CRSS

FINAL DRAINAGE REPORT

Beardsley Interceptor Channel
Outer Loop Highway/
I-17 Interchange
21st Avenue to 7th Avenue

Prepared for

**FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
AND
ARIZONA DEPARTMENT OF
TRANSPORTATION**

Prepared by

CRSS CIVIL ENGINEERS, INC.

April 28, 1994

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INTRODUCTION

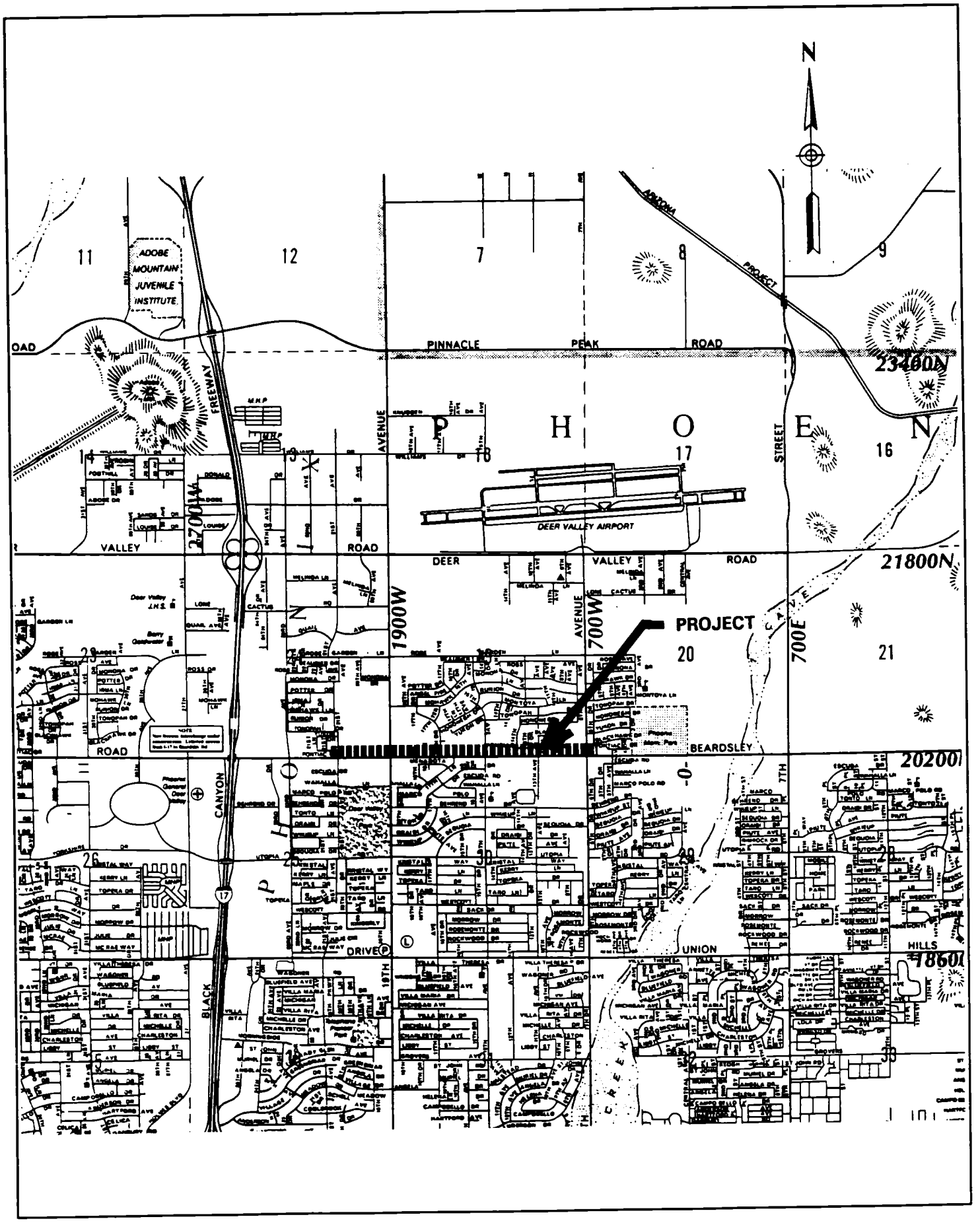
This drainage report is to be used as part of the construction for the extension of a partially constructed off-site drainage system than runs just north of Beardsley Road as part of the I-17/Outer Loop Highway Interchange project. This off-site interceptor system diverts the 100-year storm runoff to the project. To manage peak inflow to the interceptor, a series of in-line detention basins was planned.

This report follows the Concept Drainage Design Report (Greiner, 1987) for the off-site drainage system for the Outer Loop Highway from Scatter Wash to Cave Creek, and a more detailed hydrologic study of the contributing areas to the Outer Loop Interceptor completed by CRS Sirrine, Inc. (1989). The later study identified concentration points, flow splits and flow paths in detail for the design of the interceptor system of the Outer Loop I-17 interchange as far east as 15th Avenue.

This report covers the portion of the Outer Loop Storm Drainage Interceptor from about 23rd Avenue to Seventh Avenue (Figure 1). The report contains the drainage investigations performed to design the interceptor channels, culverts and storm water detention facilities along the Outer Loop Highway in accordance with project design criteria and guidelines.

This project includes a number of drainage facilities already designed for the I-17/Outer Loop Highway Interchange project (Phase II). The portion of the facility west of 15th Avenue will be mainly re-packaged, and the portion east will be new design. This report will refer to the preceding studies for the calculation of the re-packaged facilities.

The interceptor channel system alignment is placed to allow future construction of the proposed north frontage road.



VICINITY MAP

FIGURE 1

DRAINAGE AREA AND HYDROLOGY

The general flow path is in a southwesterly direction. Urban development has obliterated most of the natural drainage system and replaced it with a local street network. The majority of storm runoff is concentrated in the major arterial streets which receive direct runoff from the streets in the adjacent residential and commercial developments. The key finding made from earlier reports is that the urban arterial streets play a major role in diverting and concentrating flood flows. With the streets acting as flow carriers, the flow must be transferred from the streets to the interceptor system.

HEC-1 Model

This study utilized the 100-year storm event hydrographs from the preceding HEC-1 hydrologic model to simulate the drainage area runoff (CRS, 1989, Appendix D). The output hydrographs from this earlier study were used as a beginning point in the new model to combine and route flows in the conveyance channels and through the detention basins. The new HEC-1 developed is provided in Appendix A.

Flood routing is used to simulate the movement of a flood hydrograph as a flood wave through drainageways and detentions basins in the storm drainage system. Two types of flood routing are used, one for channel components and another for detention basin components of the storm drainage system. The methods use kinematics wave and level pool reservoir routing, respectively.

The kinematics wave method requires parameters that identify various physical features of the drainage channel including shape (width and side slopes or diameter), length, slope and roughness. Roughness coefficients for rigid channels were obtained from the Outer Loop Highway Design Procedures Manual and from Hydraulic Engineering Circular No. 15. Kinematic wave routing parameters are summarized in Table 1.

Table 1
Kinematic Wave Routing Parameters

Name	Length (Feet)	Slope	n	Config	BW/Dia (Feet)	Side Slope
RT8B*	1350	0.0046	0.035	Trap	20	0
RTRN8C*	2600	0.0046	0.016	Trap	50	0
RT8D*	2200	0.0042	0.016	Trap	50	0
RTBF	1066	0.0044	0.013	Trap	12	0
RT8F1	300	0.0044	0.016	Trap	10	2
RT8F2	800	0.0044	0.013	Trap	12	0

* From CRS 1989 Report

The level pool reservoir routing method requires parameters that describe the storage/outflow relationship for the detention basin (this includes both the operational and emergency spillways). The volume of the detention basin is a function of available right-of-way and several other criteria for detention basin layout. Basin layout provides side slopes not steeper than 3:1 (H:V), a 15-foot maintenance road around the basin perimeter, and 15-foot maintenance access ramps to the bottom of the basin. The outflow works for the basin are set to provide the maximum stored volume of runoff available for a given basin layout. The elevation of emergency spillways for detention basins coincides with existing ground and does not require any embankments to function safely. Level pool routing parameters are summarized in Table 2.

Table 2
Detention Basin
Level Pool Routing Parameters

Basin	Invert Elev.	Orifice Area (ft^2)	Outlet Q Coeff.	Outlet Q Expon.	Crest Elev.	Length	Spillway Q Coeff.	Spillway Q Expon.
A	1392.0	2.64	0.6	0.5	1412.0	100	3.0	1.5
B	1367.5	2.64	0.6	0.5	1397.0	200	3.0	1.5

ON-SITE DRAINAGE

The purpose of the on-site drainage system is to remove water from the highway and crossroad pavements on the project, maintaining the service level of the roadways during rainstorms and providing safe traffic conditions. The interceptor system is being built prior to the highway so no on-site drainage is analyzed for the highway. The cross roads intersecting Beardsley Road will not be upgraded or modified at this time. The streets currently are crowned roadway sections without curb and gutter. Flows will, therefore, flow off the road into the adjacent facility. Catch basins will be added whenever possible to intercept nuisance flows.

The Deer Valley Unified School District No. 97, located at 20402 North 15th Avenue, is affected by the acquisition of additional property for the future north frontage road. It will require relocation of approximately 650 feet of their soundwall on the south side of the property. This relocation affects the retention basin at the southwest property corner. Presently, this basin is drained by a drywell. This drywell, however, does not seem to be functioning as originally designed. Ponding has been a problem and concern to the School District. The relocation of the soundwall will remove the runoff storage capacity and will be replaced by pavement. A catch basin conveying flows to the interceptor storm drain will provide an outlet for the runoff from the property.

The inlet is designed to convey a maximum of 10 cfs to the storm drain. The inlet will provide for a removal of flows from an annual event and reduce ponding time from a 100-year storm event to about three hours. The hydrographs are shown in Figure 2.

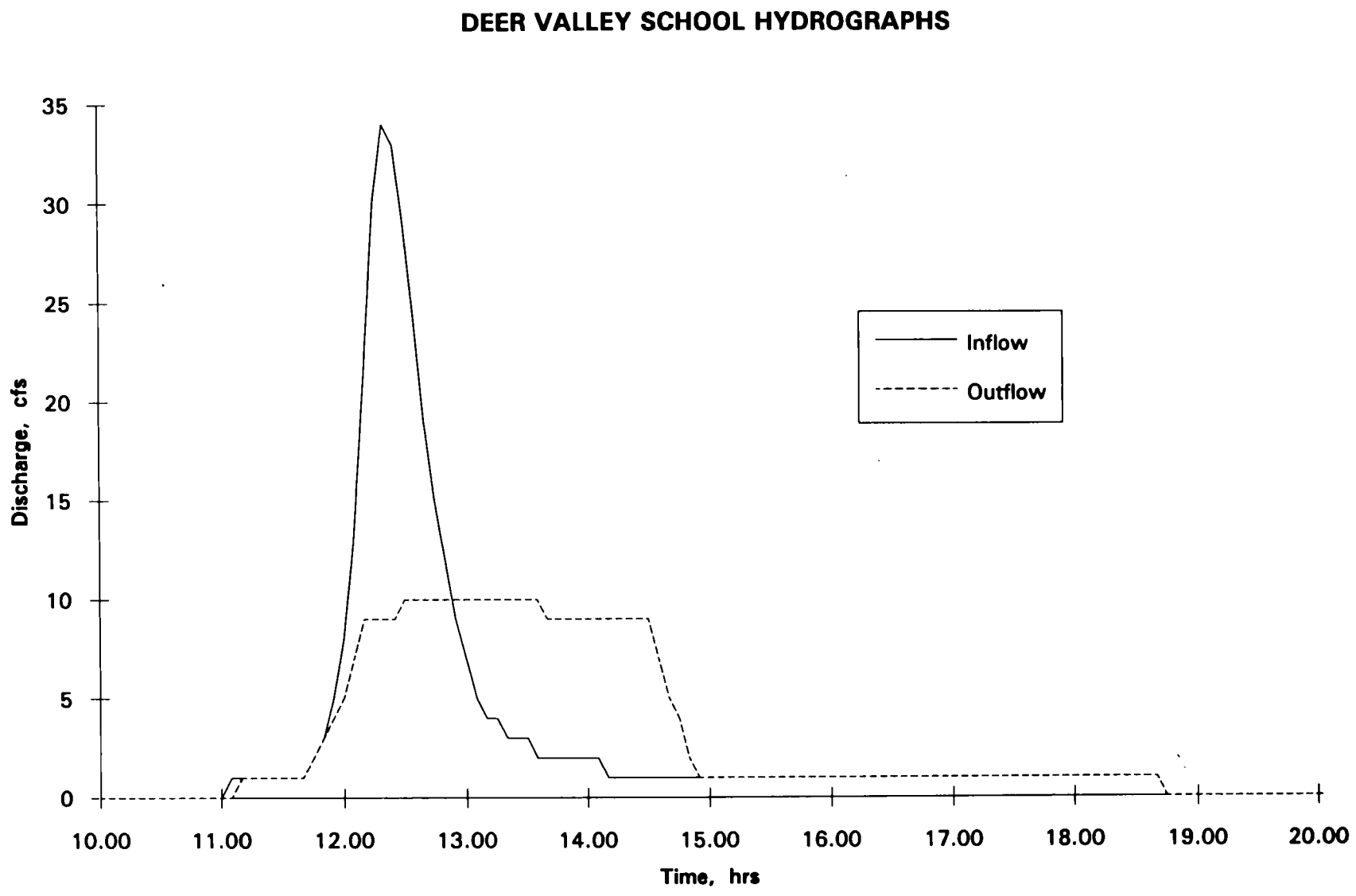

DEER VALLEY SCHOOL HYDROGRAPHS
Discharge, cfs
35
30
25
20
15
10
5
0
10.00
11.00
12.00
13.00
14.00
15.00
16.00
17.00
18.00
19.00
20.00
Time, hrs
Inflow
Outflow

FIGURE 2

OFF-SITE DRAINAGE

The purpose of the off-site drainage system is to prevent flooding of the highway for a storm magnitude of up to a 100-year return interval. Because much of the FUTURE Outer Loop Highway is depressed below the elevation of existing terrain, runoff from adjacent drainage basins must be intercepted and diverted around the highway. This collection of flows is achieved by an interceptor system paralleling Beardsley Road. This interceptor system will be built prior to the construction of the Outer Loop Highway.

The proposed interceptor for this reach runs just north of Beardsley Road, starting at Seventh Avenue and extending west to approximately 21st Drive. It consists of five major elements: inlet collectors and intakes, box culverts, open channel, storm drain, and two detention basins.

Inlet Collectors (Intakes)

At Rose Garden Lane there are three spilt flows which impact the Interceptor. They were analyzed in depth in the CRS (1989, page 31) report. These split flows occur at the intersections of Rose Garden with Seventh Avenue, 14th Avenue, and 15th Avenue. These crossroads provide a conveyance of flows to the interceptor system. The following is a list of the calculated flows from each arterial.

Table 3
Discharges for Street Flow

Location	Discharge
7th	423 cfs
14th	48 cfs
15th	280 cfs

These flows, along with sub-basin runoff flows, are picked up at the proposed detention basins and interceptor system.

Due to the large discharge conveyed in Seventh Avenue, the flow condition at Seventh Avenue and Beardsley Road was analyzed. The conveyance capacity in the street is considerably less than peak discharge at Seventh Avenue. The flow leaves the street with part going to the east, intercepted by the Seventh Avenue intake, and part to the west, intercepted by the collector system. This flow split was used in the HEC-1 model. The calculations for the flow splits are found in Appendix B.

The flows on 14th Avenue are picked up at Detention Basin A and the flows on 15th Avenue are intercepted at Detention Basin B.

The two major intakes to the interceptor system are 7th Avenue and 19th Avenue. Both of these intakes are discussed in depth later in the report.

Box Culvert

A single-barrel 12'x6' box culvert under 7th Avenue conveys flows from the intake east of 7th Avenue into the closed 12'x8' culvert box system west of 7th Avenue. The closed system is used because the right-of-way is limited to approximately 21 to 25 feet between Beardsley Road and the future north frontage road.

The closed box is 928 feet long and extends just past 10th Avenue where it transitions to a concrete-lined trapezoidal section for approximately 300 feet.

Due to the confinement of the right-of-way with the future north frontage road, the interceptor transitions back to a closed box culvert system beginning at 13th Avenue and extending to Detention Basin A just west of 14th Avenue. This box length is 804 feet. The open channel section between the two box culvert reaches provides an access ramp for maintenance.

The water surface profile for this reach was modeled using HEC-2. The flow condition is super critical. Results of HY-8, culvert analysis, at 7th Avenue were used for a starting water surface elevation. The output is included in Appendix C. A summary of the output is tabulated in Table 4.

Open Channel System

A trapezoidal channel section conveys flow from the 19th Avenue intake and multi-barrel culvert underneath 19th Avenue. This channel section is concrete-lined and has a bottom width of 20 feet and side slopes of 2:1. It is ten feet deep and has a slope of 0.2 percent. The concrete lining for the channel is estimated to have a Manning roughness coefficient of 0.016.

The channel is crossed by a bridge near 20th Avenue, which provides the land owner access to the property. This proposed bridge is a three-span continuous slab bridge and is placed on top of the channel banks. The two frontal two-foot diameter piers cause a slight backwater in the sub-critical flow regime of the channel. Even with the backwater from the piers, there is still adequate channel freeboard.

The water surface profile was modeled using HEC-2. The output is included in Appendix C. A summary of the output is tabulated in Table 5.

Table 4.
Box Culvert HEC-2 Results
From 7th Avenue to 15th Avenue

Section	Location	Type	Depth	Vel.	Vel. Hd.	Fr
2171	7th Ave	12x6	4.54	12.06	2.26	1.00
2101	Intake	12x6	4.25	12.89	2.58	1.11
2027		12x6	4.15	13.19	2.70	1.14
2017		12x8	5.22	15.12	3.55	1.17
2000		12x8	5.23	15.10	3.54	1.17
1900		12x8	5.49	14.38	3.21	1.08
1800		12x8	5.39	14.67	3.34	1.12
1700		12x8	5.71	13.81	2.96	1.02
1600		12x8	5.45	14.49	3.26	1.10
1500		12x8	5.73	13.81	2.96	1.02
1400		12x8	5.42	14.58	3.30	1.11
1300	10th Ave.	12x8	5.72	13.81	2.96	1.02
1200		12x8	5.42	14.58	3.30	1.11
1107		12x8	5.71	13.81	2.96	1.02
1106		transition	5.80	13.64	2.89	1.00
1057		trap chan	3.18	17.55	4.78	2.01
957	Open	trap chan	4.64	10.40	1.68	1.02
853	Channel	trap chan	4.38	11.29	1.98	1.13
804		transition	6.14	14.06	3.07	1.00
803	13th Ave.	12x8	6.12	14.08	3.08	1.01
700		12x8	5.82	14.84	3.42	1.09
600		12x8	6.09	14.20	3.13	1.02
500	13th Dr.	12x8	5.76	14.97	3.48	1.10
400		12x8	5.99	14.40	3.22	1.04
300		12x8	5.81	14.88	3.44	1.09
200	14th Ave.	12x8	6.09	14.20	3.13	1.02
100	Det Bas	12x8	5.75	14.99	3.49	1.10
0	A Spillway	12x8	5.98	14.42	3.23	1.04

Table 5.
Open Channel HEC-2 Results
From 19th Avenue to Detention Basin B

Section	Location	Type	Depth	Vel.	Vel. Hd.	Fr
0	Det Bas	trap chan	7.00	11.60	2.09	0.92
100	B Spillway	trap chan	7.00	11.60	2.09	0.92
170		trap chan	7.01	11.60	2.09	0.92
184		trap chan	7.01	11.57	2.08	0.92
216	Access	trap chan	8.98	8.14	1.03	0.58
230	Bridge	trap chan	8.94	8.14	1.03	0.58
300		trap chan	8.82	8.30	1.07	0.60
400		trap chan	8.66	8.53	1.13	0.62
500		trap chan	8.51	8.75	1.19	0.64
540		trans	8.46	8.83	1.21	0.65
589		6-10x4	5.28	2.89	0.13	0.22
590	19th Ave.	6-10x4	5.19	4.09	0.26	0.38
700	Culvert	6-10x4	5.05	4.09	0.26	0.38
800		6-10x4	4.93	4.09	0.26	0.38
801		rect chan	5.07	3.00	0.14	0.24
900		rect chan	4.71	3.76	0.22	0.31
1000	19th Ave.	rect chan	4.32	4.88	0.37	0.41
1100	Intake	rect chan	3.83	6.81	0.72	0.61
1157		rect chan	3.54	8.02	1.00	0.75

Storm Drain System

The storm drain system consists of extending the existing Interceptor storm drain trunk line from 21st Drive up to detention Basin B and extending it farther east to Detention Basin A were it picks up outflow from Detention Basin A. This storm drain design is repackaged from documents of the original design Phase II design (for calculations review, see CRS 1989 report).

Detention Basin Design

There are two proposed detention basins on ADOT-owned right-of-way between 21st Drive and 7th Avenue that discharge to the interceptor system. These detention basins play a primary role in the off-site drainage system by storing runoff volume and reducing peak discharge rates. The performance of the system is improved and the cost reduced, since conveyance facilities can be reduced in size. The reliability of the system is also improved since detention basins buffer the conveyance facilities against variations in inflow conditions. The outlets from Detention Basins A and B consist of a headwall with an appropriately sized restrictor plate. The restrictor plate permits the outlet pipe to operate in an unpressurized condition. The restrictor plate is anchor bolted to a standard headwall to provide required orifice area.

Detention Basin A

Detention Basin A is located between 15th Avenue and 14th Avenue. It receives an inflow hydrograph with a volume of 111 acre-feet and a peak discharge of 1,267 cfs and releases the stored volume at a peak rate of 48 cfs (see Appendix C). The maximum volume of the detention basin reservoir is 113.6 acre-feet, at elevation 1,412.0 (existing ground elevation in the southwest corner). For the 100-year inflow, the reservoir fills to elevation 1,406.7. Detention Basin A will completely drain within 36 hours after the storm (hydrographs are in Appendix D).

Detention Basin B

Detention Basin B controls runoff from the majority of the upper drainage basin. In conjunction with Basin A, this detention basin controls 82 percent of the runoff from the drainage area. Ultimately, Basin B discharges to both the interceptor storm drain and gravity storm drain (CRS, 1989). Due to the construction phasing of the Outer Loop Freeway, the gravity drain is not scheduled for construction until 1998.

Following is a description of both interim and ultimate conditions.

Ultimate

Detention Basin B receives an inflow hydrograph with a volume of 362 acre-feet and a peak discharge of 2,993 cfs (see Appendix D). The maximum volume of the detention basin reservoir is 289 acre-feet at elevation 1,396.0 (existing ground elevation in the southwest corner). For the 100-year inflow, the reservoir fills to elevation 1,392.7, retaining a volume of 247 acre-feet. The peak release rate from the detention basin is 227 cfs through dual staged outlet works. The lower stage outlet discharges to the interceptor line at a rate of 64 cfs. The upper stage outlet discharges to the gravity drain at a maximum rate of 163 cfs. Hydrographs are contained in Appendix E; for calculations refer to CRS, 1989.

Interim

The basin was analyzed without the operation of the upper level outlet. It was found that, with only the operation of the lower level outlet, an additional one foot of storage volume could contain the volume from a 100-year event. Due to the sloping of the terrain, additional berming would be required on the southwest corner of the detention basin. The berm would need to extend roughly 175 feet north and 350 feet east from the corner of the basin at the intersection of 21st Avenue and Beardsley Road, for a total berm length of 525 feet. The berm would be a maximum of one foot at the corner and taper to existing ground at these limits. With the berm, the maximum volume of the detention basin would increase to 302 acre-feet at elevation 1397.0. For the 100-year inflow, the reservoir fills to elevation 1396.7, retaining a volume of 298 acre-feet. The peak release rate from the lower level outlet is 69 cfs. The routing procedure was done with HEC-1 (Appendix F). Hydrographs are also included in Appendix E.

MAJOR INTAKES, SPILLWAYS AND OUTLETS

The interceptor system includes a number of special hydraulic sub-systems that capture and release flood flows. Special intake systems are required to convey flood flows to the interceptor line. These intake systems are designed to convey the 100-year peak discharge without flood flow reaching the Outer Loop Highway or increasing local flooding adjacent to the highway right-of-way.

7th Avenue Intake Structure

The northeast corner of 7th Avenue and Beardsley Road collects flows from both the north (Q_{100}=425 cfs) and from the east (Q_{100} = 328 cfs). The combined hydrographs for these two flows gives a peak discharge of 650 cfs for the 100-year event. These flows are collected at the 7th Avenue intake structure and conveyed to the closed box culvert system west of 7th Avenue via a 12x6 box culvert under 7th Avenue.

7th Avenue Collector System

As discussed earlier, flows conveyed south on 7th Avenue leave the road section a sheet flow across the undeveloped land west of 7th Avenue and north of Beardsley Road. The interceptor system at this location is a box culvert below ground. The sheet flow must be collected and diverted to the box culvert. It was assumed that water would spread out in a fan-type shape. The direction of flow would not only be a factor of slope but also the hydraulic head from the main flow area. The spreading affect of the flow was analyzed by a method similar to that used on 19th Avenue (CRS, 1989, Appendix I). This methodology assumes a greater flow near the area of 7th Avenue; see Appendix F.

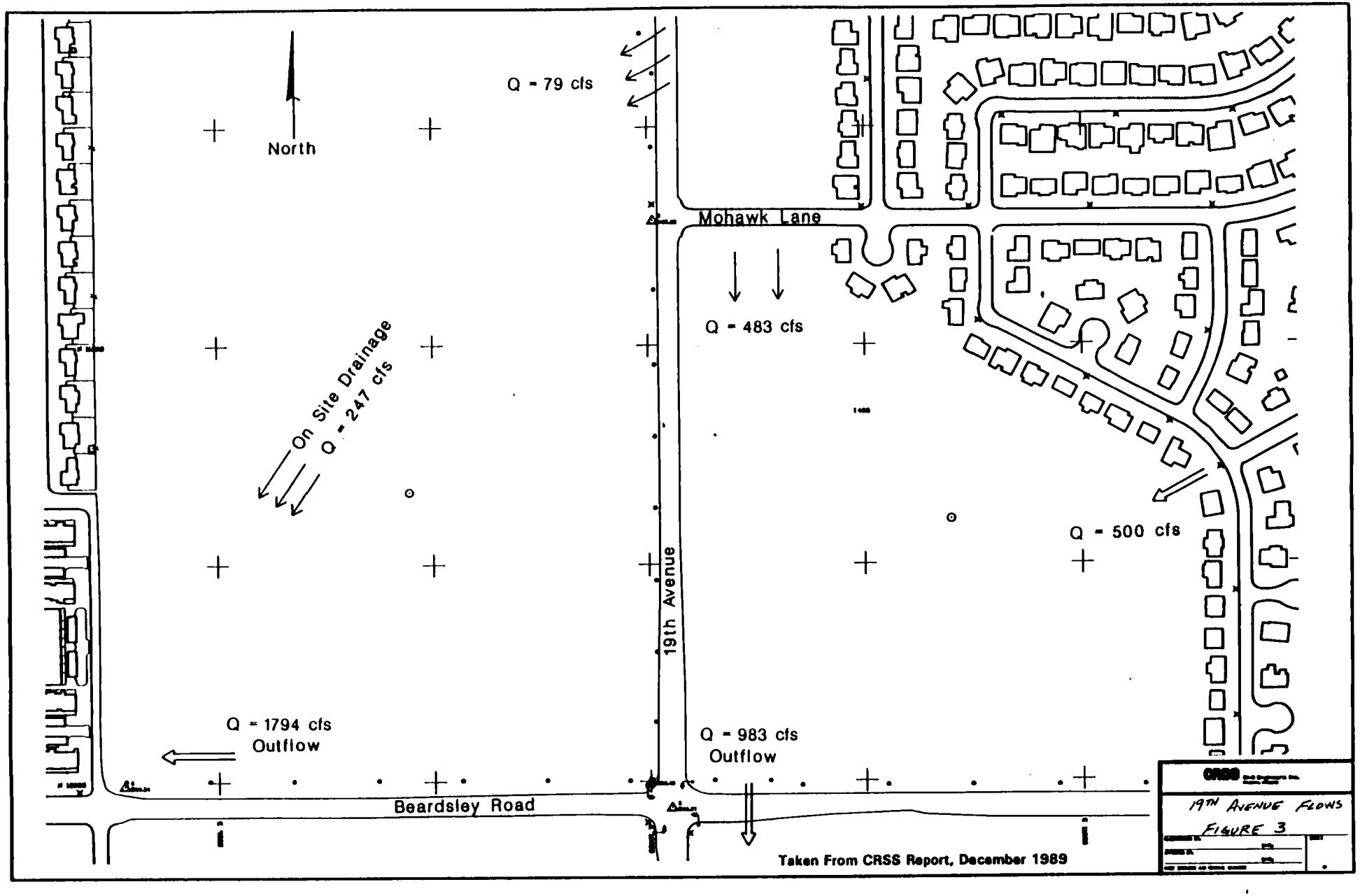
The 7th Avenue collector system uses a series of catch basins linked together by a shotcrete-lined ditch. In the area of the catch basin, both sides of the channel would drain towards the basin. This creates the required *head* to make the catch basin most efficient. Before overtopping the bank, flows beyond the capacity of the inlet cascade down to the next inlet.

19th Avenue Intake Structure

The area east of 19th Avenue and north of Beardsley Road had been the subject of much discussion during the original design, and it was considered necessary to document the pattern of flooding. A comprehensive study was completely by CRSS in 1989, "Flood Plain Delineation for 19th Avenue at Beardsley Road," which refined the flooding conditions for this intersection. The qualitative analysis phase of this study determined the distribution of flow from the various inflow sources to the area.

Storm water runoff concentrates in 19th Avenue and the drainageway located 450 feet east of 19th Avenue. The 19th Avenue intake structure functions to intercept this flow and divert it to Detention Basin B. The conclusions of the study were that 483 cfs enters the property on the southeast corner of 19th Avenue and Mohawk Lane. South of Mohawk Lane on the east side of 19th Avenue, the flow from the north merges with flows from the subdivision to the east. The combined flow totals 983 cfs. Figure 3 shows a plate from the analysis showing the locations and the magnitude of the discharges to the study area.

The 19th Avenue flood flows are conveyed to Detention Basin B via a box culvert, open channel and spillway. The profile of the interceptor channel at 19th Avenue was maintained two feet above the crown elevations of the 66-inch high-pressure water line and the 12-inch sanitary line. This provides


North
Q = 79 cfs
Mohawk Lane
Q = 483 cfs
On Site Drainage
Q = 247 cfs
Q = 500 cfs
19th Avenue
Q = 1794 cfs
Outflow
Q = 983 cfs
Outflow
Beardsley Road
Taken From CRSS Report, December 1989
19TH AVENUE FLOWS
FIGURE 3

room for the bottom slab and any encasement of the utility lines. The relocation of either line would be difficult and require extensive coordination with the City of Phoenix.

Detention Basin A and B Intake Structures

Detention Basins B and A spillways are similar in nature and function. They function to discharge the flood flow into the detention basins in a safe and efficient manner. The alignment of the approach channel is different for each. Detention Basin B intake spillway is skewed 63 degrees to the approach channel alignment where Detention Basin A intake spillway is directed into the basin. The analysis of the function of the spillway for Detention Basin B was completed in the previous CRSS study (CRS, 1989). The spillway crest for Basin B is 110 feet. Detention Basin A utilizes the same type of structure except it uses a different width. The width was decreased to maintain similar flow conditions and, therefore, similar chute and stilling basin lengths. Detention Basin A spillway width is 40 feet. The calculations are provided in Appendix E.

Low flows from the spillway will pass through an opening in the endsill to a rock-lined channel to the detention basin outlet.

REFERENCES

Federal Highway Administration, March 1984. "Drainage of Highway Pavements," Hydraulic Engineering Circular No. 12, Office of Implementation, Engineering and Highway Operations, McLean, Virginia.

U. S. Bureau of Reclamation, 1987. "Design of Small Dams", United States Department of the Interior, Denver, Colorado.

Chow, V. T., 1959. "Open-Channel Hydraulics," McGraw-Hill Book Co., New York, New York.

Arizona Department of Transportation, 1986. "Outer Loop Highway, Design Procedures Manual."

CRS Sirrine, Inc., July 1989. "Final Drainage Report, Outer Loop Highway Section 6 (OLH/I-17 Interchange) Phase II," prepared for Arizona Department of Transportation.

Greiner Engineering Science, Inc., October 1987. "Concept Drainage Design Report from Scatter Wash To Cave Creek Sta. 1170+00 To 1395+00 Outer Loop Highway," prepared for DeLeuw, Cather & Company, Outer Loop Management Consultants and Arizona Department of Transportation.

U. S. Army Corps of Engineers, September 1981. "HEC-1, Flood Hydrograph Package Users Manual," Hydrologic Engineering Center, Davis, California, revised January 1985.

CRSS, Inc., December 1989. "Flood Plain Delineation for 19th Avenue at Beardsley Road," prepared for Arizona Department of Transportation.

Simons, Li & Associates, Inc., January 1988. "State-of-the-Art Analysis of Flows on Alluvial Fans," prepared for Arizona Transportation Research Center, Arizona Department of Transportation.

APPENDIX A

HEC-1 HYDROLOGIC MODEL

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*           SEPTEMBER 1990             *
*            VERSION 4.0               *
*                                      *
*  RUN DATE  04/26/1994  TIME  13:44:43 *
*                                      *
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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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XXXXXXX  XXXX     X       XXXXX  X
X     X  X       X              X
X     X  X       X     X        X
X     X  XXXXXXX   XXXXX        XXX
```

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

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

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

  1           ID    ************************************************************************
  2           ID    *  CRSS CIVIL ENGINEERS, INC.                        MARCH 21, 1994      *
  3           ID    *                                                    FILE: INTERF.DAT    *
  4           ID    *  BEARDSLEY INTERCEPTOR - 15TH AVENUE TO 7TH AVENUE                     *
  5           ID    *                                                                        *
  6           ID    *  THIS MODEL USES THE CONCENTRATION POINTS FROM CRSS MODEL OF           *
  7           ID    *  JULY 1989                                                             *
  8           ID    *                                                                        *
  9           ID    *  THIS MODEL BASICALLY COMBINES AND ROUTES THESE HYDROGRAPHS            *
 10           ID    *  THERE HAS BEEN NO UPDATING OF HYDROLOGY FOR THIS PROJECT              *
 11           ID    *                                                                        *
 12           ID    ************************************************************************
 13           ID
              *DIAGRAM
 14           IT       5                    289
 15           IO       5
              * **********************

 16           KK    DA8B
 17           KM        RUNOFF FROM AREA 8B
 18           BA    0.12
 19           PH                   .68    1.37    2.40    2.65    2.82    3.14    3.51    3.90
 20           LS             89
 21           UD     .18

 22           KK    RT8B
 23           KM        ROUTE 8B TO ROSE GARDEN
 24           RK    1350  0.0046   0.035           TRAP       0      20
              * **************************

 25           KK    DA8C
 26           KM        RUNOFF FROM AREA 8C
 27           BA    0.21
 28           LS             80
 29           UD     .35
              * **************************

 30           KK    CB8C
 31           KM        COMBINE ROUTED 8B WITH 8C
 32           HC       2
              * **************************

 33           KK    DV8C
 34           KM        DIVERT FLOW WEST ALONG ROSE GARDEN
              * **************************
 35           KM        THE RATING HAS BEEN REVERSED AS SEEN IN PREVIOUS MODELS
 36           KM        TO REFLECT THE FLOWS CONTINUEING SOUTH ON 7TH AVENUE
              * **************************
 37           DT   DVT01
 38           DI       0     100     500    1000    2000
 39           DQ       0       0      84     222     514
```

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

 40           KK  RTRN8C
 41           KM       ROUTE 7TH AVE FLOWS SOUTH
 42           RK    2600  0.0046   0.016           TRAP       0      50
              * **************************

 43           KK    DA8E
 44           KM       RUNOFF FROM AREA 8E
 45           BA    0.15
 46           LS             86
 47           UD     .20
              * ************************************

 48           KK    DV8E
 49           KM       DIVERT 50% OF THE FLOW TO 7TH AVENUE
 50           KM       THE REMAINING TO BEARDSLEY ROAD
              * **************************
 51           DT   DVT02
 52           DI       0     100     500    1000
 53           DQ       0      50     250     500
              * ************************************

 54           KK    CB8E
 55           KM       COMBINE 8E AND 7TH AVE FLOWS
 56           HC       2
              * ************************************

 57           KK   DVC8E
 58           KM       DIVERT FLOWS WEST OF 7TH AVENUE
 59           KM       THE REMAINING GO EAST OF 7TH AVENUE
              * **************************
 60           DT   DVT03
 61           DI       0      53     219     483     847    1084
 62           DQ       0      10      77     253     507     674
              * ************************************

 63           KK    DA8D
 64           KM       RUNOFF FROM AREA 8D
 65           BA    0.28
 66           LS             80
 67           UD     .38
              * ************************************

 68           KK    RT8D
 69           KM       ROUTE WEST TO 7TH AVENUE
 70           RK    2200  0.0042   0.016           TRAP       0      50
              * ************************************

 71           KK   RTR8E
 72           KM       RETRIEVE DIVERSION FROM SUB-BASIN 8E SPLIT
 73           DR   DVT02
              * ************************************
```

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

  74          KK    CB8D
  75          KM        COMBINE 8D, 8E AND 7TH AVE FLOWS
  76          KM        THESE FLOWS ENTER THE 12X6 BOX CULVERT AT 7TH AVENUE
  77          HC       3
              * ***********************************

  78          KK  RTR7TH
  79          KM        RETRIEVE DIVERSION FROM WEST OF 7TH AVENUE
  80          DR   DVT03
              * ***********************************

  81          KK    CBCB
  82          KM        COMBINE AT THE OUTLET END OF THE BOX CULVERT
  83          HC       2
              * ************************************

  84          KK    RTBF
  85          KM        ROUTE WEST TO 13TH AVENUE IN BOX CULVERT
  86          RK    1066  0.0044   0.013           TRAP      12       0
              * ************************************

  87          KK    DA8F
  88          KM        RUNOFF FROM AREA 8F
  89          BA    0.06
  90          LS              87
  91          UD     .21
              * ***********************************

  92          KK    CB8D
  93          KM        COMBINE RTBF WITH DA8F
  94          HC       2
              * ************************************

  95          KK   RT8F1
  96          KM        ROUTE WEST IN OPEN CHANNEL
  97          RK     300  0.0044   0.016           TRAP      10       2
              * ************************************

  98          KK   RT8F2
  99          KM        ROUTE WEST TO DETENTION BASIN A IN BOX CULVERT
 100          RK     800  0.0044   0.013           TRAP      12       0
              * ************************************

 101          KK    DA8G
 102          KM        RUNOFF FROM AREA 8G
 103          BA    0.12
 104          LS              87
 105          UD     .26
              * ***********************************
```

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

 106          KK  RRN9D1
 107          KM        DISCHARGE FROM 14TH AVENUE
 108          KM        THIS HYDROGRAPH IS TAKEN DIRECTLY FROM THE OUTPUT OF
 109          KM        CRSS MODEL JULY 1989  THESE ARE FLOWS DIVERTED DOWN 14TH AVE.
 110          BA       0
 111          QI       0       0       0       0       0       0       0       0       0       0
 112          QI       0       0       0       0       0       0       0       0       0       0
 113          QI       0       0       0       0       0       0       0       0       0       0
 114          QI       0       0       0       0       0       0       0       0       0       0
 115          QI       0       0       0       0       0       0       0       0       0       0
 116          QI       0       0       0       0       0       0       0       0       0       0
 117          QI       0       0       0       0       0       0       0       0       0       0
 118          QI       0       0       0       0       0       0       0       0       0       0
 119          QI       0       0       0       0       0       0       0       0       0       0
 120          QI       0       0       0       0       0       0       0       0       0       0
 121          QI       0       0       0       0       0       0       0       0       0       0
 122          QI       0       0       0       0       0       0       0       0       0       0
 123          QI       0       0       0       0       0       0       0       0       0       0
 124          QI       0       0       0       0       0       0       0       0       0       0
 125          QI       0       0       0       0       0       0       0       3      15      34
 126          QI      46      50      51      48      43      36      28      21      15      12
 127          QI       9       6       4       3       2       1       1       1       1       0
 128          QI       0       0       0       0       0       0       0       0       0       0
 129          QI       0       0       0       0       0       0       0       0       0       0
 130          QI       0       0       0       0       0       0       0       0       0       0
 131          QI       0       0       0       0       0       0       0       0       0       0
 132          QI       0       0       0       0       0       0       0       0       0       0
 133          QI       0       0       0       0       0       0       0       0       0       0
 134          QI       0       0       0       0       0       0       0       0       0       0
 135          QI       0       0       0       0       0       0       0       0       0       0
 136          QI       0       0       0       0       0       0       0       0       0       0
 137          QI       0       0       0       0       0       0       0       0       0       0
 138          QI       0       0       0       0       0       0       0       0       0       0
 139          QI       0       0       0       0       0       0       0       0
              * ***********************************

 140          KK    CB8G
 141          KM        COMBINE RRN9D1, DA8G AND RT8F
 142          KO       1
 143          HC       3
              * ***********************************

 144          KK     DBA
 145          KM        ROUTE FLOWS THROUGHT BASIN A
 146          KO       1
 147          RS       1    STOR      -1       0
 148          SV       0     2.7   113.6     125
 149          SE    1392  1393.2    1412    1414
 150          SL    1392    2.64     0.6     0.5
 151          SS    1412     100     3.0     1.5
 152          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

   16        DA8B
                V
                V
   22        RT8B
                .
                .
   25           .        DA8C
                .           .
                .           .
   30        CB8C............
                .
                .
   37           .-------> DVT01
   33        DV8C
                V
                V
   40      RTRN8C
                .
                .
   43           .        DA8E
                .           .
                .           .
   51           .           .-------> DVT02
   48           .        DV8E
                .           .
                .           .
   54        CB8E............
                .
                .
   60           .-------> DVT03
   57       DVC8E
                .
                .
   63           .        DA8D
                .           V
                .           V
   68           .        RT8D
                .           .
                .           .
   73           .           .           .<-------   DVT02
   71           .           .       RTR8E
                .           .           .
                .           .           .
   74        CB8D........................
                .
                .
   80           .           .<-------   DVT03
   78           .      RTR7TH
                .           .
                .           .
   81        CBCB............
                V
                V
   84        RTBF
                .
                .
   87           .        DA8F
```

```
 92        CB8D............
              V
              V
 95       RT8F1
              V
              V
 98       RT8F2
              .
              .
101           .        DA8G
              .           .
              .           .
106           .           .      RRN9D1
              .           .           .
              .           .           .
140        CB8G........................
              V
              V
144         DBA
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
****************************************                                    ****************************************
*                                      *                                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *   U.S. ARMY CORPS OF ENGINEERS       *
*          SEPTEMBER 1990              *                                    *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.0                *                                    *         609 SECOND STREET            *
*                                      *                                    *      DAVIS, CALIFORNIA 95616         *
* RUN DATE  04/26/1994  TIME  13:44:43 *                                    *         (916) 756-1104               *
*                                      *                                    *                                      *
****************************************                                    ****************************************
```

```
                    ************************************************************************
                    *  CRSS CIVIL ENGINEERS, INC.                      MARCH 21, 1994      *
                    *                                                  FILE: INTERF.DAT    *
                    *  BEARDSLEY INTERCEPTOR - 15TH AVENUE TO 7TH AVENUE                   *
                    *                                                                      *
                    *  THIS MODEL USES THE CONCENTRATION POINTS FROM CRSS MODEL OF         *
                    *  JULY 1989                                                           *
                    *                                                                      *
                    *  THIS MODEL BASICALLY COMBINES AND ROUTES THESE HYDROGRAPHS          *
                    *  THERE HAS BEEN NO UPDATING OF HYDROLOGY FOR THIS PROJECT            *
                    *                                                                      *
                    ************************************************************************


 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      1    0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        289  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      2    0  ENDING DATE
                   NDTIME       0000  ENDING TIME
                   ICENT          19  CENTURY MARK

              COMPUTATION INTERVAL     .08 HOURS
                   TOTAL TIME BASE   24.00 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


       *** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION=  1
```

*** ***

:::::::::::::

```
140 KK     *      CB8G  *
           *            *
           **************

142 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          1  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

143 HC          HYDROGRAPH COMBINATION
                     ICOMP          3  NUMBER OF HYDROGRAPHS TO COMBINE

                                                    ***
```

****

HYDROGRAPH AT STATION CB8G
SUM OF 3 HYDROGRAPHS

****

DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
1		0000	1	0.	1		0605	74	0.	1		1210	147	706.	1		1815	220	26.
1		0005	2	0.	1		0610	75	0.	1		1215	148	1014.	1		1820	221	25.
1		0010	3	0.	1		0615	76	0.	1		1220	149	1227.	1		1825	222	25.
1		0015	4	0.	1		0620	77	0.	1		1225	150	1267.	1		1830	223	24.
1		0020	5	0.	1		0625	78	0.	1		1230	151	1192.	1		1835	224	24.
1		0025	6	0.	1		0630	79	0.	1		1235	152	1065.	1		1840	225	23.
1		0030	7	0.	1		0635	80	0.	1		1240	153	917.	1		1845	226	23.
1		0035	8	0.	1		0640	81	0.	1		1245	154	764.	1		1850	227	23.
1		0040	9	0.	1		0645	82	0.	1		1250	155	623.	1		1855	228	22.
1		0045	10	0.	1		0650	83	0.	1		1255	156	504.	1		1900	229	22.
1		0050	11	0.	1		0655	84	0.	1		1300	157	408.	1		1905	230	22.
1		0055	12	0.	1		0700	85	0.	1		1305	158	333.	1		1910	231	22.
1		0100	13	0.	1		0705	86	0.	1		1310	159	273.	1		1915	232	21.
1		0105	14	0.	1		0710	87	0.	1		1315	160	227.	1		1920	233	21.
1		0110	15	0.	1		0715	88	0.	1		1320	161	192.	1		1925	234	21.
1		0115	16	0.	1		0720	89	0.	1		1325	162	164.	1		1930	235	21.
1		0120	17	0.	1		0725	90	0.	1		1330	163	143.	1		1935	236	20.
1		0125	18	0.	1		0730	91	0.	1		1335	164	127.	1		1940	237	20.
1		0130	19	0.	1		0735	92	0.	1		1340	165	114.	1		1945	238	20.
1		0135	20	0.	1		0740	93	0.	1		1345	166	103.	1		1950	239	20.
1		0140	21	0.	1		0745	94	0.	1		1350	167	96.	1		1955	240	20.
1		0145	22	0.	1		0750	95	0.	1		1355	168	89.	1		2000	241	19.
1		0150	23	0.	1		0755	96	0.	1		1400	169	83.	1		2005	242	19.
1		0155	24	0.	1		0800	97	0.	1		1405	170	78.	1		2010	243	19.
1		0200	25	0.	1		0805	98	0.	1		1410	171	73.	1		2015	244	19.
1		0205	26	0.	1		0810	99	0.	1		1415	172	70.	1		2020	245	19.
1		0210	27	0.	1		0815	100	0.	1		1420	173	66.	1		2025	246	19.
1		0215	28	0.	1		0820	101	0.	1		1425	174	64.	1		2030	247	18.
1		0220	29	0.	1		0825	102	0.	1		1430	175	61.	1		2035	248	18.
1		0225	30	0.	1		0830	103	0.	1		1435	176	59.	1		2040	249	18.
1		0230	31	0.	1		0835	104	0.	1		1440	177	57.	1		2045	250	18.
1		0235	32	0.	1		0840	105	0.	1		1445	178	55.	1		2050	251	18.
1		0240	33	0.	1		0845	106	0.	1		1450	179	53.	1		2055	252	18.
1		0245	34	0.	1		0850	107	0.	1		1455	180	52.	1		2100	253	18.
1		0250	35	0.	1		0855	108	0.	1		1500	181	50.	1		2105	254	17.
1		0255	36	0.	1		0900	109	1.	1		1505	182	49.	1		2110	255	17.
1		0300	37	0.	1		0905	110	1.	1		1510	183	48.	1		2115	256	17.
1		0305	38	0.	1		0910	111	1.	1		1515	184	46.	1		2120	257	17.
1		0310	39	0.	1		0915	112	2.	1		1520	185	45.	1		2125	258	17.
1		0315	40	0.	1		0920	113	2.	1		1525	186	44.	1		2130	259	17.
1		0320	41	0.	1		0925	114	2.	1		1530	187	44.	1		2135	260	17.
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]

1	0335	44	0.	*	1	0940	117	3.	*	1	1545	190	41.	*	1	2150	263	16.
1	0340	45	0.	*	1	0945	118	3.	*	1	1550	191	40.	*	1	2155	264	16.
1	0345	46	0.	*	1	0950	119	4.	*	1	1555	192	40.	*	1	2200	265	16.
1	0350	47	0.	*	1	0955	120	4.	*	1	1600	193	39.	*	1	2205	266	16.
1	0355	48	0.	*	1	1000	121	4.	*	1	1605	194	38.	*	1	2210	267	16.
1	0400	49	0.	*	1	1005	122	5.	*	1	1610	195	37.	*	1	2215	268	16.
1	0405	50	0.	*	1	1010	123	5.	*	1	1615	196	37.	*	1	2220	269	16.
1	0410	51	0.	*	1	1015	124	5.	*	1	1620	197	36.	*	1	2225	270	15.
1	0415	52	0.	*	1	1020	125	6.	*	1	1625	198	35.	*	1	2230	271	15.
1	0420	53	0.	*	1	1025	126	6.	*	1	1630	199	35.	*	1	2235	272	15.
1	0425	54	0.	*	1	1030	127	7.	*	1	1635	200	34.	*	1	2240	273	15.
1	0430	55	0.	*	1	1035	128	8.	*	1	1640	201	34.	*	1	2245	274	15.
1	0435	56	0.	*	1	1040	129	8.	*	1	1645	202	33.	*	1	2250	275	15.
1	0440	57	0.	*	1	1045	130	9.	*	1	1650	203	33.	*	1	2255	276	15.
1	0445	58	0.	*	1	1050	131	10.	*	1	1655	204	32.	*	1	2300	277	15.
1	0450	59	0.	*	1	1055	132	11.	*	1	1700	205	32.	*	1	2305	278	15.
1	0455	60	0.	*	1	1100	133	12.	*	1	1705	206	31.	*	1	2310	279	14.
1	0500	61	0.	*	1	1105	134	13.	*	1	1710	207	31.	*	1	2315	280	14.
1	0505	62	0.	*	1	1110	135	15.	*	1	1715	208	30.	*	1	2320	281	14.
1	0510	63	0.	*	1	1115	136	17.	*	1	1720	209	30.	*	1	2325	282	14.
1	0515	64	0.	*	1	1120	137	19.	*	1	1725	210	29.	*	1	2330	283	14.
1	0520	65	0.	*	1	1125	138	21.	*	1	1730	211	29.	*	1	2335	284	14.
1	0525	66	0.	*	1	1130	139	24.	*	1	1735	212	29.	*	1	2340	285	14.
1	0530	67	0.	*	1	1135	140	30.	*	1	1740	213	28.	*	1	2345	286	14.
1	0535	68	0.	*	1	1140	141	41.	*	1	1745	214	28.	*	1	2350	287	14.
1	0540	69	0.	*	1	1145	142	60.	*	1	1750	215	27.	*	1	2355	288	14.
1	0545	70	0.	*	1	1150	143	89.	*	1	1755	216	27.	*	2	0000	289	14.
1	0550	71	0.	*	1	1155	144	136.	*	1	1800	217	27.	*				
1	0555	72	0.	*	1	1200	145	226.	*	1	1805	218	26.	*				
1	0600	73	0.	*	1	1205	146	414.	*	1	1810	219	26.	*				
				*					*					*				

****

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.00-HR
1267.	12.42	(CFS)	201.	56.	56.	56.
		(INCHES)	1.989	2.223	2.223	2.223
		(AC-FT)	100.	111.	111.	111.

CUMULATIVE AREA = .94 SQ MI

*** ***

```
          **************
          *            *
144 KK    *       DBA  *
          *            *
          **************
```

146 KO OUTPUT CONTROL VARIABLES

IPRNT	1	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

HYDROGRAPH ROUTING DATA

147 RS STORAGE ROUTING

NSTPS	1	NUMBER OF SUBREACHES
ITYP	STOR	TYPE OF INITIAL CONDITION
RSVRIC	-1.00	INITIAL CONDITION
X	.00	WORKING R AND D COEFFICIENT

```
148 SV          STORAGE          .0       2.7     113.6     125.0

149 SE        ELEVATION     1392.00   1393.20   1412.00   1414.00

150 SL        LOW-LEVEL OUTLET
                   ELEVL     1392.00  ELEVATION AT CENTER OF OUTLET
                   CAREA        2.64  CROSS-SECTIONAL AREA
                    COQL         .60  COEFFICIENT
                    EXPL         .50  EXPONENT OF HEAD

151 SS        SPILLWAY
                    CREL     1412.00  SPILLWAY CREST ELEVATION
                   SPWID      100.00  SPILLWAY WIDTH
                    COQW        3.00  WEIR COEFFICIENT
                    EXPW        1.50  EXPONENT OF HEAD
```

***

COMPUTED OUTFLOW-ELEVATION DATA

OUTFLOW	.00	12.28	13.61	15.27	17.39	20.19	24.07	29.80	39.09	56.81
ELEVATION	1392.00	1392.93	1393.15	1393.45	1393.87	1394.53	1395.59	1397.50	1401.47	1412.00
OUTFLOW	57.74	63.90	80.34	112.12	164.29	241.94	350.10	493.75	678.13	908.11
ELEVATION	1412.02	1412.08	1412.18	1412.32	1412.50	1412.72	1412.98	1413.28	1413.62	1414.00

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	.00	2.10	2.58	2.70	4.15	6.68	10.53	16.80	28.08	51.48
OUTFLOW	.00	12.28	13.61	13.92	15.27	17.39	20.19	24.07	29.80	39.09
ELEVATION	1392.00	1392.93	1393.15	1393.20	1393.45	1393.87	1394.53	1395.59	1397.50	1401.47
STORAGE	113.60	113.72	114.06	114.64	115.44	116.46	117.72	119.20	120.90	122.84
OUTFLOW	56.81	57.74	63.90	80.34	112.12	164.29	241.94	350.10	493.75	678.13
ELEVATION	1412.00	1412.02	1412.08	1412.18	1412.32	1412.50	1412.72	1412.98	1413.28	1413.62
STORAGE	125.00									
OUTFLOW	908.11									
ELEVATION	1414.00									

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HYDROGRAPH AT STATION DBA

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DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0000	1	0.	.0	1392.0	1		0805	98	0.	.0	1392.0	1		1610	195	48.	81.7	1406.6
1		0005	2	0.	.0	1392.0	1		0810	99	0.	.0	1392.0	1		1615	196	48.	81.6	1406.6
1		0010	3	0.	.0	1392.0	1		0815	100	0.	.0	1392.0	1		1620	197	48.	81.6	1406.6
1		0015	4	0.	.0	1392.0	1		0820	101	0.	.0	1392.0	1		1625	198	48.	81.5	1406.6
1		0020	5	0.	.0	1392.0	1		0825	102	0.	.0	1392.0	1		1630	199	48.	81.4	1406.5
1		0025	6	0.	.0	1392.0	1		0830	103	0.	.0	1392.0	1		1635	200	48.	81.3	1406.5
1		0030	7	0.	.0	1392.0	1		0835	104	0.	.0	1392.0	1		1640	201	48.	81.2	1406.5
1		0035	8	0.	.0	1392.0	1		0840	105	0.	.0	1392.0	1		1645	202	48.	81.1	1406.5
1		0040	9	0.	.0	1392.0	1		0845	106	0.	.0	1392.0	1		1650	203	48.	81.0	1406.5
1		0045	10	0.	.0	1392.0	1		0850	107	0.	.0	1392.0	1		1655	204	47.	80.9	1406.5
1		0050	11	0.	.0	1392.0	1		0855	108	0.	.0	1392.0	1		1700	205	47.	80.8	1406.4
1		0055	12	0.	.0	1392.0	1		0900	109	0.	.0	1392.0	1		1705	206	47.	80.7	1406.4
1		0100	13	0.	.0	1392.0	1		0905	110	0.	.0	1392.0	1		1710	207	47.	80.6	1406.4
1		0105	14	0.	.0	1392.0	1		0910	111	0.	.0	1392.0	1		1715	208	47.	80.5	1406.4
1		0110	15	0.	.0	1392.0	1		0915	112	0.	.0	1392.0	1		1720	209	47.	80.3	1406.4
1		0115	16	0.	.0	1392.0	1		0920	113	0.	.0	1392.0	1		1725	210	47.	80.2	1406.3

1	0125	18	0.	.0	1392.0	*	1	0930	115	0.	.1	1392.0	*	1	1735	212	47.	80.0	1406.3
1	0130	19	0.	.0	1392.0	*	1	0935	116	0.	.1	1392.0	*	1	1740	213	47.	79.8	1406.3
1	0135	20	0.	.0	1392.0	*	1	0940	117	1.	.1	1392.0	*	1	1745	214	47.	79.7	1406.3
1	0140	21	0.	.0	1392.0	*	1	0945	118	1.	.1	1392.1	*	1	1750	215	47.	79.6	1406.2
1	0145	22	0.	.0	1392.0	*	1	0950	119	1.	.1	1392.1	*	1	1755	216	47.	79.4	1406.2
1	0150	23	0.	.0	1392.0	*	1	0955	120	1.	.2	1392.1	*	1	1800	217	47.	79.3	1406.2
1	0155	24	0.	.0	1392.0	*	1	1000	121	1.	.2	1392.1	*	1	1805	218	47.	79.2	1406.2
1	0200	25	0.	.0	1392.0	*	1	1005	122	1.	.2	1392.1	*	1	1810	219	47.	79.0	1406.1
1	0205	26	0.	.0	1392.0	*	1	1010	123	1.	.2	1392.1	*	1	1815	220	47.	78.9	1406.1
1	0210	27	0.	.0	1392.0	*	1	1015	124	1.	.3	1392.1	*	1	1820	221	47.	78.7	1406.1
1	0215	28	0.	.0	1392.0	*	1	1020	125	2.	.3	1392.1	*	1	1825	222	47.	78.6	1406.1
1	0220	29	0.	.0	1392.0	*	1	1025	126	2.	.3	1392.1	*	1	1830	223	47.	78.4	1406.0
1	0225	30	0.	.0	1392.0	*	1	1030	127	2.	.3	1392.2	*	1	1835	224	47.	78.3	1406.0
1	0230	31	0.	.0	1392.0	*	1	1035	128	2.	.4	1392.2	*	1	1840	225	47.	78.1	1406.0
1	0235	32	0.	.0	1392.0	*	1	1040	129	2.	.4	1392.2	*	1	1845	226	47.	77.9	1406.0
1	0240	33	0.	.0	1392.0	*	1	1045	130	3.	.5	1392.2	*	1	1850	227	47.	77.8	1405.9
1	0245	34	0.	.0	1392.0	*	1	1050	131	3.	.5	1392.2	*	1	1855	228	47.	77.6	1405.9
1	0250	35	0.	.0	1392.0	*	1	1055	132	3.	.6	1392.2	*	1	1900	229	46.	77.4	1405.9
1	0255	36	0.	.0	1392.0	*	1	1100	133	4.	.6	1392.3	*	1	1905	230	46.	77.3	1405.8
1	0300	37	0.	.0	1392.0	*	1	1105	134	4.	.7	1392.3	*	1	1910	231	46.	77.1	1405.8
1	0305	38	0.	.0	1392.0	*	1	1110	135	4.	.7	1392.3	*	1	1915	232	46.	76.9	1405.8
1	0310	39	0.	.0	1392.0	*	1	1115	136	5.	.8	1392.4	*	1	1920	233	46.	76.8	1405.8
1	0315	40	0.	.0	1392.0	*	1	1120	137	5.	.9	1392.4	*	1	1925	234	46.	76.6	1405.7
1	0320	41	0.	.0	1392.0	*	1	1125	138	6.	1.0	1392.4	*	1	1930	235	46.	76.4	1405.7
1	0325	42	0.	.0	1392.0	*	1	1130	139	7.	1.1	1392.5	*	1	1935	236	46.	76.2	1405.7
1	0330	43	0.	.0	1392.0	*	1	1135	140	7.	1.3	1392.6	*	1	1940	237	46.	76.0	1405.6
1	0335	44	0.	.0	1392.0	*	1	1140	141	8.	1.4	1392.6	*	1	1945	238	46.	75.9	1405.6
1	0340	45	0.	.0	1392.0	*	1	1145	142	10.	1.7	1392.8	*	1	1950	239	46.	75.7	1405.6
1	0345	46	0.	.0	1392.0	*	1	1150	143	12.	2.2	1393.0	*	1	1955	240	46.	75.5	1405.5
1	0350	47	0.	.0	1392.0	*	1	1155	144	14.	2.9	1393.2	*	1	2000	241	46.	75.3	1405.5
1	0355	48	0.	.0	1392.0	*	1	1200	145	15.	4.0	1393.4	*	1	2005	242	46.	75.1	1405.5
1	0400	49	0.	.0	1392.0	*	1	1205	146	17.	6.1	1393.8	*	1	2010	243	46.	75.0	1405.5
1	0405	50	0.	.0	1392.0	*	1	1210	147	20.	9.8	1394.4	*	1	2015	244	46.	74.8	1405.4
1	0410	51	0.	.0	1392.0	*	1	1215	148	23.	15.6	1395.4	*	1	2020	245	46.	74.6	1405.4
1	0415	52	0.	.0	1392.0	*	1	1220	149	27.	23.1	1396.7	*	1	2025	246	46.	74.4	1405.4
1	0420	53	0.	.0	1392.0	*	1	1225	150	31.	31.5	1398.1	*	1	2030	247	46.	74.2	1405.3
1	0425	54	0.	.0	1392.0	*	1	1230	151	34.	39.8	1399.5	*	1	2035	248	46.	74.0	1405.3
1	0430	55	0.	.0	1392.0	*	1	1235	152	37.	47.3	1400.8	*	1	2040	249	45.	73.8	1405.3
1	0435	56	0.	.0	1392.0	*	1	1240	153	40.	53.9	1401.9	*	1	2045	250	45.	73.7	1405.2
1	0440	57	0.	.0	1392.0	*	1	1245	154	41.	59.4	1402.8	*	1	2050	251	45.	73.5	1405.2
1	0445	58	0.	.0	1392.0	*	1	1250	155	43.	63.8	1403.6	*	1	2055	252	45.	73.3	1405.2
1	0450	59	0.	.0	1392.0	*	1	1255	156	44.	67.4	1404.2	*	1	2100	253	45.	73.1	1405.1
1	0455	60	0.	.0	1392.0	*	1	1300	157	44.	70.3	1404.7	*	1	2105	254	45.	72.9	1405.1
1	0500	61	0.	.0	1392.0	*	1	1305	158	45.	72.5	1405.0	*	1	2110	255	45.	72.7	1405.1
1	0505	62	0.	.0	1392.0	*	1	1310	159	46.	74.3	1405.3	*	1	2115	256	45.	72.5	1405.0
1	0510	63	0.	.0	1392.0	*	1	1315	160	46.	75.7	1405.6	*	1	2120	257	45.	72.3	1405.0
1	0515	64	0.	.0	1392.0	*	1	1320	161	46.	76.8	1405.8	*	1	2125	258	45.	72.1	1405.0
1	0520	65	0.	.0	1392.0	*	1	1325	162	47.	77.7	1405.9	*	1	2130	259	45.	71.9	1404.9
1	0525	66	0.	.0	1392.0	*	1	1330	163	47.	78.5	1406.0	*	1	2135	260	45.	71.7	1404.9
1	0530	67	0.	.0	1392.0	*	1	1335	164	47.	79.1	1406.1	*	1	2140	261	45.	71.5	1404.9
1	0535	68	0.	.0	1392.0	*	1	1340	165	47.	79.6	1406.2	*	1	2145	262	45.	71.3	1404.8
1	0540	69	0.	.0	1392.0	*	1	1345	166	47.	80.0	1406.3	*	1	2150	263	45.	71.1	1404.8
1	0545	70	0.	.0	1392.0	*	1	1350	167	47.	80.3	1406.4	*	1	2155	264	45.	71.0	1404.8
1	0550	71	0.	.0	1392.0	*	1	1355	168	47.	80.7	1406.4	*	1	2200	265	45.	70.8	1404.7
1	0555	72	0.	.0	1392.0	*	1	1400	169	47.	80.9	1406.5	*	1	2205	266	45.	70.6	1404.7
1	0600	73	0.	.0	1392.0	*	1	1405	170	48.	81.2	1406.5	*	1	2210	267	44.	70.4	1404.7
1	0605	74	0.	.0	1392.0	*	1	1410	171	48.	81.3	1406.5	*	1	2215	268	44.	70.2	1404.6
1	0610	75	0.	.0	1392.0	*	1	1415	172	48.	81.5	1406.6	*	1	2220	269	44.	70.0	1404.6
1	0615	76	0.	.0	1392.0	*	1	1420	173	48.	81.6	1406.6	*	1	2225	270	44.	69.8	1404.6
1	0620	77	0.	.0	1392.0	*	1	1425	174	48.	81.8	1406.6	*	1	2230	271	44.	69.6	1404.5
1	0625	78	0.	.0	1392.0	*	1	1430	175	48.	81.9	1406.6	*	1	2235	272	44.	69.4	1404.5
1	0630	79	0.	.0	1392.0	*	1	1435	176	48.	82.0	1406.6	*	1	2240	273	44.	69.2	1404.5
1	0635	80	0.	.0	1392.0	*	1	1440	177	48.	82.0	1406.6	*	1	2245	274	44.	69.0	1404.4
1	0640	81	0.	.0	1392.0	*	1	1445	178	48.	82.1	1406.7	*	1	2250	275	44.	68.8	1404.4

1	0655	84	0.	.0	1392.0	*	1	1500	181	48.	82.2	1406.7	*	1	2305	278	44.	68.2	1404.3
1	0700	85	0.	.0	1392.0	*	1	1505	182	48.	82.2	1406.7	*	1	2310	279	44.	68.0	1404.3
1	0705	86	0.	.0	1392.0	*	1	1510	183	48.	82.2	1406.7	*	1	2315	280	44.	67.8	1404.2
1	0710	87	0.	.0	1392.0	*	1	1515	184	48.	82.2	1406.7	*	1	2320	281	44.	67.6	1404.2
1	0715	88	0.	.0	1392.0	*	1	1520	185	48.	82.2	1406.7	*	1	2325	282	44.	67.4	1404.2
1	0720	89	0.	.0	1392.0	*	1	1525	186	48.	82.1	1406.7	*	1	2330	283	44.	67.2	1404.1
1	0725	90	0.	.0	1392.0	*	1	1530	187	48.	82.1	1406.7	*	1	2335	284	44.	66.9	1404.1
1	0730	91	0.	.0	1392.0	*	1	1535	188	48.	82.1	1406.7	*	1	2340	285	43.	66.7	1404.1
1	0735	92	0.	.0	1392.0	*	1	1540	189	48.	82.0	1406.7	*	1	2345	286	43.	66.5	1404.0
1	0740	93	0.	.0	1392.0	*	1	1545	190	48.	82.0	1406.6	*	1	2350	287	43.	66.3	1404.0
1	0745	94	0.	.0	1392.0	*	1	1550	191	48.	82.0	1406.6	*	1	2355	288	43.	66.1	1404.0
1	0750	95	0.	.0	1392.0	*	1	1555	192	48.	81.9	1406.6	*	2	0000	289	43.	65.9	1403.9
1	0755	96	0.	.0	1392.0	*	1	1600	193	48.	81.8	1406.6	*						
1	0800	97	0.	.0	1392.0	*	1	1605	194	48.	81.8	1406.6	*						
						*							*						

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PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.00-HR
48.	15.08	(CFS)	47.	23.	23.	23.
		(INCHES)	.468	.908	.908	.908
		(AC-FT)	23.	46.	46.	46.

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	24.00-HR
82.	15.17	80.	37.	37.	37.

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	24.00-HR
1406.67	15.17	1406.37	1398.61	1398.61	1398.61

CUMULATIVE AREA = .94 SQ MI

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	DA8B	286.	12.25	31.	9.	9.	.12		
ROUTED TO	RT8B	275.	12.33	31.	9.	9.	.12		
HYDROGRAPH AT	DA8C	260.	12.42	40.	11.	11.	.21		
2 COMBINED AT	CB8C	515.	12.33	71.	20.	20.	.33		
DIVERSION TO	DVT01	88.	12.33	7.	2.	2.	.33		
HYDROGRAPH AT	DV8C	427.	12.33	63.	18.	18.	.33		
ROUTED TO	RTRN8C	423.	12.42	63.	18.	18.	.33		
HYDROGRAPH AT	DA8E	311.	12.25	35.	10.	10.	.15		
DIVERSION TO	DVT02	156.	12.25	18.	5.	5.	.15		
HYDROGRAPH AT	DV8E	156.	12.25	18.	5.	5.	.15		
2 COMBINED AT	CB8E	535.	12.42	81.	23.	23.	.48		
DIVERSION TO	DVT03	289.	12.42	32.	8.	8.	.48		
HYDROGRAPH AT	DVC8E	246.	12.42	49.	14.	14.	.48		
HYDROGRAPH AT	DA8D	328.	12.50	53.	15.	15.	.28		
ROUTED TO	RT8D	325.	12.50	53.	15.	15.	.28		
HYDROGRAPH AT	RTR8E	156.	12.25	18.	5.	5.	.00		
3 COMBINED AT	CB8D	650.	12.42	119.	34.	34.	.76		
HYDROGRAPH AT	RTR7TH	289.	12.42	32.	8.	8.	.00		
2 COMBINED AT	CBCB	939.	12.42	151.	42.	42.	.76		
ROUTED TO	RTBF	936.	12.42	151.	42.	42.	.76		
HYDROGRAPH AT	DA8F	126.	12.25	15.	4.	4.	.06		
2 COMBINED AT	CB8D	1030.	12.42	166.	47.	47.	.82		
ROUTED TO	RT8F1	1029.	12.42	166.	47.	47.	.82		
ROUTED TO	RT8F2	1027.	12.42	166.	47.	47.	.82		
HYDROGRAPH AT	DA8G	227.	12.33	29.	8.	8.	.12		
HYDROGRAPH AT	RRN9D1	51.	12.67	6.	1.	1.	.00		
3 COMBINED AT	CB8G	1267.	12.42	201.	56.	56.	.94		
ROUTED TO	DBA	48.	15.08	47.	23.	23.	.94	1406.67	15.17

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

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
RT8B	MANE	1.99	281.56	739.21	2.72	5.00	274.88	740.00	2.72

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1743E+02 EXCESS= .0000E+00 OUTFLOW= .1741E+02 BASIN STORAGE= .3863E-01 PERCENT ERROR= -.1

RTRN8C	MANE	2.40	424.52	744.63	2.02	5.00	423.38	745.00	2.02

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3562E+02 EXCESS= .0000E+00 OUTFLOW= .3556E+02 BASIN STORAGE= .1053E+00 PERCENT ERROR= -.1

RT8D	MANE	2.10	327.40	754.40	1.94	5.00	324.94	750.00	1.94

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2908E+02 EXCESS= .0000E+00 OUTFLOW= .2901E+02 BASIN STORAGE= .7880E-01 PERCENT ERROR= .0

RTBF	MANE	.33	937.12	745.22	2.07	5.00	935.81	745.00	2.08

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8411E+02 EXCESS= .0000E+00 OUTFLOW= .8407E+02 BASIN STORAGE= .5186E-01 PERCENT ERROR= .0

RT8F1	MANE	.20	1029.18	745.20	2.11	5.00	1028.98	745.00	2.11

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9224E+02 EXCESS= .0000E+00 OUTFLOW= .9222E+02 BASIN STORAGE= .1584E-01 PERCENT ERROR= .0

RT8F2	MANE	.21	1027.99	745.18	2.11	5.00	1027.11	745.00	2.11

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9225E+02 EXCESS= .0000E+00 OUTFLOW= .9220E+02 BASIN STORAGE= .4091E-01 PERCENT ERROR= .0

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

APPENDIX B

7TH AVENUE FLOWS

CRSS	PROJECT: Beardsley Interceptor	JOB NO		NO. 1
	CLIENT: ADOT	DESIGNED BY: JFM	DATE: 2/14/93	OF 4
	SUBJECT: 7TH Avenue	CHECKED BY: MBS	DATE: 2/24/93	

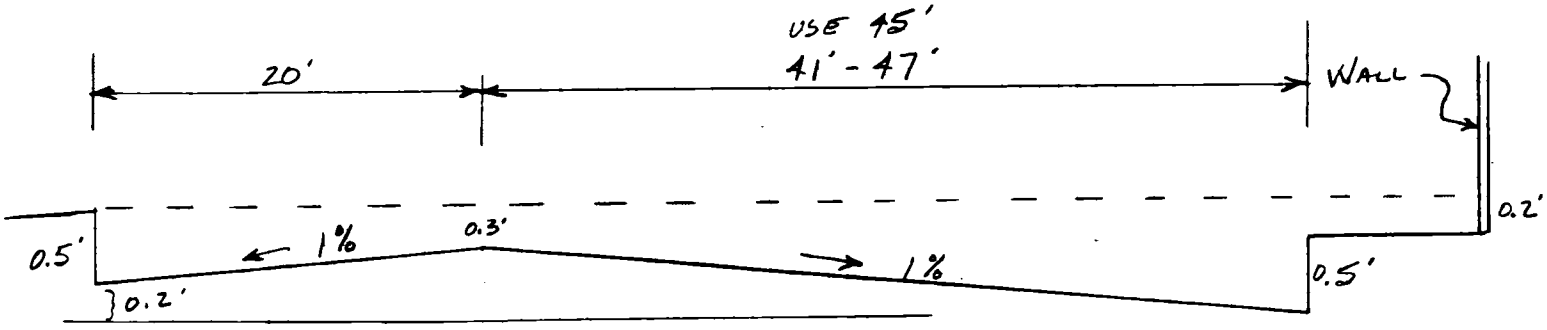
7TH Avenue

Cross Section Estimate
(Taken from contour and Topo maps)

Longitudinal slope - Centerline $S = \frac{2}{324} = 0.0062$
Gutter $S = \frac{2}{336} = 0.0060$ } USE 0.0060

Cross Slope

Left $\frac{36' \times 0.006}{20'} = 0.0108$
Right $\frac{66' * 0.006}{43'} = 0.0092$ } USE 0.0100



Q = 31 cfs Q = 102 cfs

EAST ROADWAY SECTION

STAGE - DISCHARGE CURVE DATA
Using Composite Roughness

DEPTH	DISCHARGE	VEL	AREA	TOPWIDTH
0.10	0.55	0.97	0.56	11.24
0.20	3.47	1.54	2.25	22.49
0.30	10.23	2.02	5.06	33.74
0.40	22.03	2.45	9.00	44.98
0.50	43.20	3.20	13.50	45.01
0.60	67.01	3.55	18.89	53.93
0.70	101.65	4.19	24.28	53.95
0.80	141.72	4.78	29.68	53.97
0.90	186.86	5.33	35.07	53.99
1.00	236.73	5.85	40.47	54.00
1.10	291.10	6.35	45.88	54.02
1.20	349.75	6.82	51.28	54.04
1.30	412.49	7.28	56.68	54.06
1.40	479.16	7.72	62.09	54.08

WEST ROADWAY SECTION

STAGE - DISCHARGE CURVE DATA
Using Composite Roughness

DEPTH	DISCHARGE	VEL	AREA	TOPWIDTH
0.10	0.48	0.97	0.50	9.96
0.20	3.08	1.55	1.99	19.92
0.30	9.74	2.45	3.98	19.93
0.40	19.10	3.19	5.98	19.95
0.50	30.77	3.86	7.97	19.97
0.60	44.51	4.46	9.97	19.98
0.70	60.17	5.03	11.97	20.00
0.80	77.60	5.55	13.97	20.02
0.90	96.70	6.05	15.97	20.03
1.00	117.37	6.53	17.98	20.05
1.10	139.56	6.98	19.98	20.07
1.20	163.18	7.42	21.99	20.08

CRSS	PROJECT: Beardsley Interceptor	JOB NO		NO. 3
	CLIENT: ADOT	DESIGNED BY: JFM	DATE: 2/14/93	OF 4
	SUBJECT: 7th Avenue	CHECKED BY: MBS	DATE: 2/24/94	

7th Avenue

These Splits will be input into HEC-1 to reflect the combination of the addition of the hydrograph splits

① split Sub-basin 8E
50% will outlet to Beardsley Road via 5th Ave
50% will outlet to 7th Ave via Yukon Dr.

② After 7th Avenue is full flows will flow west out of roadway section (East Restricted by Block wall)

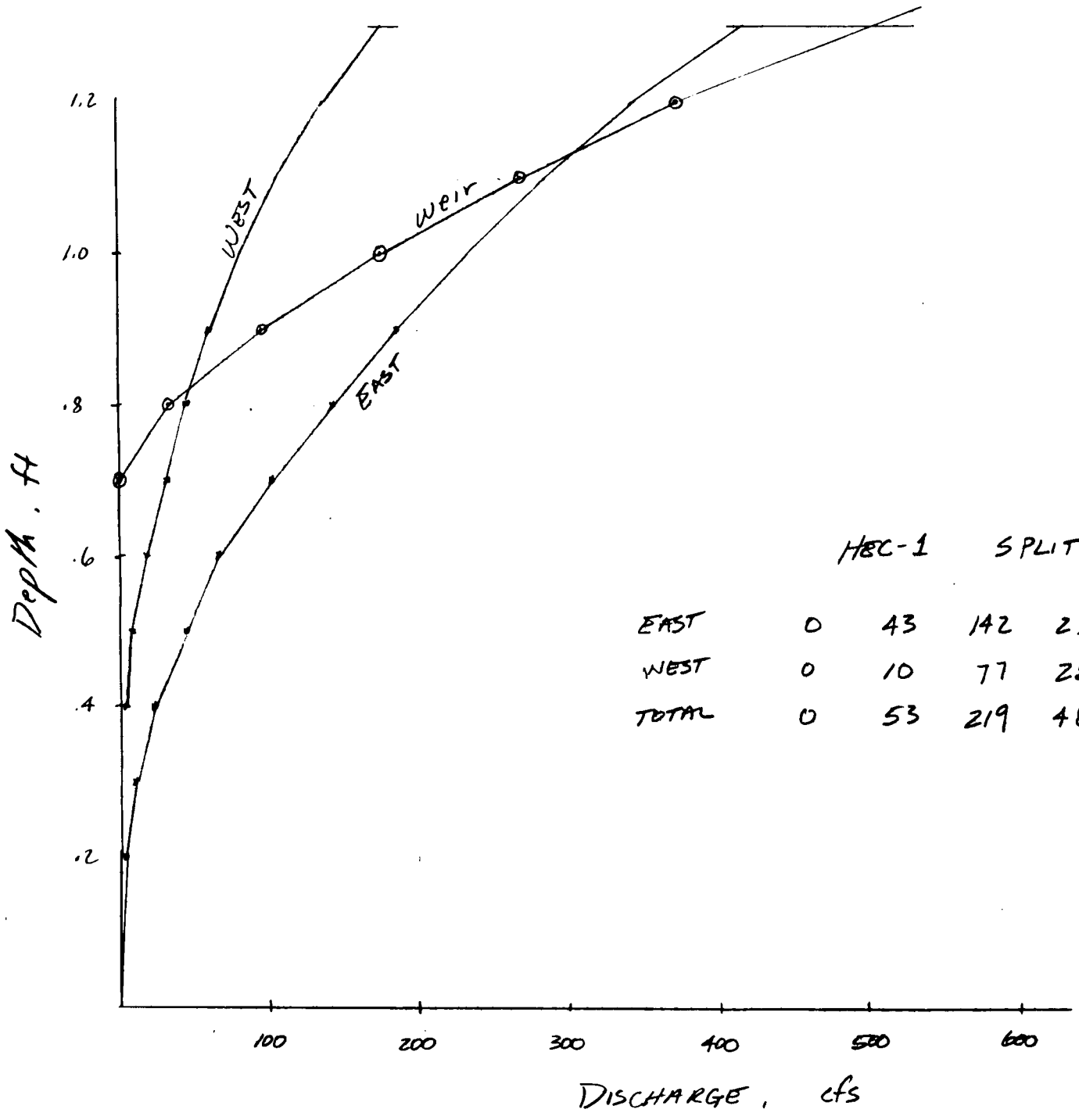
WEIR EQ.

$Q = C_w P d^{1.5}$

$C_w = 3.0$

$P \doteq 350'$

depth	Q EAST	Q WEST	depth WIER WEST	Q WIER WEST	TOTAL WEST
.1	0.55	0			0
.2	3.47	0			0
.3	10.23	0.48			0
.4	22.03	3.07			3
.5	43.21	9.70			10
.6	67.02	19.00			19
.7	101.68	30.57	0	0	31
.8	141.80	44.18	.1	33	77
.9	186.99	59.65	.2	94	154
1.0	230	80	.3	173	253
1.1	283	104	.4	266	370
1.2	340	136	.5	371	507
1.3	410	174	[illegible]	500	674



HEC-1 SPLIT

EAST	0	43	142	230	340	410
WEST	0	10	77	253	507	674
TOTAL	0	53	219	483	847	1084

CRSS

PROJECT: Beardsley Interceptor
CLIENT: ADOT
SUBJECT: 7TH Avenue Split

JOB NO.
DESIGNED BY: JFM
DATE: 2/14/94
CHECKED BY: MBS
DATE: 2/24/94
NO. 4 OF 4

APPENDIX C

HEC-2 BOX CULVERT

CURRENT DATE: 04-18-1994
CURRENT TIME: 09:09:26

FILE DATE: 04-08-1994
FILE NAME: DBF

FHWA CULVERT ANALYSIS
HY-8, VERSION 3.2

U	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1414.59	1413.96	144.00	1 RCB	12.00	6.00	.012	CONVENTIONAL
4								

FILE: DBF CULVERT HEADWATER ELEVATION (FT) DATE: 04-08-1994

DISCHARGE	1	2	3	4	5	6	ROADWAY
0	1418.03	0.00	0.00	0.00	0.00	0.00	1430.00
70	1416.49	0.00	0.00	0.00	0.00	0.00	1430.60
140	1417.00	0.00	0.00	0.00	0.00	0.00	1430.94
210	1417.69	0.00	0.00	0.00	0.00	0.00	1431.24
280	1418.13	0.00	0.00	0.00	0.00	0.00	1431.50
350	1419.05	0.00	0.00	0.00	0.00	0.00	1431.74
420	1419.51	0.00	0.00	0.00	0.00	0.00	1431.97
490	1420.01	0.00	0.00	0.00	0.00	0.00	1432.18
560	1420.54	0.00	0.00	0.00	0.00	0.00	1432.38
630	1421.12	0.00	0.00	0.00	0.00	0.00	1432.58
650	1421.29	0.00	0.00	0.00	0.00	0.00	1432.63

CURRENT DATE: 04-18-1994
CURRENT TIME: 09:09:26

FILE DATE: 04-08-1994
FILE NAME: DBF

CULVERT # 1

PERFORMANCE CURVE FOR 1 BARREL(S)

Q (cfs)	HWE (ft)	TWE (ft)	ICH (ft)	OCH (ft)	FLOW TYPE	CCE (ft)	FCE (ft)	TCE (ft)	VO (fps)
0	1415.63	1418.03	0.00	3.44	0-NF	1415.63	1414.59	0.00	0.00
70	1416.38	1418.03	1.52	1.79	5-S2	0.00	0.00	0.00	1.43
140	1417.00	1418.03	2.41	2.10	5-S2	0.00	0.00	0.00	8.53
210	1417.69	1418.03	3.10	2.25	5-S2	1417.69	1414.59	0.00	9.71
280	1418.13	1418.03	3.54	2.36	5-S2	1418.13	1414.59	0.00	10.74
350	1419.05	1418.03	3.94	4.46	6-FF	1418.53	1414.59	0.00	7.17
420	1419.51	1418.03	4.31	4.92	6-FF	1418.90	1414.59	0.00	8.60
490	1420.01	1418.03	4.67	5.42	6-FF	1419.26	1414.59	0.00	10.03
560	1420.54	1418.03	5.01	5.95	6-FF	1419.60	1414.59	0.00	11.43
630	1421.12	1418.03	5.33	6.53	6-FF	1419.92	1414.59	0.00	11.89
650	1421.29	1418.03	5.42	6.70	6-FF	1420.01	1414.59	0.00	12.01

El. inlet face invert 1414.59 ft El. outlet invert 1413.96 ft
El. inlet throat invert 0.00 ft El. inlet crest 1415.63 ft

(1' depression)

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2171.00
INLET ELEVATION (FT)	1415.59
OUTLET STATION (FT)	2027.00
OUTLET ELEVATION (FT)	1413.96
NUMBER OF BARRELS	1.00
SLOPE (V-FT/H-FT)	0.0044
CULVERT LENGTH ALONG SLOPE (FT)	144.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	12.00 FT
BARREL RISE	6.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION	YES

CURRENT DATE: 04-18-1994
CURRENT TIME: 09:09:26

FILE DATE: 04-08-1994
FILE NAME: DBF

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1418.03

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	25.00
CREST LENGTH (FT)	50.00
OVERTOPPING CREST ELEVATION (FT)	1430.00

```
****************************************************
*  WATER SURFACE PROFILES                          *
*  VERSION OF NOVEMBER 1976                        *
*  UPDATED MAY 1984                                *
*  IBM-PC-XT VERSION AUGUST 1985                   *
*  RUN DATE  04-26-94   TIME  08:34:34             *
****************************************************
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*************************************
*  U.S. ARMY CORPS OF ENGINEERS     *
*  THE HYDROLOGIC ENGINEERING CENTER *
*  609 SECOND STREET, SUITE D       *
*  DAVIS, CALIFORNIA 95616          *
*  (916) 440-2105 (FTS) 448-2105    *
*************************************
```

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

THIS RUN EXECUTED 04-26-94

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**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
  IBM-PC-XT VERSION AUGUST 1985
**************************************************
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FR
T1      Beardsley Road Drainage between DB-F and DB-A
T2      ENTIRE SUPERCRITICAL REACH
T3      THE CHANNEL AS OF 4-18-94

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

      0.       0.       0.       1. -1.000000      .00       .0     650.   418.300     .000

J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

    -1.000     .000   -1.000     .000     .000     .000   -1.000     .000     .000     .000

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

   150.000   38.000    8.000   10.000     .000     .000     .000     .000     .000     .000

J5  LPRNT    NUMSEC                 ********REQUESTED SECTION NUMBERS********

   -10.000  -10.000     .000     .000     .000     .000     .000     .000     .000     .000

NC      .013      .013      .013      .100      .300      .000      .000      .000      .000      .000
X1   2171.000     4.000   100.000   112.000    70.000    70.000    70.000      .000      .000      .000
BT      2.000   100.000   423.590   420.590   112.000   423.590   420.590      .000      .000      .000
GR    420.590   100.000   414.590   100.100   414.590   111.900   420.590   112.000      .000      .000

X1   2101.000      .000      .000      .000    74.000    74.000    74.000      .000     -.308      .000
X2      .000      .000      .000      .000      .000      .000     1.000      .000      .000      .000

X1   2027.000      .000      .000      .000    10.000    10.000    10.000      .000     -.326      .000
X2      .000      .000      .000      .000      .000      .000     1.000      .000      .000      .000

X1   2017.000     4.000   100.000   112.000    17.000    17.000    17.000      .000      .000      .000
X2    938.000      .000      .000      .000      .000      .000      .000      .000      .000      .000
BT      2.000   100.000   422.910   419.910   112.000   422.910   419.910      .000      .000      .000
GR    419.910   100.000   411.910   100.100   411.910   111.900   419.910   112.000      .000      .000
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X1	2000.000	.000	.000	.000	100.000	100.000	100.000	.000	-.075	.000
X2	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
X1	1900.000	.000	.000	.000	100.000	100.000	100.000	.000	-.440	.000
X2	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
X1	1800.000	.000	.000	.000	100.000	100.000	100.000	.000	-.440	.000
X2	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
X1	1700.000	.000	.000	.000	100.000	100.000	100.000	.000	-.440	.000
X2	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
X1	1600.000	.000	.000	.000	100.000	100.000	100.000	.000	-.440	.000
X2	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
X1	1500.000	.000	.000	.000	100.000	100.000	100.000	.000	-.440	.000
X2	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
X1	1400.000	.000	.000	.000	100.000	100.000	100.000	.000	-.440	.000
X2	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
X1	1300.000	.000	.000	.000	100.000	100.000	100.000	.000	-.440	.000
X2	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
X1	1200.000	.000	.000	.000	93.000	93.000	93.000	.000	-.440	.000
X2	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
X1	1107.000	.000	.000	.000	1.000	1.000	1.000	.000	-.409	.000
X2	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
NC	.016	.016	.016	.300	.500	.000	.000	.000	.000	.000
X1	1106.000	.000	.000	.000	49.000	49.000	49.000	.000	.000	.000
X1	1057.000	4.000	100.000	158.000	100.000	100.000	100.000	.000	.000	.000
X2	1025.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
GR	419.190	100.000	407.690	123.000	407.690	135.000	419.190	158.000	.000	.000
X1	957.000	.000	.000	.000	104.000	104.000	104.000	.000	-.440	.000
X1	853.000	.000	.000	.000	49.000	49.000	49.000	.000	-.458	.000
X1	804.000	4.000	100.000	112.000	1.000	1.000	1.000	.000	.000	.000
GR	414.570	100.000	406.570	100.100	406.570	111.900	414.570	112.000	.000	.000
NC	.013	.013	.013	.100	.300	.000	.000	.000	.000	.000
X1	803.000	.000	.000	.000	103.000	103.000	103.000	.000	.000	.000
BT	2.000	100.000	417.570	414.570	112.000	417.570	414.570	.000	.000	.000

X1	700.000	.000	.000	.000	100.000	100.000	100.000	.000	-.453	.000
X2	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
X1	600.000	.000	.000	.000	100.000	100.000	100.000	.000	-.440	.000
X2	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
X1	500.000	.000	.000	.000	100.000	100.000	100.000	.000	-.440	.000
X2	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
X1	400.000	.000	.000	.000	100.000	100.000	100.000	.000	-.440	.000
X2	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
X1	300.000	.000	.000	.000	100.000	100.000	100.000	.000	-.440	.000
X2	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
X1	200.000	.000	.000	.000	100.000	100.000	100.000	.000	-.440	.000
X2	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
X1	100.000	.000	.000	.000	100.000	100.000	100.000	.000	-.440	.000
X2	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
X1	.000	.000	.000	.000	.000	.000	.000	.000	-.440	.000
X2	.000	.000	.000	.000	.000	.000	1.000	.000	.000	.000
EJ	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

THIS RUN EXECUTED 04-26-94

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**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
  IBM-PC-XT VERSION AUGUST 1985
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

THE CHANNEL AS OF 4-18-9

SUMMARY PRINTOUT

	SECNO	DEPTH	HV
*	2171.000	4.54	2.26
	2101.000	4.25	2.58
	2027.000	4.15	2.70
	2017.000	5.22	3.55
	2000.000	5.23	3.54
*	1900.000	5.49	3.21
	1800.000	5.39	3.34
*	1700.000	5.71	2.96
	1600.000	5.45	3.26
*	1500.000	5.73	2.96
	1400.000	5.42	3.30
*	1300.000	5.72	2.96
	1200.000	5.42	3.30
*	1107.000	5.71	2.96
*	1106.000	5.80	2.89
	1057.000	3.18	4.78
	957.000	4.64	1.68

	SECNO	DEPTH	HV
	853.000	4.38	1.98
*	804.000	6.14	3.07
*	803.000	6.12	3.08
	700.000	5.82	3.42
*	600.000	6.09	3.13
	500.000	5.76	3.48
*	400.000	5.99	3.22
	300.000	5.81	3.44
*	200.000	6.09	3.13
	100.000	5.75	3.49
*	.000	5.98	3.23

THE CHANNEL AS OF 4-18-9

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
*	2171.000	.00	423.59	420.59	414.59	650.00	419.13	419.13	421.39	31.41	12.06	53.91	115.98
	2101.000	70.00	423.59	420.28	414.28	650.00	418.54	418.82	421.11	37.75	12.88	50.45	105.80
	2027.000	74.00	423.59	419.96	413.96	650.00	418.11	418.50	420.81	40.33	13.20	49.26	102.35
	2017.000	10.00	422.91	419.91	411.91	938.00	417.13	417.69	420.69	44.63	15.12	62.02	140.41
	2000.000	17.00	422.91	419.83	411.83	938.00	417.07	417.61	420.61	44.35	15.09	62.17	140.85
*	1900.000	100.00	422.91	419.39	411.39	938.00	416.89	417.17	420.09	38.87	14.37	65.28	150.45
	1800.000	100.00	422.91	418.95	410.95	938.00	416.34	416.73	419.68	41.04	14.66	63.97	146.41
*	1700.000	100.00	422.91	418.51	410.51	938.00	416.23	416.29	419.19	34.96	13.81	67.90	158.64
	1600.000	100.00	422.91	418.07	410.07	938.00	415.53	415.85	418.79	39.70	14.48	64.77	148.87
*	1500.000	100.00	422.91	417.63	409.63	938.00	415.36	415.41	418.33	34.96	13.81	67.90	158.64
	1400.000	100.00	422.91	417.19	409.19	938.00	414.61	414.97	417.92	40.49	14.59	64.29	147.41
*	1300.000	100.00	422.91	416.75	408.75	938.00	414.48	414.53	417.44	34.96	13.81	67.90	158.64
	1200.000	100.00	422.91	416.31	408.31	938.00	413.73	414.09	417.03	40.35	14.57	64.38	147.66
*	1107.000	93.00	422.91	415.91	407.91	938.00	413.62	413.68	416.58	34.96	13.81	67.90	158.64
*	1106.000	1.00	.00	.00	407.91	938.00	413.70	413.70	416.59	51.12	13.63	68.81	131.19
	1057.000	49.00	.00	.00	407.69	1025.00	419.19 410.87	412.35	415.64	122.56	17.54	58.44	92.59
	957.000	100.00	.00	.00	407.25	1025.00	411.89	411.93	413.57	28.74	10.39	98.67	191.20
	853.000	104.00	.00	.00	406.79	1025.00	411.17	411.47	413.15	36.07	11.28	90.84	170.68
*	804.000	49.00	.00	.00	406.57	1025.00	412.71	412.71	415.78	52.30	14.06	72.91	141.73
*	803.000	1.00	417.57	414.57	406.57	1025.00	412.69	412.71	415.77	34.69	14.08	72.78	174.03
	700.000	103.00	417.57	414.12	406.12	1025.00	411.94	412.26	415.36	39.89	14.84	69.06	162.28
*	600.000	100.00	417.57	413.68	405.68	1025.00	411.76	411.82	414.89	35.42	14.19	72.21	172.22
	500.000	100.00	417.57	413.24	405.24	1025.00	410.99	411.38	414.48	40.91	14.98	68.42	160.26
*	400.000	100.00	417.57	412.80	404.80	1025.00	410.79	410.94	414.01	36.80	14.40	71.18	168.96

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
	300.000	100.00	417.57	412.36	404.36	1025.00	410.17	410.50	413.60	40.18	14.88	68.88	161.71
*	200.000	100.00	417.57	411.92	403.92	1025.00	410.01	410.06	413.13	35.42	14.19	72.21	172.22
	100.000	100.00	417.57	411.48	403.48	1025.00	409.23	409.62	412.72	40.98	14.99	68.37	160.12
*	.000	100.00	417.57	411.04	403.04	1025.00	409.02	409.18	412.25	36.95	14.42	71.08	168.62

THE CHANNEL AS OF 4-18-9

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	2171.000	650.00	419.13	.00	.00	.83	11.95	.00
	2101.000	650.00	418.54	.00	-.59	.00	11.94	70.00
	2027.000	650.00	418.11	.00	-.43	.00	11.94	74.00
	2017.000	938.00	417.13	.00	-.98	.00	11.93	10.00
	2000.000	938.00	417.07	.00	-.06	.00	11.93	17.00
*	1900.000	938.00	416.89	.00	-.18	.00	11.94	100.00
	1800.000	938.00	416.34	.00	-.54	.00	11.93	100.00
*	1700.000	938.00	416.23	.00	-.12	.00	11.94	100.00
	1600.000	938.00	415.53	.00	-.70	.00	11.94	100.00
*	1500.000	938.00	415.36	.00	-.17	.00	11.94	100.00
	1400.000	938.00	414.61	.00	-.75	.00	11.94	100.00
*	1300.000	938.00	414.48	.00	-.14	.00	11.94	100.00
	1200.000	938.00	413.73	.00	-.74	.00	11.94	100.00
*	1107.000	938.00	413.62	.00	-.12	.00	11.94	93.00
*	1106.000	938.00	413.70	.00	.08	.00	11.94	1.00
	1057.000	1025.00	410.87	.00	-2.84	.00	24.73	49.00
	957.000	1025.00	411.89	.00	1.03	.00	30.55	100.00
	853.000	1025.00	411.17	.00	-.73	.00	29.51	104.00
*	804.000	1025.00	412.71	.00	1.54	.00	11.95	49.00
*	803.000	1025.00	412.69	.00	-.02	.00	11.95	1.00
	700.000	1025.00	411.94	.00	-.76	.00	11.95	103.00
*	600.000	1025.00	411.76	.00	-.17	.00	11.95	100.00
	500.000	1025.00	410.99	.00	-.77	.00	11.94	100.00
*	400.000	1025.00	410.79	.00	-.20	.00	11.95	100.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	300.000	1025.00	410.17	.00	-.62	.00	11.95	100.00
*	200.000	1025.00	410.01	.00	-.16	.00	11.95	100.00
	100.000	1025.00	409.23	.00	-.78	.00	11.94	100.00
*	.000	1025.00	409.02	.00	-.21	.00	11.95	100.00

SUMMARY OF ERRORS AND SPECIAL NOTES

```
CAUTION  SECNO=  2171.000  PROFILE= 1  CRITICAL DEPTH ASSUMED

CAUTION  SECNO=  1900.000  PROFILE= 1  MINIMUM SPECIFIC ENERGY

CAUTION  SECNO=  1700.000  PROFILE= 1  MINIMUM SPECIFIC ENERGY

CAUTION  SECNO=  1500.000  PROFILE= 1  MINIMUM SPECIFIC ENERGY

CAUTION  SECNO=  1300.000  PROFILE= 1  MINIMUM SPECIFIC ENERGY

CAUTION  SECNO=  1107.000  PROFILE= 1  MINIMUM SPECIFIC ENERGY

CAUTION  SECNO=  1106.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=  1106.000  PROFILE= 1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=  1106.000  PROFILE= 1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION  SECNO=   804.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=   804.000  PROFILE= 1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=   804.000  PROFILE= 1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION  SECNO=   803.000  PROFILE= 1  MINIMUM SPECIFIC ENERGY

CAUTION  SECNO=   600.000  PROFILE= 1  MINIMUM SPECIFIC ENERGY

CAUTION  SECNO=   400.000  PROFILE= 1  MINIMUM SPECIFIC ENERGY

CAUTION  SECNO=   200.000  PROFILE= 1  MINIMUM SPECIFIC ENERGY

CAUTION  SECNO=      .000  PROFILE= 1  MINIMUM SPECIFIC ENERGY
```

THIS RUN EXECUTED 04-26-94

```
**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
  IBM-PC-XT VERSION AUGUST 1985
**************************************************
```

APPENDIX C

HEC-2 OPEN CHANNEL

```
****************************************************
*  WATER SURFACE PROFILES                          *
*  VERSION OF NOVEMBER 1976                        *
*  UPDATED MAY 1984                                *
*  IBM-PC-XT VERSION AUGUST 1985                   *
*  RUN DATE  04-26-94   TIME  15:20:29               *
****************************************************
```

```
*************************************
*  U.S. ARMY CORPS OF ENGINEERS     *
*  THE HYDROLOGIC ENGINEERING CENTER *
*  609 SECOND STREET, SUITE D       *
*  DAVIS, CALIFORNIA 95616          *
  *  (916) 440-2105 (FTS) 448-2105
*************************************
```

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

THIS RUN EXECUTED 04-26-94

```
**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
  IBM-PC-XT VERSION AUGUST 1985
**************************************************


FR
C
T1      Beardsley Drainage - 19th Ave. w/Bridge
T2      Analysis of Bridge (2' Piers) effect on WSEL
T3      100-yr Storm Q=2760

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

      0.        0.        0.        0.   .000000      .00       .0     2760.   395.780     .000

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN       ALLDC     IBW       CHNIM     ITRACE

    -1.000      .000      .000      .000      .000      .000   -1.000      .000      .000      .000

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

    150.000   38.000     8.000    10.000      .000      .000      .000      .000      .000      .000

J5  LPRNT    NUMSEC                    ********REQUESTED SECTION NUMBERS********

    -10.000  -10.000      .000      .000      .000      .000      .000      .000      .000      .000

NC       .016      .016      .016      .100      .300      .000      .000      .000      .000      .000
         Entrance to Det Bas B Spillway
X1       .000     4.000    70.000   130.000      .000      .000      .000      .000      .000      .000
GR    398.780    70.000   388.780    90.000   388.780   110.000   398.780   130.000      .000      .000

X1    100.000      .000      .000      .000   100.000   100.000   100.000      .000      .200      .000

X1    170.000      .000      .000      .000    70.000    70.000    70.000      .000      .140      .000

X1    184.000      .000      .000      .000    14.000    14.000    14.000      .000      .028      .000
X3     10.000      .000      .000      .000      .000      .000      .000      .000      .000      .000

SB      1.050     1.560     2.600      .000    20.000     4.000   413.000     2.000   389.210   389.150
         Upstream Face of Bridge
X1    216.000      .000      .000      .000    32.000    32.000    32.000      .000      .064      .000
X2       .000      .000     1.000   400.400   401.230      .000      .000     1.330      .000      .000
X3     10.000      .000      .000      .000      .000      .000      .000      .000      .000      .000
BT      4.000    70.000   401.230   400.100    87.500   401.490   400.360   112.500   401.530   400.400
BT    130.000   401.330   400.200      .000      .000      .000      .000      .000      .000      .000
```

```
X1    230.000      .000      .000      .000    14.000    14.000    14.000      .000      .028      .000

X1    300.000      .000      .000      .000    70.000    70.000    70.000      .000      .140      .000

X1    400.000      .000      .000      .000   100.000   100.000   100.000      .000      .200      .000

X1    500.000      .000      .000      .000   100.000   100.000   100.000      .000      .200      .000

        End of transition/drop, Q=2760 cfs
X1    540.000      .000      .000      .000    40.000    40.000    40.000      .000      .080      .000

X1    589.000     4.000      .000    65.000    49.000    49.000    49.000      .000      .000     1.000
X2    983.000      .000      .000      .000      .000      .000      .000      .000      .000      .000
GR    400.750      .000   394.250      .100   394.250    64.900   400.750    65.000      .000      .000

NC       .013      .013      .013      .000      .000      .000      .000      .000      .000      .000
        Exit of 6-10'x4' RCBC
X1    590.000    24.000      .000    65.000     1.000     1.000     1.000      .000      .000     1.000
BT      2.000      .000   400.250   398.250    65.000   400.250   398.250      .000      .000      .000
GR    398.250      .000   394.250      .100   394.250    10.000   398.250    10.100   398.250    11.000
GR    394.250    11.100   394.250    21.000   398.250    21.100   398.250    22.000   394.250    22.100
GR    394.250    32.000   398.250    32.100   398.250    33.000   394.250    33.100   394.250    43.000
GR    398.250    43.100   398.250    44.000   394.250    44.100   394.250    54.000   398.250    54.100
GR    398.250    55.000   394.250    55.100   394.250    64.900   398.250    65.000      .000      .000

X1    700.000      .000      .000      .000   110.000   110.000   110.000      .000      .220      .000
X2       .000      .000      .000      .000      .000      .000     1.000      .000      .000      .000

        Entrance to 6-10'x4' RCBC, Q=983 cfs
X1    800.000      .000      .000      .000   100.000   100.000   100.000      .000      .200     1.000
X2       .000      .000      .000      .000      .000      .000     1.000      .000      .000      .000

NC       .016      .016      .016      .000      .000      .000      .000      .000      .000      .000
X1    801.080     4.000      .000    65.000     1.000     1.000     1.000      .000      .000     1.000
GR    401.170      .000   394.670      .100   394.670    64.900   401.170    65.000      .000      .000

X1    900.000     4.000      .000    51.000    99.000    99.000    99.000      .000      .000      .000
X2    900.000      .000      .000      .000      .000      .000      .000      .000      .000      .000
GR    401.490      .000   394.990      .100   394.990    50.900   401.490    51.000      .000      .000

X1   1000.000     4.000      .000    38.000   100.000   100.000   100.000      .000      .000      .000
X2    800.000      .000      .000      .000      .000      .000      .000      .000      .000      .000
GR    401.810      .000   395.310      .100   395.310    37.900   401.810    38.000      .000      .000

X1   1100.000     4.000      .000    25.000   100.000   100.000   100.000      .000      .000      .000
X2    650.000      .000      .000      .000      .000      .000      .000      .000      .000      .000
GR    402.130      .000   395.630      .100   395.630    24.900   402.130    25.000      .000      .000
```

Beggining of Rect Channel, Q=500 cfs

X1	1157.000	4.000	.000	17.700	57.000	57.000	57.000	.000	.000	.000
X2	500.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
GR	402.310	.000	395.810	.100	395.810	17.600	402.310	17.700	.000	.000
EJ	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

THIS RUN EXECUTED 04-26-94

```
**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
  IBM-PC-XT VERSION AUGUST 1985
**************************************************
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

100-yr Storm Q=2760

SUMMARY PRINTOUT

	SECNO	DEPTH	HV
	.000	7.00	2.09
	100.000	7.00	2.09
	170.000	7.01	2.09
	184.000	7.01	2.08
*	216.000	8.96	1.03
	230.000	8.94	1.03
	300.000	8.82	1.07
	400.000	8.66	1.13
	500.000	8.51	1.19
	540.000	8.46	1.21
	589.000	5.28	.13
	590.000	5.19	.26
	700.000	5.05	.26
	800.000	4.93	.26
	801.000	5.07	.14
	900.000	4.71	.22
	1000.000	4.32	.37

SECNO	DEPTH	HV
1100.000	3.83	.72
1157.000	3.54	1.00

100-yr Storm Q=2760

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
	.000	.00	.00	.00	388.78	2760.00	395.78	395.46	397.87	20.15	11.60	238.00	614.86
	100.000	100.00	.00	.00	388.98	2760.00	395.98	395.66	398.07	20.13	11.59	238.07	615.11
	170.000	70.00	.00	.00	389.12	2760.00	396.13	395.80	398.21	20.11	11.59	238.18	615.49
	184.000	14.00	.00	.00	389.15	2760.00	396.16	395.83	398.24	20.08	11.58	238.28	615.85
*	216.000	32.00	401.23	400.40	389.21	2760.00	398.17	.00	399.19	7.60	8.13	339.54	1000.89
	230.000	14.00	.00	.00	389.24	2760.00	398.18	395.90	399.21	7.65	8.15	338.76	997.74
	300.000	70.00	.00	.00	389.38	2760.00	398.20	396.04	399.27	8.08	8.31	332.03	970.80
	400.000	100.00	.00	.00	389.58	2760.00	398.24	396.23	399.37	8.69	8.53	323.41	936.53
	500.000	100.00	.00	.00	389.78	2760.00	398.29	396.43	399.48	9.32	8.76	315.14	903.96
	540.000	40.00	.00	.00	389.86	2760.00	398.32	396.51	399.53	9.54	8.83	312.47	893.50
	589.000	49.00	.00	.00	394.25	983.00	399.53	396.17	399.66	1.27	2.87	342.51	872.89
	590.000	1.00	400.25	398.25	394.25	983.00	399.44	396.29	399.70	8.01	4.10	239.60	347.27
	700.000	110.00	400.25	398.47	394.47	983.00	399.52	396.51	399.79	8.01	4.10	239.60	347.27
	800.000	100.00	400.25	398.67	394.67	983.00	399.60	396.71	399.87	8.01	4.10	239.60	347.27
	801.000	1.00	.00	.00	394.67	983.00	399.74	396.59	399.88	1.44	2.99	328.92	818.94
	900.000	99.00	.00	.00	394.99	900.00	399.70	397.12	399.92	2.59	3.75	239.71	559.19
	1000.000	100.00	.00	.00	395.31	800.00	399.63	397.71	400.00	5.17	4.89	163.59	351.76
	1100.000	100.00	.00	.00	395.63	650.00	399.46	398.39	400.18	12.87	6.83	95.20	181.18
	1157.000	57.00	.00	.00	395.81	500.00	399.35	398.73	400.36	21.69	8.03	62.24	107.35

100-yr Storm Q=2760

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	.000	2760.00	395.78	.00	.00	.00	48.00	.00
	100.000	2760.00	395.98	.00	.20	.00	48.01	100.00
	170.000	2760.00	396.13	.00	.14	.00	48.01	70.00
	184.000	2760.00	396.16	.00	.03	.00	48.02	14.00
*	216.000	2760.00	398.17	.00	2.01	.00	55.82	32.00
	230.000	2760.00	398.18	.00	.01	.00	55.77	14.00
	300.000	2760.00	398.20	.00	.03	.00	55.28	70.00
	400.000	2760.00	398.24	.00	.04	.00	54.66	100.00
	500.000	2760.00	398.29	.00	.05	.00	54.05	100.00
	540.000	2760.00	398.32	.00	.02	.00	53.85	40.00
	589.000	983.00	399.53	.00	1.21	.00	64.96	49.00
	590.000	983.00	399.44	.00	-.09	.00	65.00	1.00
	700.000	983.00	399.52	.00	.09	.00	65.00	110.00
	800.000	983.00	399.60	.00	.08	.00	65.00	100.00
	801.000	983.00	399.74	.00	.14	.00	64.96	1.00
	900.000	900.00	399.70	.00	-.04	.00	50.94	99.00
	1000.000	800.00	399.63	.00	-.07	.00	37.93	100.00
	1100.000	650.00	399.46	.00	-.17	.00	24.92	100.00
	1157.000	500.00	399.35	.00	-.10	.00	17.61	57.00

SUMMARY OF ERRORS AND SPECIAL NOTES

CAUTION SECNO= 216.000 PROFILE= 1 HYDRAULIC JUMP D.S.

THIS RUN EXECUTED 04-26-94

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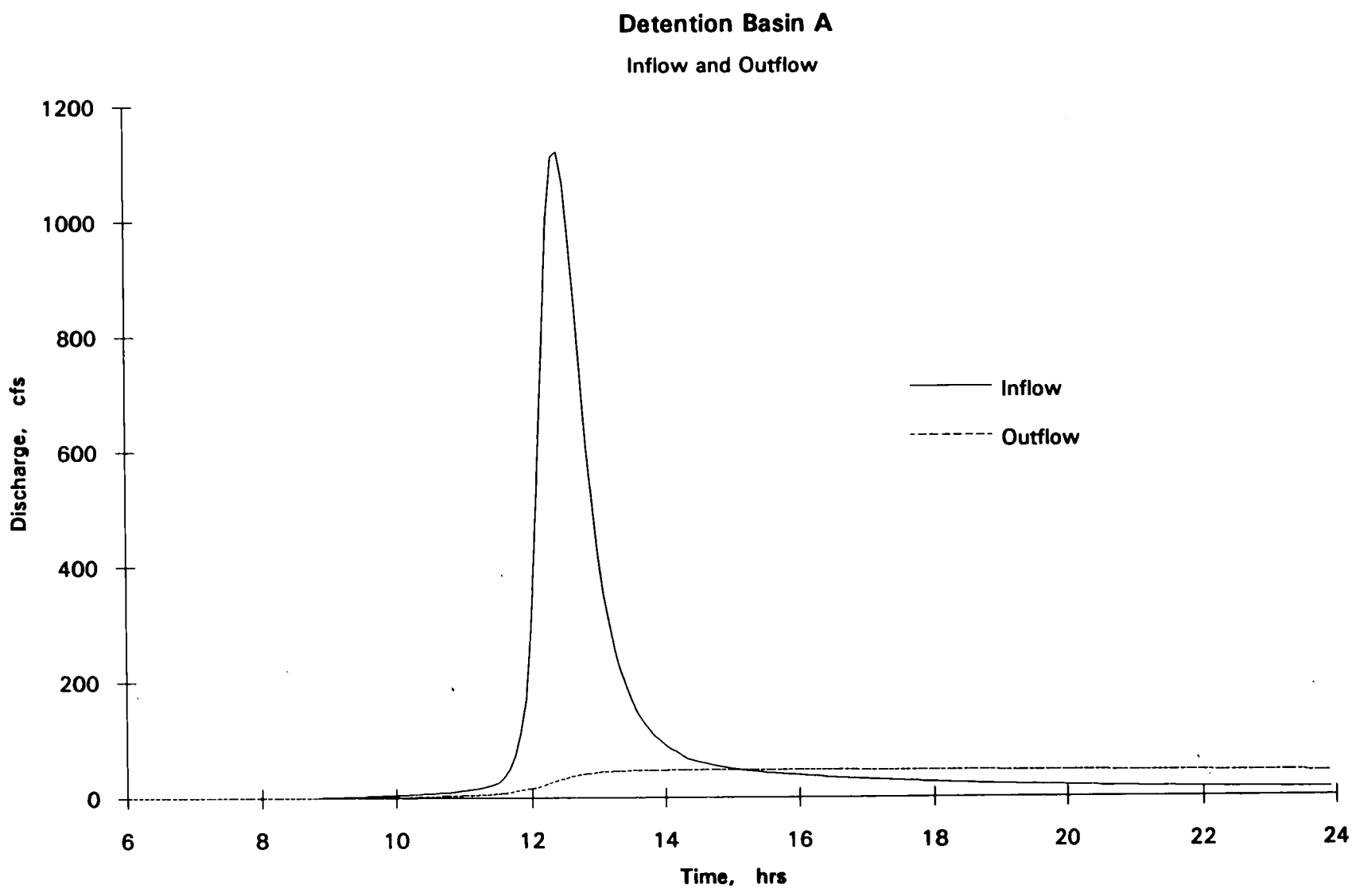
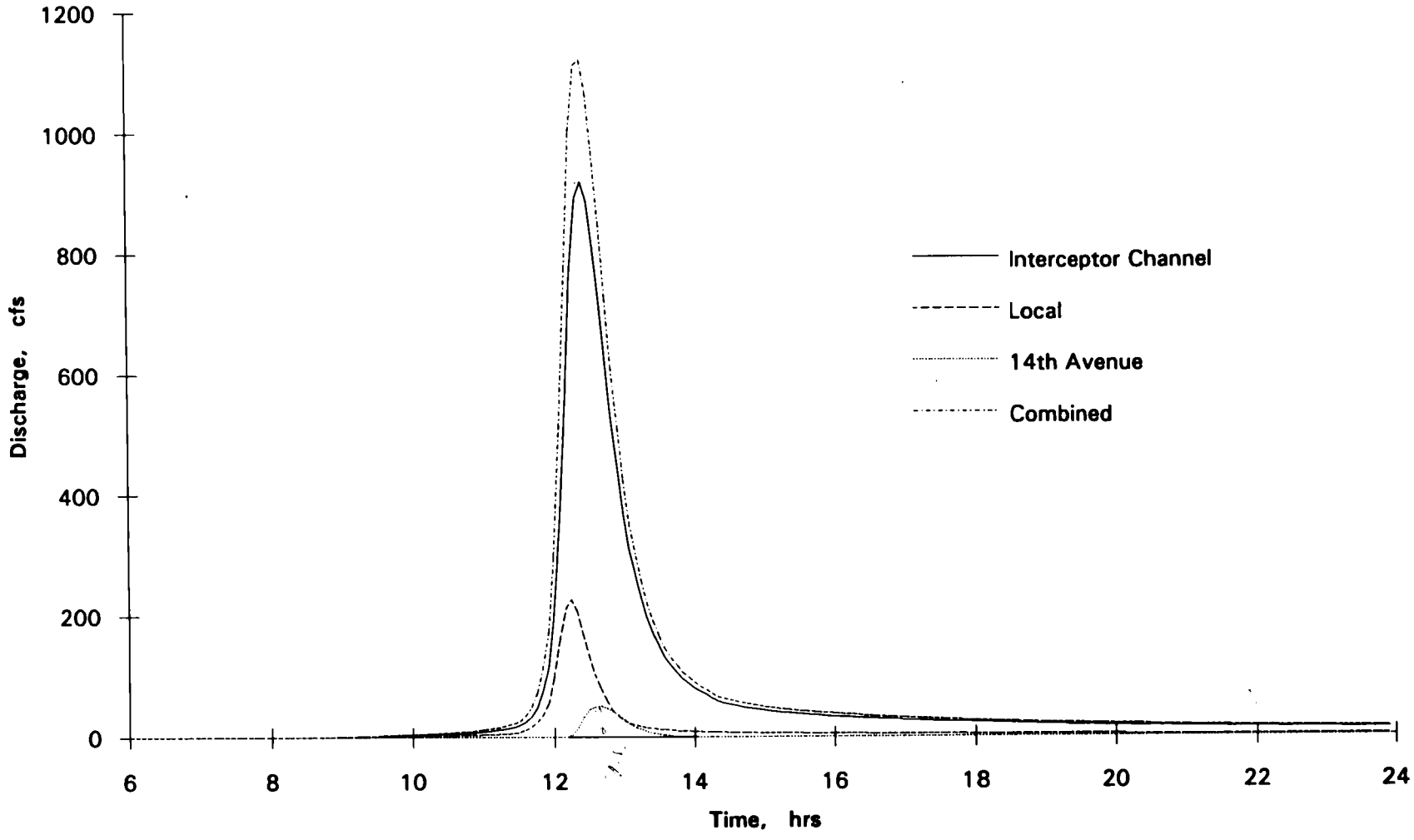
**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
  IBM-PC-XT VERSION AUGUST 1985
**************************************************
```

APPENDIX D

DETENTION BASIN A


Detention Basin A
Inflow and Outflow
1200
1000
800
600
400
200
0
Discharge, cfs
6
8
10
12
14
16
18
20
22
24
Time, hrs
Inflow
Outflow

Detention Basin A Inflows



Job:	Date
Calc by: JFM	2/22/94
Checked by: MBS	2/24/94
Dwg Chk:	

DETENTION BASIN A
Spillway - Basin Length

d1 is calculated from:

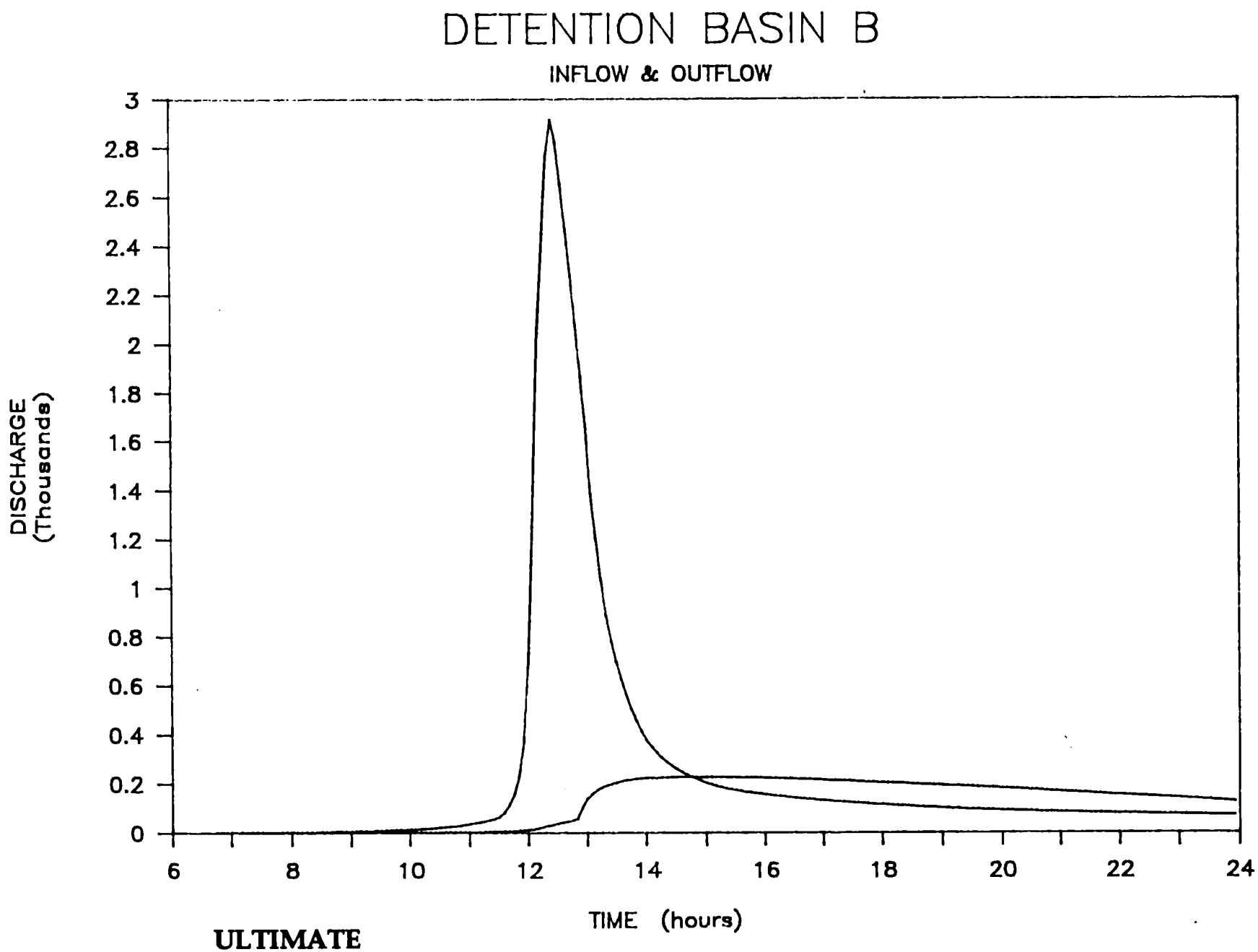
S = 0.5
W = 40'
n = 0.018
Z = 0

Inflow	Stage	Depth*	d1	Vel	Fr	d2	L/d2**	L
0	1392.0	0.0	0	0	0	0	0	0
116	1393.3	1.3	0.1654	17.54	7.60	1.70	6.12	10.4
199	1393.6	1.6	0.2289	21.74	8.01	2.48	6.12	15.2
349	1394.0	2.0	0.3212	27.16	8.45	3.68	6.12	22.5
560	1394.7	2.7	0.4275	32.75	8.83	5.13	6.12	31.4
772	1395.8	3.8	0.5192	37.17	9.09	6.42	6.12	39.3
893	1397.0	5.0	0.5671	39.36	9.21	7.11	6.12	43.5
919	1398.2	6.2	0.5771	39.81	9.24	7.26	6.12	44.4 ✓
887	1399.5	7.5	0.5648	39.26	9.21	7.08	6.12	43.3
816	1400.6	8.6	0.537	37.99	9.14	6.68	6.12	40.9
721	1401.6	9.6	0.4982	36.18	9.03	6.12	6.12	37.4
619	1402.5	10.5	0.4542	34.07	8.91	5.50	6.12	33.7
525	1403.2	11.2	0.4111	31.93	8.77	4.90	6.12	30.0
442	1403.8	11.8	0.3705	29.83	8.64	4.35	6.12	26.6
370	1404.3	12.3	0.3327	27.8	8.49	3.83	6.12	23.5
310	1404.7	12.7	0.299	25.92	8.35	3.38	6.12	20.7
265	1405.1	13.1	0.272	24.35	8.23	3.03	6.12	18.6
229	1405.3	13.3	0.2491	22.98	8.11	2.74	6.12	16.7

* add 1.75 foot to depth due to stilling basin inset
** from Chow, 1959 - Figure 15-4.

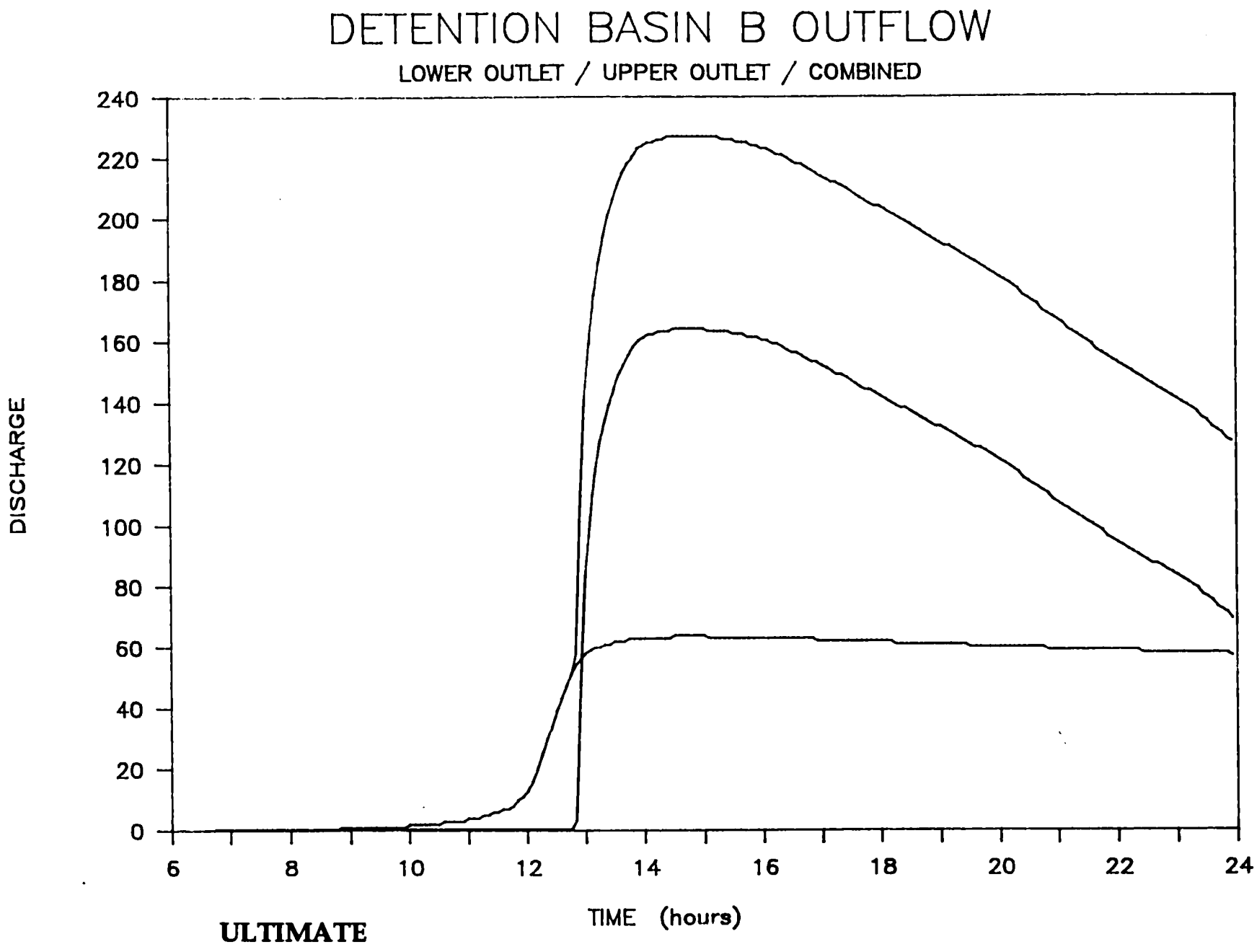
APPENDIX E

DETENTIN BASIN B



ULTIMATE

Taken From CRSS Report, July 1989



ULTIMATE

Taken From CRSS Report, July 1989

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*           SEPTEMBER 1990             *
*            VERSION 4.0               *
*                                      *
*  RUN DATE  04/26/1994  TIME  12:38:40 *
*                                      *
****************************************
```

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

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        OUTERLOOP HIGHWAY OFFSITE DRAINAGE    100 YEAR
  2           ID        23RD AVENUE TO 7TH AVENUE
  3           ID        MARCH 24, 1989                 FILE:  TRYB.DAT
  4           ID        ********************************************
  5           ID        BASIN B WITHOUT AN UPPER LEVEL OUTLET
  6           ID        BERM AROUND THE BASIN
  7           ID        ********************************************
              *DIAGRAM
  8           IT       5                    289
  9           IO       5

 10           KK    DA8B
 11           KM        RUNOFF FROM SUB-BASIN 8B
 12           BA    0.12
              *        100-year rainfall
 13           PH                  0.68    1.37    2.40    2.65    2.82    3.14    3.51    3.90
              *       50-year rainfall
              * PH                0.61    1.22    2.16    2.38    2.52    2.80    3.13    3.
 14           LS             89
 15           UD    0.18

 16           KK    RT8B
 17           KM        ROUTE 8B TO ROSE GARDEN
 18           RK    1350  0.0046   0.035           TRAP       0      20

 19           KK    DA8C
 20           KM        RUNOFF FROM SUB-BASIN 8C
 21           BA    0.21
 22           LS             80
 23           UD    0.35

 24           KK    CB8C
 25           KM        COMBINE ROUTED 8B WITH 8C
 26           HC       2

 27           KK    DV8C
 28           KM        DIVERT FLOWS SOUTH ON 7TH AVENUE
 29           DT   DVT01
 30           DI       0     100     500    1000    2000
 31           DQ       0     100     416     778    1486

 32           KK    RT8C
 33           KM        ROUTE REMAINING FLOW WEST ON ROSE GARDEN
 34           RK    1000  0.0042   0.030           TRAP       8       2

 35           KK    DA8A
 36           KM        RUNOFF FROM SUB-BASIN 8A
 37           BA    0.67
 38           LS             80
 39           UD    0.50
```

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

  40          KK    RT8A
  41          KM        ROUTE 8A TO CULVERT BELOW DEER VALLEY AIRPORT
  42          RK    3900  0.0042   0.030           TRAP       8       2

  43          KK    DA9A
  44          KM        RUNOFF FROM SUB-BASIN 9A
  45          BA    0.39
  46          LS              80
  47          UD    0.31

  48          KK    RT9A
  49          KM        ROUTE 9A THROUGH CAP STRUCTURE
  50          RS       1    STOR      -1       0
  51          SV       0      12      55     173     318     493     697     930
  52          SE    1515    1516    1517    1518    1519    1520    1521    1522
  53          SL    1515     4.9     0.7     0.5
  54          SS    1521     100     3.0     1.5

  55          KK  RT9ACP
  56          KM        ROUTE 9A CAP RUNOFF THROUGH 9B
  57          RK    8200  0.0067   0.035           TRAP      12       2

  58          KK    DA9B
  59          KM        RUNOFF FROM SUB-BASIN 9B
  60          BA    0.58
  61          LS              80
  62          UD    0.52

  63          KK    CB9B
  64          KM        COMBINE ROUTED 9A WITH 9B RUNOFF
  65          HC       2

  66          KK    RT9B
  67          KM        ROUTE 9B TO THE CULVERT BELOW DEER VALLEY AIRPORT
  68          RK    2250  0.0046   0.024           CIRC    4.50

  69          KK    DA9C
  70          KM        RUNOFF FROM SUB-BASIN 9C
  71          BA    0.21
  72          LS              96
  73          UD    0.19

  74          KK    CB9C
  75          KM        COMBINE ROUTED 8A AND 9B WITH 9C
  76          HC       3

  77          KK    RT9C
  78          KM        ROUTE 9C TO ROSE GARDEN
  79          RK    2750  0.0067   0.045           TRAP      30       2
```

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

  80          KK    DA9D
  81          KM        RUNOFF FROM SUB-BASIN 9D
  82          BA    0.15
  83          LS              83
  84          UD    0.26

  85          KK    CB9D
  86          KM        COMBINE ROUTED 8C,AND 9B WITH 9D
  87          HC       3

  88          KK   DV9D1
  89          KM        DIVERT FLOWS SOUTH ON 14TH AVENUE
  90          DT   DVT02
  91          DI       0     300     500    1000    2000
  92          DQ       0       0       1      16      78

  93          KK   RT9D1
  94          KM        ROUTE REMAINING FLOW WEST ON ROSE GARDEN
  95          RK    1400  0.0042   0.030           TRAP       8      20

  96          KK   DV9D2
  97          KM        DIVERT FLOWS SOUTH ON 15TH AVENUE
  98          DT   DVT03
  99          DI       0     100     250     350     499     984    1922
 100          DQ       0      12      50      76     112     201     343

 101          KK   RT9D2
 102          KM        ROUTE THE REMAINING FLOW WEST TO 19TH AVENUE
 103          RK    2100  0.0042   0.030           TRAP       8      20

 104          KK    DA9F
 105          KM        RUNOFF FROM SUB-BASIN 9F
 106          BA    0.17
 107          LS              80
 108          UD    0.32

 109          KK    RT9F
 110          KM        ROUTE 9F TO DEER VALLEY CULVERT
 111          RK    1200  0.0046   0.016           TRAP       0      50

 112          KK    DA9G
 113          KM        RUNOFF FROM SUB-BASIN 9G
 114          BA    0.30
 115          LS              87
 116          UD    0.30

 117          KK    CB9G
 118          KM        COMBINE ROUTED 9F WITH 9G
 119          HC       2
```

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

 120          KK    RT9G
 121          KM        ROUTE 9G SOUTH TO ROSE GARDEN
 122          RK    2650  0.0046   0.016           TRAP       0      50

 123          KK    DA9H
 124          KM        RUNOFF FROM SUB-BASIN 9H
 125          BA    0.36
 126          LS             89
 127          UD    0.24

 128          KK    CB9H
 129          KM        COMBINE ROUTED 9D2 AND 9G WITH 9H
 130          HC       3

 131          KK    RT9H
 132          KM        ROUTE 9H SOUTH TO DETENTION* BASIN B
 133          RK    2600  0.0046   0.016           TRAP       0      50

 134          KK   RN9D2
 135          KM        RETRIEVE DIVERSION FROM ROSE GARDEN AND 15TH AVENUE
 136          DR   DVT03

 137          KK  RRN9D2
 138          KM        ROUTE RN9D2
 139          RK    2400  0.0045   0.016           TRAP       0      50

 140          KK    DA9E
 141          KM        RUNOFF FROM SUB-BASIN 9E
 142          BA    0.19
 143          LS             87
 144          UD    0.19

 145          KK    CM9E
 146          KM        COMBINE ROUTED RN9D2 AND 9E
 147          HC       2

 148          KK    RT9E
 149          KM        ROUTE 9E TO DETENTION* BASIN B
 150          RK    1300  0.0067   0.035           TRAP       8       2

 151          KK    DA9I
 152          KM        RUNOFF FROM SUB-BASIN 9I INTO DETENTION* BASIN B
 153          BA    0.16
 154          LS             80
 155          UD    0.22

 156          KK    CB9I
 157          KM        COMBINE ROUTED 9H AND 9E WITH 9I
 158          KO       I
 159          HC       3
```

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


 160          KK     DBB
 161          KM        ROUTE FLOWS THROUGH BASIN B, DUEL-STAGE OUTLET
 162          KM        NO UPPER LEVEL OUTLET
 163          KM        PER FCD ALTERNATIVE
 164          KO       1
 165          RS       1    STOR      -1       0
 166          SV       0     8.2    29.8    64.1   106.3   168.1   179.8   192.6   212.9   242.0
 167          SV   268.5   315.0   340.8
              * SQ     0      10      20      30      40      54      96     138     180       2
              * SQ   247     337
 168          SE  1367.5  1369.4  1371.7  1375.2  1379.5  1385.8  1387.0  1388.3  1390.0  1392.3
 169          SE  1394.4  1398.0  1400.0
 170          SL  1368.0    2.64    0.61     0.5
 171          SS  1398.0    200.     3.0     1.5
 172          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

   10       DA8B
               V
               V
   16       RT8B
               .
               .
   19          .        DA8C
               .           .
               .           .
   24       CB8C............
               .
               .
   29          .-------->   DVT01
   27       DV8C
               V
               V
   32       RT8C
               .
               .
   35          .        DA8A
               .           V
               .           V
   40          .        RT8A
               .           .
               .           .
   43          .           .        DA9A
               .           .           V
               .           .           V
   48          .           .        RT9A
               .           .           V
               .           .           V
   55          .           .      RT9ACP
               .           .           .
               .           .           .
   58          .           .           .        DA9B
               .           .           .           .
               .           .           .           .
   63          .           .        CB9B............
               .           .           V
               .           .           V
   66          .           .        RT9B
               .           .           .
               .           .           .
   69          .           .           .        DA9C
               .           .           .           .
               .           .           .           .
   74          .        CB9C........................
               .           V
               .           V
   77          .        RT9C
               .           .
               .           .
   80          .           .        DA9D
               .           .           .
               .           .           .
   85       CB9D........................
               .
```

```
 88      DV9D1
            V
            V
 93      RT9D1
            .
            .
 98         .-------> DVT03
 96      DV9D2
            V
            V
101      RT9D2
            .
            .
104         .       DA9F
            .          V
            .          V
109         .       RT9F
            .          .
            .          .
112         .          .       DA9G
            .          .          .
            .          .          .
117         .       CB9G............
            .          V
            .          V
120         .       RT9G
            .          .
            .          .
123         .          .       DA9H
            .          .          .
            .          .          .
128      CB9H......................
            V
            V
131      RT9H
            .
            .
136         .          .<-------  DVT03
134         .      RN9D2
            .          V
            .          V
137         .     RRN9D2
            .          .
            .          .
140         .          .       DA9E
            .          .          .
            .          .          .
145         .       CM9E............
            .          V
            .          V
148         .       RT9E
            .          .
            .          .
151         .          .       DA9I
            .          .          .
            .          .          .
156      CB9I......................
            V
            V
160       DBB
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*          SEPTEMBER 1990              *
*           VERSION 4.0                *
*                                      *
*  RUN DATE  04/26/1994  TIME  12:38:40 *
*                                      *
****************************************
```

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

```
                    OUTERLOOP HIGHWAY OFFSITE DRAINAGE    100 YEAR
                    23RD AVENUE TO 7TH AVENUE
                    MARCH 24, 1989                FILE:  TRYB.DAT
                    ********************************************
                    BASIN B WITHOUT AN UPPER LEVEL OUTLET
                    BERM AROUND THE BASIN
                    ********************************************

  9 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      1    0  STARTING DATE
                   ITIME        0000  STARTING TIME
                      NQ        289  NUMBER OF HYDROGRAPH ORDINATES
                  NDDATE      2    0  ENDING DATE
                  NDTIME        0000  ENDING TIME
                  ICENT          19  CENTURY MARK

              COMPUTATION INTERVAL     .08 HOURS
                   TOTAL TIME BASE   24.00 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


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


          **************
          *            *
156 KK    *     CB9I   *
          *            *
          **************

158 KO        OUTPUT CONTROL VARIABLES
                   IPRNT          1  PRINT CONTROL
                   IPLOT          0  PLOT CONTROL
                   QSCAL         0.  HYDROGRAPH PLOT SCALE
```

***

HYDROGRAPH AT STATION CB9I
SUM OF 3 HYDROGRAPHS

DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
1		0000	1	0.	1		0605	74	0.	1		1210	147	1247.	1		1815	220	111.
1		0005	2	0.	1		0610	75	0.	1		1215	148	1921.	1		1820	221	110.
1		0010	3	0.	1		0615	76	0.	1		1220	149	2542.	1		1825	222	108.
1		0015	4	0.	1		0620	77	1.	1		1225	150	2922.	1		1830	223	107.
1		0020	5	0.	1		0625	78	1.	1		1230	151	2993.	1		1835	224	106.
1		0025	6	0.	1		0630	79	1.	1		1235	152	2878.	1		1840	225	105.
1		0030	7	0.	1		0635	80	1.	1		1240	153	2681.	1		1845	226	103.
1		0035	8	0.	1		0640	81	1.	1		1245	154	2451.	1		1850	227	102.
1		0040	9	0.	1		0645	82	1.	1		1250	155	2212.	1		1855	228	101.
1		0045	10	0.	1		0650	83	1.	1		1255	156	1972.	1		1900	229	100.
1		0050	11	0.	1		0655	84	2.	1		1300	157	1738.	1		1905	230	99.
1		0055	12	0.	1		0700	85	2.	1		1305	158	1521.	1		1910	231	98.
1		0100	13	0.	1		0705	86	2.	1		1310	159	1322.	1		1915	232	97.
1		0105	14	0.	1		0710	87	2.	1		1315	160	1149.	1		1920	233	96.
1		0110	15	0.	1		0715	88	2.	1		1320	161	1002.	1		1925	234	95.
1		0115	16	0.	1		0720	89	2.	1		1325	162	876.	1		1930	235	95.
1		0120	17	0.	1		0725	90	2.	1		1330	163	770.	1		1935	236	94.
1		0125	18	0.	1		0730	91	2.	1		1335	164	680.	1		1940	237	93.
1		0130	19	0.	1		0735	92	2.	1		1340	165	605.	1		1945	238	92.
1		0135	20	0.	1		0740	93	3.	1		1345	166	540.	1		1950	239	92.
1		0140	21	0.	1		0745	94	3.	1		1350	167	487.	1		1955	240	91.
1		0145	22	0.	1		0750	95	3.	1		1355	168	442.	1		2000	241	90.
1		0150	23	0.	1		0755	96	3.	1		1400	169	404.	1		2005	242	90.
1		0155	24	0.	1		0800	97	4.	1		1405	170	372.	1		2010	243	89.
1		0200	25	0.	1		0805	98	4.	1		1410	171	345.	1		2015	244	88.
1		0205	26	0.	1		0810	99	4.	1		1415	172	321.	1		2020	245	88.
1		0210	27	0.	1		0815	100	4.	1		1420	173	301.	1		2025	246	87.
1		0215	28	0.	1		0820	101	5.	1		1425	174	284.	1		2030	247	87.
1		0220	29	0.	1		0825	102	5.	1		1430	175	268.	1		2035	248	86.
1		0225	30	0.	1		0830	103	5.	1		1435	176	255.	1		2040	249	85.
1		0230	31	0.	1		0835	104	6.	1		1440	177	243.	1		2045	250	85.
1		0235	32	0.	1		0840	105	6.	1		1445	178	233.	1		2050	251	84.
1		0240	33	0.	1		0845	106	6.	1		1450	179	223.	1		2055	252	84.
1		0245	34	0.	1		0850	107	7.	1		1455	180	215.	1		2100	253	83.
1		0250	35	0.	1		0855	108	7.	1		1500	181	207.	1		2105	254	83.
1		0255	36	0.	1		0900	109	8.	1		1505	182	200.	1		2110	255	82.
1		0300	37	0.	1		0905	110	8.	1		1510	183	194.	1		2115	256	82.
1		0305	38	0.	1		0910	111	9.	1		1515	184	188.	1		2120	257	81.
1		0310	39	0.	1		0915	112	9.	1		1520	185	183.	1		2125	258	81.
1		0315	40	0.	1		0920	113	10.	1		1525	186	178.	1		2130	259	80.
1		0320	41	0.	1		0925	114	10.	1		1530	187	174.	1		2135	260	80.
1		0325	42	0.	1		0930	115	11.	1		1535	188	171.	1		2140	261	80.
1		0330	43	0.	1		0935	116	12.	1		1540	189	167.	1		2145	262	79.
1		0335	44	0.	1		0940	117	13.	1		1545	190	164.	1		2150	263	79.
1		0340	45	0.	1		0945	118	13.	1		1550	191	161.	1		2155	264	78.
1		0345	46	0.	1		0950	119	14.	1		1555	192	159.	1		2200	265	78.
1		0350	47	0.	1		0955	120	15.	1		1600	193	156.	1		2205	266	77.
1		0355	48	0.	1		1000	121	16.	1		1605	194	153.	1		2210	267	77.
1		0400	49	0.	1		1005	122	17.	1		1610	195	151.	1		2215	268	77.
1		0405	50	0.	1		1010	123	18.	1		1615	196	149.	1		2220	269	76.
1		0410	51	0.	1		1015	124	19.	1		1620	197	146.	1		2225	270	76.
1		0415	52	0.	1		1020	125	20.	1		1625	198	144.	1		2230	271	75.
1		[illegible]	53	0.	1		1025	126	22.	1		1630	199	142.	1		2235	272	75.

1	0430	55	0.	*	1	1035	128	25.	*	1	1640	201	138.	*	1	2245	274	74.
1	0435	56	0.	*	1	1040	129	27.	*	1	1645	202	136.	*	1	2250	275	74.
1	0440	57	0.	*	1	1045	130	29.	*	1	1650	203	135.	*	1	2255	276	74.
1	0445	58	0.	*	1	1050	131	31.	*	1	1655	204	133.	*	1	2300	277	73.
1	0450	59	0.	*	1	1055	132	33.	*	1	1700	205	131.	*	1	2305	278	73.
1	0455	60	0.	*	1	1100	133	36.	*	1	1705	206	129.	*	1	2310	279	72.
1	0500	61	0.	*	1	1105	134	39.	*	1	1710	207	128.	*	1	2315	280	72.
1	0505	62	0.	*	1	1110	135	43.	*	1	1715	208	126.	*	1	2320	281	72.
1	0510	63	0.	*	1	1115	136	46.	*	1	1720	209	125.	*	1	2325	282	71.
1	0515	64	0.	*	1	1120	137	51.	*	1	1725	210	123.	*	1	2330	283	71.
1	0520	65	0.	*	1	1125	138	56.	*	1	1730	211	122.	*	1	2335	284	71.
1	0525	66	0.	*	1	1130	139	62.	*	1	1735	212	121.	*	1	2340	285	71.
1	0530	67	0.	*	1	1135	140	70.	*	1	1740	213	119.	*	1	2345	286	70.
1	0535	68	0.	*	1	1140	141	86.	*	1	1745	214	118.	*	1	2350	287	70.
1	0540	69	0.	*	1	1145	142	117.	*	1	1750	215	117.	*	1	2355	288	70.
1	0545	70	0.	*	1	1150	143	168.	*	1	1755	216	116.	*	2	0000	289	69.
1	0550	71	0.	*	1	1155	144	250.	*	1	1800	217	114.	*				
1	0555	72	0.	*	1	1200	145	391.	*	1	1805	218	113.	*				
1	0600	73	0.	*	1	1205	146	700.	*	1	1810	219	112.	*				
				*					*					*				

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PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.00-HR
2993.	12.50	(CFS)	626.	183.	183.	183.
		(INCHES)	1.657	1.936	1.936	1.936
		(AC-FT)	310.	362.	362.	362.

CUMULATIVE AREA = 3.51 SQ MI

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          *            *
160 KK    *      DBB   *
          *            *
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164 KO OUTPUT CONTROL VARIABLES

IPRNT	1	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

HYDROGRAPH ROUTING DATA

165 RS STORAGE ROUTING

NSTPS	1	NUMBER OF SUBREACHES
ITYP	STOR	TYPE OF INITIAL CONDITION
RSVRIC	-1.00	INITIAL CONDITION
X	.00	WORKING R AND D COEFFICIENT

166 SV	STORAGE	.0	8.2	29.8	64.1	106.3	168.1	179.8	192.6	212.9	242.0
		268.5	315.0	340.8							
168 SE	ELEVATION	1367.50	1369.40	1371.70	1375.20	1379.50	1385.80	1387.00	1388.30	1390.00	1392.30
		1394.40	1398.00	1400.00							

170 SL LOW-LEVEL OUTLET

ELEVL	1368.00	ELEVATION AT CENTER OF OUTLET
CAREA	2.64	CROSS-SECTIONAL AREA

171 SS SPILLWAY

CREL	1398.00	SPILLWAY CREST ELEVATION
SPWID	200.00	SPILLWAY WIDTH
COQW	3.00	WEIR COEFFICIENT
EXPW	1.50	EXPONENT OF HEAD

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COMPUTED OUTFLOW-ELEVATION DATA

OUTFLOW	.00	.00	12.70	14.39	16.59	19.59	23.91	30.68	42.80	70.74
ELEVATION	1367.50	1368.00	1368.97	1369.24	1369.65	1370.30	1371.43	1373.64	1378.98	1398.00
OUTFLOW	72.51	84.56	117.07	180.20	284.08	438.87	654.72	941.78	1310.19	1770.12
ELEVATION	1398.02	1398.08	1398.18	1398.32	1398.50	1398.72	1398.98	1399.28	1399.62	1400.00

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	.00	2.16	6.33	7.51	8.20	10.55	16.66	27.25	29.80	48.86
OUTFLOW	.00	.00	12.70	14.39	15.28	16.59	19.59	23.91	24.84	30.68
ELEVATION	1367.50	1368.00	1368.97	1369.24	1369.40	1369.65	1370.30	1371.43	1371.70	1373.64
STORAGE	64.10	101.23	106.30	168.10	179.80	192.60	212.90	242.00	268.50	315.00
OUTFLOW	34.66	42.80	43.80	54.49	56.30	58.19	60.58	63.67	66.36	70.74
ELEVATION	1375.20	1378.98	1379.50	1385.80	1387.00	1388.30	1390.00	1392.30	1394.40	1398.00
STORAGE	315.26	316.04	317.33	319.14	321.46	324.30	327.65	331.52	335.90	340.80
OUTFLOW	72.51	84.56	117.07	180.20	284.08	438.87	654.72	941.78	1310.19	1770.12
ELEVATION	1398.02	1398.08	1398.18	1398.32	1398.50	1398.72	1398.98	1399.28	1399.62	1400.00

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HYDROGRAPH AT STATION DBB

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DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0000	1	0.	2.2	1368.0	1		0805	98	1.	2.4	1368.1	1		1610	195	67.	280.1	1395.3
1		0005	2	0.	2.2	1368.0	1		0810	99	1.	2.4	1368.1	1		1615	196	68.	280.7	1395.3
1		0010	3	0.	2.2	1368.0	1		0815	100	1.	2.5	1368.1	1		1620	197	68.	281.3	1395.4
1		0015	4	0.	2.2	1368.0	1		0820	101	1.	2.5	1368.1	1		1625	198	68.	281.8	1395.4
1		0020	5	0.	2.2	1368.0	1		0825	102	1.	2.5	1368.1	1		1630	199	68.	282.3	1395.5
1		0025	6	0.	2.2	1368.0	1		0830	103	1.	2.5	1368.1	1		1635	200	68.	282.8	1395.5
1		0030	7	0.	2.2	1368.0	1		0835	104	1.	2.6	1368.1	1		1640	201	68.	283.3	1395.5
1		0035	8	0.	2.2	1368.0	1		0840	105	1.	2.6	1368.1	1		1645	202	68.	283.8	1395.6
1		0040	9	0.	2.2	1368.0	1		0845	106	1.	2.6	1368.1	1		1650	203	68.	284.3	1395.6
1		0045	10	0.	2.2	1368.0	1		0850	107	2.	2.7	1368.1	1		1655	204	68.	284.7	1395.7
1		0050	11	0.	2.2	1368.0	1		0855	108	2.	2.7	1368.1	1		1700	205	68.	285.2	1395.7
1		0055	12	0.	2.2	1368.0	1		0900	109	2.	2.7	1368.1	1		1705	206	68.	285.6	1395.7
1		0100	13	0.	2.2	1368.0	1		0905	110	2.	2.8	1368.1	1		1710	207	68.	286.0	1395.8
1		0105	14	0.	2.2	1368.0	1		0910	111	2.	2.8	1368.2	1		1715	208	68.	286.4	1395.8
1		0110	15	0.	2.2	1368.0	1		0915	112	2.	2.9	1368.2	1		1720	209	68.	286.8	1395.8
1		0115	16	0.	2.2	1368.0	1		0920	113	2.	2.9	1368.2	1		1725	210	68.	287.2	1395.8
1		0120	17	0.	2.2	1368.0	1		0925	114	2.	3.0	1368.2	1		1730	211	68.	287.6	1395.9
1		0125	18	0.	2.2	1368.0	1		0930	115	3.	3.0	1368.2	1		1735	212	68.	287.9	1395.9
1		0130	19	0.	2.2	1368.0	1		0935	116	3.	3.1	1368.2	1		1740	213	68.	288.3	1395.9
1		0135	20	0.	2.2	1368.0	1		0940	117	3.	3.1	1368.2	1		1745	214	68.	288.6	1396.0
1		0140	21	0.	2.2	1368.0	1		0945	118	3.	3.2	1368.2	1		1750	215	68.	289.0	1396.0
1		0145	22	0.	2.2	1368.0	1		0950	119	3.	3.3	1368.3	1		1755	216	68.	289.3	1396.0
1		0150	23	0.	2.2	1368.0	1		0955	120	4.	3.4	1368.3	1		1800	217	68.	289.6	1396.0
1		0155	24	0.	2.2	1368.0	1		1000	121	4.	3.4	1368.3	1		1805	218	68.	289.9	1396.1

1	0205	26	0.	2.2	1368.0	*	1	1010	123	4.	3.6	1368.3	*	1	1815	220	68.	290.5	1396.1
1	0210	27	0.	2.2	1368.0	*	1	1015	124	5.	3.7	1368.4	*	1	1820	221	68.	290.8	1396.1
1	0215	28	0.	2.2	1368.0	*	1	1020	125	5.	3.8	1368.4	*	1	1825	222	68.	291.1	1396.2
1	0220	29	0.	2.2	1368.0	*	1	1025	126	5.	3.9	1368.4	*	1	1830	223	69.	291.4	1396.2
1	0225	30	0.	2.2	1368.0	*	1	1030	127	6.	4.0	1368.4	*	1	1835	224	69.	291.6	1396.2
1	0230	31	0.	2.2	1368.0	*	1	1035	128	6.	4.2	1368.5	*	1	1840	225	69.	291.9	1396.2
1	0235	32	0.	2.2	1368.0	*	1	1040	129	7.	4.3	1368.5	*	1	1845	226	69.	292.1	1396.2
1	0240	33	0.	2.2	1368.0	*	1	1045	130	7.	4.4	1368.5	*	1	1850	227	69.	292.4	1396.2
1	0245	34	0.	2.2	1368.0	*	1	1050	131	7.	4.6	1368.6	*	1	1855	228	69.	292.6	1396.3
1	0250	35	0.	2.2	1368.0	*	1	1055	132	8.	4.8	1368.6	*	1	1900	229	69.	292.8	1396.3
1	0255	36	0.	2.2	1368.0	*	1	1100	133	8.	4.9	1368.6	*	1	1905	230	69.	293.0	1396.3
1	0300	37	0.	2.2	1368.0	*	1	1105	134	9.	5.1	1368.7	*	1	1910	231	69.	293.2	1396.3
1	0305	38	0.	2.2	1368.0	*	1	1110	135	10.	5.4	1368.7	*	1	1915	232	69.	293.4	1396.3
1	0310	39	0.	2.2	1368.0	*	1	1115	136	10.	5.6	1368.8	*	1	1920	233	69.	293.6	1396.3
1	0315	40	0.	2.2	1368.0	*	1	1120	137	11.	5.9	1368.9	*	1	1925	234	69.	293.8	1396.4
1	0320	41	0.	2.2	1368.0	*	1	1125	138	12.	6.1	1368.9	*	1	1930	235	69.	294.0	1396.4
1	0325	42	0.	2.2	1368.0	*	1	1130	139	13.	6.5	1369.0	*	1	1935	236	69.	294.2	1396.4
1	0330	43	0.	2.2	1368.0	*	1	1135	140	13.	6.8	1369.1	*	1	1940	237	69.	294.3	1396.4
1	0335	44	0.	2.2	1368.0	*	1	1140	141	14.	7.3	1369.2	*	1	1945	238	69.	294.5	1396.4
1	0340	45	0.	2.2	1368.0	*	1	1145	142	15.	7.9	1369.3	*	1	1950	239	69.	294.7	1396.4
1	0345	46	0.	2.2	1368.0	*	1	1150	143	16.	8.7	1369.5	*	1	1955	240	69.	294.8	1396.4
1	0350	47	0.	2.2	1368.0	*	1	1155	144	16.	10.1	1369.6	*	1	2000	241	69.	295.0	1396.4
1	0355	48	0.	2.2	1368.0	*	1	1200	145	17.	12.2	1369.8	*	1	2005	242	69.	295.1	1396.5
1	0400	49	0.	2.2	1368.0	*	1	1205	146	19.	15.8	1370.2	*	1	2010	243	69.	295.3	1396.5
1	0405	50	0.	2.2	1368.0	*	1	1210	147	22.	22.4	1370.9	*	1	2015	244	69.	295.4	1396.5
1	0410	51	0.	2.2	1368.0	*	1	1215	148	26.	33.1	1372.0	*	1	2020	245	69.	295.5	1396.5
1	0415	52	0.	2.2	1368.0	*	1	1220	149	31.	48.3	1373.6	*	1	2025	246	69.	295.6	1396.5
1	0420	53	0.	2.2	1368.0	*	1	1225	150	35.	66.9	1375.5	*	1	2030	247	69.	295.8	1396.5
1	0425	54	0.	2.2	1368.0	*	1	1230	151	40.	87.0	1377.5	*	1	2035	248	69.	295.9	1396.5
1	0430	55	0.	2.2	1368.0	*	1	1235	152	44.	106.9	1379.6	*	1	2040	249	69.	296.0	1396.5
1	0435	56	0.	2.2	1368.0	*	1	1240	153	47.	125.7	1381.5	*	1	2045	250	69.	296.1	1396.5
1	0440	57	0.	2.2	1368.0	*	1	1245	154	50.	143.1	1383.2	*	1	2050	251	69.	296.2	1396.5
1	0445	58	0.	2.2	1368.0	*	1	1250	155	53.	158.8	1384.8	*	1	2055	252	69.	296.3	1396.6
1	0450	59	0.	2.2	1368.0	*	1	1255	156	55.	172.8	1386.3	*	1	2100	253	69.	296.4	1396.6
1	0455	60	0.	2.2	1368.0	*	1	1300	157	57.	185.2	1387.5	*	1	2105	254	69.	296.5	1396.6
1	0500	61	0.	2.2	1368.0	*	1	1305	158	59.	196.0	1388.6	*	1	2110	255	69.	296.6	1396.6
1	0505	62	0.	2.2	1368.0	*	1	1310	159	60.	205.4	1389.4	*	1	2115	256	69.	296.7	1396.6
1	0510	63	0.	2.2	1368.0	*	1	1315	160	61.	213.5	1390.0	*	1	2120	257	69.	296.8	1396.6
1	0515	64	0.	2.2	1368.0	*	1	1320	161	61.	220.5	1390.6	*	1	2125	258	69.	296.9	1396.6
1	0520	65	0.	2.2	1368.0	*	1	1325	162	62.	226.5	1391.1	*	1	2130	259	69.	297.0	1396.6
1	0525	66	0.	2.2	1368.0	*	1	1330	163	63.	231.8	1391.5	*	1	2135	260	69.	297.0	1396.6
1	0530	67	0.	2.2	1368.0	*	1	1335	164	63.	236.3	1391.9	*	1	2140	261	69.	297.1	1396.6
1	0535	68	0.	2.2	1368.0	*	1	1340	165	63.	240.3	1392.2	*	1	2145	262	69.	297.2	1396.6
1	0540	69	0.	2.2	1368.0	*	1	1345	166	64.	243.8	1392.4	*	1	2150	263	69.	297.2	1396.6
1	0545	70	0.	2.2	1368.0	*	1	1350	167	64.	246.9	1392.7	*	1	2155	264	69.	297.3	1396.6
1	0550	71	0.	2.2	1368.0	*	1	1355	168	64.	249.7	1392.9	*	1	2200	265	69.	297.4	1396.6
1	0555	72	0.	2.2	1368.0	*	1	1400	169	65.	252.1	1393.1	*	1	2205	266	69.	297.4	1396.6
1	0600	73	0.	2.2	1368.0	*	1	1405	170	65.	254.4	1393.3	*	1	2210	267	69.	297.5	1396.6
1	0605	74	0.	2.2	1368.0	*	1	1410	171	65.	256.4	1393.4	*	1	2215	268	69.	297.5	1396.6
1	0610	75	0.	2.2	1368.0	*	1	1415	172	65.	258.2	1393.6	*	1	2220	269	69.	297.6	1396.7
1	0615	76	0.	2.2	1368.0	*	1	1420	173	65.	259.9	1393.7	*	1	2225	270	69.	297.6	1396.7
1	0620	77	0.	2.2	1368.0	*	1	1425	174	66.	261.5	1393.8	*	1	2230	271	69.	297.7	1396.7
1	0625	78	0.	2.2	1368.0	*	1	1430	175	66.	262.9	1394.0	*	1	2235	272	69.	297.7	1396.7
1	0630	79	0.	2.2	1368.0	*	1	1435	176	66.	264.3	1394.1	*	1	2240	273	69.	297.8	1396.7
1	0635	80	0.	2.2	1368.0	*	1	1440	177	66.	265.5	1394.2	*	1	2245	274	69.	297.8	1396.7
1	0640	81	0.	2.2	1368.0	*	1	1445	178	66.	266.7	1394.3	*	1	2250	275	69.	297.8	1396.7
1	0645	82	0.	2.2	1368.0	*	1	1450	179	66.	267.8	1394.3	*	1	2255	276	69.	297.9	1396.7
1	0650	83	0.	2.2	1368.0	*	1	1455	180	66.	268.9	1394.4	*	1	2300	277	69.	297.9	1396.7
1	0655	84	0.	2.2	1368.0	*	1	1500	181	66.	269.9	1394.5	*	1	2305	278	69.	297.9	1396.7
1	0700	85	0.	2.2	1368.0	*	1	1505	182	67.	270.8	1394.6	*	1	2310	279	69.	297.9	1396.7
1	0705	86	0.	2.2	1368.0	*	1	1510	183	67.	271.7	1394.7	*	1	2315	280	69.	298.0	1396.7
1	0710	87	0.	2.2	1368.0	*	1	1515	184	67.	272.6	1394.7	*	1	2320	281	69.	298.0	1396.7
1	0715	88	0.	2.3	1368.0	*	1	1520	185	67.	273.4	1394.8	*	1	2325	282	69.	298.0	1396.7
1	0720	89	0.	2.3	1368.0	*	1	1525	186	67.	274.2	1394.8	*	1	2330	283	69.	298.0	1396.7
1	0725	90	0.	2.3	1368.0	*	1	1530	187	67.	274.9	1394.9	*	1	2335	284	69.	298.0	1396.7

1	0735	92	0.	2.3	1368.0	*	1	1540	189	67.	276.4	1395.0	*	1	2345	286	69.	298.1	1396.7
1	0740	93	0.	2.3	1368.0	*	1	1545	190	67.	277.0	1395.1	*	1	2350	287	69.	298.1	1396.7
1	0745	94	1.	2.3	1368.0	*	1	1550	191	67.	277.7	1395.1	*	1	2355	288	69.	298.1	1396.7
1	0750	95	1.	2.4	1368.0	*	1	1555	192	67.	278.3	1395.2	*	2	0000	289	69.	298.1	1396.7
1	0755	96	1.	2.4	1368.0	*	1	1600	193	67.	279.0	1395.2	*						
1	0800	97	1.	2.4	1368.1	*	1	1605	194	67.	279.6	1395.3	*						
						*							*						

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PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.00-HR
69.	24.00	(CFS)	69.	34.	34.	34.
		(INCHES)	.183	.355	.355	.355
		(AC-FT)	34.	67.	67.	67.

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	24.00-HR
298.	24.00	296.	135.	135.	135.

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	24.00-HR
1396.69	24.00	1396.50	1381.08	1381.08	1381.08

CUMULATIVE AREA = 3.51 SQ MI

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	DA8B	286.	12.25	31.	9.	9.	.12		
ROUTED TO	RT8B	275.	12.33	31.	9.	9.	.12		
HYDROGRAPH AT	DA8C	260.	12.42	40.	11.	11.	.21		
2 COMBINED AT	CB8C	515.	12.33	71.	20.	20.	.33		
DIVERSION TO	DVT01	427.	12.33	63.	18.	18.	.33		
HYDROGRAPH AT	DV8C	88.	12.33	7.	2.	2.	.33		
ROUTED TO	RT8C	84.	12.42	7.	2.	2.	.33		
HYDROGRAPH AT	DA8A	668.	12.58	126.	35.	35.	.67		
ROUTED TO	RT8A	666.	12.67	126.	35.	35.	.67		
HYDROGRAPH AT	DA9A	512.	12.42	74.	20.	20.	.39		
ROUTED TO	RT9A	32.	13.83	31.	15.	15.	.39	1516.36	13.83
ROUTED TO	RT9ACP	32.	14.33	31.	14.	14.	.39		
HYDROGRAPH AT	DA9B	561.	12.58	109.	30.	30.	.58		
2 COMBINED AT	CB9B	561.	12.58	135.	44.	44.	.97		
ROUTED TO	RT9B	559.	12.67	135.	44.	44.	.97		
HYDROGRAPH AT	DA9C	582.	12.25	67.	19.	19.	.21		
3 COMBINED AT	CB9C	1395.	12.58	322.	98.	98.	1.85		
ROUTED TO	RT9C	1388.	12.67	322.	98.	98.	1.85		
HYDROGRAPH AT	DA9D	246.	12.33	32.	9.	9.	.15		
3 COMBINED AT	CB9D	1575.	12.58	361.	108.	108.	2.33		
DIVERSION TO	DVT02	52.	12.58	6.	1.	1.	2.33		
HYDROGRAPH AT	DV9D1	1523.	12.58	355.	107.	107.	2.33		
ROUTED TO	RT9D1	1512.	12.67	355.	107.	107.	2.33		
DIVERSION TO	DVT03	281.	12.67	66.	19.	19.	2.33		
HYDROGRAPH AT	DV9D2	1231.	12.67	288.	88.	88.	2.33		
ROUTED TO	RT9D2	1229.	12.67	288.	88.	88.	2.33		
HYDROGRAPH AT	DA9F	221.	12.42	32.	9.	9.	.17		
ROUTED TO	RT9F	217.	12.42	32.	9.	9.	.17		

2 COMBINED AT	CB9G	729.	12.42	105.	29.	29.	.47		
ROUTED TO	RT9G	716.	12.42	105.	29.	29.	.47		
HYDROGRAPH AT	DA9H	740.	12.33	93.	26.	26.	.36		
3 COMBINED AT	CB9H	2347.	12.50	484.	143.	143.	3.16		
ROUTED TO	RT9H	2345.	12.50	484.	143.	143.	3.16		
HYDROGRAPH AT	RN9D2	281.	12.67	66.	19.	19.	.00		
ROUTED TO	RRN9D2	280.	12.67	66.	19.	19.	.00		
HYDROGRAPH AT	DA9E	417.	12.25	46.	13.	13.	.19		
2 COMBINED AT	CM9E	542.	12.33	112.	32.	32.	.19		
ROUTED TO	RT9E	533.	12.33	112.	32.	32.	.19		
HYDROGRAPH AT	DA9I	248.	12.25	30.	8.	8.	.16		
3 COMBINED AT	CB9I	2993.	12.50	626.	183.	183.	3.51		
ROUTED TO	DBB	69.	24.00	69.	34.	34.	3.51	1396.69	24.00

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

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
RT8B	MANE	1.99	281.56	739.21	2.72	5.00	274.88	740.00	2.72

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1743E+02 EXCESS= .0000E+00 OUTFLOW= .1741E+02 BASIN STORAGE= .3863E-01 PERCENT ERROR= -.1

RT8C	MANE	1.19	87.67	742.46	.20	5.00	84.41	745.00	.20

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3593E+01 EXCESS= .0000E+00 OUTFLOW= .3603E+01 BASIN STORAGE= .1339E-05 PERCENT ERROR= -.3

RT8A	MANE	2.26	665.93	760.08	1.94	5.00	665.67	760.00	1.93

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6942E+02 EXCESS= .0000E+00 OUTFLOW= .6918E+02 BASIN STORAGE= .2598E+00 PERCENT ERROR= .0

RT9ACP	MANE	4.99	32.01	860.45	1.33	5.00	32.01	860.00	1.33

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2928E+02 EXCESS= .0000E+00 OUTFLOW= .2760E+02 BASIN STORAGE= .1637E+01 PERCENT ERROR= .1

RT9B	MANE	1.23	560.24	758.33	1.69	5.00	559.47	760.00	1.69

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8768E+02 EXCESS= .0000E+00 OUTFLOW= .8753E+02 BASIN STORAGE= .2164E+00 PERCENT ERROR= -.1

RT9C	MANE	1.63	1391.44	759.00	1.97	5.00	1387.70	760.00	1.97

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1950E+03 EXCESS= .0000E+00 OUTFLOW= .1940E+03 BASIN STORAGE= .9118E+00 PERCENT ERROR= .0

RT9D1	MANE	1.29	1520.39	757.23	1.70	5.00	1511.60	760.00	1.70

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2121E+03 EXCESS= .0000E+00 OUTFLOW= .2116E+03 BASIN STORAGE= .4539E+00 PERCENT ERROR= .0

RT9D2	MANE	1.88	1229.76	762.61	1.40	5.00	1228.52	760.00	1.40

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1744E+03 EXCESS= .0000E+00 OUTFLOW= .1738E+03 BASIN STORAGE= .6212E+00 PERCENT ERROR= .0

RT9F	MANE	1.25	220.62	747.49	1.95	5.00	216.99	745.00	1.95

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1768E+02 EXCESS= .0000E+00 OUTFLOW= .1767E+02 BASIN STORAGE= .2832E-01 PERCENT ERROR= -.1

[illegible]	MANE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

```
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5819E+02 EXCESS= .0000E+00 OUTFLOW= .5807E+02 BASIN STORAGE= .1424E+00 PERCENT ERROR=    .0

            RT9H  MANE        1.63   2345.84    751.06      1.68      5.00   2345.36    750.00       1.68

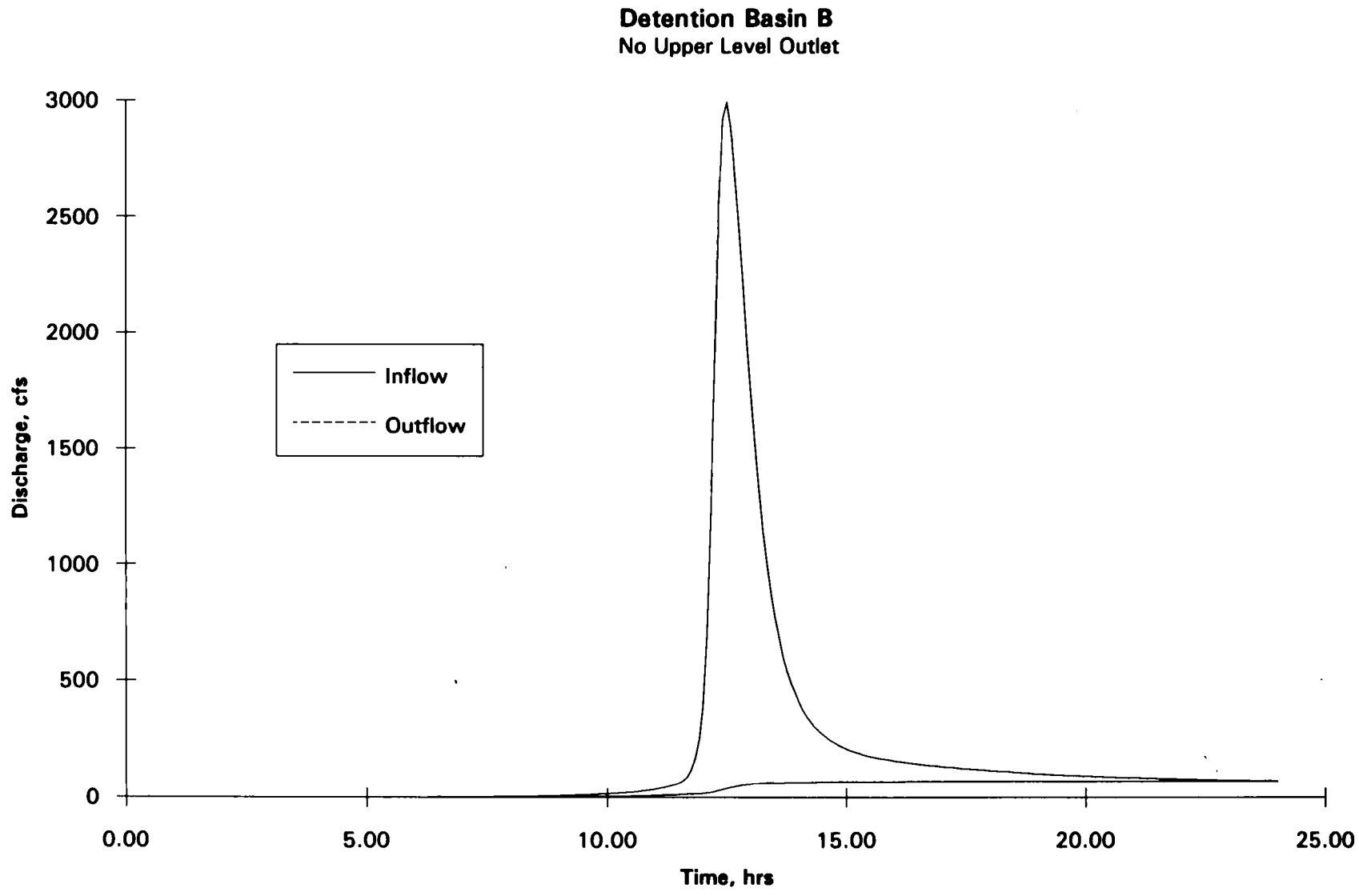
CONTINUITY SUMMARY (AC-FT) - INFLOW= .2839E+03 EXCESS= .0000E+00 OUTFLOW= .2835E+03 BASIN STORAGE= .6884E+00 PERCENT ERROR=   -.1

           RRN9D2  MANE        2.40    280.64    764.37     -1.00      5.00    280.14    760.00      -1.00

            RT9E  MANE         .78    541.34    741.65      6.18      5.00    532.91    740.00       6.18

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6272E+02 EXCESS= .0000E+00 OUTFLOW= .6265E+02 BASIN STORAGE= .8036E-01 PERCENT ERROR=    .0


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


Detention Basin B
No Upper Level Outlet
3000
2500
2000
1500
1000
500
0
Discharge, cfs
Inflow
Outflow
0.00
5.00
10.00
15.00
20.00
25.00
Time, hrs

INTERIM

APPENDIX F

7TH AVENUE FLOW SPREAD

CRSS	PROJECT: Beardsley Drainage	JOB NO		NO.
	CLIENT: ADOT	DESIGNED BY: MBS	DATE: 4-8-94	
	SUBJECT: Collector Channel Design	CHECKED BY: JFM	DATE: 4/12/94	OF

$R = \sqrt{x^2 + 670^2}$ ✓

$K = \frac{L}{x}$ ✓

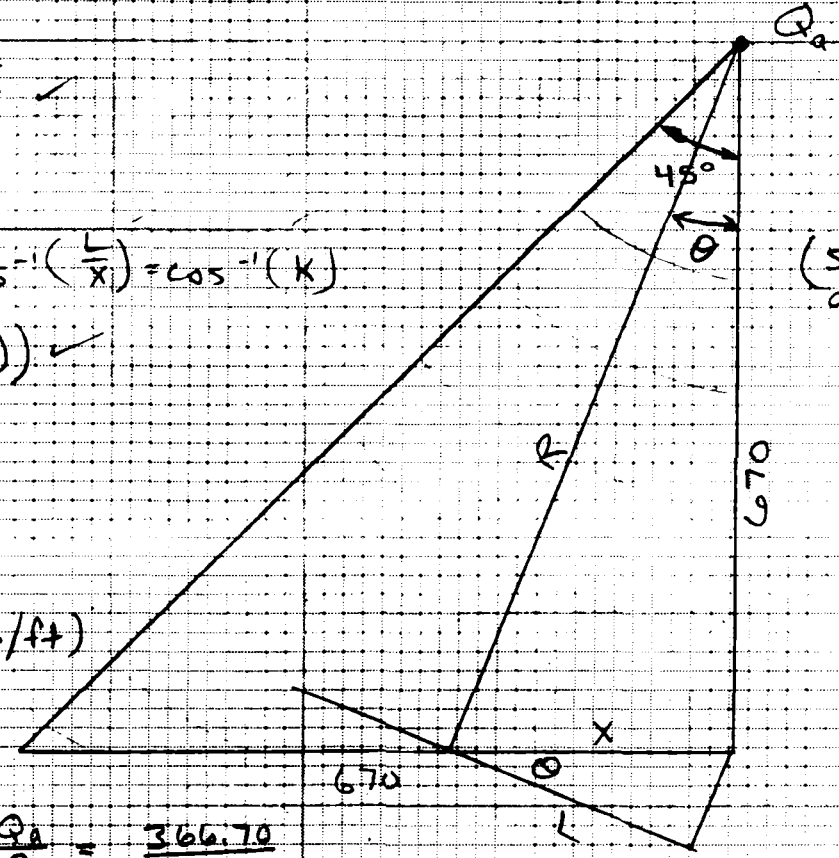
$\theta = \sin^{-1}\left(\frac{x}{R}\right) = \cos^{-1}\left(\frac{L}{x}\right) = \cos^{-1}(K)$

$K = \cos\left(\sin^{-1}\left(\frac{x}{R}\right)\right)$ ✓

$Q_a = 288$ cfs

$A_f = 45°$

q = unit discharge (cfs/ft)



(see attached photo)

$q = \frac{2 Q_a 90}{A_f \pi R} = \frac{4 Q_a}{\pi R} = \frac{366.70}{R}$

$q' = K q$

Ideal Alluvial Fan Eq for $\theta \leq 90°$
(q calcd. along radial contours)

Corrected for skewed interception

CRSS
Civil Engineers Inc.

Beardsley Drainage
Aluvial Fan Calcs
West of Det Bas F

Project No.:C86755.13
Client: ADOT
Designed by:Bret Seiter
Date:4/12/94

< 90 Degrees	
Aluvial Fan angle	45
Adjacent Dist	670
Qa	288

x	R	q	q'	q ave	Q	Q tot
	670	0.55	0.55			
50	672	0.55	0.54	0.55	27.3	27.3
100	677	0.54	0.54	0.54	27.0	54.3
150	687	0.53	0.52	0.53	26.4	80.7
200	699	0.52	0.50	0.51	25.6	106.3
250	715	0.51	0.48	0.49	24.6	130.9
300	734	0.50	0.46	0.47	23.4	154.3
350	756	0.49	0.43	0.44	22.1	176.4
400	780	0.47	0.40	0.42	20.8	197.3
450	807	0.45	0.38	0.39	19.5	216.8
500	836	0.44	0.35	0.36	18.2	235.0
550	867	0.42	0.33	0.34	17.0	251.9
600	899	0.41	0.30	0.32	15.8	267.7
650	933	0.39	0.28	0.29	14.6	282.4
670	948	0.39	0.27	0.28	5.6	287.9

(RL) → Reach length

dist	x	R	q	q'	q' ave	Q	Q tot
		670	0.55	0.55			
34	34	671	0.55	0.55	0.55	18.6	18.6
34	68	673	0.54	0.54	0.54	18.5	37.1
34	102	678	0.54	0.53	0.54	18.3	55.4
34	136	684	0.54	0.53	0.53	18.0	73.4
35	171	691	0.53	0.51	0.52	18.2	91.6
36	207	701	0.52	0.50	0.51	18.2	109.8
36	243	713	0.51	0.48	0.49	17.7	127.5
38	281	727	0.50	0.47	0.47	18.0	145.6
40	321	743	0.49	0.45	0.46	18.2	163.8
42	363	762	0.48	0.42	0.43	18.2	182.0
44	407	784	0.47	0.40	0.41	18.1	200.1
47	454	809	0.45	0.38	0.39	18.2	218.3
50	504	838	0.44	0.35	0.36	18.1	236.4
54	558	872	0.42	0.32	0.34	18.2	254.6
58	616	910	0.40	0.30	0.31	18.0	272.6
60	676	952	0.39	0.27	0.28	17.0	289.6

Checked by: JFM
Date: 4/12/94

File:ALUVFAN.XLS