	1.	0.03		
2 COMBINED AT	12C P	323.	6.17	42.	14.	13.	0.89		
HYDROGRAPH AT	G8A	27.	6.08	3.	1.	1.	0.06		
2 COMBINED AT	12C Q	345.	6.17	45.	15.	14.	0.95		

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

						INTERPOLATED TO COMPUTATION INTERVAL			
ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
G1-12A	MANE	1.50	84.71	367.50	0.64	5.00	81.11	365.00	0.63

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.6098E+01 EXCESS=0.0000E+00 OUTFLOW=0.6098E+01 BASIN STORAGE=0.2045E-03 PERCENT ERROR= 0.0

G2-12B	MANE	1.25	29.43	372.50	0.39	5.00	27.87	375.00	0.39

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2229E+01 EXCESS=0.0000E+00 OUTFLOW=0.2231E+01 BASIN STORAGE=0.1256E-02 PERCENT ERROR= -0.1

12B12C	MANE	2.00	238.87	372.00	0.62	5.00	238.71	370.00	0.62

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1995E+02 EXCESS=0.0000E+00 OUTFLOW=0.1995E+02 BASIN STORAGE=0.2991E-02 PERCENT ERROR= 0.0

12C12F	MANE	0.94	309.08	371.07	0.57	5.00	305.13	370.00	0.57

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2623E+02 EXCESS=0.0000E+00 OUTFLOW=0.2623E+02 BASIN STORAGE=0.8251E-03 PERCENT ERROR= 0.0

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

HEC-1 ANALYSIS
10-YEAR FREQUENCY STORM

HEC1 S/N: 1343000062   HMVersion: 6.33   Data File: X:\870000.ALL\871571\HYDRO\HEC1\ABSD\ABSD10.DAT

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              MAY   1991              *
*            VERSION 4.0.1E            *
*                                      *
* RUN DATE  08/26/1998  TIME  09:49:35 *
*                                      *
****************************************
```

```
***************************************
*                                     *
*   U.S. ARMY CORPS OF ENGINEERS      *
*   HYDROLOGIC ENGINEERING CENTER     *
*        609 SECOND STREET            *
*      DAVIS, CALIFORNIA 95616        *
*          (916) 756-1104             *
*                                     *
***************************************
```

```
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
```

```
:::::::::::::::::::::::::::::::::::::::::
:::::::::::::::::::::::::::::::::::::::::
:::                                   :::
:::  Full Microcomputer Implementation :::
:::                by                 :::
:::        Haestad Methods, Inc.      :::
:::                                   :::
:::::::::::::::::::::::::::::::::::::::::
:::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

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

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

          ID     A PORTION OF COTTONWOOD CREEK AYERS DBPS MODEL REVISED TO PROVIDE
          ID     A DESIGN PEAK FLOW RATE FOR A STORM DRAIN OUTFALL LINE TO BE CONSTRUCTED
          ID     ADJACENT TO AUSTIN BLUFFS PARKWAY BETWEEN MEADOW RIDGE DRIVE AND
          ID     COTTONWOOD CREEK. REVISED BY JR ENGINEERING, VANCE FOSSINGER ON 8-05-97
          ID     100 YR 24 HR STORM
          ID
          ID     MODEL IS PRELIMINARY
          ID
          ID     COTTONWOOD CREEK DBPS AYRES PROJECT NO. 34-0330.00
          ID     FUTURE CONDITIONS - INPUT FILE 100FDREV.INP
          ID     CN AND LAGS REVISED BASED UPON SEPTEMBER 4TH, 1996 MEETING WITH
          ID     CITY OF COLORADO SPRINGS ENGINEERING STAFF
          ID     10 YEAR 24 HOUR STORM
          *DIAGRAM
          IT       5 01SEP89     800     300
          IO       5

          KK      G1
          KM      RUNOFF FROM  G1
          BA   0.180
          LS       0     81.7
          UD   0.180
          IN      15
          PB   3.0
          PC   .0000   .0005   .0015   .0030   .0045   .0060   .0080   .0100   .0120   .0143
          PC   .0165   .0188   .0210   .0233   .0255   .0278   .0320   .0390   .0460   .0530
          PC   .0600   .0750   .1000   .4000   .7000   .7250   .7500   .7650   .7800   .7900
          PC   .8000   .8100   .8200   .8250   .8300   .8350   .8400   .8450   .8500   .8550
          PC   .8600   .8638   .8675   .8713   .8750   .8788   .8825   .8863   .8900   .8938
          PC   .8975   .9013   .9050   .9083   .9115   .9148   .9180   .9210   .9240   .9270
          PC   .9300   .9325   .9350   .9375   .9400   .9425   .9450   .9475   .9500   .9525
          PC   .9550   .9575   .9600   .9625   .9650   .9675   .9700   .9725   .9750   .9775
          PC   .9800   .9813   .9825   .9838   .9850   .9863   .9875   .9888   .9900   .9913
          PC   .9925   .9938   .9950   .9963   .9975   .9988   1.000

          KK  G1-12A
          KM      ROUTE G1 TO DESIGN POINT 12A
          RD    2400    .023    .013       0    CIRC     5.5

          KK      G3
          KM      RUNOFF FROM  G3
          BA   0.183
          LS       0     79.4
          UD   0.270

          KK     12A
          KM      COMBINE G1-12A,G3
          HC       2

          KK      G2
          KM      RUNOFF FROM  G2
          BA   0.107
          LS       0     75.3
          UD   0.150
```

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

              KK  G2-12B
              KM     ROUTE G2 TO DESIGN POINT 12B
              RD    2900    .042    .035       0    TRAP       5       8

              KK      G4
              KM     RUNOFF FROM  G4
              BA   0.132
              LS       0    87.0
              UD   0.230

              KK     12B
              KM     COMBINE 12A,G2-12B,G4
              HC       3

              KK  12B12C
              KM     ROUTE 12B TO DESIGN POINT 12C
              KO       0
              RD    2500    .025    .015       0    TRAP      10       5

              KK      G5
              KM     RUNOFF FROM  G5
              BA   0.118
              LS       0    76.3
              UD   0.190

              KK      G6
              KM     RUNOFF FROM  G6
              BA   0.139
              LS       0    78.1
              UD   0.200

              KK     12C
              KM     COMBINE 12B-12C,G5,G6 FOR TOTAL FLOW AT MEADOW RIDGE
              HC       3

              KK  12C12F
              KM     ROUTE 12C TO DESIGN POINT 12F AT CONFLUENCE W/ COTTONWOOD CREEK
              KO       0
              RD    1650    .028    .013       0    CIRC       8

              KK     G7A
              KM     RUNOFF FROM  G7A
              BA  0.0294
              LS       0    88.0
              UD    0.18

              KK    12C2
              KM     COMBINE 12C12F AND G7A FOR TOTAL FLOW IN AUSTIN BLUFFS TRIBUTARY
              KO       2       2     200
              HC       2
```

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

KK   G8A
KM     RUNOFF FROM  G8A
BA   0.0645
LS      0      80.1
UD   0.17

KK     12C3
KM     COMBINE 12CC AND G8A FOR TOTAL FLOW IN AUSTIN BLUFFS TRIBUTARY
HC      2
ZZ
```

```
             SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE    (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

  16        G1
             V
             V
  33    G1-12A
             .
             .
  36         .         G3
             .          .
             .          .
  41       12A...........
             .
             .
  44         .         G2
             .          V
             .          V
  49         .     G2-12B
             .          .
             .          .
  52         .          .         G4
             .          .          .
             .          .          .
  57       12B......................
             V
             V
  60    12B12C
             .
             .
  64         .         G5
             .          .
             .          .
  69         .          .         G6
             .          .          .
             .          .          .
  74       12C......................
             V
             V
  77    12C12F
             .
             .
  81         .      G7A
             .          .
             .          .
  86       12C...........
             .
             .
  90         .      G8A
             .          .
             .          .
  95       12C...........

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
HEC1 S/N: 1343000062        HMVersion: 6.33    Data File: X:\870000.ALL\871571\HYDRO\HEC1\ABSD\ABSD10.DAT

****************************************                                              ****************************************
*                                      *                                              *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                              *   U.S. ARMY CORPS OF ENGINEERS       *
*              MAY  1991               *                                              *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.0.1E             *                                              *         609 SECOND STREET            *
*                                      *                                              *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE  08/26/1998  TIME  09:49:35 *                                             *          (916) 756-1104              *
*                                      *                                              *                                      *
****************************************                                              ****************************************



                    A PORTION OF COTTONWOOD CREEK AYERS DBPS MODEL REVISED TO PROVIDE
                    A DESIGN PEAK FLOW RATE FOR A STORM DRAIN OUTFALL LINE TO BE CONSTRUCTED
                    ADJACENT TO AUSTIN BLUFFS PARKWAY BETWEEN MEADOW RIDGE DRIVE AND
                    COTTONWOOD CREEK. REVISED BY JR ENGINEERING, VANCE FOSSINGER ON 8-05-97
                    100 YR 24 HR STORM

                    MODEL IS PRELIMINARY

                    COTTONWOOD CREEK DBPS AYRES PROJECT NO. 34-0330.00
                    FUTURE CONDITIONS - INPUT FILE 100FDREV.INP
                    CN AND LAGS REVISED BASED UPON SEPTEMBER 4TH, 1996 MEETING WITH
                    CITY OF COLORADO SPRINGS ENGINEERING STAFF
                    10 YEAR 24 HOUR STORM

  15 IO        OUTPUT CONTROL VARIABLES
                    IPRNT           5  PRINT CONTROL
                    IPLOT           0  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT        HYDROGRAPH TIME DATA
                     NMIN           5  MINUTES IN COMPUTATION INTERVAL
                    IDATE     1SEP89  STARTING DATE
                    ITIME        0800  STARTING TIME
                       NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE     2SEP89  ENDING DATE
                   NDTIME        0855  ENDING TIME
                    ICENT          19  CENTURY MARK

            COMPUTATION INTERVAL    0.08 HOURS
                 TOTAL TIME BASE   24.92 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


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


         **************
         *            *
  60 KK  *   12B12C   *
         *            *
         **************

  62 KO        OUTPUT CONTROL VARIABLES
                    IPRNT           5  PRINT CONTROL
                    IPLOT           0  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE


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


         **************
         *            *
  77 KK  *   12C12F   *
         *            *
         **************

  79 KO        OUTPUT CONTROL VARIABLES
                    IPRNT           5  PRINT CONTROL
                    IPLOT           0  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE


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


         **************
         *            *
  86 KK  *     12C    *      2
         *            *
         **************

  88 KO        OUTPUT CONTROL VARIABLES
                    IPRNT           2  PRINT CONTROL
                    IPLOT           2  PLOT CONTROL
                    QSCAL        200.  HYDROGRAPH PLOT SCALE

  89 HC        HYDROGRAPH COMBINATION
                    ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                             ***

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

                                                 HYDROGRAPH AT STATION      12C
                                                     SUM OF  2 HYDROGRAPHS

*************************************************************************************************************************************
                                    *                               *                              *
  DA MON HRMN  ORD        FLOW      *  DA MON HRMN  ORD      FLOW   *  DA MON HRMN  ORD      FLOW  *  DA MON HRMN  ORD         FLOW
                                    *                               *                              *
   1 SEP 0800    1          0.      *   1 SEP 1415   76      648.   *   1 SEP 2030  151       18.  *   2 SEP 0245  226          13.
```

1 SEP 0805	2	0.	1 SEP 1420	77	482.	1 SEP 2035	152	18.	2 SEP 0250	227	13.
1 SEP 0810	3	0.	1 SEP 1425	78	347.	1 SEP 2040	153	18.	2 SEP 0255	228	13.
1 SEP 0815	4	0.	1 SEP 1430	79	254.	1 SEP 2045	154	18.	2 SEP 0300	229	13.
1 SEP 0820	5	0.	1 SEP 1435	80	196.	1 SEP 2050	155	19.	2 SEP 0305	230	13.
1 SEP 0825	6	0.	1 SEP 1440	81	158.	1 SEP 2055	156	19.	2 SEP 0310	231	13.
1 SEP 0830	7	0.	1 SEP 1445	82	130.	1 SEP 2100	157	19.	2 SEP 0315	232	13.
1 SEP 0835	8	0.	1 SEP 1450	83	109.	1 SEP 2105	158	18.	2 SEP 0320	233	13.
1 SEP 0840	9	0.	1 SEP 1455	84	94.	1 SEP 2110	159	18.	2 SEP 0325	234	13.
1 SEP 0845	10	0.	1 SEP 1500	85	84.	1 SEP 2115	160	18.	2 SEP 0330	235	13.
1 SEP 0850	11	0.	1 SEP 1505	86	77.	1 SEP 2120	161	18.	2 SEP 0335	236	13.
1 SEP 0855	12	0.	1 SEP 1510	87	71.	1 SEP 2125	162	17.	2 SEP 0340	237	13.
1 SEP 0900	13	0.	1 SEP 1515	88	65.	1 SEP 2130	163	17.	2 SEP 0345	238	13.
1 SEP 0905	14	0.	1 SEP 1520	89	60.	1 SEP 2135	164	16.	2 SEP 0350	239	13.
1 SEP 0910	15	0.	1 SEP 1525	90	55.	1 SEP 2140	165	16.	2 SEP 0355	240	13.
1 SEP 0915	16	0.	1 SEP 1530	91	52.	1 SEP 2145	166	16.	2 SEP 0400	241	13.
1 SEP 0920	17	0.	1 SEP 1535	92	49.	1 SEP 2150	167	16.	2 SEP 0405	242	13.
1 SEP 0925	18	0.	1 SEP 1540	93	48.	1 SEP 2155	168	16.	2 SEP 0410	243	12.
1 SEP 0930	19	0.	1 SEP 1545	94	48.	1 SEP 2200	169	16.	2 SEP 0415	244	11.
1 SEP 0935	20	0.	1 SEP 1550	95	47.	1 SEP 2205	170	16.	2 SEP 0420	245	10.
1 SEP 0940	21	0.	1 SEP 1555	96	47.	1 SEP 2210	171	16.	2 SEP 0425	246	9.
1 SEP 0945	22	0.	1 SEP 1600	97	47.	1 SEP 2215	172	16.	2 SEP 0430	247	8.
1 SEP 0950	23	0.	1 SEP 1605	98	47.	1 SEP 2220	173	16.	2 SEP 0435	248	7.
1 SEP 0955	24	0.	1 SEP 1610	99	45.	1 SEP 2225	174	15.	2 SEP 0440	249	7.
1 SEP 1000	25	0.	1 SEP 1615	100	41.	1 SEP 2230	175	15.	2 SEP 0445	250	7.
1 SEP 1005	26	0.	1 SEP 1620	101	37.	1 SEP 2235	176	15.	2 SEP 0450	251	7.
1 SEP 1010	27	0.	1 SEP 1625	102	32.	1 SEP 2240	177	15.	2 SEP 0455	252	7.
1 SEP 1015	28	0.	1 SEP 1630	103	29.	1 SEP 2245	178	15.	2 SEP 0500	253	7.
1 SEP 1020	29	0.	1 SEP 1635	104	27.	1 SEP 2250	179	15.	2 SEP 0505	254	6.
1 SEP 1025	30	0.	1 SEP 1640	105	26.	1 SEP 2255	180	15.	2 SEP 0510	255	6.
1 SEP 1030	31	0.	1 SEP 1645	106	25.	1 SEP 2300	181	15.	2 SEP 0515	256	6.
1 SEP 1035	32	0.	1 SEP 1650	107	24.	1 SEP 2305	182	15.	2 SEP 0520	257	6.
1 SEP 1040	33	0.	1 SEP 1655	108	24.	1 SEP 2310	183	15.	2 SEP 0525	258	6.
1 SEP 1045	34	0.	1 SEP 1700	109	24.	1 SEP 2315	184	14.	2 SEP 0530	259	6.
1 SEP 1050	35	0.	1 SEP 1705	110	24.	1 SEP 2320	185	14.	2 SEP 0535	260	6.
1 SEP 1055	36	0.	1 SEP 1710	111	24.	1 SEP 2325	186	14.	2 SEP 0540	261	6.
1 SEP 1100	37	0.	1 SEP 1715	112	24.	1 SEP 2330	187	13.	2 SEP 0545	262	6.
1 SEP 1105	38	0.	1 SEP 1720	113	24.	1 SEP 2335	188	13.	2 SEP 0550	263	6.
1 SEP 1110	39	0.	1 SEP 1725	114	24.	1 SEP 2340	189	13.	2 SEP 0555	264	6.
1 SEP 1115	40	0.	1 SEP 1730	115	24.	1 SEP 2345	190	13.	2 SEP 0600	265	6.
1 SEP 1120	41	0.	1 SEP 1735	116	24.	1 SEP 2350	191	13.	2 SEP 0605	266	6.
1 SEP 1125	42	0.	1 SEP 1740	117	24.	1 SEP 2355	192	13.	2 SEP 0610	267	6.
1 SEP 1130	43	0.	1 SEP 1745	118	24.	2 SEP 0000	193	13.	2 SEP 0615	268	6.
1 SEP 1135	44	0.	1 SEP 1750	119	24.	2 SEP 0005	194	13.	2 SEP 0620	269	6.
1 SEP 1140	45	0.	1 SEP 1755	120	24.	2 SEP 0010	195	13.	2 SEP 0625	270	6.
1 SEP 1145	46	0.	1 SEP 1800	121	24.	2 SEP 0015	196	13.	2 SEP 0630	271	6.
1 SEP 1150	47	0.	1 SEP 1805	122	24.	2 SEP 0020	197	13.	2 SEP 0635	272	6.
1 SEP 1155	48	0.	1 SEP 1810	123	24.	2 SEP 0025	198	13.	2 SEP 0640	273	6.
1 SEP 1200	49	0.	1 SEP 1815	124	23.	2 SEP 0030	199	13.	2 SEP 0645	274	6.
1 SEP 1205	50	0.	1 SEP 1820	125	22.	2 SEP 0035	200	13.	2 SEP 0650	275	6.
1 SEP 1210	51	0.	1 SEP 1825	126	21.	2 SEP 0040	201	13.	2 SEP 0655	276	6.
1 SEP 1215	52	0.	1 SEP 1830	127	20.	2 SEP 0045	202	13.	2 SEP 0700	277	6.
1 SEP 1220	53	0.	1 SEP 1835	128	19.	2 SEP 0050	203	13.	2 SEP 0705	278	6.
1 SEP 1225	54	0.	1 SEP 1840	129	19.	2 SEP 0055	204	13.	2 SEP 0710	279	6.
1 SEP 1230	55	0.	1 SEP 1845	130	18.	2 SEP 0100	205	13.	2 SEP 0715	280	6.
1 SEP 1235	56	0.	1 SEP 1850	131	18.	2 SEP 0105	206	13.	2 SEP 0720	281	6.
1 SEP 1240	57	0.	1 SEP 1855	132	18.	2 SEP 0110	207	13.	2 SEP 0725	282	6.
1 SEP 1245	58	0.	1 SEP 1900	133	18.	2 SEP 0115	208	13.	2 SEP 0730	283	6.
1 SEP 1250	59	0.	1 SEP 1905	134	18.	2 SEP 0120	209	13.	2 SEP 0735	284	6.
1 SEP 1255	60	0.	1 SEP 1910	135	18.	2 SEP 0125	210	13.	2 SEP 0740	285	6.
1 SEP 1300	61	0.	1 SEP 1915	136	18.	2 SEP 0130	211	13.	2 SEP 0745	286	6.
1 SEP 1305	62	0.	1 SEP 1920	137	18.	2 SEP 0135	212	13.	2 SEP 0750	287	6.
1 SEP 1310	63	0.	1 SEP 1925	138	18.	2 SEP 0140	213	13.	2 SEP 0755	288	6.
1 SEP 1315	64	0.	1 SEP 1930	139	18.	2 SEP 0145	214	13.	2 SEP 0800	289	6.
1 SEP 1320	65	0.	1 SEP 1935	140	18.	2 SEP 0150	215	13.	2 SEP 0805	290	6.
1 SEP 1325	66	0.	1 SEP 1940	141	18.	2 SEP 0155	216	13.	2 SEP 0810	291	6.
1 SEP 1330	67	0.	1 SEP 1945	142	18.	2 SEP 0200	217	13.	2 SEP 0815	292	5.
1 SEP 1335	68	1.	1 SEP 1950	143	18.	2 SEP 0205	218	13.	2 SEP 0820	293	4.
1 SEP 1340	69	12.	1 SEP 1955	144	18.	2 SEP 0210	219	13.	2 SEP 0825	294	3.
1 SEP 1345	70	60.	1 SEP 2000	145	18.	2 SEP 0215	220	13.	2 SEP 0830	295	2.
1 SEP 1350	71	183.	1 SEP 2005	146	18.	2 SEP 0220	221	13.	2 SEP 0835	296	1.
1 SEP 1355	72	368.	1 SEP 2010	147	18.	2 SEP 0225	222	13.	2 SEP 0840	297	1.
1 SEP 1400	73	584.	1 SEP 2015	148	18.	2 SEP 0230	223	13.	2 SEP 0845	298	0.
1 SEP 1405	74	750.	1 SEP 2020	149	18.	2 SEP 0235	224	13.	2 SEP 0850	299	0.
1 SEP 1410	75	768.	1 SEP 2025	150	18.	2 SEP 0240	225	13.	2 SEP 0855	300	0.

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.92-HR
768.	6.17	(CFS)	96.	30.	29.	29.
		(INCHES)	1.009	1.276	1.276	1.276
		(AC-FT)	48.	60.	60.	60.

CUMULATIVE AREA = 0.89 SQ MI

STATION 12C

```
                          (O) OUTFLOW
           0.       400.      800.       0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
DAHRMN PER
 10800   10---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.
 10805   20
 10810   30
 10815   40
 10820   50
 10825   60
 10830   70
 10835   80
 10840   90
 10845  100
 10850  110 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 10855  120
 10900  130
 10905  140
 10910  150
 10915  160
 10920  170
 10925  180
 10930  190
 10935  200
 10940  210 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 10945  220
 10950  230
 10955  240
 11000  250
 11005  260
 11010  270
 11015  280
 11020  290
 11025  300
 11030  310 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 11035  320
 11040  330
 11045  340
 11050  350
 11055  360
 11100  370
 11105  380
 11110  390
 11115  400
 11120  410 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 11125  420
 11130  430
 11135  440
 11140  450
 11145  460
 11150  470
 11155  480
 11200  490
 11205  500
 11210  510 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 11215  520
 11220  530
 11225  540
 11230  550
 11235  560
 11240  570
 11245  580
 11250  590
 11255  600
 11300  610 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 11305  620
 11310  630
 11315  640
 11320  650
 11325  660
 11330  670
 11335  680
 11340  690
 11345  70. O
 11350  71. . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 11355  72.        O.
 11400  73.          .    O   .
 11405  74.          .        O.
 11410  75.          .        O.
 11415  76.          .     O
 11420  77.          . O
 11425  78.         O.
 11430  79.     O    .
 11435  80.    O     .
 11440  81. . O . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 11445  82.  O
 11450  83.  O
 11455  84. O
 11500  85. O
 11505  86. O
 11510  87. O
 11515  88. O
 11520  89.O
 11525  90.O
 11530  91.O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 11535  92.O
 11540  93.O
 11545  94.O
 11550  95.O
 11555  96.O
 11600  97.O
 11605  98.O
 11610  99.O
 11615 100.O
 11620 101.O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 11625 102.O
 11630 103.O
 11635 104.O
 11640 105.O
 11645 106.O
 11650 107.O
 11655 108.O
 11700 109.O
 11705 110.O
 11710 111.O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 11715 112.O
 11720 113.O
 11725 114.O
 11730 115.O
```

11735	116.0
11740	117.0
11745	118.0
11750	119.0
11755	120.0
11800	121.0
11805	122.0
11810	123.0
11815	124.0
11820	125.0
11825	126.0
11830	1270
11835	1280
11840	1290
11845	1300
11850	1310
11855	1320
11900	1330
11905	1340
11910	1350
11915	1360
11920	1370
11925	1380
11930	1390
11935	1400
11940	1410
11945	1420
11950	1430
11955	1440
12000	1450
12005	1460
12010	1470
12015	1480
12020	1490
12025	1500
12030	1510
12035	1520
12040	1530
12045	1540
12050	1550
12055	1560
12100	1570
12105	1580
12110	1590
12115	1600
12120	1610
12125	1620
12130	1630
12135	1640
12140	1650
12145	1660
12150	1670
12155	1680
12200	1690
12205	1700
12210	1710
12215	1720
12220	1730
12225	1740
12230	1750
12235	1760
12240	1770
12245	1780
12250	1790
12255	1800
12300	1810
12305	1820
12310	1830
12315	1840
12320	1850
12325	1860
12330	1870
12335	1880
12340	1890
12345	1900
12350	1910
12355	1920
20000	1930
20005	1940
20010	1950
20015	1960
20020	1970
20025	1980
20030	1990
20035	2000
20040	2010
20045	2020
20050	2030
20055	2040
20100	2050
20105	2060
20110	2070
20115	2080
20120	2090
20125	2100
20130	2110
20135	2120
20140	2130
20145	2140
20150	2150
20155	2160
20200	2170
20205	2180
20210	2190
20215	2200
20220	2210
20225	2220
20230	2230
20235	2240
20240	2250
20245	2260
20250	2270
20255	2280
20300	2290
20305	2300
20310	2310
20315	2320
20320	2330
20325	2340
20330	2350

20335	2360
20340	2370
20345	2380
20350	2390
20355	2400
20400	2410
20405	2420
20410	2430
20415	2440
20420	2450
20425	2460
20430	2470
20435	2480
20440	2490
20445	2500
20450	2510
20455	2520
20500	2530
20505	2540
20510	2550
20515	2560
20520	2570
20525	2580
20530	2590
20535	2600
20540	2610
20545	2620
20550	2630
20555	2640
20600	2650
20605	2660
20610	2670
20615	2680
20620	2690
20625	2700
20630	2710
20635	2720
20640	2730
20645	2740
20650	2750
20655	2760
20700	2770
20705	2780
20710	2790
20715	2800
20720	2810
20725	2820
20730	2830
20735	2840
20740	2850
20745	2860
20750	2870
20755	2880
20800	2890
20805	2900
20810	2910
20815	2920
20820	2930
20825	2940
20830	2950
20835	2960
20840	2970
20845	2980
20850	2990
20855	3000

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	G1	193.	6.08	21.	7.	6.	0.18		
ROUTED TO	G1-12A	187.	6.08	21.	7.	6.	0.18		
HYDROGRAPH AT	G3	142.	6.17	19.	6.	6.	0.18		
2 COMBINED AT	12A	321.	6.08	40.	13.	12.	0.36		
HYDROGRAPH AT	G2	84.	6.08	9.	3.	3.	0.11		
ROUTED TO	G2-12B	81.	6.17	9.	3.	3.	0.11		
HYDROGRAPH AT	G4	169.	6.08	20.	6.	6.	0.13		
3 COMBINED AT	12B	562.	6.08	68.	22.	21.	0.60		
ROUTED TO	12B12C	553.	6.17	68.	22.	21.	0.60		
HYDROGRAPH AT	G5	91.	6.08	10.	3.	3.	0.12		
HYDROGRAPH AT	G6	117.	6.08	13.	4.	4.	0.14		
3 COMBINED AT	12C	735.	6.17	92.	29.	28.	0.86		
ROUTED TO	12C12F	735.	6.17	92.	29.	28.	0.86		
HYDROGRAPH AT	G7A	42.	6.08	5.	1.	1.	0.03		
2 COMBINED AT	12C P	768.	6.17	96.	30.	29.	0.89		
HYDROGRAPH AT	G8A	64.	6.08	7.	2.	2.	0.06		
2 COMBINED AT	12C Q	819.	6.17	103.	33.	31.	0.95		

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

						INTERPOLATED TO COMPUTATION INTERVAL			
ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
G1-12A	MANE	1.70	191.11	366.54	1.36	5.00	187.39	365.00	1.36

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1305E+02 EXCESS=0.0000E+00 OUTFLOW=0.1305E+02 BASIN STORAGE=0.1984E-03 PERCENT ERROR= 0.0

G2-12B	MANE	1.50	81.82	369.00	0.98	5.00	81.13	370.00	0.97

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.5574E+01 EXCESS=0.0000E+00 OUTFLOW=0.5577E+01 BASIN STORAGE=0.1345E-02 PERCENT ERROR= -0.1

12B12C	MANE	2.00	561.82	368.00	1.33	5.00	552.80	370.00	1.33

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4269E+02 EXCESS=0.0000E+00 OUTFLOW=0.4269E+02 BASIN STORAGE=0.3732E-02 PERCENT ERROR= 0.0

12C12F	MANE	0.79	734.79	369.97	1.26	5.00	734.68	370.00	1.26

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.5756E+02 EXCESS=0.0000E+00 OUTFLOW=0.5756E+02 BASIN STORAGE=0.9525E-03 PERCENT ERROR= 0.0

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

HEC-1 ANALYSIS
100-YEAR FREQUENCY STORM

HEC1 S/N: 1343000062   HMVersion: 6.33   Data File: X:\870000.ALL\871571\HYDRO\HEC1\ABSD\ABSD100.DAT

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              MAY  1991               *
*           VERSION 4.0.1E             *
*                                      *
* RUN DATE  12/03/1997  TIME  10:38:18 *
*                                      *
****************************************
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****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*   HYDROLOGIC ENGINEERING CENTER      *
*        609 SECOND STREET             *
*     DAVIS, CALIFORNIA 95616          *
*         (916) 756-1104               *
*                                      *
****************************************
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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
```

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::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::
:::                                    :::
:::  Full Microcomputer Implementation :::
:::               by                   :::
:::       Haestad Methods, Inc.        :::
:::                                    :::
::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

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

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

  1            ID    A PORTION OF COTTONWOOD CREEK AYERS DBPS MODEL REVISED TO PROVIDE
  2            ID    A DESIGN PEAK FLOW RATE FOR A STORM DRAIN OUTFALL LINE TO BE CONSTRUCTED
  3            ID    ADJACENT TO AUSTIN BLUFFS PARKWAY BETWEEN MEADOW RIDGE DRIVE AND
  4            ID    COTTONWOOD CREEK. REVISED BY JR ENGINEERING, VANCE FOSSINGER ON 8-05-97
  5            ID    100 YR 24 HR STORM
  6            ID
  7            ID    MODEL IS PRELIMINARY
  8            ID
  9            ID    COTTONWOOD CREEK DBPS AYRES PROJECT NO. 34-0330.00
 10            ID    FUTURE CONDITIONS - INPUT FILE 100FDREV.INP
 11            ID    CN AND LAGS REVISED BASED UPON SEPTEMBER 4TH, 1996 MEETING WITH
 12            ID    CITY OF COLORADO SPRINGS ENGINEERING STAFF
 13            ID    100 YEAR 24 HOUR STORM - RUN DATE 10-08-96
               *DIAGRAM
 14            IT       5 01SEP89      800       300
 15            IO       5

 16            KK      G1
 17            KM     RUNOFF FROM  G1
 18            BA   0.180
 19            LS       0     81.7
 20            UD   0.180
 21            IN      15
 22            PB    4.4
 23            PC   .0000   .0005   .0015   .0030   .0045   .0060   .0080   .0100   .0120   .0143
 24            PC   .0165   .0188   .0210   .0233   .0255   .0278   .0320   .0390   .0460   .0530
 25            PC   .0600   .0750   .1000   .4000   .7000   .7250   .7500   .7650   .7800   .7900
 26            PC   .8000   .8100   .8200   .8250   .8300   .8350   .8400   .8450   .8500   .8550
 27            PC   .8600   .8638   .8675   .8713   .8750   .8788   .8825   .8863   .8900   .8938
 28            PC   .8975   .9013   .9050   .9083   .9115   .9148   .9180   .9210   .9240   .9270
 29            PC   .9300   .9325   .9350   .9375   .9400   .9425   .9450   .9475   .9500   .9525
 30            PC   .9550   .9575   .9600   .9625   .9650   .9675   .9700   .9725   .9750   .9775
 31            PC   .9800   .9813   .9825   .9838   .9850   .9863   .9875   .9888   .9900   .9913
 32            PC   .9925   .9938   .9950   .9963   .9975   .9988   1.000

 33            KK  G1-12A
 34            KM     ROUTE G1 TO DESIGN POINT 12A
 35            RD    2400    .023    .013       0    CIRC     5.5

 36            KK      G3
 37            KM     RUNOFF FROM  G3
 38            BA   0.183
 39            LS       0     79.4
 40            UD   0.270

 41            KK     12A
 42            KM     COMBINE G1-12A,G3
 43            HC       2

 44            KK      G2
 45            KM     RUNOFF FROM  G2
 46            BA   0.107
 47            LS       0     75.3
 48            UD   0.150
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LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 49            KK  G2-12B
 50            KM     ROUTE G2 TO DESIGN POINT 12B
 51            RD    2900    .042    .035       0    TRAP       5       8

 52            KK      G4
 53            KM     RUNOFF FROM  G4
 54            BA   0.132
 55            LS       0    87.0
 56            UD   0.230

 57            KK     12B
 58            KM     COMBINE 12A,G2-12B,G4
 59            HC       3

 60            KK  12B12C
 61            KM     ROUTE 12B TO DESIGN POINT 12C
 62            KO       0
 63            RD    2500    .025    .015       0    TRAP      10       5

 64            KK      G5
 65            KM     RUNOFF FROM  G5
 66            BA   0.118
 67            LS       0    76.3
 68            UD   0.190

 69            KK      G6
 70            KM     RUNOFF FROM  G6
 71            BA   0.139
 72            LS       0    78.1
 73            UD   0.200

 74            KK     12C
 75            KM     COMBINE 12B-12C,G5,G6 FOR TOTAL FLOW AT MEADOW RIDGE
 76            HC       3

 77            KK  12C12F
 78            KM     ROUTE 12C TO DESIGN POINT 12F AT CONFLUENCE W/ COTTONWOOD CREEK
 79            KO       0
 80            RD    1650    .028    .013       0    CIRC       8

 81            KK     G7A
 82            KM     RUNOFF FROM  G7A
 83            BA  0.0294
 84            LS       0    88.0
 85            UD    0.18

 86            KK    12C2
 87            KM     COMBINE 12C12F AND G7A FOR TOTAL FLOW IN AUSTIN BLUFFS TRIBUTARY
 88            KO       2       2     200
 89            HC       2
```

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

  90          KK   G8A
  91          KM     RUNOFF FROM  G8A
  92          BA   0.0645
  93          LS        0     80.1
  94          UD   0.17

  95          KK     12C3
  96          KM     COMBINE 12CC AND G8A FOR TOTAL FLOW IN AUSTIN BLUFFS TRIBUTARY
  97          HC        2
  98          ZZ
```

```
               SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

  16          G1
               V
               V
  33      G1-12A
               .
               .
  36           .          G3
               .           .
               .           .
  41         12A............
               .
               .
  44           .          G2
               .           V
               .           V
  49           .      G2-12B
               .           .
               .           .
  52           .           .          G4
               .           .           .
               .           .           .
  57         12B........................
               V
               V
  60      12B12C
               .
               .
  64           .          G5
               .           .
               .           .
  69           .           .          G6
               .           .           .
               .           .           .
  74         12C........................
               V
               V
  77      12C12F
               .
               .
  81           .       G7A
               .           .
               .           .
  86         12C............
               .
               .
  90           .       G8A
               .           .
               .           .
  95         12C............

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

HEC1 S/N: 1343000062   HMVersion: 6.33   Data File: X:\870000.ALL\871571\HYDRO\HEC1\ABSD\ABSD100.DAT

```
****************************************                   ****************************************
*                                      *                   *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                   *   U.S. ARMY CORPS OF ENGINEERS       *
*              MAY  1991               *                   *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.0.1E             *                   *        609 SECOND STREET             *
*                                      *                   *     DAVIS, CALIFORNIA 95616          *
* RUN DATE  12/03/1997  TIME  10:38:18 *                   *          (916) 756-1104              *
*                                      *                   *                                      *
****************************************                   ****************************************
```

```
                      A PORTION OF COTTONWOOD CREEK AYERS DBPS MODEL REVISED TO PROVIDE
                      A DESIGN PEAK FLOW RATE FOR A STORM DRAIN OUTFALL LINE TO BE CONSTRUCTED
                      ADJACENT TO AUSTIN BLUFFS PARKWAY BETWEEN MEADOW RIDGE DRIVE AND
                      COTTONWOOD CREEK. REVISED BY JR ENGINEERING, VANCE FOSSINGER ON 8-05-97
                      100 YR 24 HR STORM

                      MODEL IS PRELIMINARY

                      COTTONWOOD CREEK DBPS AYRES PROJECT NO. 34-0330.00
                      FUTURE CONDITIONS - INPUT FILE 100FDREV.INP
                      CN AND LAGS REVISED BASED UPON SEPTEMBER 4TH, 1996 MEETING WITH
                      CITY OF COLORADO SPRINGS ENGINEERING STAFF
                      100 YEAR 24 HOUR STORM - RUN DATE 10-08-96

  15 IO         OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE    1SEP89  STARTING DATE
                      ITIME       0800  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE    2SEP89  ENDING DATE
                     NDTIME       0855  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL    0.08 HOURS
                      TOTAL TIME BASE   24.92 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

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

           **************
           *            *
  60 KK    *   12B12C   *
           *            *
           **************

  62 KO         OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

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

           **************
           *            *
  77 KK    *   12C12F   *
           *            *
           **************

  79 KO         OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

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

           **************
           *            *
  86 KK    *     12C    *     2
           *            *
           **************

  88 KO         OUTPUT CONTROL VARIABLES
                      IPRNT          2  PRINT CONTROL
                      IPLOT          2  PLOT CONTROL
                      QSCAL       200.  HYDROGRAPH PLOT SCALE

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

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

                                              HYDROGRAPH AT STATION       12C
                                                  SUM OF  2 HYDROGRAPHS

*********************************************************************************************************************************
```

DA MON HRMN	ORD	FLOW	*	DA MON HRMN	ORD	FLOW	*	DA MON HRMN	ORD	FLOW	*	DA MON HRMN	ORD	FLOW
1 SEP 0800	1	0.	*	1 SEP 1415	76	1198.	*	1 SEP 2030	151	31.	*	2 SEP 0245	226	21.

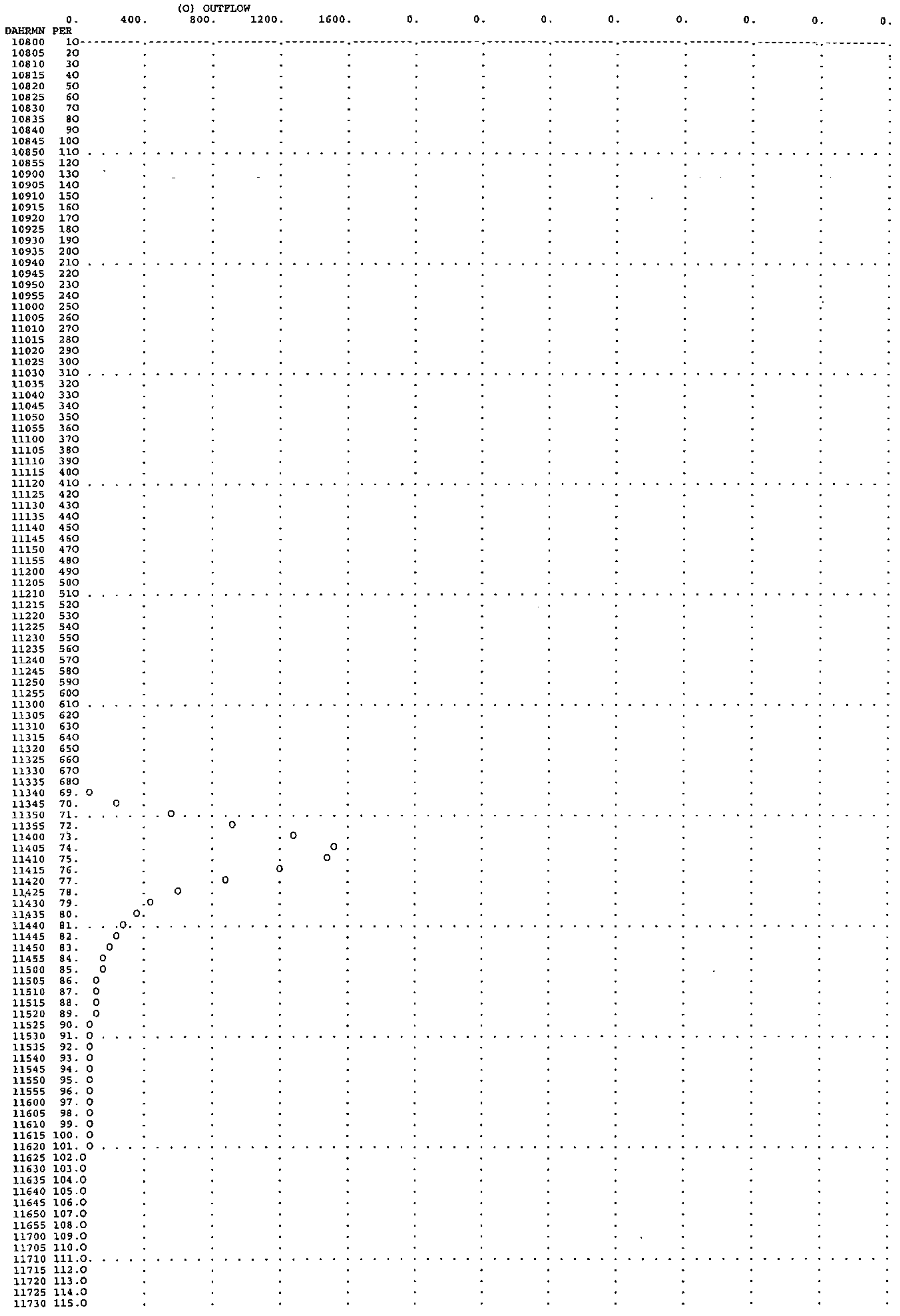
1 SEP 0805	2	0.	*	1 SEP 1420	77	871.	*	1 SEP 2035	152	31.	*	2 SEP 0250	227	21.
1 SEP 0810	3	0.	*	1 SEP 1425	78	618.	*	1 SEP 2040	153	31.	*	2 SEP 0255	228	21.
1 SEP 0815	4	0.	*	1 SEP 1430	79	452.	*	1 SEP 2045	154	31.	*	2 SEP 0300	229	21.
1 SEP 0820	5	0.	*	1 SEP 1435	80	348.	*	1 SEP 2050	155	31.	*	2 SEP 0305	230	21.
1 SEP 0825	6	0.	*	1 SEP 1440	81	278.	*	1 SEP 2055	156	31.	*	2 SEP 0310	231	21.
1 SEP 0830	7	0.	*	1 SEP 1445	82	227.	*	1 SEP 2100	157	31.	*	2 SEP 0315	232	21.
1 SEP 0835	8	0.	*	1 SEP 1450	83	189.	*	1 SEP 2105	158	31.	*	2 SEP 0320	233	21.
1 SEP 0840	9	0.	*	1 SEP 1455	84	162.	*	1 SEP 2110	159	31.	*	2 SEP 0325	234	21.
1 SEP 0845	10	0.	*	1 SEP 1500	85	144.	*	1 SEP 2115	160	30.	*	2 SEP 0330	235	21.
1 SEP 0850	11	0.	*	1 SEP 1505	86	132.	*	1 SEP 2120	161	29.	*	2 SEP 0335	236	21.
1 SEP 0855	12	0.	*	1 SEP 1510	87	122.	*	1 SEP 2125	162	29.	*	2 SEP 0340	237	21.
1 SEP 0900	13	0.	*	1 SEP 1515	88	112.	*	1 SEP 2130	163	28.	*	2 SEP 0345	238	21.
1 SEP 0905	14	0.	*	1 SEP 1520	89	102.	*	1 SEP 2135	164	28.	*	2 SEP 0350	239	21.
1 SEP 0910	15	0.	*	1 SEP 1525	90	94.	*	1 SEP 2140	165	27.	*	2 SEP 0355	240	21.
1 SEP 0915	16	0.	*	1 SEP 1530	91	88.	*	1 SEP 2145	166	27.	*	2 SEP 0400	241	21.
1 SEP 0920	17	0.	*	1 SEP 1535	92	85.	*	1 SEP 2150	167	27.	*	2 SEP 0405	242	21.
1 SEP 0925	18	0.	*	1 SEP 1540	93	83.	*	1 SEP 2155	168	27.	*	2 SEP 0410	243	20.
1 SEP 0930	19	0.	*	1 SEP 1545	94	82.	*	1 SEP 2200	169	27.	*	2 SEP 0415	244	19.
1 SEP 0935	20	0.	*	1 SEP 1550	95	81.	*	1 SEP 2205	170	27.	*	2 SEP 0420	245	17.
1 SEP 0940	21	0.	*	1 SEP 1555	96	81.	*	1 SEP 2210	171	27.	*	2 SEP 0425	246	15.
1 SEP 0945	22	0.	*	1 SEP 1600	97	81.	*	1 SEP 2215	172	26.	*	2 SEP 0430	247	13.
1 SEP 0950	23	0.	*	1 SEP 1605	98	80.	*	1 SEP 2220	173	26.	*	2 SEP 0435	248	12.
1 SEP 0955	24	0.	*	1 SEP 1610	99	76.	*	1 SEP 2225	174	26.	*	2 SEP 0440	249	11.
1 SEP 1000	25	0.	*	1 SEP 1615	100	69.	*	1 SEP 2230	175	25.	*	2 SEP 0445	250	11.
1 SEP 1005	26	0.	*	1 SEP 1620	101	61.	*	1 SEP 2235	176	25.	*	2 SEP 0450	251	11.
1 SEP 1010	27	0.	*	1 SEP 1625	102	54.	*	1 SEP 2240	177	25.	*	2 SEP 0455	252	11.
1 SEP 1015	28	0.	*	1 SEP 1630	103	49.	*	1 SEP 2245	178	25.	*	2 SEP 0500	253	11.
1 SEP 1020	29	0.	*	1 SEP 1635	104	45.	*	1 SEP 2250	179	25.	*	2 SEP 0505	254	11.
1 SEP 1025	30	0.	*	1 SEP 1640	105	43.	*	1 SEP 2255	180	25.	*	2 SEP 0510	255	11.
1 SEP 1030	31	0.	*	1 SEP 1645	106	42.	*	1 SEP 2300	181	25.	*	2 SEP 0515	256	11.
1 SEP 1035	32	0.	*	1 SEP 1650	107	42.	*	1 SEP 2305	182	25.	*	2 SEP 0520	257	11.
1 SEP 1040	33	0.	*	1 SEP 1655	108	41.	*	1 SEP 2310	183	25.	*	2 SEP 0525	258	11.
1 SEP 1045	34	0.	*	1 SEP 1700	109	41.	*	1 SEP 2315	184	24.	*	2 SEP 0530	259	11.
1 SEP 1050	35	0.	*	1 SEP 1705	110	41.	*	1 SEP 2320	185	23.	*	2 SEP 0535	260	11.
1 SEP 1055	36	0.	*	1 SEP 1710	111	41.	*	1 SEP 2325	186	22.	*	2 SEP 0540	261	11.
1 SEP 1100	37	0.	*	1 SEP 1715	112	41.	*	1 SEP 2330	187	22.	*	2 SEP 0545	262	11.
1 SEP 1105	38	0.	*	1 SEP 1720	113	41.	*	1 SEP 2335	188	22.	*	2 SEP 0550	263	11.
1 SEP 1110	39	0.	*	1 SEP 1725	114	41.	*	1 SEP 2340	189	21.	*	2 SEP 0555	264	11.
1 SEP 1115	40	0.	*	1 SEP 1730	115	41.	*	1 SEP 2345	190	21.	*	2 SEP 0600	265	11.
1 SEP 1120	41	0.	*	1 SEP 1735	116	41.	*	1 SEP 2350	191	21.	*	2 SEP 0605	266	11.
1 SEP 1125	42	0.	*	1 SEP 1740	117	41.	*	1 SEP 2355	192	21.	*	2 SEP 0610	267	11.
1 SEP 1130	43	0.	*	1 SEP 1745	118	41.	*	2 SEP 0000	193	21.	*	2 SEP 0615	268	11.
1 SEP 1135	44	0.	*	1 SEP 1750	119	41.	*	2 SEP 0005	194	21.	*	2 SEP 0620	269	11.
1 SEP 1140	45	0.	*	1 SEP 1755	120	41.	*	2 SEP 0010	195	21.	*	2 SEP 0625	270	11.
1 SEP 1145	46	0.	*	1 SEP 1800	121	41.	*	2 SEP 0015	196	21.	*	2 SEP 0630	271	11.
1 SEP 1150	47	0.	*	1 SEP 1805	122	41.	*	2 SEP 0020	197	21.	*	2 SEP 0635	272	11.
1 SEP 1155	48	0.	*	1 SEP 1810	123	40.	*	2 SEP 0025	198	21.	*	2 SEP 0640	273	11.
1 SEP 1200	49	0.	*	1 SEP 1815	124	38.	*	2 SEP 0030	199	21.	*	2 SEP 0645	274	11.
1 SEP 1205	50	0.	*	1 SEP 1820	125	36.	*	2 SEP 0035	200	21.	*	2 SEP 0650	275	11.
1 SEP 1210	51	0.	*	1 SEP 1825	126	35.	*	2 SEP 0040	201	21.	*	2 SEP 0655	276	11.
1 SEP 1215	52	0.	*	1 SEP 1830	127	33.	*	2 SEP 0045	202	21.	*	2 SEP 0700	277	11.
1 SEP 1220	53	0.	*	1 SEP 1835	128	32.	*	2 SEP 0050	203	21.	*	2 SEP 0705	278	11.
1 SEP 1225	54	0.	*	1 SEP 1840	129	31.	*	2 SEP 0055	204	21.	*	2 SEP 0710	279	11.
1 SEP 1230	55	0.	*	1 SEP 1845	130	31.	*	2 SEP 0100	205	21.	*	2 SEP 0715	280	11.
1 SEP 1235	56	0.	*	1 SEP 1850	131	31.	*	2 SEP 0105	206	21.	*	2 SEP 0720	281	11.
1 SEP 1240	57	0.	*	1 SEP 1855	132	31.	*	2 SEP 0110	207	21.	*	2 SEP 0725	282	11.
1 SEP 1245	58	0.	*	1 SEP 1900	133	31.	*	2 SEP 0115	208	21.	*	2 SEP 0730	283	11.
1 SEP 1250	59	0.	*	1 SEP 1905	134	31.	*	2 SEP 0120	209	21.	*	2 SEP 0735	284	11.
1 SEP 1255	60	0.	*	1 SEP 1910	135	31.	*	2 SEP 0125	210	21.	*	2 SEP 0740	285	11.
1 SEP 1300	61	0.	*	1 SEP 1915	136	31.	*	2 SEP 0130	211	21.	*	2 SEP 0745	286	11.
1 SEP 1305	62	0.	*	1 SEP 1920	137	31.	*	2 SEP 0135	212	21.	*	2 SEP 0750	287	11.
1 SEP 1310	63	0.	*	1 SEP 1925	138	31.	*	2 SEP 0140	213	21.	*	2 SEP 0755	288	11.
1 SEP 1315	64	0.	*	1 SEP 1930	139	31.	*	2 SEP 0145	214	21.	*	2 SEP 0800	289	11.
1 SEP 1320	65	0.	*	1 SEP 1935	140	31.	*	2 SEP 0150	215	21.	*	2 SEP 0805	290	10.
1 SEP 1325	66	1.	*	1 SEP 1940	141	31.	*	2 SEP 0155	216	21.	*	2 SEP 0810	291	9.
1 SEP 1330	67	1.	*	1 SEP 1945	142	31.	*	2 SEP 0200	217	21.	*	2 SEP 0815	292	8.
1 SEP 1335	68	10.	*	1 SEP 1950	143	31.	*	2 SEP 0205	218	21.	*	2 SEP 0820	293	6.
1 SEP 1340	69	62.	*	1 SEP 1955	144	31.	*	2 SEP 0210	219	21.	*	2 SEP 0825	294	4.
1 SEP 1345	70	238.	*	1 SEP 2000	145	31.	*	2 SEP 0215	220	21.	*	2 SEP 0830	295	3.
1 SEP 1350	71	548.	*	1 SEP 2005	146	31.	*	2 SEP 0220	221	21.	*	2 SEP 0835	296	2.
1 SEP 1355	72	928.	*	1 SEP 2010	147	31.	*	2 SEP 0225	222	21.	*	2 SEP 0840	297	1.
1 SEP 1400	73	1296.	*	1 SEP 2015	148	31.	*	2 SEP 0230	223	21.	*	2 SEP 0845	298	1.
1 SEP 1405	74	1527.	*	1 SEP 2020	149	31.	*	2 SEP 0235	224	21.	*	2 SEP 0850	299	0.
1 SEP 1410	75	1474.	*	1 SEP 2025	150	31.	*	2 SEP 0240	225	21.	*	2 SEP 0855	300	0.
			*				*				*			

****

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.92-HR
1527.	6.08	(CFS)	187.	57.	55.	55.
		(INCHES)	1.956	2.404	2.404	2.404
		(AC-FT)	93.	114.	114.	114.

CUMULATIVE AREA = 0.89 SQ MI

STATION 12C



11735	116.0
11740	117.0
11745	118.0
11750	119.0
11755	120.0
11800	121.0
11805	122.0
11810	123.0
11815	124.0
11820	125.0
11825	126.0
11830	127.0
11835	128.0
11840	129.0
11845	130.0
11850	131.0
11855	132.0
11900	133.0
11905	134.0
11910	135.0
11915	136.0
11920	137.0
11925	138.0
11930	139.0
11935	140.0
11940	141.0
11945	142.0
11950	143.0
11955	144.0
12000	145.0
12005	146.0
12010	147.0
12015	148.0
12020	149.0
12025	150.0
12030	151.0
12035	152.0
12040	153.0
12045	154.0
12050	155.0
12055	156.0
12100	157.0
12105	158.0
12110	159.0
12115	160.0
12120	161.0
12125	162.0
12130	163.0
12135	164.0
12140	165.0
12145	166.0
12150	167.0
12155	168.0
12200	169.0
12205	170.0
12210	171.0
12215	172.0
12220	173.0
12225	174.0
12230	175.0
12235	176.0
12240	177.0
12245	178.0
12250	179.0
12255	180.0
12300	181.0
12305	182.0
12310	183.0
12315	184.0
12320	185.0
12325	186.0
12330	187.0
12335	188.0
12340	189.0
12345	190.0
12350	191.0
12355	192.0
20000	193.0
20005	194.0
20010	195.0
20015	196.0
20020	197.0
20025	198.0
20030	199.0
20035	200.0
20040	201.0
20045	202.0
20050	203.0
20055	204.0
20100	205.0
20105	206.0
20110	207.0
20115	208.0
20120	209.0
20125	210.0
20130	211.0
20135	212.0
20140	213.0
20145	214.0
20150	215.0
20155	216.0
20200	217.0
20205	218.0
20210	219.0
20215	220.0
20220	221.0
20225	222.0
20230	223.0
20235	224.0
20240	225.0
20245	226.0
20250	227.0
20255	228.0
20300	229.0
20305	230.0
20310	231.0
20315	232.0
20320	233.0
20325	234.0
20330	235.0

20335	236.0
20340	237.0
20345	238.0
20350	239.0
20355	240.0
20400	241.0
20405	242.0
20410	243.0
20415	2440
20420	2450
20425	2460
20430	2470
20435	2480
20440	2490
20445	2500
20450	2510
20455	2520
20500	2530
20505	2540
20510	2550
20515	2560
20520	2570
20525	2580
20530	2590
20535	2600
20540	2610
20545	2620
20550	2630
20555	2640
20600	2650
20605	2660
20610	2670
20615	2680
20620	2690
20625	2700
20630	2710
20635	2720
20640	2730
20645	2740
20650	2750
20655	2760
20700	2770
20705	2780
20710	2790
20715	2800
20720	2810
20725	2820
20730	2830
20735	2840
20740	2850
20745	2860
20750	2870
20755	2880
20800	2890
20805	2900
20810	2910
20815	2920
20820	2930
20825	2940
20830	2950
20835	2960
20840	2970
20845	2980
20850	2990
20855	3000

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	G1	363.	6.08	40.	12.	12.	0.18		
ROUTED TO	G1-12A	358.	6.08	40.	12.	12.	0.18		
HYDROGRAPH AT	G3	284.	6.17	37.	11.	11.	0.18		
2 COMBINED AT	12A	635.	6.08	77.	24.	23.	0.36		
HYDROGRAPH AT	G2	174.	6.08	18.	6.	6.	0.11		
ROUTED TO	G2-12B	168.	6.08	18.	6.	6.	0.11		
HYDROGRAPH AT	G4	296.	6.08	36.	11.	10.	0.13		
3 COMBINED AT	12B	1100.	6.08	131.	40.	39.	0.60		
ROUTED TO	12B12C	1056.	6.08	131.	40.	39.	0.60		
HYDROGRAPH AT	G5	191.	6.08	21.	7.	6.	0.12		
HYDROGRAPH AT	G6	237.	6.08	27.	8.	8.	0.14		
3 COMBINED AT	12C	1484.	6.08	179.	55.	53.	0.86		
ROUTED TO	12C12F	1456.	6.08	179.	55.	53.	0.86		
HYDROGRAPH AT	G7A	71.	6.08	8.	2.	2.	0.03		
2 COMBINED AT	12C P	1527.	6.08	187.	57.	55.	0.89		
HYDROGRAPH AT	G8A	123.	6.08	13.	4.	4.	0.06		
2 COMBINED AT	12C Q	1651.	6.08	200.	61.	59.	0.95		

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

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	PEAK	TIME TO PEAK	VOLUME
						INTERPOLATED TO COMPUTATION INTERVAL			
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
G1-12A	MANE	1.50	358.11	365.25	2.52	5.00	357.53	365.00	2.52

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2422E+02 EXCESS=0.0000E+00 OUTFLOW=0.2422E+02 BASIN STORAGE=0.2088E-03 PERCENT ERROR= 0.0

G2-12B	MANE	1.75	174.47	367.50	2.00	5.00	168.35	365.00	1.99

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1139E+02 EXCESS=0.0000E+00 OUTFLOW=0.1139E+02 BASIN STORAGE=0.1326E-02 PERCENT ERROR= -0.1

12B12C	MANE	1.81	1090.68	366.58	2.48	5.00	1055.73	365.00	2.48

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.7948E+02 EXCESS=0.0000E+00 OUTFLOW=0.7949E+02 BASIN STORAGE=0.5011E-02 PERCENT ERROR= 0.0

12C12F	MANE	0.69	1478.44	366.09	2.38	5.00	1456.15	365.00	2.38

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1090E+03 EXCESS=0.0000E+00 OUTFLOW=0.1090E+03 BASIN STORAGE=0.1306E-02 PERCENT ERROR= 0.0

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

HYDRAULIC CALCULATIONS

BOX CULVERT ANALYSIS
DATA SHEETS

BOX CULVERT OPEN CHANNEL HYDRAULIC SUMMARY

1 Station	2 Channel Slope	3 Q100 Peak cfs	4 V100 Peak fps	5 d100 ft	6 Q@ d-5.8' cfs	7 Q100 6 hr AV cfs	8 V100 6 hr AV fps	9 d100 6 hr AV ft	10 Q10 Peak cfs	11 V10 Peak fps	12 d10 Peak ft	13 Q10 6 hr AV cfs	14 V10 6 hr AV fps	15 d10 6 hr AV ft	16 Q2 Peak cfs	17 V2 Peak fps fps	18 D2 6 hr AV ft	19 Q2 6 hr AV cfs	20 V2 6 hr AV fps	21 d2 6 hr AV ft
2+08.5 to 2.+45	3.32%	1651	36.7	4.08	2650	200	18.5	0.98	819	29.9	2.49	103	14.5	0.65	345	22.4	1.40	45	10.6	0.39
2+61 to 4+21.44	3.0%	1651	35.4	4.24	2520	200	17.9	1.02	819	28.8	2.58	103	14.0	0.67	345	21.7	1.45	45	10.3	0.40
4+31.44 to 8+56.12	2.69%	1651	34.0	4.41	2390	200	17.3	1.05	819	27.8	2.68	103	13.6	0.69	345	20.9	1.50	45	9.9	0.41
8+66.12 to 11+92.74	3.0%	1651	35.4	4.24	2520	200	17.9	1.02	819	28.8	2.58	103	14.0	0.67	345	21.7	1.45	45	10.3	0.40
12+02.74 to 13+72.2	3.0%	1651	35.4	4.24	2520	200	17.9	1.02	819	28.8	2.58	103	14.0	0.67	345	21.7	1.45	45	10.3	0.40
13+82.2 to 18+59.90	2.56%	1484	32.5	4.15	2320	179	16.3	1.00	735	26.4	2.53	92	12.7	0.65	311	19.9	1.42	40	9.3	0.39
18+79.33 to 19+86.47	6.0%	1319	42.5	2.83	3600	179-	21.4	0.76	735	35.2	1.90	92-	16.7	0.50	311-	26.2	1.08	40-	12.1	0.30
19+86.47 to 20+09.53	3.86%	1319	36.4	3.30	2860	179-	18.61	0.87	735	30.4	2.20	92-	14.5	0.58	311-	22.7	1.25	40-	10.6	0.34

V=15 fps, S= 0.06
Worksheet for Rectangular Channel

Project Description	
Project File	untitled.fm2
Worksheet	AUSTIN BLUFFS BOX CULVERT
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.060000	ft/ft
Depth	0.42	ft
Bottom Width	11.00	ft

Results		
Discharge	69.07	cfs
Flow Area	4.62	ft^2
Wetted Perimeter	11.84	ft
Top Width	11.00	ft
Critical Depth	1.07	ft
Critical Slope	0.003052	ft/ft
Velocity	14.95	ft/s
Velocity Head	3.47	ft
Specific Energy	3.89	ft
Froude Number	0.00	

V=15 fps, S= 0.03
Worksheet for Rectangular Channel

Project Description	
Project File	untitled.fm2
Worksheet	AUSTIN BLUFFS BOX CULVERT
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.030000	ft/ft
Depth	0.75	ft
Bottom Width	11.00	ft

Results		
Discharge	123.81	cfs
Flow Area	8.25	ft²
Wetted Perimeter	12.50	ft
Top Width	11.00	ft
Critical Depth	1.58	ft
Critical Slope	0.002961	ft/ft
Velocity	15.01	ft/s
Velocity Head	3.50	ft
Specific Energy	4.25	ft
Froude Number	0.00	

BOX CULVERT STA. 2+08.5 TO 2+45
Worksheet for Rectangular Channel

Project Description	
Project File	untitled.fm2
Worksheet	AUSTIN BLUFFS STORM SEWER OUTFALL
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.033200	ft/ft
Bottom Width	11.00	ft
Discharge	1,651.00	cfs

Results		
Depth	4.08	ft
Flow Area	44.93	ft^2
Wetted Perimeter	19.17	ft
Top Width	11.00	ft
Critical Depth	8.88	ft
Critical Slope	0.004283	ft/ft
Velocity	36.75	ft/s
Velocity Head	20.99	ft
Specific Energy	25.07	ft
Froude Number	0.00	

BOX CULVERT STA. 2+61 TO 4+21.44
Worksheet for Rectangular Channel

Project Description	
Project File	untitled.fm2
Worksheet	AUSTIN BLUFFS STORM SEWER OUTFALL
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.030000	ft/ft
Bottom Width	11.00	ft
Discharge	1,651.00	cfs

Results		
Depth	4.24	ft
Flow Area	46.61	ft^2
Wetted Perimeter	19.47	ft
Top Width	11.00	ft
Critical Depth	8.88	ft
Critical Slope	0.004283	ft/ft
Velocity	35.42	ft/s
Velocity Head	19.50	ft
Specific Energy	23.74	ft
Froude Number	0.00	

BOX CULVERT STA. 4+31.44 TO 8+56.12
Worksheet for Rectangular Channel

Project Description	
Project File	untitled.fm2
Worksheet	AUSTIN BLUFFS STORM SEWER OUTFALL
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.026900	ft/ft
Bottom Width	11.00	ft
Discharge	1,651.00	cfs

Results		
Depth	4.41	ft
Flow Area	48.50	ft²
Wetted Perimeter	19.82	ft
Top Width	11.00	ft
Critical Depth	8.88	ft
Critical Slope	0.004283	ft/ft
Velocity	34.04	ft/s
Velocity Head	18.01	ft
Specific Energy	22.42	ft
Froude Number	0.00	

BOX CULVERT STA. 8+66.12 TO 11+92.74
Worksheet for Rectangular Channel

Project Description	
Project File	untitled.fm2
Worksheet	AUSTIN BLUFFS STORM SEWER OUTFALL
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.030000	ft/ft
Bottom Width	11.00	ft
Discharge	1,651.00	cfs

Results		
Depth	4.24	ft
Flow Area	46.61	ft^2
Wetted Perimeter	19.47	ft
Top Width	11.00	ft
Critical Depth	8.88	ft
Critical Slope	0.004283	ft/ft
Velocity	35.42	ft/s
Velocity Head	19.50	ft
Specific Energy	23.74	ft
Froude Number	0.00	

BOX CULVERT STA. 12+02.77 TO 13+72.2
Worksheet for Rectangular Channel

Project Description	
Project File	untitled.fm2
Worksheet	AUSTIN BLUFFS STORM SEWER OUTFALL
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.030000	ft/ft
Bottom Width	11.00	ft
Discharge	1,651.00	cfs

Results		
Depth	4.24	ft
Flow Area	46.61	ft^2
Wetted Perimeter	19.47	ft
Top Width	11.00	ft
Critical Depth	8.88	ft
Critical Slope	0.004283	ft/ft
Velocity	35.42	ft/s
Velocity Head	19.50	ft
Specific Energy	23.74	ft
Froude Number	0.00	

BOX CULVERT STA. 13+82.2 TO 18+59.9
Worksheet for Rectangular Channel

Project Description	
Project File	untitled.fm2
Worksheet	AUSTIN BLUFFS STORM SEWER OUTFALL
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.025600	ft/ft
Bottom Width	11.00	ft
Discharge	1,484.00	cfs

Results		
Depth	4.15	ft
Flow Area	45.69	ft^2
Wetted Perimeter	19.31	ft
Top Width	11.00	ft
Critical Depth	8.27	ft
Critical Slope	0.004140	ft/ft
Velocity	32.48	ft/s
Velocity Head	16.39	ft
Specific Energy	20.55	ft
Froude Number	0.00	

BOX CULVERT STA. 18+79.33 TO 19+86.47
Worksheet for Rectangular Channel

Project Description	
Project File	untitled.fm2
Worksheet	AUSTIN BLUFFS STORM SEWER OUTFALL
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.060000	ft/ft
Bottom Width	11.00	ft
Discharge	1,319.00	cfs

Results		
Depth	2.83	ft
Flow Area	31.08	ft^2
Wetted Perimeter	16.65	ft
Top Width	11.00	ft
Critical Depth	7.65	ft
Critical Slope	0.003995	ft/ft
Velocity	42.44	ft/s
Velocity Head	27.99	ft
Specific Energy	30.82	ft
Froude Number	0.00	

BOX CULVERT STA. 19+86.47 TO 20+09.53
Worksheet for Rectangular Channel

Project Description	
Project File	untitled.fm2
Worksheet	AUSTIN BLUFFS STORM SEWER OUTFALL
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.038600	ft/ft
Bottom Width	11.00	ft
Discharge	1,319.00	cfs

Results		
Depth	3.30	ft
Flow Area	36.26	ft²
Wetted Perimeter	17.59	ft
Top Width	11.00	ft
Critical Depth	7.65	ft
Critical Slope	0.003995	ft/ft
Velocity	36.37	ft/s
Velocity Head	20.56	ft
Specific Energy	23.86	ft
Froude Number	0.00	

BOX CULVERT
RATING TABLES

Table
Rating Table for Rectangular Channel

Project Description	
Project File	untitled.fm2
Worksheet	AUSTIN BLUFFS STORM SEWER OUTFALL
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Discharge

Constant Data		
Mannings Coefficient	0.013	
Depth	5.80	ft
Bottom Width	11.00	ft

Input Data	Minimum	Maximum	Increment
Channel Slope	0.025000	0.031000	0.000500 ft/ft

Rating Table

Channel Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)
0.025000	2,303.12	36.10
0.025500	2,326.04	36.46
0.026000	2,348.73	36.81
0.026500	2,371.21	37.17
0.027000	2,393.48	37.52
0.027500	2,415.54	37.86
0.028000	2,437.40	38.20
0.028500	2,459.06	38.54
0.029000	2,480.54	38.88
0.029500	2,501.83	39.21
0.030000	2,522.95	39.54
0.030500	2,543.88	39.87
0.031000	2,564.65	40.20

Table
Rating Table for Rectangular Channel

Project Description	
Project File	untitled.fm2
Worksheet	AUSTIN BLUFFS STORM SEWER OUTFALL
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Discharge

Constant Data		
Mannings Coefficient	0.013	
Depth	5.80	ft
Bottom Width	11.00	ft

Input Data	Minimum	Maximum	Increment
Channel Slope	0.050000	0.070000	0.005000 ft/ft

Channel Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)
0.050000	3,257.11	51.05
0.055000	3,416.08	53.54
0.060000	3,567.98	55.92
0.065000	3,713.68	58.21
0.070000	3,853.86	60.41

Table
Rating Table for Rectangular Channel

Project Description	
Project File	untitled.fm2
Worksheet	AUSTIN BLUFFS STORM SEWER OUTFALL
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Discharge

Constant Data		
Mannings Coefficient	0.013	
Bottom Width	11.00	ft

Input Data	Minimum	Maximum	Increment	
Channel Slope	0.025000	0.070000	0.005000	ft/ft
Depth	0.50	3.00	0.50	ft

Rating Table

Depth (ft)	Channel Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)
0.50	0.025000	59.09	10.74
0.50	0.030000	64.73	11.77
0.50	0.035000	69.91	12.71
0.50	0.040000	74.74	13.59
0.50	0.045000	79.28	14.41
0.50	0.050000	83.56	15.19
0.50	0.055000	87.64	15.94
0.50	0.060000	91.54	16.64
0.50	0.065000	95.28	17.32
0.50	0.070000	98.87	17.98
1.00	0.025000	177.85	16.17
1.00	0.030000	194.82	17.71
1.00	0.035000	210.43	19.13
1.00	0.040000	224.96	20.45
1.00	0.045000	238.61	21.69
1.00	0.050000	251.51	22.86
1.00	0.055000	263.79	23.98
1.00	0.060000	275.52	25.05
1.00	0.065000	286.77	26.07
1.00	0.070000	297.60	27.05
1.50	0.025000	332.72	20.16
1.50	0.030000	364.47	22.09
1.50	0.035000	393.68	23.86
1.50	0.040000	420.86	25.51
1.50	0.045000	446.39	27.05

Table
Rating Table for Rectangular Channel

Rating Table

Depth (ft)	Channel Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)
1.50	0.050000	470.53	28.52
1.50	0.055000	493.50	29.91
1.50	0.060000	515.44	31.24
1.50	0.065000	536.49	32.51
1.50	0.070000	556.74	33.74
2.00	0.025000	513.25	23.33
2.00	0.030000	562.24	25.56
2.00	0.035000	607.29	27.60
2.00	0.040000	649.22	29.51
2.00	0.045000	688.60	31.30
2.00	0.050000	725.85	32.99
2.00	0.055000	761.28	34.60
2.00	0.060000	795.13	36.14
2.00	0.065000	827.60	37.62
2.00	0.070000	858.84	39.04
2.50	0.025000	713.12	25.93
2.50	0.030000	781.18	28.41
2.50	0.035000	843.78	30.68
2.50	0.040000	902.03	32.80
2.50	0.045000	956.75	34.79
2.50	0.050000	1,008.50	36.67
2.50	0.055000	1,057.73	38.46
2.50	0.060000	1,104.76	40.17
2.50	0.065000	1,149.87	41.81
2.50	0.070000	1,193.28	43.39
3.00	0.025000	928.07	28.12
3.00	0.030000	1,016.65	30.81

BOX CULVERT
JUNCTION LOSS CALCULATIONS

BOX CULVERT JUNCTION LOSS CALCULATIONS

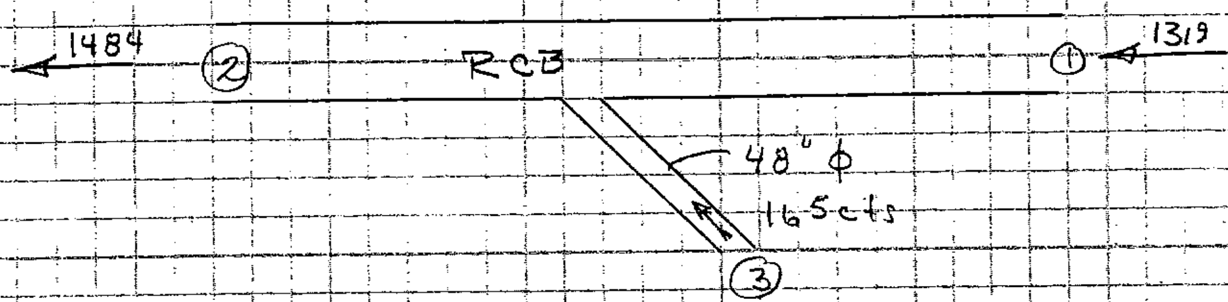
Note: Junction loss calculations were computed in accordance with "Hydraulic Analysis of Junctions" Bureau of Engineering, City of Los Angeles, Office Standard No. 115 Storm Drain design Division 1968, Page 1968, Page 19, Case E: Super-critical flow up and downstream.

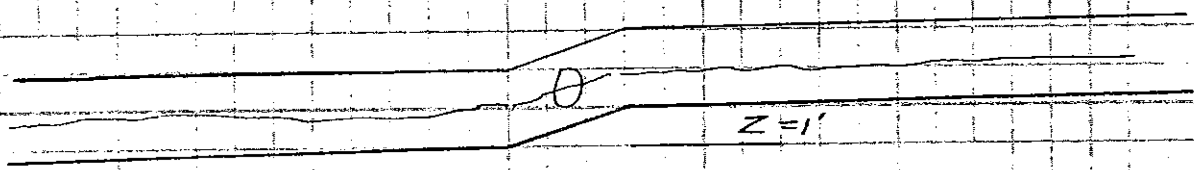
General Formula: Net hydrostatic pressure at a junction equals the change in momentum through the junction plus friction loss

JR Engineering, Ltd.

CLIENT: LAPLATA — JOB NO. 8717.12
PROJECT: AUSTIN BLUFFS — BY: JRB — CHK. BY: — DATE:
SUBJECT: S.D. JUNCT. LOSS STA. 18+69.73 — SHEET NO. 1 OF 2

6'R X 11'S RCB
SUPERCRITICAL FLOW
Z=1





	①	②	③
Q cfs	1319	1484	165
FLOW AREA	31.13	45.65	12.6
VEL	42.44	32.48	13.1
d_{normal}	2.83	4.15	
$d_{critical}$	7.65	8.27	

$$M_{2c} = \frac{Q_2^2}{A_{2c}\,g} = \frac{(1484)^2}{(90.97)\,g} = 752$$

$$M_{1N} + M_3 \cos\theta + \tfrac{1}{2}(A_{1N} + A_{2N})(Z + D_{1N} - D_{2c}) =$$

$$\frac{(1319)^2}{(31.13)(32.2)} + \frac{(165)^2(.707)}{(12.6)(32.2)} + \tfrac{1}{2}(31.13 + 45.65)(1 + 2.83 - 8.27) =$$

$$1735.62 + 47.44 + (46.07)(4.44) = 1988$$

$$M_{c2} < 1988 \quad D_2 = D_{1N} = 2.83$$

JR Engineering, Ltd.

CLIENT: LAPLATA JOB NO.:
PROJECT: AUSTIN BLUFFS BY: JRB CHK. BY: DATE:
SUBJECT: S.D. JUNCT. LOSS STA. 18+69.73 SHEET NO. 2 OF 2

DETERMINE D_2

$$\tfrac{1}{2}(A_1 + A_2)(Z + D_1 - D_2) = \frac{Q_2^2}{A_2 g} - \frac{Q_1^2}{A_1 g} - \frac{Q_3^2 \cos\theta}{A_3 g}$$

$$\tfrac{1}{2}(31.13 + A_2)(1 + 2.83 - D_2) = \frac{68\,393}{A_2} - 1735.62 - 47.44$$

TRY $D_2 = 3.45$

$$\tfrac{1}{2}(34.54)(0.38) = 1802.19 - 1735.62 - 47.44$$

$$6.56 \doteq 19.13$$

$D_2 = 3.45'$ < BOX HEIGHT OK

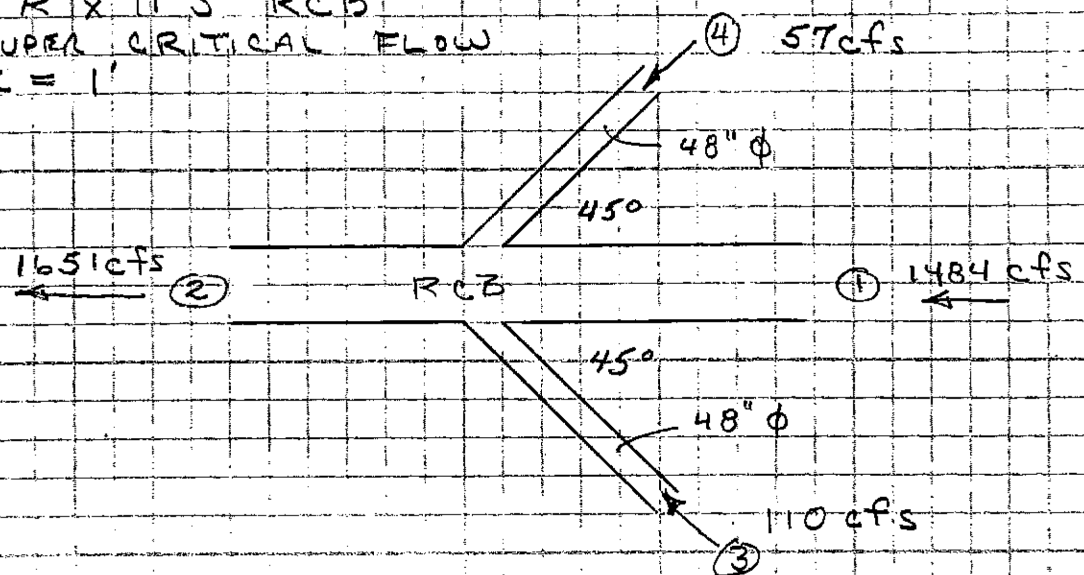
JR Engineering, Ltd.

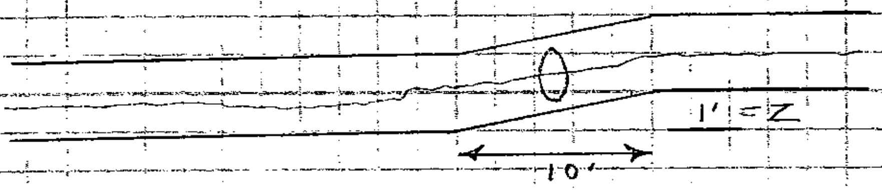
CLIENT LAPLATA JOB NO. 8717.12

PROJECT AUSTIN BLUFFS BY JRB CHK. BY ______ DATE ______

SUBJECT S.D. JUNCT. LOSS STA 13+77.2 SHEET NO. 1 OF 2

6'R x 11'S RCB
SUPER CRITICAL FLOW
Z = 1'





	①	②	③	④
Q cfs	1484	1651	110	57
FLOW AREA s.f.	45.65	46.64	12.6	12.6
VEL fps	32.48	35.42	8.7	4.5
d NORMAL	4.15	4.24	—	—
d CRITICAL	8.27	8.88	—	—

$$M_{2C} = \frac{Q_2^2}{A_{2C}\,g} = \frac{1651^2}{(97.08)(32.2)} = 866.6$$

$$M_{IN} + M_3 \cos\theta + M_4 \cos\theta + \tfrac{1}{2}(A_{IN} + A_{2N})(Z + D_{IN} - D_{2C}) =$$

$$\frac{1484^2}{(45.65)(32.2)} + \frac{(110)^2(.707)}{(12.6)(32.2)} + \frac{(57)^2 0.707}{12.6 \cdot 32.2} +$$

$$\tfrac{1}{2}(45.69 + 97.68)(1 + 4.15 - 8.88) = 1270$$

$M_{2C} < 1270 \quad D_1 = D_{IN} = 4.15'$

DETERMINE D_2

$$\tfrac{1}{2}(A_1 + A_2)(Z + D_1 - D_2) = \frac{Q_2^2}{A_2 g} - \frac{Q_1^2}{A_1 g} - \frac{Q_3^2 \cos\theta}{A_3 g} - \frac{Q_4^2 \cos\theta}{A_4 g}$$

$$\tfrac{1}{2}(45.65 + A_2)(1 + 4.15 - D_2) = \frac{1651^2}{A_2(32.2)} - 1524.94$$

TRY $D_2 = 5.01'$

$$\tfrac{1}{2}(45.65 + 55.11)(0.14) = 1536.06 - 1524.94$$

$$7.05 \doteq 11.11$$

$$D_2 = 5.01'$$

NOTE: IF Q_4 CONNECTION IS DELETED

$D_2 = 4.8,$

IN NEITHER CASE DOES THE WATER LEVEL REACH THE 6' BOX HEIGHT

JR Engineering, Ltd.

CLIENT: LAPLATA JOB NO. 8717.12

PROJECT: AUSTIN BLUFFS BY: JRB CHK. BY: DATE:

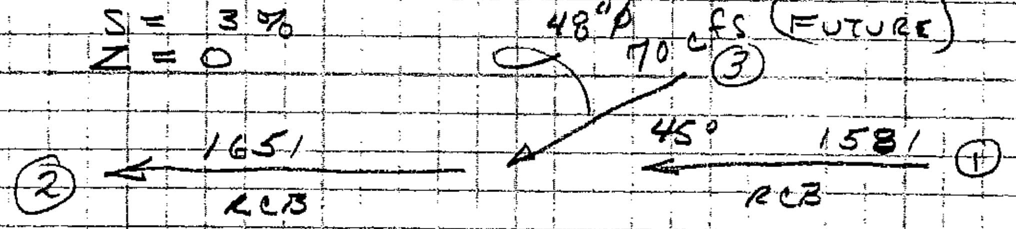
SUBJECT: S.D. JUNCT. LOSS FUTURE CONNECTION SHEET NO. 1 OF 1

CHECK IMPACT OF FUTURE CONNECT TO RBC

11'S x 6'R RCB

S = 3%

Z = 0



	①	②	③
Q	1581	1651	70
FLOW AREA	45.17	46.64	12.6
VEL.	35.00	35.42	5.5
d normal	4.11	4.24	—
d critical	8.63	8.88	—

FROM SPREAD SHEET OF PRESSURE-MOMENTUM EQUATION; $D_2 = 4.50'$

VARIFY RESULTS

$$\tfrac{1}{2}(A_1 + A_2)(Z + D_1 - D_2) = \frac{Q_2^2}{A_2 g} - \frac{Q_1^2}{A_1 g} - \frac{Q_3^2 \cos\theta}{A_3 g}$$

$$\tfrac{1}{2}(45.17 + (11)(4.50))(0 + 4.11 - 4.50) = \frac{1651^2}{(11)(4.5)(32.2)} - \frac{1581^2}{(45.17)\,32.2} - \frac{70^2}{(12.6)\,32.2}$$

$$(47.34)(-0.39) = 1710.15 - 1718.53 - 12.07$$

$$-18.46 \doteq -20.45 \checkmark \quad D_2 = 4.50' \pm$$

THUS FUTURE CONNECTIONS SHOULD NOT CAUSE WATER LEVELS TO REACH THE 6' BOX HEIGHT

BOX CULVERT
BEND LOSSES

BOX CULVERT DESIGN CRITERIA:

Bend losses were estimate as follows based on coefficients from TENT. STDS. of the Hydraulic Inst.:

Bends 17° - 21°

Use: $0.07 \frac{V^2}{2g}$ for Miter Bends

Total Loss = $0.07 \frac{V^2}{2g}$ + Friction Loss

$= 0.07\,(35^2/64.4) + 0.3' = 1.6'$

Bends 27° - 32°

Use: $0.13 \frac{V^2}{2g}$ for Miter Bends

Total Loss = $0.13 \frac{V^2}{2g}$ + Friction Loss

$= 0.13\,(35^2/64.4) + 0.3' = 2.8'$

BOX CULVERT
VELOCITY – DURATION SUMMARY

ESTIMATE THE TIME INTERVAL IN EACH FREQUENCY STORM WHEN THE WATER VELOCITY IS OVER 15 FPS

CHANNEL DATA:

1.	S = 0.03,	V = 15 fps,	Q = 124 cfs,	D = 0.75
2.	S = 0.06,	V = 15 fps,	Q = 69 cfs,	D = 0.42

2-Year Frequency Storm:
- Condition 1: Time interval from HEC-1 data 13:55 to 14:30; 35 mins
- Condition 2: Time interval from HEC-1 data 13:50 to 14:45; 55 mins

10-Year Frequency Storm:
- Condition 1: Time interval from HEC-1 data 13:45 to 14:50; 1 hr 5 mins
- Condition 2: Time interval from HEC-1 data 13:45 to 15:10; 1 hr 25 mins

100-Year Frequency Storm:
- Condition 1: Time interval from HEC-1 data 13:40 to 15:10; 1 hr 30 mins
- Condition 2: Time interval from HEC-1 data 13:40 to 16:15; 2 hr 35 mins

BOX CULVERT
MANHOLE/SUMP INLET
CALCULATIONS

MANHOLE/SUMP INLET STATION 13+56

Calculate Required Inlet Area Based on Oriface Equation

Design Flow Q_{100} = 39 cfs

$$Q = CA\sqrt{2gh}$$

$$Q = 0.62(A)\sqrt{2gh} \qquad \text{let } h = 1' \text{ max.}$$

$$39 = 0.62(A)\sqrt{2(32.2)(1)}$$

$$A = 7.84 \text{ sq ft.}$$

Provide openings on two sides

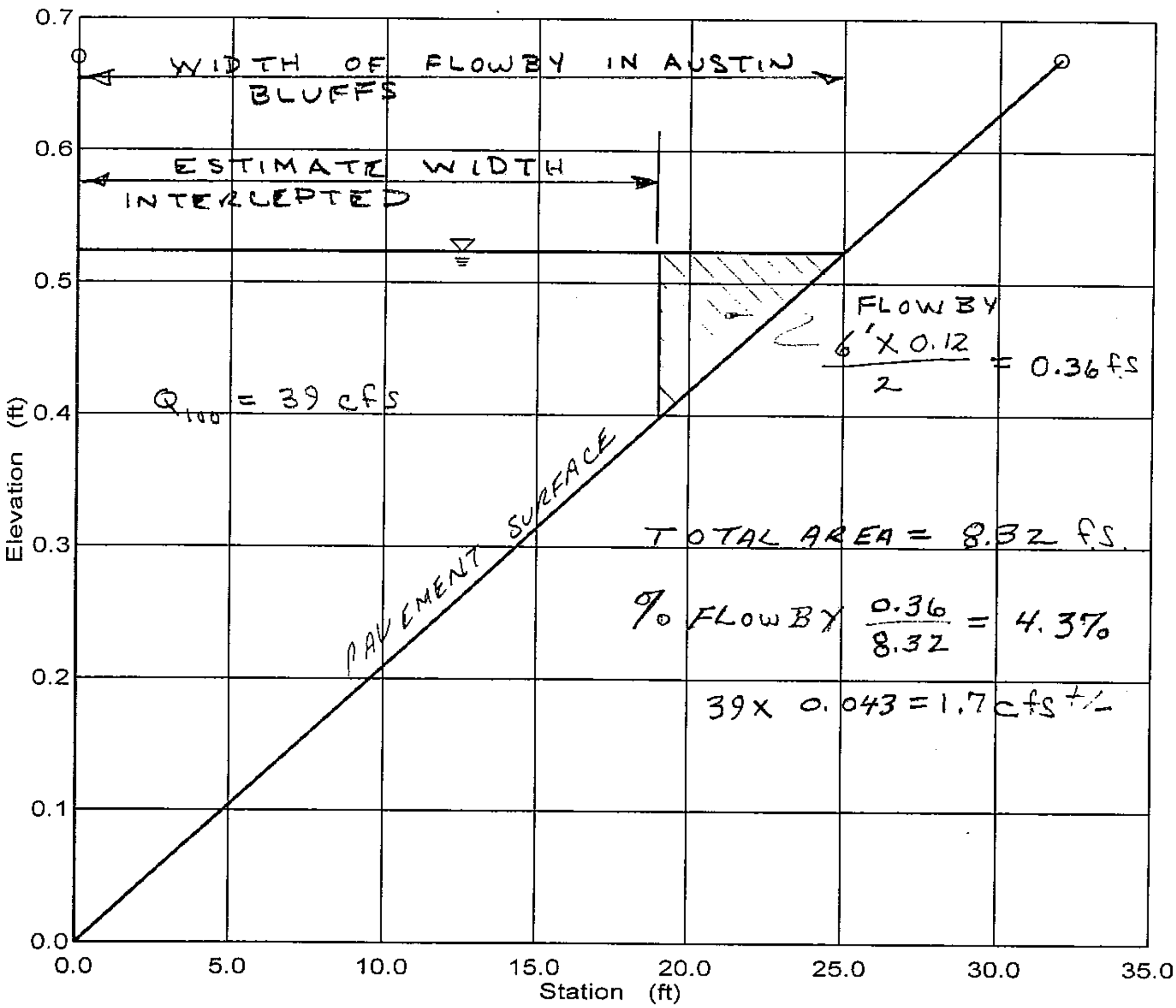
2@(4' x 1.33') = 10.64 sq ft. Gross Area

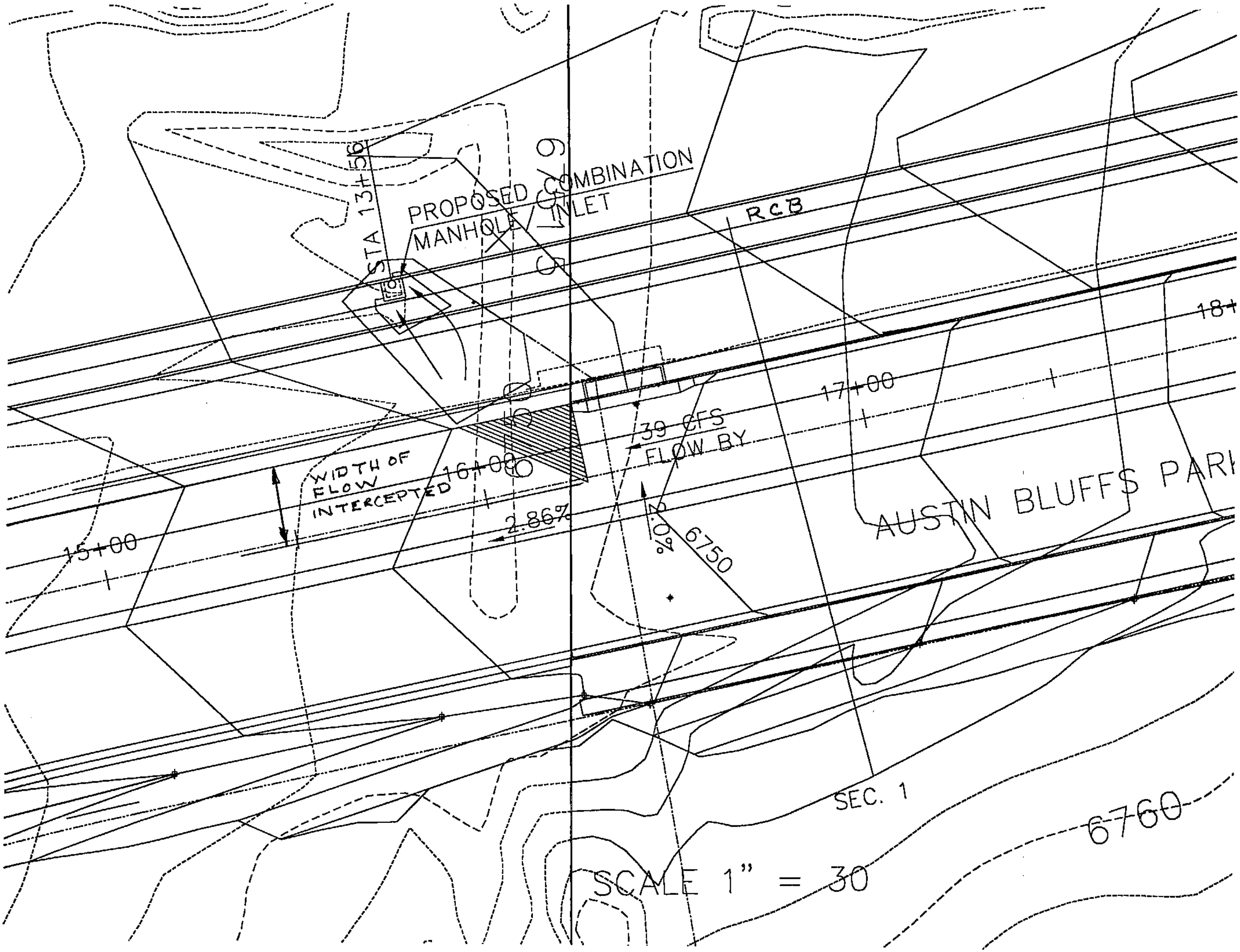
Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	untitled.fm2
Worksheet	AUSTIN BLUFFS TEMP. INLET
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

ESTIMATE AMOUNT OF FLOWBY CAPTURED AT INLET STA. 13+56.

Section Data		
Wtd. Mannings Coefficient	0.017	
Channel Slope	0.028600	ft/ft
Water Surface Elevation	0.52	ft
Discharge	39.00	cfs





STA 13+56
PROPOSED COMBINATION
MANHOLE / INLET
RCB
39 CFS
FLOW BY
WIDTH OF
FLOW
INTERCEPTED
15+00
16+00
17+00
18+
2.86%
2.0%
6750
AUSTIN BLUFFS PARK
SEC. 1
6760
SCALE 1" = 30

HYDRAULIC CALCULATIONS
BAFFLED CHUTE DROP STRUCTURE

DESIGN OF BAFFLED CHUTE DROP STRUCTURE

Q_{100} = 1651 cfs

Chute Width: 32 ft

$Q = \frac{1651}{32\text{ ft}}$ = 51.6 cfs/ft of width < 60 cfs

Recommend Entrance Velocity: 6 fps +/-

$Y_C = \sqrt[3]{\frac{8^2}{g}} = \sqrt[3]{\frac{51.6}{32.2}}$ = 4.36' (Critical Depth)

$V_C = \sqrt[3]{gq} = \sqrt[3]{(32.2)(51.6)}$ = 11.84 fps

Baffle Height: $H = 0.8\ Y_C$ = 0.8(4.36') = 3.5'

Side Wall Height, Normal to Slope:

3H = 3(3.5') = 10.5'

Spacing Between Baffles, S:

Colorado Springs Drainage Criteria Manual Figure 10-13

S = 2H = 2(3.5') = 7'

Bureau of Reclamation Design of Small Dams

S = H(Slope); Bottom Slope = 4:1

S = 4H = 4(3.5') = 14' max

Used: 9.25'; 7' < 9.25'>14'

Baffle Block Width and Spacing:

Center Blocks: W = 1½H = 1½(3.5) = 5.25'

Used: W = 5.33

Spacing: SW = 1½H = 5.25', Used: 5.33'

Wall Block: W = 1/3 to 1/2H = 1.17' to 2.63', Used 2.67'

PLANS
AUSTIN BLUFFS STORM SEWER OUTFALL