Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

DRAINAGE DESIGN REPORT
CONTRACT 86-06
OUTER LOOP HIGHWAY PROJECT
PROJECT NO. RBM 600-0-305

VOLUME II OF II

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 21087
ROBERT E. JACOBS
Date Signed 4-17-90
ARIZONA, U.S.A.

TABLE OF CONTENTS

VOLUME I

Section

1.0 DRAINAGE NARRATIVE

1.1 Introduction

1.2 Hydrology

1.3 Drainageways

1.4 Detention Basins

1.5 Storm Drains

2.0 55th AVENUE DRAINAGEWAY

2.1 Culvert Computation Sheet

3.0 SKUNK CREEK CHANNELIZATION

3.1 HEC II - Existing Condition

3.2 HEC II - Prop. Condition - D.S. of OLH

3.3 Culvert Computation Sheet

3.4 HEC II - Prop. Condition - U.S. of OLH

3.5 Superelevation Computations

3.6 Drop Structure Design

3.7 Rip Rap Design

3.8 Plan & Profile Sheets

4.0 SCATTER WASH CHANNELIZATION

4.1 HEC II - Existing Condition

4.2 HEC II - Prop. Condition - D.S. of OLH

4.3 Culvert Computation Sheet

4.4 HEC II - Prop. Condition - U.S. of OLH

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 21007
ROBERT E. JACOBS
Date Signed 4-17-90
ARIZONA, U.S.A.

TABLE OF CONTENTS (cont.)

Section

4.5 Offsite Runoff Calculations

4.6 Drop Structure Design

4.7 Rip Rap Design

5.0 51ST AVE. DETENTION BASIN

5.1 Drainage Area Map (by OLHMC)

5.2 Stage Storage Computations

5.3 Stage Discharge Computations

5.4 HEC I - Outlet Control

5.5 HEC I - Emergency Spillway Only

5.6 HEC I - Drain Time Under Free Outfall

5.7 HEC II - Inflow Channel

VOLUME II

6.0 35TH AVE. DETENTION BASIN

6.1 HEC I (by OLHMC)

6.2 Side Weir Analysis

6.3 Stage Storage Compuations

6.4 Stage Discharge Computations

6.5 HEC I - 35th Av Det. Basin

6.6 HEC I - Spillway Only

6.7 HEC II - Diversion Channel

6.8 W.S. Profile - 35th Ave. to Basin

6.9 Culvert Cross Sections

6.10 HEC I - Test Cases for varying diversion

INTRODUCTION

The purpose of this report is to present the assumptions, criteria, and analysis used in the design of drainage facilities for Section 5-C of the proposed Outer Loop Highway (OLH). This segment of the OLH begins approximately 500 feet east of 59th Avenue and closely parallels the Beardsley Road alignment to approximately 500 feet east of 35th Avenue. The improvements for this section consist of an elevated mainline roadway with paralleling frontage roads which have vertical alignments that are typically near existing grade. A portion of the frontage road system utilizes existing Beardsley Road. Three drainageways are encountered within this project - the 55th Avenue Drainageway (also known as the Arrowhead Lakes Outlet), Skunk Creek, and Scatter Wash. In addition to the drainageways, two detention basins have been incorporated on the north side of the OLH to attenuate the flow contributions from offsite drainage areas. One detention basin is located just north of the North Frontage Road approximately 500 feet east of 51st Avenue. The other detention basin is located on the northeast corner of 35th Avenue and the North Frontage Road.

HYDROLOGY

The offsite hydrology analysis for the drainageways was prepared by others and provided to Stanley/Mettee-McGill-Murphy, Inc. (S/MMM) by the Outer Loop Management Consultant (OLMC). The following table is a summary of the 100 year discharges for the various drainageways found in the previously mentioned hydrology analysis.

OFFSITE HYDROLOGY TABLE

Description	Discharge (cfs)
55th Avenue Drainageway	2,520
Skunk Creek	2,600
Scatter Wash	6,100

Additional hydrologic information on the watersheds above the proposed detention basins was provided by the OLMC. This information consisted of a 100 year HEC I analysis for each watershed, and an inflow hydrograph for each detention basin location. S/MMM utilized this information to complete flood routing computations and determine the necessary storage volumes for the detention basins.

The onsite hydrologic analysis was completed by S/MMM using the methods outlined in the manual of "Hydrologic Design for Highway Drainage in Arizona" by the Arizona Highway Department Bridge Division. The above methods were applied to determine the rainfall intensities for 2 year, 5 year, 10 year, 25 year, 50 year, and 100 year return period storms with 1 hour, 6 hour, and 24 hour durations. The 10 year, 1 hour event was then selected as the design storm for the roadway drainage facilities as set forth in the Outer Loop Highway Design Procedures Manual. The 10 year, 1 hour rainfall intensity was employed in conjunction with the rational method (see Section 7) to determine the flows to be used for catch basin and storm drain design. All roadway drainage design was completed in accordance with the guidelines and criteria specified in the Outer Loop Highway Design Procedures Manual.

DRAINAGEWAYS

55th Avenue Drainageway

The 55th Avenue Drainageway provides an outlet for the Arrowhead Lakes detention system through a 6 - 10' x 4' concrete box culvert underneath existing Beardsley Road. At the direction of the OLMC this culvert was analyzed to determine its existing capacity, which was found to be 2,400 cfs operating under inlet control. The drainageway will continue from the existing CBC in a concrete lined vertical wall channel to the mainline where it will be conveyed via a 6 - 10' x 4' CBC to its outlet just south of the South Frontage Road.

Skunk Creek

The second drainageway encountered on this project is Skunk Creek. The Skunk Creek watershed is a major flood contributor in the northwest Phoenix area. As a result, there has been a great deal of work completed to mitigate the impact on the Skunk Creek floodplain. The U.S. Corps of Engineers has completed the Adobe Dam flood control project to reduce the 100 year peak discharge into Skunk Creek. The 100 year discharge is now calculated to be 2,600 cfs. Skunk Creek crosses this project just east of 43rd Avenue in an unimproved channel. The existing channel flows westerly for approximately 1,300 feet to an improved unlined channel which was constructed to convey Skunk Creek flows through the Overland Hills Subdivision. The improvements designed for Skunk Creek at the Outer Loop Highway Project include channelization and a series of drop structures, bank protection, a 5 - 10' x 6' concrete box culvert under the roadway, and an improved downstream channel. The concrete box culvert has been located to allow for a future Traffic Interchange to be constructed at 43rd Avneue.

Scatter Wash

The third drainageway on this project is Scatter Wash. Scatter Wash is the largest drainageway crossing this segment of the Outer Loop Highway. The existing Scatter Wash channel is ill

defined. The 100 year discharge of 6,100 cfs results in an approximate 2,000 foot wide floodplain as it crosses existing Beardsley Road.

The improvements designed for Scatter Wash have been developed to control and convey the 6,100 cfs flow under the Outer Loop Highway Project. The channel improvements for Scatter Wash will intercept the flow as it sheets across 35th Avenue north of Beardsley Road. The channelization then funnels the flow down to a minimum width of 120' wide and incorporates a series of three drop structures to reduce flow velocities and meet roadway vertical alignment requirements. The collected flow is then passed under the Outer Loop Highway in a 10 - 10' x 6' concrete box culvert. The height of one cell of the box culvert has been increased to 8 feet at the direction of A.D.O.T. for the City of Phoenix for an equipment pass. Channel improvements have been extended from the CBC outlet, which allow the flow to expand to meet the existing downstream floodway width. The banks will be concrete lined.

DETENTION BASINS

51st Avenue Detention Basin

The 51st Avenue Detention basin has been designed to handle the 100 year storm using the inflow information provided the OLMC. Flood routing computations were performed using HEC 1 to determine the peak storage volume required. The peak storage requirement for the 51st Avenue Detention basin is 34 acre-ft. In the case of a storm that exceeds the freeboard, the basin emergency spillway will direct the overflow south to the North Frontage Road to 51st Avenue overland. The 51st Avenue Detention basin outlet has been designed to handle an additional 17.7 cfs above its peak discharge to accommodate additional runoff expected by the City of Phoenix. Computations indicate this outlet will drain the detention basin within 36 hours.

35th Avenue Detention Basin

The 35th Avenue Detention basin has also been designed to handle a 100 year storm with the inflow information provided by the OLMC. Similar analysis was performed for this basin to determine the necessary peak storage volume. The peak storage requirement for the 35th Avenue Detention basin is 34 acre-ft. In the event the capacity of the basin is exceeded, the side weir that delivers runoff will function also as a spillway for the detention basin. The overflow then will continue in the diversion channel to Scatter Wash.

The inlet channel that delivers runoff to the detention basin was sized to carry 582 cfs. Provisions were made in the delivery system for a side flow weir inlet into the basin which allows 250 cfs to bypass the basin. Drainage of the detention basin will be accomplished by a 36" RCP outlet line to Scatter Wash.

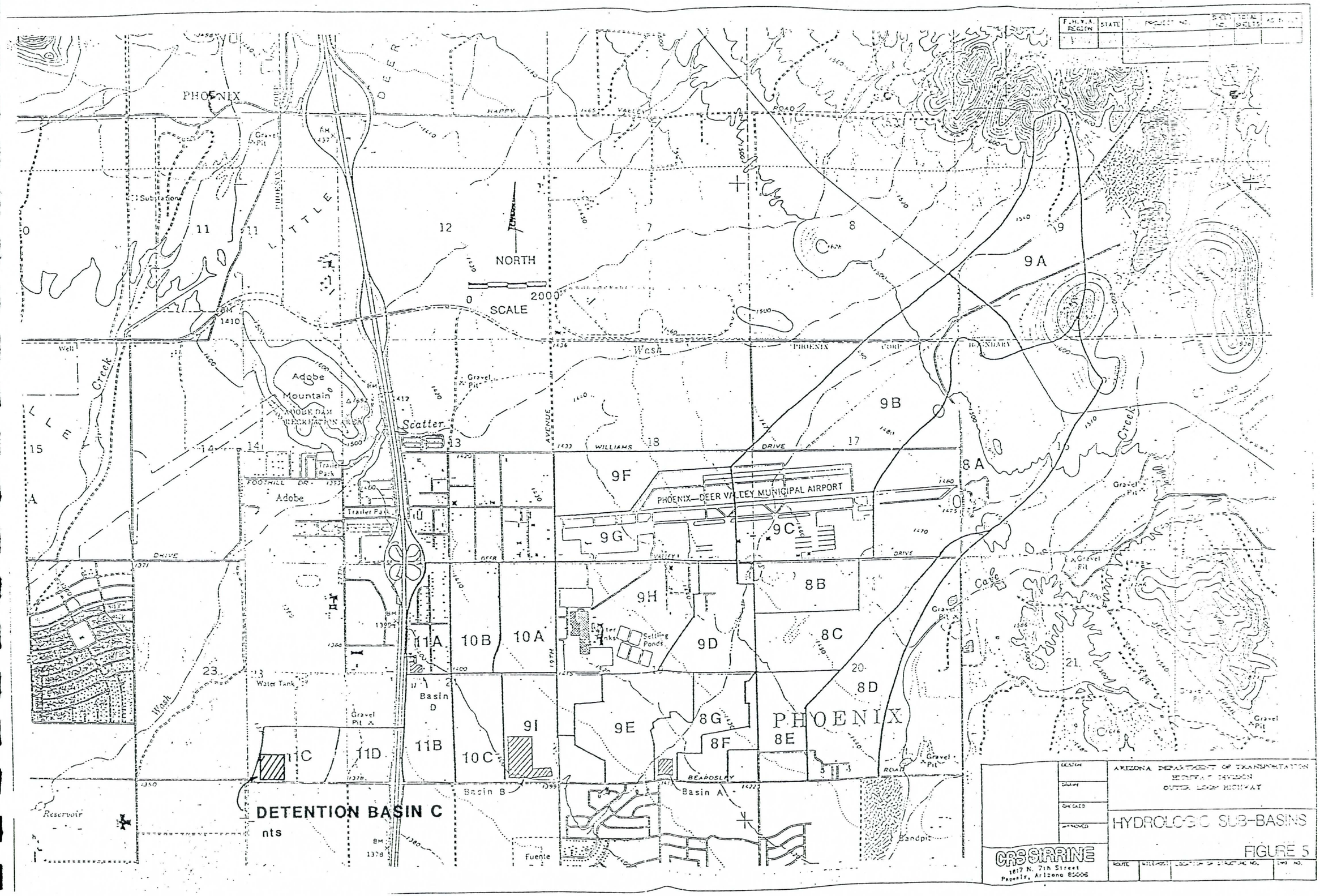
STORM DRAINS

Drainage of the Outer Loop Highway will be provided by a storm drain system which will convey the runoff to one of the drainageways that crosses this section with the exception of runoff from the 55th Avenue Drainageway on west to 59th Avenue. This drainage will be picked up by the section to the west (Sec 5-b). All flows east of Scatter wash will outlet into it. Runoff between Scatter Wash and Skunk Creek will be collected and discharged into Skunk Creek. Runoff from Skunk Creek to 51st Avenue will be picked up and carried to the 55th Avenue Drainageway and discharged. The sizing of the storm drain is based upon the 10 year storm event with the hydraulic grade line for the 10 year storm to remain below the catch basin inlet.

TABLE OF CONTENTS (cont.)

Section	
7.0	PAVEMENT DRAINAGE HYDROLOGY
7.1	Rainfall Intensities
7.2	Rainfall Intensiy Curves
8.0	INLET SIZING
8.1	Pavement Drainage Worksheets
8.2	Pavement Drainage Area Maps
9.0	STORM DRAIN DESIGN
9.1	Circular Pipe Values
9.2	Storm Sewer Calculation Sheets
10.0	SCOUR ANALYSIS

TAB 1


PHOENIX
NORTH
SCALE
0
2000
Adobe Mountain
Scatter
Wash
Creek
Adobe
Trailer Park
Gravel Pit
Substation
Water Tank
Reservoir
Fuente
Basin A
Basin B
Basin D
Settling Ponds
Sandpit
PHOENIX—DEER VALLEY MUNICIPAL AIRPORT
WILLIAMS DRIVE
BEARDSLEY
FOOTHILL DR.
HAPPY VALLEY ROAD
PHOENIX CORP. BOUNDARY
9A
9B
9C
9D
9E
9F
9G
9H
9I
8A
8B
8C
8D
8E
8F
8G
10A
10B
10C
11A
11B
11C
11D
DETENTION BASIN C
nts
ARIZONA DEPARTMENT OF TRANSPORTATION
HYDROLOGIC SUB-BASINS
FIGURE 5
CRS SIRRINE
1617 N. 7th Street
Phoenix, Arizona 85006

1

****

FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985

U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616

****

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

1

HEC-1 INPUT PAGE 1

```
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 MODIFIED TO 35TH AVE BY DCCO(9/89)
  3           ID       SEPTEMBER 6, 1989              FILE:  S6N.DAT
              *DIAGRAM
  4           IT      5                    288
  5           ID      5

  6           KK    DA8B
  7           KM       RUNOFF FROM SUB-BASIN 8B
  8           BA    0.12
  9           PH                  0.68    1.37    2.40    2.65    2.82    3.14    3.51    3.90
 10           LS             89
 11           UD    0.29

 12           KK    RT8B
 13           KM       ROUTE 8B TO ROSE GARDEN
 14           RK    1350  0.0046   0.035           TRAP       0      20

 15           KK    DA8C
 16           KM       RUNOFF FROM SUB-BASIN 8C
 17           BA    0.21
 18           LS             80
 19           UD    0.35

 20           KK    CB8C
 21           KM       COMBINE ROUTED 8B WITH 8C
 22           HC      2

 23           KK    DV8C
 24           KM       DIVERT FLOWS SOUTH ON 7TH AVENUE
 25           DT   DVT01
 26           DI      0     100     500    1000    2000
 27           DQ      0     100     416     778    1486

 28           KK    RT8C
 29           KM       ROUTE REMAINING FLOW WEST ON ROSE GARDEN
```

1

```
30          RK    1000  0.0042   0.030           TRAP      8      2

31          KK    DA8A
32          KM        RUNOFF FROM SUB-BASIN 8A
33          BA    0.67
34          LS              80
35          UD    0.50

36          KK    RT8A
37          KM        ROUTE 8A TO CULVERT BELOW DEER VALLEY AIRPORT
38          RK    3900  0.0042   0.030           TRAP      8      2

39          KK    DA9A
40          KM        RUNOFF FROM SUB-BASIN 9A
41          BA    0.39
42          LS              80
43          UD    0.31
```



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

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

51          KK  RT9ACP
52          KM        ROUTE 9A CAP RUNOFF THROUGH 9B
53          RK    8200  0.0067   0.035           TRAP     12      2

54          KK    DA9B
55          KM        RUNOFF FROM SUB-BASIN 9B
56          BA    0.58
57          LS              80
58          UD    0.52

59          KK    CB9B
60          KM        COMBINE ROUTED 9A WITH 9B RUNOFF
61          HC      2

62          KK    RT9B
63          KM        ROUTE 9B TO THE CULVERT BELOW DEER VALLEY AIRPORT
64          RK    2250  0.0046   0.024           CIRC    4.50

65          KK    DA9C
66          KM        RUNOFF FROM SUB-BASIN 9C
67          BA    0.21
68          LS              96
69          UD    0.29

70          KK    CB9C
```

```
 71          KM       COMBINE ROUTED 8A AND 9B WITH 9C
 72          HC      3

 73          KK    RT9C
 74          KM       ROUTE 9C TO ROSE GARDEN
 75          RK    2750  0.0067   0.045           TRAP      30       2

 76          KK    DA9D
 77          KM       RUNOFF FROM SUB-BASIN 9D
 78          BA    0.15
 79          LS             83
 80          UD    0.29

 81          KK    CB9D
 82          KM       COMBINE ROUTED 8C,AND 9B WITH 9D
 83          HC      3
1                                        HEC-1 INPUT                                                PAGE  3

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


 84          KK   DV9D1
 85          KM       DIVERT FLOWS SOUTH ON 14TH AVENUE
 86          DT   DVT02
 87          DI      0     300     500    1000    2000
 88          DQ      0       0       1      16      78

 89          KK   RT9D1
 90          KM       ROUTE REMAINING FLOW WEST ON ROSE GARDEN
 91          RK    1400  0.0042   0.030           TRAP       8      20

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

 97          KK   RT9D2
 98          KM       ROUTE THE REMAINING FLOW WEST TO 19TH AVENUE
 99          RK    2100  0.0042   0.030           TRAP       8      20

100          KK    DA96
101          KM       RUNOFF FROM SUB-BASIN 96
102          BA    0.25
103          LS             87
104          UD    0.30

105          KK    RT96
106          KM       ROUTE 96 SOUTH TO ROSE GARDEN
107          RK    2650  0.0046   0.016           TRAP       0      50

108          KK    DA9H
109          KM       RUNOFF FROM SUB-BASIN 9H
110          BA    0.36
111          LS             89
```

```
112          UD    0.29

113          KK    CB9H
114          KM        COMBINE ROUTED 9D2 AND 9G WITH 9H
115          HC       3

116          KK    RT9H
117          KM        ROUTE 9H SOUTH TO DETENTION BASIN B
118          RK    2600  0.0046   0.016            TRAP       0      50

119          KK   RN9D2
120          KM        RETRIEVE DIVERSION FROM ROSE GARDEN AND 15TH AVENUE
121          DR   DVT03

122          KK  RRN9D2
123          KM        ROUTE RN9D2
124          RK    2400  0.0045   0.016            TRAP       0      50
1                                          HEC-1 INPUT                                                    PAGE  4

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


125          KK    DA9E
126          KM        RUNOFF FROM SUB-BASIN 9E
127          BA    0.19
128          LS              87
129          UD    0.29

130          KK    CM9E
131          KM        COMBINE ROUTED RN9D2 AND 9E
132          HC       2

133          KK    RT9E
134          KM        ROUTE 9E TO DETENTION BASIN B
135          RK    1300  0.0067   0.035            TRAP       8       2

136          KK    DA9I
137          KM        RUNOFF FROM SUB-BASIN 9I INTO DETENTION BASIN B
138          BA    0.16
139          LS              80
140          UD    0.29

141          KK    CB9I
142          KM        COMBINE ROUTED 9H AND 9E WITH 9I
143          HC       3

144          KK     DBB
145          KM        ROUTE FLOWS THROUGH BASIN B, DUEL-STAGE OUTLET
146          RS       1    STOR      -1       0
147          SV       0     8.2    29.8    64.1   106.3   168.1   179.8   192.6   212.9   242.0
148          SV   268.5   315.0
149          SQ       0      10      20      30      40      54      96     138     180     223
150          SQ     247     337
151          SE  1367.6  1369.4  1371.7  1375.2  1379.5  1385.8  1387.0  1388.3  1390.0  1392.3
152          SE  1394.4  1398.0
```

```
153          KK   DVDBB
154          KM        DIVERT UPPER STAGE OUTLET TO GRAVITY DRAIN
155          DT   DVT05
156          DI       0      10      20      30      40      54      96     138     180     223
157          DI     247     337
158          DQ       0       0       0       0       0       0      40      80     120     160
159          DQ     181     267

160          KK    RN8C
161          KM        RETRIEVE DIVERSION FROM 7TH & ROSE GARDEN
162          DR   DVT01

163          KK  RTRN8C
164          KM        ROUTE DIVERSION TO BEARDSLEY
165          RK    2600  0.0046   0.025            TRAP       0      50
```



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

166          KK    DA8E
167          KM        RUNOFF FROM SUB-BASIN 8E
168          BA    0.13
169          LS              86
170          UD    0.29

171          KK    DA8D
172          KM        RUNOFF FROM SUB-BASIN 8D
173          BA    0.28
174          LS              80
175          UD    0.38

176          KK    RT8D
177          KM        ROUTE WEST TO 7TH AVE
178          RK    1300  0.0033   0.018            TRAP      12       0

179          KK    CB8D
180          KM        COMBINE 8E WITH ROUTED RN8C AND ROUTED RT8D
181          HC       3

182          KK    RTCB8D
183          KM        ROUTE COMBINED HYDROGRAPH WEST TO 14TH AVE
184          RK    1800  0.0033   0.018            TRAP      16       0

185          KK    DA8F
186          KM        RUNOFF FROM SUB-BASIN 8F
187          BA    0.08
188          LS              87
189          UD    0.29

190          KK    CB8F
191          KM        COMBINE ROUTED CB8D AND 8F
192          HC       2
```

```
193          KK  RTCB8F
194          KM        ROUTE COMBINED HYDROGRAPH TO DET. BASIN A
195          RK     300  0.0033   0.018            TRAP      18       0

196          KK   RN9D1
197          KM        RETRIEVE DIVERSION FROM ROSE GARDEN AND 14TH AVENUE
198          DR   DVT02

199          KK  RRN9D1
200          KM        ROUTE RN9D1 TO DETENTION BASIN A
201          RK    2800  0.0044   0.016            TRAP       0      50

202          KK    DA86
203          KM        RUNOFF FROM SUB-BASIN 86
204          BA    0.12
205          LS              87
206          UD    0.29
```



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


207          KK    CB8F
208          KM        COMBINE ROUTED 8F AND RN9D1 WITH 86
209          HC       3

210          KK     DBA
211          KM        ROUTE FLOWS THROUGH BASIN A, 42" OUTLET
212          RS       1    STOR      -1       0
213          SV       0     2.7   113.6     125
214          SE    1392  1393.2    1412    1414
215          SL    1392    2.64     0.6     0.5
216          SS    1412     100     3.0     1.5

217          KK   RTDBA
218          KM        ROUTE DETENTION BASIN A TO DETENTION BASIN B
219          RK    5000  0.0050   0.012            CIRC       3

220          KK    CBAB
221          KM        COMBINE DETENTION BASINS A AND B OUTFLOWS
222          HC       2

223          KK    RTAB
224          KM        ROUTE CBAB TO 23RD AVENUE
225          RK    1385 0.00152   0.012            CIRC       5

226          KK   DA10A
227          KM        RUNOFF FROM SUB-BASIN 10A
228          BA    0.12
229          LS              82
230          UD    0.29

231          KK   RT10A
232          KM        ROUTE 10A WEST TO 23RD AVENUE
233          RK    1100  0.0042   0.016            TRAP       0      50
```

```
234          KK   DA10B
235          KM        RUNOFF FROM SUB-BASIN 10B
236          BA    0.12
237          LS              82
238          UD    0.29

239          KK   CB10B
240          KM        COMBINE 10A WITH 10B
241          HC       2

242          KK   DV10B
243          KM        DIVERT WEST ALONG ROSE GARDEN
244          DT     DVT
245          DI       0     500    1000    2000
246          DQ       0     500    1000    2000
1                                        HEC-1 INPUT                                          PAGE  7

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

247          KK   RT10B
248          KM        ROUTE REMAINING FLOW SOUTH TO BEARDSLEY
249          RK    2600  0.0046   0.016            TRAP       0      50

250          KK   DA10C
251          KM        RUNOFF FROM SUB-BASIN 10C
252          BA    0.12
253          LS              87
254          UD    0.29

255          KK   CB10C
256          KM        COMBINE ROUTED 10B WITH 10C
257          HC       2

258          KK  CB10C2
259          KM        COMBINE OUTFLOW OF DETENTION BASINS A & B WITH CB10C
260          HC       2

261          KK   RT10C
262          KM        ROUTE FLOW WEST TO WEST OF INTEL PROPERTY
263          RK    1135 0.00152   0.012            CIRC       8

264          KK   RN10B
265          KM        RETRIEVE DIVERSION FROM ROSE GARDEN AND 23RD AVENUE
266          DR     DVT

267          KK  RT10B2
268          KM        ROUTE RETRIEVE WEST TO I-17
269          RK    1100  0.0042   0.016            TRAP       0      50

270          KK   DA11A
271          KM        RUNOFF FROM SUB-BASIN 11A
272          BA    0.10
273          LS              85
```

```
274          UD    0.29

275          KK   CB11A
276          KM        COMBINE 11A WITH ROUTED 10B2
277          HC       2

278          KK     DBD
279          KM        ROUTE 11A & 10B INFLOWS THRU DETENTION BASIN D
280          RS       1    STOR      -1       0
281          SV       0     0.7    25.4    30.0
282          SE    1381  1382.5  1396.0  1398.0
283          SL    1381    2.41     0.6     0.5
284          SS    1397     100     3.0     1.5

285          KK   RT11A
286          KM        ROUTE DETENTION BASIN D SOUTH
287          RK    2500  0.0046   0.012           CIRC       3
```



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

288          KK   DA11B
289          KM        RUNOFF FROM SUB-BASIN 11B
290          BA    0.12
291          LS              B2
292          UD    0.29

293          KK   DB11B
294          KM        ROUTE 11B THROUGH SMALL DETENTION BASIN AT INTEL
295          RS       1    STOR      -1       0
296          SV       0    0.35     1.9    3.07    4.56    6.00
297          SE    1383    1384    1386    1388    1390    1392
298          SL    1383    7.07     0.6     0.5
299          SS    1390     100     3.0     1.5

300          KK   CB11B
301          KM        COMBINE 11B WITH ROUTED DETENTION BASIN D OUTFLOW AND FLOWS FROM EAST
302          HC       3

303          KK   RT11B
304          KM        ROUTE WEST TO P11D
305          RK    1400 0.00152   0.012           CIRC       8

306          KK   DA11D
307          KM        RUNOFF FROM SUB-BASIN P11D
308          BA    0.13
309          LS              B2
310          UD    1.01

311          KK   CB11D
312          KM        COMBINE HYDROGRAPHS P11D AND OUTFLOW FROM DETENTION BASIN AT INTEL
313          HC       2

314          KK   RT11D
```

```
315        KM       ROUTE HYDROGRAPH TO DA P11C
316        RK    1950  0.0044   0.012           TRAP      8      2

317        KK   DA11C
318        KM       RUNOFF FROM SUB-BASIN P11C
319        BA    0.22
320        LS              83
321        UD    1.27

322        KK   CB11C
323        KM       COMBINE HYDROGRAPHS AT THE BASE OF P11C
324        HC      2

325        KK   RT11C
326        KM       ROUTE P11C TO P11B
327        RK    1950  0.0044   0.012           TRAP      8      2
```



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

328        KK   DA11B
329        KM       RUNOFF FROM DA P11B
330        BA    0.18
331        LS              90
332        UD    1.27

333        KK   CB11B
334        KM       COMBINE HYDRGRAPHS AT P11B (TO BASIN C)
335        HC      2

336        KK    DVBC
337        KM   DIVERT FLOW TO DETENTION BASIN C
338        DT    DVSW
339        DI      0     150     250     251     750
340        DQ      0     150     250     250     250

341        KK    RTBC
342        KM   ROUTE FLOW THROUGH DETENTION BASIN C (33" ORIFICE)
343        KO      1
344        RS      1    STOR      -1       0
345        SA   2.15    2.24    2.32    2.52    2.71    2.91    3.12    3.67
346        SE   1338    1339    1340    1342    1344    1346    1348    1353
347        SL   1339    5.94      .6      .5
348        SS   1352      40     2.7     1.5

349        KK    RVSW
350        KM   RETRIEVE BASIN BYPASS FLOW DVSW
351        DR    DVSW

352        KK    CBSW
353        KM   COMBINE TOTAL INFLOW TO SCATTER WASH
354        KO      1
355        HC      2
356        ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

   6        DA8B
               V
               V
  12        RT8B
               .
               .
  15           .        DA8C
               .           .
               .           .
  20        CB8C............
               .
               .
  25           .-------> DVT01
  23        DV8C
               V
               V
  28        RT8C
               .
               .
  31           .        DA8A
               .           V
               .           V
  36           .        RT8A
               .           .
               .           .
  39           .           .        DA9A
               .           .           V
               .           .           V
  44           .           .        RT9A
               .           .           V
               .           .           V
  51           .           .      RT9ACP
               .           .           .
               .           .           .
  54           .           .           .        DA9B
               .           .           .           .
               .           .           .           .
  59           .           .        CB9B............
               .           .           V
               .           .           V
  62           .           .        RT9B
               .           .           .
               .           .           .
  65           .           .           .        DA9C
               .           .           .           .
               .           .           .           .
  70           .        CB9C........................
               .           V
```

```
          .          V
73        .        RT9C
          .          .
          .          .
76        .          .        DA9D
          .          .          .
          .          .          .
81     CB9D.......................
          .
          .
86        .-------> DVT02
84     DV9D1
          V
          V
89     RT9D1
          .
          .
94        .-------> DVT03
92     DV9D2
          V
          V
97     RT9D2
          .
          .
100       .        DA9G
          .          V
          .          V
105       .        RT9G
          .          .
          .          .
108       .          .        DA9H
          .          .          .
          .          .          .
113    CB9H.......................
          V
          V
116    RT9H
          .
          .
121       .          .<-------   DVT03
119       .       RN9D2
          .          V
          .          V
122       .      RRN9D2
          .          .
          .          .
125       .          .        DA9E
          .          .          .
          .          .          .
130       .       CM9E............
          .          V
          .          V
133       .        RT9E
          .          .
          .          .
```

```
136          .          .        DA9I
             .          .          .
             .          .          .
141       CB9I.......................
             V
             V
144        DBB
             .
             .
155          .-------> DVT05
153      DVDBB
             .
             .
162          .          .<-------   DVT01
160          .       RN8C
             .          V
             .          V
163          .      RTRN8C
             .          .
             .          .
166          .          .        DA8E
             .          .          .
             .          .          .
171          .          .          .        DA8D
             .          .          .          V
             .          .          .          V
176          .          .          .        RT8D
             .          .          .          .
             .          .          .          .
179          .       CB8D.......................
             .          V
             .          V
182          .       RTCB
             .          .
             .          .
185          .          .        DA8F
             .          .          .
             .          .          .
190          .       CB8F............
             .          V
             .          V
193          .      RTCB8F
             .          .
             .          .
198          .          .          .<-------   DVT02
196          .          .      RN9D1
             .          .          V
             .          .          V
199          .          .     RRN9D1
             .          .          .
             .          .          .
202          .          .          .        DA86
             .          .          .          .
             .          .          .          .
207          .       CB8F.......................
```

```
            .          V
            .          V
210         .        DBA
            .          V
            .          V
217         .      RTDBA
            .          .
            .          .
220       CBAB............
            V
            V
223       RTAB
            .
            .
226         .      DA10A
            .          V
            .          V
231         .      RT10A
            .          .
            .          .
234         .          .      DA10B
            .          .          .
            .          .          .
239         .      CB10B............
            .          .
            .          .
244         .          .------->     DVT
242         .      DV10B
            .          V
            .          V
247         .      RT10B
            .          .
            .          .
250         .          .      DA10C
            .          .          .
            .          .          .
255         .      CB10C............
            .          .
            .          .
258     CB10C2............
            V
            V
261      RT10C
            .
            .
266         .          .<-------     DVT
264         .      RN10B
            .          V
            .          V
267         .     RT10B2
            .          .
            .          .
270         .          .      DA11A
            .          .          .
            .          .          .
```

```
275          .      CB11A............
             .         V
             .         V
278          .       DBD
             .         V
             .         V
285          .      RT11A
             .         .
             .         .
288          .         .      DA11B
             .         .         V
             .         .         V
293          .         .      DB11B
             .         .         .
             .         .         .
300       CB11B......................
             V
             V
303       RT11B
             .
             .
306          .      DA11D
             .         .
             .         .
311       CB11D............
             V
             V
314       RT11D
             .
             .
317          .      DA11C
             .         .
             .         .
322       CB11C............
             V
             V
325       RT11C
             .
             .
328          .      DA11B
             .         .
             .         .
333       CB11B............
             .
             .
338          .------->    DVSW
336        DVBC
             V
             V
341        RTBC
             .
             .
351          .         .<-------    DVSW
349          .       RVSW
             .         .
```

```
                .          .
  352       CBSW............

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1                                                    ****
                          FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
            U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                                     ****



                          OUTERLOOP HIGHWAY OFFSITE DRAINAGE     100 YEAR
                          23RD AVENUE TO 7TH AVENUE MODIFIED TO 35TH AVE BY DCCO(9/89)
                          SEPTEMBER 6, 1989              FILE:  S6N.DAT

   5 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        288  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1    0  ENDING DATE
                     NDTIME       2355  ENDING TIME

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   23.92 HOURS

         ENGLISH UNITS

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN      116. TO      951.
               THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
               THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)



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


          **************
          *            *
  341 KK  *      RTBC  *
          *            *
          **************

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

             HYDROGRAPH ROUTING DATA
```

```
344 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

345 SA            AREA      2.2      2.2      2.3      2.5      2.7      2.9      3.1      3.7

346 SE        ELEVATION    1338.00  1339.00  1340.00  1342.00  1344.00  1346.00  1348.00  1353.00

347 SL        LOW-LEVEL OUTLET
                   ELEVL    1339.00  ELEVATION AT CENTER OF OUTLET
                   CAREA       5.94  CROSS-SECTIONAL AREA
                    COQL        .60  COEFFICIENT
                    EXPL        .50  EXPONENT OF HEAD

348 SS        SPILLWAY
                    CREL    1352.00  SPILLWAY CREST ELEVATION
                   SPWID      40.00  SPILLWAY WIDTH
                    COQW       2.70  WEIR COEFFICIENT
                    EXPW       1.50  EXPONENT OF HEAD
```

***

COMPUTED STORAGE-ELEVATION DATA

STORAGE	.00	2.19	4.47	9.31	14.54	20.16	26.19	43.15
ELEVATION	1338.00	1339.00	1340.00	1342.00	1344.00	1346.00	1348.00	1353.00

COMPUTED OUTFLOW-ELEVATION DATA

OUTFLOW	.00	.00	33.78	37.37	41.81	47.45	54.85	64.98	79.71	103.06
ELEVATION	1338.00	1339.00	1340.40	1340.71	1341.14	1341.76	1342.68	1344.17	1346.78	1352.00
OUTFLOW	103.31	104.39	106.90	111.44	118.60	129.01	143.25	161.91	185.62	214.95
ELEVATION	1352.01	1352.05	1352.10	1352.17	1352.26	1352.37	1352.50	1352.65	1352.81	1353.00

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	.00	2.19	4.47	5.40	6.14	7.18	8.70	9.31	11.05	14.54
OUTFLOW	.00	.00	28.58	33.78	37.37	41.81	47.45	49.51	54.85	63.91
ELEVATION	1338.00	1339.00	1340.00	1340.40	1340.71	1341.14	1341.76	1342.00	1342.68	1344.00
STORAGE	15.00	20.16	22.45	26.19	39.53	39.59	39.70	39.89	40.15	40.47
OUTFLOW	64.98	75.62	79.71	85.75	103.06	103.31	104.39	106.90	111.44	118.60
ELEVATION	1344.17	1346.00	1346.78	1348.00	1352.00	1352.01	1352.05	1352.10	1352.17	1352.26
STORAGE	40.86	41.33	41.86	42.47	43.15					
OUTFLOW	129.01	143.25	161.91	185.62	214.95					
ELEVATION	1352.37	1352.50	1352.65	1352.81	1353.00					

****

HYDROGRAPH AT STATION RTBC

****

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	23.92-HR
+ (CFS)	(HR)					
		(CFS)				
+ 93.	14.25		74.	22.	22.	22.
		(INCHES)	.137	.163	.163	.163
		(AC-FT)	37.	44.	44.	44.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	23.92-HR
+ (AC-FT)	(HR)				
32.	14.25	21.	7.	7.	7.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	23.92-HR
+ (FEET)	(HR)				
1349.72	14.25	1346.00	1340.90	1340.90	1340.90

CUMULATIVE AREA = 5.01 SQ MI

*** ***

```
            **************
            *            *
 352 KK     *      CBSW  *
            *            *
            **************
```

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

 355 HC         HYDROGRAPH COMBINATION
                     ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE
```

***

****

HYDROGRAPH AT STATION CBSW
SUM OF 2 HYDROGRAPHS

****

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	23.92-HR

Combined Peak Discharge to Scatter Wash

+	(CFS)	(HR)					
			(CFS)				
+	343	14.25		293.	117.	117.	117.
			(INCHES)	.544	.863	.863	.863
			(AC-FT)	145.	230.	230.	230.

CUMULATIVE AREA = 5.01 SQ MI

1

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

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	DA8B	228.	12.25	31.	9.	9.	.12		
+	ROUTED TO	RT8B	222.	12.33	31.	9.	9.	.12		
+	HYDROGRAPH AT	DA8C	260.	12.33	40.	11.	11.	.21		
+	2 COMBINED AT	CB8C	482.	12.33	71.	20.	20.	.33		
+	DIVERSION TO	DVT01	402.	12.33	64.	18.	18.	.33		
+	HYDROGRAPH AT	DV8C	80.	12.33	7.	2.	2.	.33		
+	ROUTED TO	RT8C	79.	12.42	7.	2.	2.	.33		
+	HYDROGRAPH AT	DA8A	667.	12.50	126.	35.	35.	.67		
+	ROUTED TO	RT8A	659.	12.58	126.	35.	35.	.67		
+	HYDROGRAPH AT	DA9A	512.	12.33	74.	20.	20.	.39		
+	ROUTED TO	RT9A	32.	13.75	31.	15.	15.	.39		
+									1516.35	13.75
+	ROUTED TO	RT9ACP	32.	14.67	31.	14.	14.	.39		
	HYDROGRAPH AT									

+		DA9B	560.	12.50	109.	30.	30.	.58
	2 COMBINED AT						
+		CB9B	564.	12.50	135.	44.	44.	.97
	ROUTED TO						
+		RT9B	564.	12.58	135.	44.	44.	.97
	HYDROGRAPH AT						
+		DA9C	479.	12.25	67.	19.	19.	.21
	3 COMBINED AT						
+		CB9C	1482.	12.50	323.	99.	99.	1.85
	ROUTED TO						
+		RT9C	1479.	12.58	324.	98.	98.	1.85
	HYDROGRAPH AT						
+		DA9D	231.	12.25	32.	9.	9.	.15
	3 COMBINED AT						
+		CB9D	1671.	12.58	362.	109.	109.	2.33
	DIVERSION TO						
+		DVT02	58.	12.58	6.	2.	2.	2.33
	HYDROGRAPH AT						
+		DV9D1	1613.	12.58	356.	107.	107.	2.33
	ROUTED TO						
+		RT9D1	1612.	12.58	357.	107.	107.	2.33
	DIVERSION TO						
+		DVT03	296.	12.58	66.	19.	19.	2.33
	HYDROGRAPH AT						
+		DV9D2	1316.	12.58	290.	88.	88.	2.33
	ROUTED TO						
+		RT9D2	1309.	12.67	290.	88.	88.	2.33
	HYDROGRAPH AT						
+		DA9G	435.	12.25	61.	17.	17.	.25
	ROUTED TO						
+		RT9G	430.	12.42	62.	17.	17.	.25
	HYDROGRAPH AT						
+		DA9H	684.	12.25	93.	26.	26.	.36
	3 COMBINED AT						
+		CB9H	2021.	12.50	442.	132.	132.	2.94
	ROUTED TO						
+		RT9H	2018.	12.58	444.	132.	132.	2.94

	HYDROGRAPH AT								
+		RN9D2	296.	12.58	66.	19.	19.	.00	
	ROUTED TO								
+		RRN9D2	294.	12.75	67.	19.	19.	.00	
	HYDROGRAPH AT								
+		DA9E	338.	12.25	46.	13.	13.	.19	
	2 COMBINED AT								
+		CM9E	516.	12.42	112.	32.	32.	.19	
	ROUTED TO								
+		RT9E	510.	12.42	112.	32.	32.	.19	
	HYDROGRAPH AT								
+		DA9I	217.	12.25	30.	8.	8.	.16	
	3 COMBINED AT								
+		CB9I	2651.	12.50	586.	172.	172.	3.29	
	ROUTED TO								
+		DBB	206.	14.83	193.	79.	79.	3.29	
+									1391.40 14.83
	DIVERSION TO								
+		DVT05	144.	14.83	132.	50.	50.	3.29	
	HYDROGRAPH AT								
+		DVDBB	62.	14.83	61.	29.	29.	3.29	
	HYDROGRAPH AT								
+		RN8C	402.	12.33	64.	18.	18.	.00	
	ROUTED TO								
+		RTRN8C	403.	12.42	66.	19.	19.	.00	
	HYDROGRAPH AT								
+		DA8E	224.	12.25	31.	9.	9.	.13	
	HYDROGRAPH AT								
+		DA8D	328.	12.42	53.	15.	15.	.28	
	ROUTED TO								
+		RT8D	327.	12.42	53.	15.	15.	.28	
	3 COMBINED AT								
+		CB8D	918.	12.42	149.	42.	42.	.41	
	ROUTED TO								
+		RTCB	910.	12.42	149.	42.	42.	.41	
	HYDROGRAPH AT								
+		DA8F	143.	12.25	19.	5.	5.	.08	

	2 COMBINED AT								
+		CB8F	1029.	12.42	168.	47.	47.	.49	
	ROUTED TO								
+		RTCB8F	1027.	12.42	168.	47.	47.	.49	
	HYDROGRAPH AT								
+		RN9D1	58.	12.58	6.	2.	2.	.00	
	ROUTED TO								
+		RRN9D1	56.	12.67	6.	2.	2.	.00	
	HYDROGRAPH AT								
+		DA86	214.	12.25	29.	8.	8.	.12	
	3 COMBINED AT								
+		CB8F	1227.	12.42	204.	57.	57.	.61	
	ROUTED TO								
+		DBA	48.	15.17	48.	23.	23.	.61	
+									1406.86 15.17
	ROUTED TO								
+		RTDBA	48.	15.25	48.	23.	23.	.61	
	2 COMBINED AT								
+		CBAB	110.	15.00	109.	52.	52.	3.90	
	ROUTED TO								
+		RTAB	110.	15.00	109.	52.	52.	3.90	
	HYDROGRAPH AT								
+		DA10A	177.	12.25	24.	7.	7.	.12	
	ROUTED TO								
+		RT10A	176.	12.33	25.	7.	7.	.12	
	HYDROGRAPH AT								
+		DA10B	177.	12.25	24.	7.	7.	.12	
	2 COMBINED AT								
+		CB10B	350.	12.33	49.	14.	14.	.24	
	DIVERSION TO								
+		DVT	350.	.08	49.	14.	14.	.24	
	HYDROGRAPH AT								
+		DV10B	0.	.08	0.	0.	0.	.24	
	ROUTED TO								
+		RT10B	0.	.08	0.	0.	0.	.24	
	HYDROGRAPH AT								
+		DA10C	214.	12.25	29.	8.	8.	.12	

	2 COMBINED AT								
+		CB10C	214.	12.25	29.	8.	8.	.36	
	2 COMBINED AT								
+		CB10C2	250.	12.33	127.	60.	60.	4.26	
	ROUTED TO								
+		RT10C	250.	12.33	127.	60.	60.	4.26	
	HYDROGRAPH AT								
+		RN10B	350.	12.33	49.	14.	14.	.00	
	ROUTED TO								
+		RT10B2	342.	12.33	49.	14.	14.	.00	
	HYDROGRAPH AT								
+		DA11A	166.	12.25	23.	6.	6.	.10	
	2 COMBINED AT								
+		CB11A	503.	12.33	72.	20.	20.	.10	
	ROUTED TO								
+		DBD	45.	13.42	41.	18.	18.	.10	
+									1395.82 13.42
	ROUTED TO								
+		RT11A	45.	13.42	41.	18.	18.	.10	
	HYDROGRAPH AT								
+		DA11B	177.	12.25	24.	7.	7.	.12	
	ROUTED TO								
+		DB11B	85.	12.67	24.	7.	7.	.12	
+									1389.28 12.67
	3 COMBINED AT								
+		CB11B	349.	12.33	190.	84.	84.	4.48	
	ROUTED TO								
+		RT11B	348.	12.42	190.	84.	84.	4.48	
	HYDROGRAPH AT								
+		DA11D	85.	13.08	26.	7.	7.	.13	
	2 COMBINED AT								
+		CB11D	386.	12.42	216.	91.	91.	4.61	
	ROUTED TO								
+		RT11D	386.	12.50	216.	91.	91.	4.61	
	HYDROGRAPH AT								
+		DA11C	125.	13.33	46.	13.	13.	.22	
	2 COMBINED AT								

```
+                    CB11C     455.  13.00      262.      103.      103.      4.83
        ROUTED TO
+                    RT11C     455.  13.00      262.      103.      103.      4.83
        HYDROGRAPH AT
+                    DA11B     132.  13.25       48.       13.       13.       .18
        2 COMBINED AT
+                    CB11B     582.  13.08      310.      117.      117.      5.01
        DIVERSION TO
+                     DVSW     250.  13.08      222.       95.       95.      5.01
        HYDROGRAPH AT
+                     DVBC     332.  13.08       88.       22.       22.      5.01
        ROUTED TO
+                     RTBC      93.  14.25       74.       22.       22.      5.01
+                                                                        1349.72      14.25
        HYDROGRAPH AT
+                     RVSW     250.  12.25      222.       95.       95.       .00
        2 COMBINED AT
+                     CBSW     343.  14.25      293.      117.      117.      5.01


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

35th Avenue Detention Basin

The 35th Avenue Detention Basin side weir was designed utilizing the broad crested weir equation. An incremental length of 10' was used to derive discharges for heads from .10 ft. to 2.00 ft. Using these discharges along with the staging table for the inlet channel the side weir was analyzed. Discharges for each 10 ft. increment were subtracted from the remaining flow until only 250 cfs remained. From the results it was determined that a control structure was necessary to increase the depth and therefore shorten the length of the weir required.

The control structure serves a dual purpose in the design. In its first stage it acts to increase the depth on the inlet channel to increase discharge over the side weir until the detention basin reaches capacity. At capacity, the side flow weir becomes inundated and all channel flow continues downstream. At this stage, the control structure is functioning as the 40 ft. emergency spillway for the detention basin.

35TH AV DETENTION BASIN
SIDE WEIR ANALYSIS
SEPT 89
FILE: SIDE2.WK1

WEIR LENGTH (CUMULATIVE)	AVAILABLE HEAD DOWNSTREAM	"Q" DISCHARGED OVER WEIR	Q" REMAINING	WATER DEPTH
0	1.3	0	582	3.5
10	1.1	34.6	547.4	3.3
20	1.0	29.8	517.6	3.2
30	0.9	25.4	492.2	3.1
40	0.8	20.4	471.8	3.0
50	0.8	20.4	451.4	3.0
60	0.7	16.7	434.7	2.9
70	0.7	16.7	418.0	2.9
80	0.6	12.8	405.2	2.8
90	0.6	12.8	392.4	2.8
100	0.6	12.8	379.6	2.8
110	0.6	12.8	366.8	2.8
120	0.6	12.8	354.0	* 2.8
130	0.6	12.8	341.2	* 2.8
140	0.6	12.8	328.4	* 2.8
150	0.6	12.8	315.6	* 2.8
160	0.6	12.8	302.8	* 2.8
170	0.6	12.8	290.0	* 2.8
180	0.6	12.8	277.2	* 2.8
190	0.6	12.8	264.4	* 2.8
200	0.6	12.8	251.6	* 2.8

* CONTROL STRUCTURE REQUIRED TO DEVELOP HEAD

35TH AVE DETENTION BASIN
WEIR ANALYSIS
L = 10.00

BROAD CRESTED WEIR
Qw=CLH^1.5

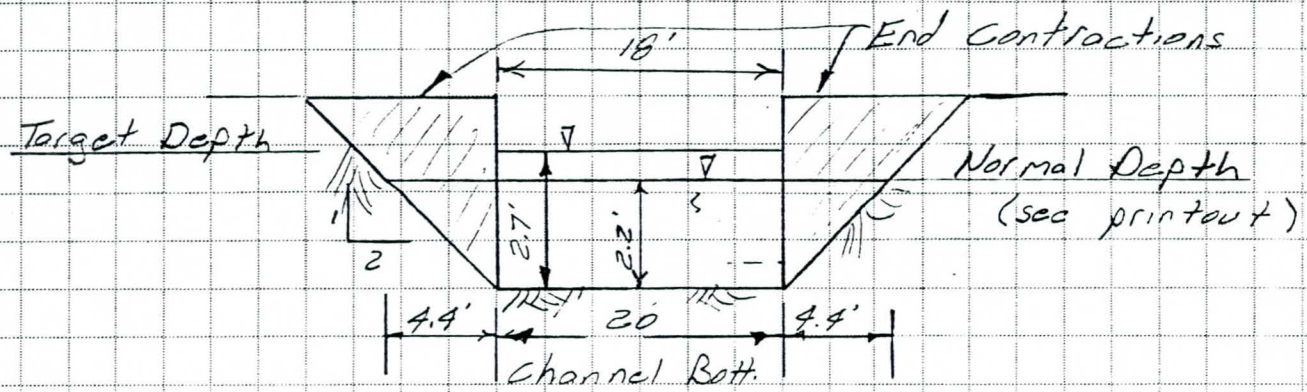
H(FT)	C	Qw(CFS)
0.10	2.69	0.85
0.20	2.69	2.41
0.30	2.72	4.47
0.40	2.72	6.88
0.50	2.75	9.72
0.60	2.75	12.78
0.70	2.85	16.69
0.80	2.85	20.39
0.90	2.98	25.44
1.00	2.98	29.80
1.10	3.00	34.61
1.20	3.08	40.49
1.30	3.14	46.54
1.40	3.20	53.01
1.50	3.24	59.52
1.60	3.28	66.38
1.70	3.29	72.92
1.80	3.31	79.93
1.90	3.30	86.43
2.00	3.30	93.34

STANLEY/METTEE-McGILL-MURPHY
1450 EAST INDIAN SCHOOL ROAD
PHOENIX, ARIZONA 85014

JOB [illegible]
SHEET NO. 1 OF 4
CALCULATED BY MAL DATE 9/29/89
CHECKED BY DATE
SCALE

Determine discharge for the following section.

Objective: Size end contractions that increase the backwater .5' for Q = 250 cfs.



Using Method by Kindsvater and Carter

Ref: Handbook of Hydraulics
by Brater and King
6th Ed.

Using average channel width for b

$b = [18 + (20+4.4+4.4)] \div 2 = 23.4$ ft

L = crest width = 18

$L/b = 18/23.4 = 0.77 \Rightarrow K_L = 0.013$ (See fig 5-3a)

$H/P = 0 \Rightarrow C_c = 3.15$

$L_c = 18 + .013 = 18.013$
$H_c = 2.7 + .003 = 2.703$

$Q = C_c L_c H_c^{3/2} = 3.15 \times 18.013 \times 2.703^{3/2} = 255$ cfs OK

PRODUCT 205-1 NEBS Inc. Groton, Mass. 01471 To Order PHONE TOLL FREE 1-800-225-6380

STANLEY/METTEE-McGILL-MURPHY

JOB NAME.....703-1 FILE..000703-1

09-25-1989 TIME 11:15:38

HYDROLOGY----------502

DESIGN DATA
TRAPEZOIDAL SECTION
WIDTH AT BOTTOM..... 20 FEET
SIDE SLOPE ON LEFT..... 2 /1
SIDE SLOPE ON RIGHT.... 2 /1

MANNING'S N..... .018
SLOPE..... .00160

DEPTH FT.	W.AT TOP FT.	P.WET FT.	AREA (SQ.FT.)	VEL.FT/SEC		RATE CFS	
0	20	20	0	0	F_R	0	$= V/\sqrt{gy}$
.1	20.4	20.45	2.02	.71		1.43	
.2	20.8	20.89	4.08	1.11		4.55	
.3	21.2	21.34	6.18	1.45		8.96	
.4	21.6	21.79	8.32	1.74		14.5	
.5	22	22.24	10.5	2.01		21.08	
.6	22.4	22.68	12.72	2.25		28.64	
.7	22.8	23.13	14.98	2.48		37.13	
.8	23.2	23.58	17.28	2.69		46.51	
.9	23.6	24.02	19.62	2.89		56.76	
1	24	24.47	22	3.08		67.85	
1.1	24.4	24.92	24.42	3.27		79.77	
1.2	24.8	25.37	26.88	3.44		92.51	
3	25.2	25.81	29.38	3.61		106.04	
.4	25.6	26.26	31.92	3.77		120.37	
1.5	26	26.71	34.5	3.93		135.49	
1.6	26.4	27.16	37.12	4.08		151.38	
1.7	26.8	27.6	39.78	4.22		168.05	
1.8	27.2	28.05	42.48	4.37		185.49	
1.9	27.6	28.5	45.22	4.5		203.69	
2	28	28.94	48	4.64		222.67	(250cfs)
2.1	28.4	29.39	50.82	4.77		242.4	
2.2	28.8	29.84	53.68	4.9	0.58	262.9	diversion
2.3	29.2	30.29	56.58	5.02		284.16	
2.4	29.6	30.73	59.52	5.14		306.19	
2.5	30	31.18	62.5	5.26		328.98	
2.6	30.4	31.63	65.52	5.38		352.53	
2.7	30.8	32.07	68.58	5.5		376.85	
2.8	31.2	32.52	71.68	5.61		401.94	
2.9	31.6	32.97	74.82	5.72		427.8	
3	32	33.42	78	5.83		454.43	
3.1	32.4	33.86	81.22	5.93		481.83	
3.2	32.8	34.31	84.48	6.04		510.02	(582cfs)
3.3	33.2	34.76	87.78	6.14		538.98	
3.4	33.6	35.21	91.12	6.24		568.72	Max Inflo
3.5	34	35.65	94.5	6.34	0.60	599.25	
3.6	34.4	36.1	97.92	6.44		630.56	
3.7	34.8	36.55	101.38	6.54		662.67	
3.8	35.2	36.99	104.88	6.63		695.57	
9	35.6	37.44	108.42	6.73		729.27	
4	36	37.89	112	6.82		763.78	

1.3' Available Head (Initial)

****

From Eq. (5-37):

$$C_e = 3.22 + 0.40\frac{H}{P}$$
$$= 3.20 + 0.11 = 3.31$$

Then, from Eq. (5-34),

$$Q = C_e L_e H_e^{3/2}$$
$$= 3.31 \times 4.997 \times (0.843)^{3/2} = 12.8 \text{ cu ft per sec}$$

Horizontal Sharp-crested Weirs with End Contractions. When the weir length L is less than the width of the channel b, the weir opening is in the form of a notch, with the ends of the notch having sharp edges and causing contractions in the same manner as the horizontal portion of the crest. A much smaller number of tests has been made on weirs of this type than on weirs without end contractions.

Tests made by Francis[1] indicated that the effect of the end contractions could be taken care of by reducing L in Eq. (5-10) by $0.2H$. The more recent work of Kindsvater and Carter[1] indicates that this procedure is not accurate for all conditions. Efforts to compensate for the end contractions led to the development of the *Cipolletti weir*.

This type of weir has ends which are not vertical but have a slope of 1:4, horizontal to vertical. This slope was chosen to provide sufficient additional discharge to compensate for the end contractions. However, experiments by Flinn and Dyer[2] and others indicate that the side slope of the notch should be greater than 1:4.

The experimentation by Kindsvater and Carter previously reported (p. 5-9) included tests on horizontal weirs with end contractions. Their procedure provides what is probably the best available method for estimating the discharge through rectangular notched sharp-edged weirs. The results are given in the form of two figures which are reproduced here in Fig. 5-3*a* and *b*. In Fig. 5-3*a* is shown a curve relating k_L to L/b, and in Fig. 5-3*b* are shown lines of C_e versus H/P for various values of L/b, the top line being the line representing Eq. (5-37), which applies to the case of $L/b = 1$. The use of these curves will be illustrated by means of an example.

[1] *Op. cit.*

[2] A. D. Flinn and C. W. D. Dyer, The Cipolletti Trapezoidal Weir, *Trans. ASCE*, vol. 32, 1894.

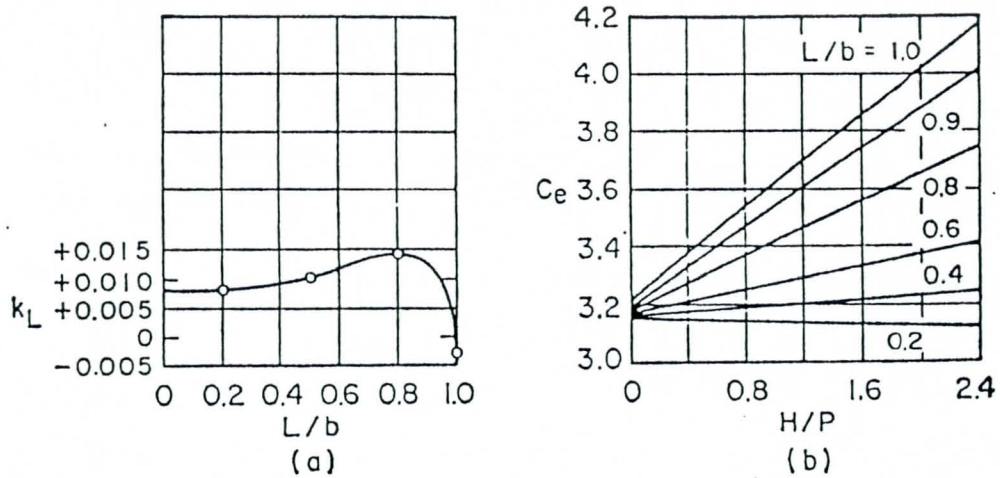


FIG. 5-3. Coefficients, horizontal sharp-crested weirs with end contractions.

Example 5-2. A rectangular notched sharp-crested weir having a horizontal crest 3 ft long located 2 ft above the bottom is centered in a rectangular channel 5 ft wide. Determine the discharge when the head is 0.40 ft.

$$\frac{L}{b} = 3/5 = 0.60 \qquad \frac{H}{P} = 0.40/2.0 = 0.20$$

Then, from Fig. 5-3*b*,

$$C_e = 3.19$$

From Fig. 5-3*a*, $k_L = +0.012$, and taking $k_H = 0.003$,

$$L_e = 3 + 0.012 = 3.012 \text{ ft}$$

and

$$H_e = 0.40 + 0.003 = 0.403 \text{ ft}$$

Then

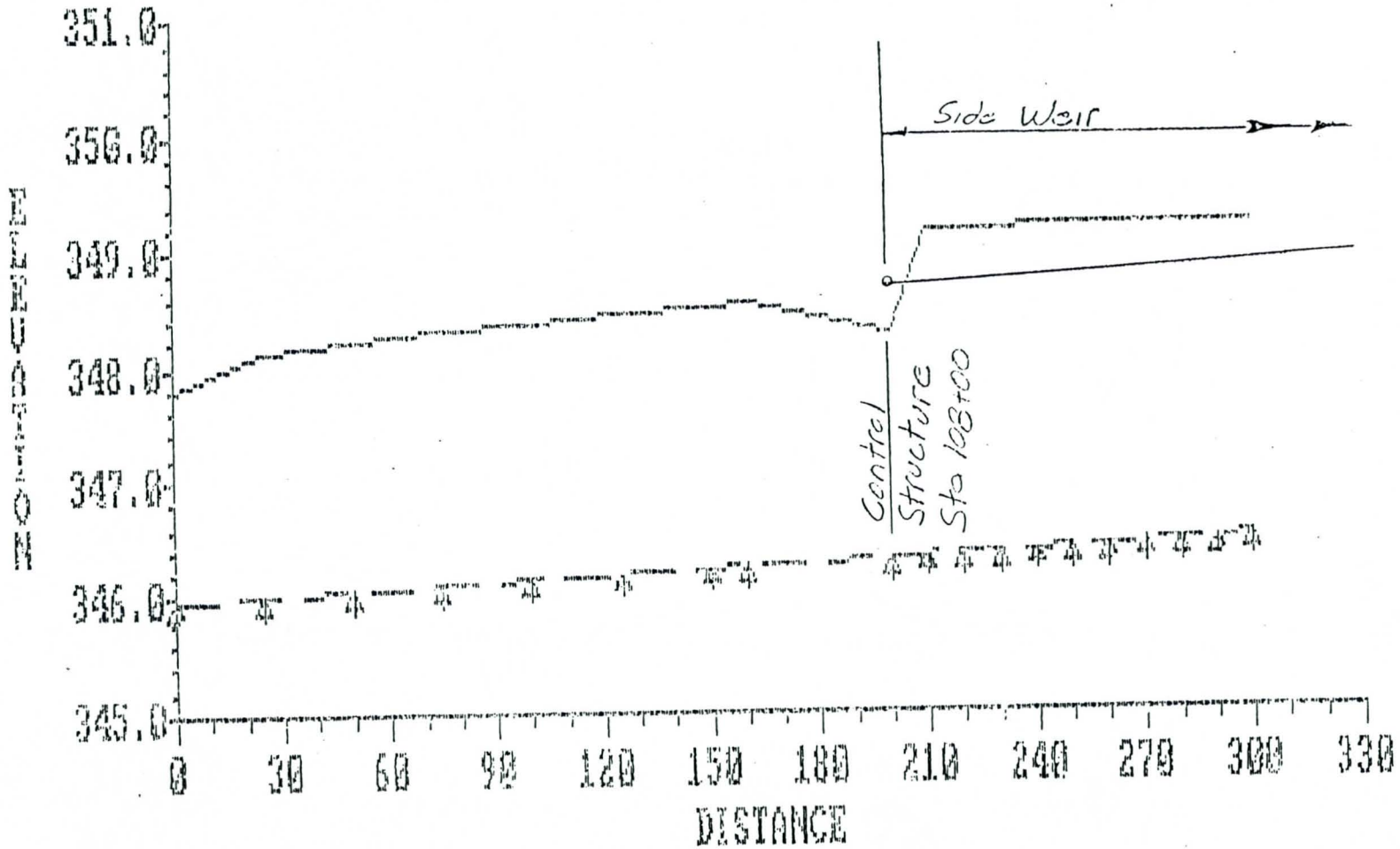
$$Q = C_e L_e H_e^{3/2} = 3.19 \times 3.012 \times 0.403^{3/2}$$

and making use of Table 5-1, if desired,

$$Q = 2.47 \text{ cu ft per sec}$$

WATER SURFACE PROFILE

Q - 250 cfs



35AVE DETENTION BASIN
STAGE STORAGE

3:1 SIDE SLOPES
SIZE : A 305
B 510
C 545

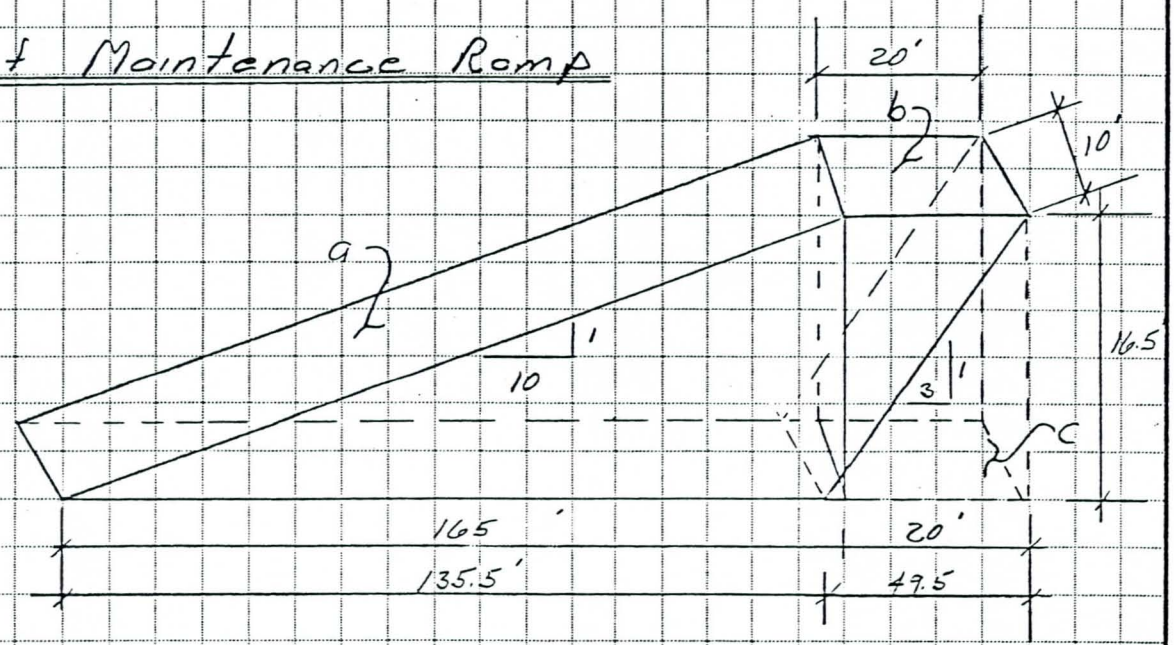
TOP AREA 160887.5 SF 3.69
TOP ELEV 1351

ELEVATION	SURFACE AREA (AC)	INCREMENTAL VOLUME(AC-FT)	ACCUMULATIVE VOLUME (AC-FT)
1351	3.693468	3.636547	43.43932
1350	3.579625	6.936524	39.80277
1348	3.356898	6.497681	32.86625
1346	3.140782	6.072061	26.36857
1344	2.931278	5.659664	20.29651
1342	2.728386	5.260491	14.63584
1340	2.532105	4.874540	9.376354
1338	2.342435	4.501813	4.501813
1336	2.159377	0	0

STANLEY/METTEE-McGILL-MURPHY
1450 EAST INDIAN SCHOOL ROAD
PHOENIX, ARIZONA 85014

JOB 35th Ave Detention Basin
SHEET NO. ____ OF ____
CALCULATED BY MAL DATE 10/13/89
CHECKED BY ____ DATE ____
SCALE ____

Volume of Maintenance Ramp



Item		Volume		
a	wedge	$10 \times 165 \times 16.5 \times 1/2$	$= 13{,}612.5\ ft^3$	$= 0.3125$ Ac-ft
b	cube	$20' \times 10' \times 16.5'$	$= 3{,}300.0\ ft^3$	$= 0.0758$ Ac-ft
c	wedge	$10' \times 49.5' \times 16.5' \times 1/2$	$= 4{,}083.7\ ft^3$	$= -0.0938$ Ac-ft
				0.2945 Ac-ft

Use ratio to subtract from Basin Capacity

$0.2945 \div 16.5' = 0.0178$ Ac-ft/ft

Amount is neglible & is therefore omitted

PRODUCT 205-1 NEBS Inc., Groton, Mass. 01471 To Order PHONE TOLL FREE 1-800-225-6380

STAGE DISCHARGE TABLE
35 AVE. DETENTION BASIN
SEPT 1989 File:DIS35Z.WK1

OUTFALL ELEVATION (10YR WS) 1337.75

OUTFALL LENGTH 2105.00

CONC. PIPE (N) 0.012

HEAD LOSS (Hf) = (1+Ke+(29L n^2/Rh^1.33) x v^2/2g
= W S ELEVATION - OUTFALL ELEVATION

PIPE DIAMETER (in) 36
(ft) 3.00
Rh=D/4= 0.75
Rh^1.33 0.68

W S ELEVATION	Hf	DISCHARGE (CFS)
1338.00	0.25	7.48
1340.00	2.25	22.43
1342.00	4.25	30.83
1344.00	6.25	37.39
1346.00	8.25	42.95
1348.00	10.25	47.88
1350.00	12.25	52.34
1351.00	13.25	54.44

```
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 MODIFIED TO 25TH AVE BY DCCO(9/89)
  3           ID       SEPTEMBER 6, 1989              FILE: 35DT2.IN
  4           ID       36" OUTFALL LINE TO SCATTER WASH
 339          DT    DVSW
 340          DI       0     150     250     251     750
 341          DQ       0     150     250     250     250

 342          KK    RTBC
 343          KM   ROUTE FLOW THROUGH DETENTION BASIN C (36" OUTLET)
 344          KO       1       2
 345          RS       1    STOR      -1       0
*** FREE ***
 346          SV       0    4.50    9.38   14.64   20.30   26.37   32.87   39.80   43.44
 347          SE    1336    1338    1340    1342    1344    1346    1348    1350    1351
 348          SQ   23.72   31.83   38.25   43.74   48.61   53.04   57.13   60.94   62.76
*** FIX ***

 349          KK    RVSW
 350          KM   RETRIEVE BASIN BYPASS FLOW DVSW
 351          DR    DVSW

 352          KK    CBSW
 353          KM   COMBINE TOTAL INFLOW TO SCATTER WASH
 354          KO       1
 355          HC       2
 356          ZZ
```

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
+	2 COMBINED AT	CB11B	582.	13.08	310.	117.	117.	5.01		
+	DIVERSION TO	DVSW	250.	13.08	222.	95.	95.	5.01		
+	HYDROGRAPH AT	DVBC	332.	13.08	88.	22.	22.	5.01		
+	ROUTED TO	RTBC	58.	14.50	52.	33.	33.	5.01	1348.22	14.50
+	HYDROGRAPH AT	RVSW	250.	12.25	222.	95.	95.	.00		
+	2 COMBINED AT	CBSW	308.	14.50	271.	128.	128.	5.01		

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

```
      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 MODIFIED TO 35TH AVE BY DCCO(9/89)
        3           ID       SEPTEMBER 6, 1989              FILE: 35DT5.IN
        4           ID       OUTFALL LINE TO SCATTER WASH ASSUMED CLOGGED
        5           ID       CONTROL STRUCTURE ACTS AS EMERGENCY SPILLWAY
      339           KK    DVBC
      340           KM   DIVERT FLOW TO DETENTION BASIN C
      341           DT    DVSW
      342           DI       0     150     250     251     750
      343           DQ       0     150     250     250     250

      344           KK    RTBC
      345           KM   ROUTE FLOW THROUGH DETENTION BASIN C (36" OUTLET)
      346           KO       1       2
      347           RS       1    STOR      -1       0
*** FREE ***
      348           SV       0    4.50    9.38   14.64   20.30   26.37   32.87   39.80   43.44
      349           SE    1336    1338    1340    1342    1344    1346    1348    1350    1351
      350           SS  1349.1    32.0     3.0     1.5
*** FIX ***

      351           KK    RVSW
      352           KM   RETRIEVE BASIN BYPASS FLOW DVSW
      353           DR    DVSW

      354           KK    CBSW
      355           KM   COMBINE TOTAL INFLOW TO SCATTER WASH
      356           KO       1
      357           HC       2
      358           ZZ
1
```

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

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	2 COMBINED AT	CB11B	582.	13.08	310.	117.	117.	5.01		
+	DIVERSION TO	DVSW	250.	13.08	222.	95.	95.	5.01		
+	HYDROGRAPH AT	DVBC	332.	13.08	88.	22.	22.	5.01		
+	ROUTED TO	RTBC	131.	14.08	23.	6.	6.	5.01		
+									1350.33	14.08
+	HYDROGRAPH AT	RVSW	250.	12.25	222.	95.	95.	.00		
+	2 COMBINED AT	CBSW	381.	14.08	244.	100.	100.	5.01		

```
1*************************************************
* WATER SURFACE PROFILES                        *
* VERSION OF NOVEMBER 1976                      *
* UPDATED MAY 1984                              *
* IBM-PC-XT VERSION AUGUST 1985                 *
* RUN DATE  10-13-89   TIME  13:44:02           *
*************************************************
```

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

```
1
 10-13-89     13:44:03                                                    PAGE    1
```

THIS RUN EXECUTED 10-13-89

```
*************************************************
 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 FREE FORMAT
C
T1       35TH AV DETENTION CHANNEL
T2       250 CFS BYPASS - WITH DROP AT 1ST CONTROL STRUCTURE
T3       STANLEY CONSULTANTS OF AZ  -35CH5.IN-

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

      0.       2.       0.       0. -1.000000      .00       .0       0.   336.500     .000

J2  NPROF    IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

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


NC      .015     .015     .015     .100     .300     .000     .000     .000     .000     .000
GT     2.000 1830.000 1961.000     .000     .000     .000     .000     .000     .000     .000
X1   117.460    4.000 9936.000 10064.000     .000     .000     .000     .000     .000     .000
X1   341.000 9935.000  334.500  9936.000  334.500 10064.000  341.000 10064.000     .000     .000
```

```
NC      .030      .030      .030      .000      .000      .000      .000      .000      .000      .000
X1   8737.000     5.000  9933.600 10066.400    20.000    80.000    50.000      .000      .000      .000
     341.000  9933.600   335.200  9945.000   334.700 10000.000   335.200 10055.000   341.000 10066.400

QT     2.000  1580.000  1580.000      .000      .000      .000      .000      .000      .000      .000
X1   117.480     5.000  9933.500 10066.400    55.000    35.000    41.930      .000      .000      .000
GR   341.000  9933.600   335.300  9945.000   334.800 10000.000   335.300 10055.000   341.000 10066.400

X1   117.580     5.000  9853.000 10136.000   500.000   575.000   549.000      .000      .000      .000
GR   343.000  9853.000   337.500  9865.000   337.010 10000.000   337.500 10125.000   343.000 10136.000

NC      .000      .000      .018      .000      .000      .000      .000      .000      .000      .000
QT     2.000   250.000   381.000      .000      .000      .000      .000      .000      .000      .000
        ******** CONFLUENCE OF DIVERSION CHANNEL AND SCATTER WASH *************
X1  -8737.000     4.000    86.350   110.600      .000      .000      .000      .000      .000      .000
GR   340.000    86.350   335.180    96.000   335.180   104.000   338.480   110.600      .000      .000
1
 10-13-89     13:44:03                                                                          PAGE    2


X1   8800.000     4.000    86.000   110.700    62.000    62.000    62.000      .000      .000      .000
GR   339.900    86.000   335.530    96.000   335.380   104.000   338.750   110.700      .000      .000

X1   9000.000     4.000    89.550   110.760   200.000   200.000   200.000      .000      .000      .000
GR   339.640    89.550   336.420    95.000   336.260   104.000   339.640   110.760      .000      .000

X1   9200.000      .000      .000      .000   200.000   200.000   200.000      .000      .880      .000

X1   9400.000      .000      .000      .000   200.000   200.000   200.000      .000      .880      .000

X1   9466.000      .000      .000      .000    66.000    66.000    66.000      .000      .290      .000

X1   9486.000     4.000    93.670   106.330    20.000    20.000    20.000      .000      .000      .000
X3     10.000      .000      .000      .000      .000      .000      .000      .000      .000      .000
GR   342.470    93.670   338.470    93.670   338.470   106.330   342.470   106.330      .000      .000

NC      .000      .000      .012      .000      .000      .000      .000      .000      .000      .000
SB     1.050     1.500     2.500      .000    12.670      .670    48.000      .000   338.670   338.470
        ******** 2 - 6 X 4 CBC , ENTRANCE INTO STATE LAND ************
X1   9530.000     4.000    93.670   106.330    44.000    44.000    44.000      .000      .000      .000
X2      .000      .000     1.000   342.670   344.940      .000      .000      .000      .000      .000
X3     10.000      .000      .000      .000      .000      .000      .000   342.670   342.670      .000
BT     2.000    93.670   344.670      .000   106.330   344.670      .000      .000      .000      .000
GR   344.670    93.670   338.670    93.670   338.670   106.330   344.670   106.330      .000      .000

NC      .000      .000      .018      .000      .000      .000      .000      .000      .000      .000
X1   9537.000     4.000    86.300   113.740     7.000     7.000     7.000      .000      .000      .000
GR   342.790    86.300   338.700    94.480   338.680   105.520   342.790   113.740      .000      .000

X1   9550.000     4.000    87.580   112.740    13.000    13.000    13.000      .000      .000      .000
GR   343.050    87.580   338.840    96.000   338.680   104.000   343.050   112.740      .000      .000

     9600.000      .000      .000      .000    50.000    50.000    50.000      .000      .220      .000
```

X1	9700.000	.000	.000	.000	100.000	100.000	100.000	.000	.440	.000
	9800.000	.000	.000	.000	100.000	100.000	100.000	.000	.440	.000
X1	9900.000	.000	.000	.000	100.000	100.000	100.000	.000	.440	.000
X1	10000.000	.000	.000	.000	100.000	100.000	100.000	.000	.440	.000
X1	10100.000	.000	.000	.000	100.000	100.000	100.000	.000	.440	.000
X1	10200.000	.000	.000	.000	100.000	100.000	100.000	.000	.440	.000
X1	10300.000	.000	.000	.000	100.000	100.000	100.000	.000	.440	.000

1

X1	10335.000	4.000	96.000	104.000	35.000	35.000	35.000	.000	.000	.000
X3	10.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
GR	347.140	96.000	342.140	96.000	342.140	104.000	347.140	104.000	.000	.000
NC	.000	.000	.012	.300	.500	.000	.000	.000	.000	.000
SE	.000	1.600	2.600	.000	8.000	.000	40.000	.000	342.300	342.140

******* 1 - 8 X 5 CBC UNDER 35TH AV *********

X1	10499.000	4.000	96.000	104.000	154.000	154.000	154.000	.000	.000	.000
X2	.000	.000	1.000	347.300	348.700	.000	.000	.000	.000	.000
X3	10.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
GR	349.720	96.000	342.300	96.000	342.300	104.000	349.720	104.000	.000	.000
NC	.000	.000	.018	.000	.000	.000	.000	.000	.000	.000
X1	10514.000	4.000	81.690	118.310	14.000	14.000	14.000	.000	.000	.000
GR	349.500	81.690	342.440	95.810	342.440	104.190	349.500	118.310	.000	.000
X1	10525.000	4.000	81.570	118.290	11.000	11.000	11.000	.000	.000	.000
GR	349.600	81.570	342.550	95.670	342.550	104.330	349.530	118.290	.000	.000
X1	10550.000	4.000	81.470	118.250	25.000	25.000	25.000	.000	.000	.000
GR	349.730	81.470	342.800	95.330	342.800	104.670	349.590	118.250	.000	.000
X1	10575.000	4.000	81.340	118.200	25.000	25.000	25.000	.000	.000	.000
GR	349.880	81.340	343.050	95.000	343.050	105.000	349.650	118.200	.000	.000
X1	10600.000	4.000	81.190	118.150	25.000	25.000	25.000	.000	.000	.000
GR	350.040	81.190	343.300	94.670	343.300	105.330	349.710	118.200	.000	.000
X1	10625.000	4.000	81.030	118.110	25.000	25.000	25.000	.000	.000	.000
GR	350.200	81.030	343.550	94.330	343.550	105.670	349.770	118.110	.000	.000
X1	10650.000	4.000	80.880	118.060	25.000	25.000	25.000	.000	.000	.000
GR	350.360	80.880	343.800	94.000	343.800	105.000	349.830	118.060	.000	.000
X1	10675.000	4.000	80.730	118.010	25.000	25.000	25.000	.000	.000	.000
GR	350.520	80.730	344.050	93.670	344.050	106.330	349.890	118.010	.000	.000

```
X1  10700.000     4.000    80.570   117.970    25.000    25.000    25.000      .000      .000      .000
GR    350.680    80.570   344.300    93.330   344.300   106.670   349.950   117.970      .000      .000

X1  10725.000     4.000    80.740   117.420    25.000    25.000    25.000      .000      .000      .000
GR    350.680    80.740   344.550    93.000   344.550   107.000   350.010   117.420      .000      .000

X1  10750.000     4.000    80.590   117.870    25.000    25.000    25.000      .000      .000      .000
GR    350.840    80.590   344.800    92.670   344.800   107.330   350.070   117.870      .000      .000

X1  10775.000     4.000    80.430   117.830    25.000    25.000    25.000      .000      .000      .000
GR    351.000    80.430   345.050    92.330   345.050   107.670   350.130   117.830      .000      .000
1
 10-13-89     12:44:03                                                                          PAGE    4


NC      .018      .018      .018      .000      .000      .000      .000      .000      .000      .000
X1  10800.000     8.000    91.000   109.000    25.000    25.000    25.000      .000      .000      .000
X3     10.000      .000      .000      .000      .000      .000      .000      .000      .000      .000
GR    351.300    80.000   349.100    86.400   349.100    91.000   345.300    91.000   345.300   109.000
GR    349.100   109.000   349.100   115.180   350.200   117.800      .000      .000      .000      .000

        *******18' CONTROL STRUCTURE AND EMERGENCY SPILLWAY *****************
X1  10801.000     8.000    91.000   109.000     1.000     1.000     1.000      .000      .000      .000
GR    351.300    80.000   349.100    86.400   349.100    91.000   346.480    91.000   346.120   109.000
GR    349.100   109.000   349.100   115.180   350.200   118.000      .000      .000      .000      .000

NC      .030      .030      .018      .000      .000      .000      .000      .000      .000      .000
X1  10810.000     4.000    80.000   118.000     9.000     9.000     9.000      .000      .000      .000
GR    351.320    80.000   346.520    90.000   346.120   110.000   350.320   118.000      .000      .000

X1  10820.000      .000      .000      .000    10.000    10.000    10.000      .000      .014      .000

X1  10830.000      .000      .000      .000    10.000    10.000    10.000      .000      .014      .000

X1  10840.000      .000      .000      .000    10.000    10.000    10.000      .000      .014      .000

X1  10850.000      .000      .000      .000    10.000    10.000    10.000      .000      .014      .000

X1  10860.000      .000      .000      .000    10.000    10.000    10.000      .000      .014      .000

X1  10870.000      .000      .000      .000    10.000    10.000    10.000      .000      .014      .000

X1  10880.000      .000      .000      .000    10.000    10.000    10.000      .000      .014      .000

X1  10890.000      .000      .000      .000    10.000    10.000    10.000      .000      .014      .000

X1  10900.000      .000      .000      .000    10.000    10.000    10.000      .000      .014      .000
EJ      .000      .000      .000      .000      .000      .000      .000      .000      .000      .000
1
 10-13-89     13:44:03                                                                          PAGE    5


 SECNO    DEPTH    CWSEL    CRIWS    WSELK    EG       HV       HL       OLOSS    BANK ELEV
```

```
   Q        QLOB     QCH      QROB     ALOB     ACH      AROB     VOL      TWA   LEFT/RIGHT
   TIME     VLOB     VCH      VROB     XNL      XNCH     XNR      WTN      ELMIN     SSTA
   SLOPE    XLOBL    XLCH     XLOBR    ITRIAL   IDC      ICONT    CORAR    TOPWID    ENDST


*PROF 1


CCHV=    .100 CEHV=    .300
*SECNO 117.460
3720 CRITICAL DEPTH ASSUMED
   117.46     1.85   336.35   336.35   336.50   337.28      .93      .00      .00   341.00
    1830.       0.    1830.       0.       0.     235.       0.       0.       0.   341.00
      .00      .00     7.75      .00     .015     .015     .015     .000   334.50  9936.00
  .002808       0.       0.       0.        0       10        0      .00   128.00 10064.00
0
*SECNO 8737.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  8737.00     2.27   336.97   336.97      .00   337.97      .99      .25      .02   341.00
    1830.       0.    1830.       0.       0.     229.       0.       0.       0.   341.00
      .00      .00     8.00      .00     .030     .030     .030     .000   334.70  9941.51
  .010750      20.      50.      80.       20       11        0      .00   116.98 10058.49
0
*SECNO 117.480

3301 HV CHANGED MORE THAN HVINS

   117.48     3.07   337.87      .00      .00   338.24      .37      .21      .06   341.00
    1580.       0.    1580.       0.       0.     323.       0.       1.       0.   341.00
      .00      .00     4.89      .00     .030     .030     .030     .000   334.80  9939.87
  .002651      55.      42.      35.        3        0        0      .00   120.26 10060.13
0
*SECNO 117.580
   117.58     2.21   339.22      .00      .00   339.35      .14     1.10      .02   343.00
    1580.       0.    1580.       0.       0.     518.       0.       6.       3.   343.00
      .05      .00     3.05      .00     .030     .030     .030     .000   337.01  9861.24
  .001574     500.     549.     575.        4        0        0      .00   267.21 10128.45
0
*SECNO -8737.000
START TRIB COMP
  -8737.000  8737.000   336.974
1
 10-13-89     13:44:03                                                                PAGE    6


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


301 HV CHANGED MORE THAN HVINS
```

```
3720 CRITICAL DEPTH ASSUMED
        ******** CONFLUENCE OF DIVERSION CHANNEL AND SCATTER WASH *************
  8737.00     2.51   337.69   337.69      .00   338.60      .91      .00      .00   340.00
     250.       0.     250.       0.       0.      33.       0.       6.       3.   338.48
      .05      .00     7.66      .00     .030     .018     .030     .000   335.18    90.98
  .004243       0.       0.       0.        0        8        0      .00    18.03   109.02
0
*SECNO 8800.000
  8800.00     2.70   338.08      .00      .00   338.85      .76      .24      .01   339.90
     250.       0.     250.       0.       0.      36.       0.       6.       3.   338.75
      .05      .00     7.02      .00     .030     .018     .030     .000   335.38    90.17
  .003428      62.      52.      62.        3        0        0      .00    19.19   109.36
0
*SECNO 9000.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  9000.00     2.59   338.85   338.85      .00   339.76      .91      .76      .04   339.64
     250.       0.     250.       0.       0.      33.       0.       6.       3.   339.64
      .06      .00     7.54      .00     .030     .018     .030     .000   335.26    91.14
  .004218     200.     200.     200.        2        8        0      .00    18.05   109.18
0
*SECNO 9200.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  9200.00     2.58   339.72   339.72      .00   340.54      .92      .85      .00   340.52
     250.       0.     250.       0.       0.      33.       0.       6.       3.   340.52
      .07      .00     7.68      .00     .030     .018     .030     .000   337.14    91.16
  .004284     200.     200.     200.        0        5        0      .00    18.01   109.16

*SECNO 9400.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  9400.00     2.58   340.60   340.60      .00   341.52      .91      .86      .00   341.40
     250.       0.     250.       0.       0.      33.       0.       6.       3.   341.40
      .08      .00     7.67      .00     .030     .018     .030     .000   338.02    91.15
  .004269     200.     200.     200.        0        5        0      .00    18.01   109.17
0
1
 10-13-89    13:44:03                                                                PAGE    7


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


*SECNO 9455.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  9456.00     2.58   340.89   340.89      .00   341.81      .91      .28      .00   341.69
     250.       0.     250.       0.       0.      33.       0.       6.       3.   341.69
      .09      .00     7.67      .00     .030     .018     .030     .000   338.31    91.15
  .004270      66.      66.      66.        0        5        0      .00    18.01   109.17
```

```
0
*SECNO 9485.000

95 OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=     342.47 ELREA=     342.47

  9486.00     2.44   340.91      .00      .00   341.93     1.02      .09      .03   342.47
     250.       0.     250.       0.       0.      31.       0.       6.       3.   342.47
      .08      .00     8.09      .00     .030     .018     .030     .000   338.47    93.67
  .004511      20.      20.      20.        2        0        0      .00    12.66   106.33
0

SPECIAL BRIDGE

5227 DOWNSTREAM ELEV IS    340.39 ,NOT    340.91 HYDRAULIC JUMP OCCURS DOWNSTREAM (IF LOW FLOW CONTROLS)

SB  XK        XKOR      COFQ      RDLEN     BWC       BWP       BAREA     SS        ELCHU     ELCHD
    1.05      1.50      2.60       .00     12.67       .67     48.00       .00    338.67    338.47

*SECNO 9530.000
CLASS B LOW FLOW

3420 BRIDGE W.S.=    340.95 BRIDGE VELOCITY=,      9.75      CALCULATED CHANNEL AREA=,       27.

 EGPRS      EGLWC       H3       QWEIR      QLOW      BAREA   TRAPEZOID      ELLC      ELTRD
                                                                 AREA
      .00    342.33      .00        0.      250.       48.       48.      342.67    344.94


 .95 OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=     342.67 ELREA=     342.67

       ******** 2 - 6 X 4 CBC , ENTRANCE INTO STATE LAND ************
  9530.00     2.98   341.65      .00      .00   342.33      .68      .40      .00   344.67
     250.       0.     250.       0.       0.      38.       0.       6.       3.   344.67
      .08      .00     5.53      .00     .000     .012     .000     .000   338.67    93.67
  .001118      44.      44.      44.        0        0        0      .00    12.66   106.33
0
1
 10-13-89     13:44:03                                                                    PAGE    9


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


*SECNO 9537.000
  9537.00     3.44   342.12      .00      .00   342.38      .26      .01      .04   342.79
     250.       0.     250.       0.       0.      61.       0.       6.       3.   342.79
      .08      .00     4.07      .00     .030     .018     .030     .000   338.68    87.54
  .000787       7.       7.       7.        3        0        0      .00    24.77   112.40
0
*SECNO 9550.000
  9550.00     3.33   342.01      .00      .00   342.45      .44      .01      .05   343.05
```

```
     250.       0.     250.       0.       0.      47.       0.       6.       3.   343.05
      .09      .00     5.30     .00     .030     .018     .030     .000   338.68    89.65
  .001526      13.      13.      13.        2        0        0      .00    21.01   110.67

*SECNO 9600.000
  9600.00     3.14   342.04      .00      .00   342.55      .52      .09      .03   343.27
     250.       0.     250.       0.       0.      43.       0.       7.       3.   343.27
      .09      .00     5.79     .00     .030     .018     .030     .000   338.90    90.04
  .001958      50.      50.      50.        2        0        0      .00    20.24   110.28
0
*SECNO 9700.000
  9700.00     2.80   342.14      .00      .00   342.86      .73      .24      .06   343.71
     250.       0.     250.       0.       0.      37.       0.       7.       3.   343.71
      .09      .00     6.84     .00     .030     .018     .030     .000   339.34    90.72
  .003104     100.     100.     100.        2        0        0      .00    18.88   109.60
0
*SECNO 9800.000
  9800.00     2.60   342.38   342.36      .00   343.27      .89      .36      .05   344.15
     250.       0.     250.       0.       0.      33.       0.       7.       3.   344.15
      .09      .00     7.58     .00     .030     .018     .030     .000   339.78    91.11
  .004125     100.     100.     100.        2       11        0      .00    18.10   109.21
0
*SECNO 9900.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  9900.00     2.58   342.80   342.80      .00   343.72      .92      .42      .01   344.59
     250.       0.     250.       0.       0.      33.       0.       7.       3.   344.59
      .10      .00     7.69     .00     .030     .018     .030     .000   340.22    91.16
  .004295     100.     100.     100.        2        5        0      .00    18.00   109.16

1
 10-13-89    13:44:03                                                                  PAGE    9

   SECNO    DEPTH    CWSEL    CRIWS    WSELK    EG       HV       HL       OLOSS   BANK ELEV
   Q        BLOB     GCH      GROB     ALOB     ACH      AROB     VOL      TWA   LEFT/RIGHT
   TIME     VLOB     VCH      VROB     XNL      XNCH     XNR      WTN      ELMIN     SSTA
   SLOPE    XLOBL    XLCH     XLOBR    ITRIAL   IDC      ICONT    CORAR    TOPWID    ENDST


*SECNO 10000.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
 10000.00     2.58   343.24   343.24      .00   344.16      .91      .43      .00   345.03
     250.       0.     250.       0.       0.      33.       0.       7.       3.   345.03
      .10      .00     7.67     .00     .030     .018     .030     .000   340.65    91.15
  .004267     100.     100.     100.        0        5        0      .00    18.02   109.17
0
*SECNO 10100.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
 10100.00     2.58   343.68   343.68      .00   344.60      .92      .43      .00   345.47
     250.       0.     250.       0.       0.      33.       0.       7.       3.   345.47
      .11      .00     7.68     .00     .030     .018     .030     .000   341.10    91.15
  .004274     100.     100.     100.        0        5        0      .00    18.01   109.17
```

```
0
 *SECNO 10200.000
 7185 MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
  10200.00     2.58   344.12   344.12      .00   345.04      .91      .43      .00   345.91
     250.        0.     250.       0.       0.      33.       0.       7.       3.   345.91
      .11       .00     7.67      .00     .030     .018     .030     .000   341.54    91.15
   .004269     100.     100.     100.        0        5        0      .00    18.01   109.17
0
 *SECNO 10300.000
 7185 MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
  10300.00     2.58   344.56   344.56      .00   345.48      .91      .43      .00   346.35
     250.        0.     250.       0.       0.      33.       0.       7.       3.   346.35
      .11       .00     7.68      .00     .030     .018     .030     .000   341.98    91.15
   .004271     100.     100.     100.        0        5        0      .00    18.01   109.17
0
 *SECNO 10335.000

 3301 HV CHANGED MORE THAN HVINS

 3585 20 TRIALS ATTEMPTED WSEL,CWSEL
 3693 PROBABLE MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
1
  10-13-89     13:44:03                                                                    PAGE   10


    SECNO    DEPTH    CWSEL    CRIWS    WSELK    EG       HV       HL       CLOSS   BANK ELEV
    Q        ELOB     QCH      QROB     ALOB     ACH      AROB     VOL      TWA   LEFT/RIGHT
    TIME     VLOB     VCH      VROB     XNL      XNCH     XNR      WTN      ELMIN      SSTA
    SLOPE    XLOBL    XLCH     XLOBR    ITRIAL   IDC      ICONT    CORAR    TOPWID     ENDST


 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      347.14 ELREA=      347.14

  10335.00     3.11   345.25   345.25      .00   346.82     1.57      .19      .20   347.14
     250.        0.     250.       0.       0.      25.       0.       7.       3.   347.14
      .11       .00    10.06      .00     .030     .018     .030     .000   342.14    96.00
   .007042      35.      35.      35.       20       11        0      .00     8.00   104.00
0
 CCHV=    .300 CEHV=    .500

 SPECIAL BRIDGE

 SB  XK        XKOR      COFQ      RDLEN     BWC       BWP       BAREA     SS        ELCHU     ELCHD
       .00      1.60      2.60       .00      8.00       .00     40.00       .00    342.30    342.14

 *SECNO 10499.000

 6070,LOW FLOW BY NORMAL BRIDGE

 EGPRB=      .000  EGLWC=   346.978  ELLC=   347.300  FCWSE=   345.247  ELTRD=   348.700
```

```
3301 HV CHANGED MORE THAN HVINS

70 NORMAL BRIDGE,NRD=  0 MIN ELTRD=  348.70 MAX ELLC=  347.30

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      349.72 ELREA=      349.72

       ******* 1 - 8 X 5 CBC UNDER 35TH AV *********
 10499.00     4.32   346.62      .00      .00   347.43      .81      .39      .23   349.72
    250.       0.     250.       0.       0.      35.       0.       7.       3.   349.72
     .12      .00     7.22      .00     .030     .012     .030     .000   342.30    96.00
  .001280     154.     154.     154.        4        0        0      .00     8.00   104.00
0
*SECNO 10514.000

3301 HV CHANGED MORE THAN HVINS

 10514.00     5.10   347.54      .00      .00   347.65      .11      .01      .21   349.50
    250.       0.     250.       0.       0.      95.       0.       7.       3.   349.50
     .12      .00     2.64      .00     .030     .018     .030     .000   342.44    85.61
  .000232      14.      14.      14.        3        0        0      .00    28.79   114.39
0
1
 10-13-89    13:44:03                                                                PAGE   11

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

*SECNO 10525.000
 10525.00     4.99   347.54      .00      .00   347.65      .11      .00      .00   349.50
    250.       0.     250.       0.       0.      93.       0.       7.       3.   349.53
     .12      .00     2.58      .00     .030     .018     .030     .000   342.55    85.67
  .000242      11.      11.      11.        0        0        0      .00    28.66   114.33
0
*SECNO 10550.000
 10550.00     4.74   347.54      .00      .00   347.67      .12      .01      .00   349.73
    250.       0.     250.       0.       0.      89.       0.       7.       3.   349.59
     .12      .00     2.79      .00     .030     .018     .030     .000   342.80    85.83
  .000274      25.      25.      25.        0        0        0      .00    28.34   114.17
0
*SECNO 10575.000
 10575.00     4.50   347.55      .00      .00   347.68      .13      .01      .01   349.88
    250.       0.     250.       0.       0.      86.       0.       7.       3.   349.65
     .13      .00     2.92      .00     .030     .018     .030     .000   343.05    86.00
  .000312      25.      25.      25.        0        0        0      .00    28.01   114.00
0
*SECNO 10600.000
 10600.00     4.25   347.55      .00      .00   347.70      .15      .01      .01   350.04
    250.       0.       0.     250.       0.       0.      82.       7.       3.   400.04
     .13      .00      .00     3.05     .030     .018     .030     .000   343.30    86.16
```

```
  .000834     25.      25.      25.       0        0        0      .00    27.71   113.87
0
*SECNO 10625.000
 0625.00     4.01   347.56      .00      .00   347.72      .16      .01      .01   350.20
    250.       0.     250.       0.       0.      78.       0.       7.       3.   349.77
     .13      .00     3.21      .00     .030     .018     .030     .000   343.55    86.30
  .000412     25.      25.      25.       0        0        0      .00    27.41   113.70
0
*SECNO 10650.000
 10650.00     3.76   347.56      .00      .00   347.74      .18      .01      .01   350.36
    250.       0.     250.       0.       0.      74.       0.       7.       3.   349.83
     .13      .00     3.40      .00     .030     .018     .030     .000   343.80    86.46
  .000455     25.      25.      25.       1        0        0      .00    27.07   113.54
0
1
 10-13-89    13:44:03                                                                PAGE   12

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

*SECNO 10675.000
 10675.00     3.51   347.56      .00      .00   347.76      .20      .01      .01   350.52
    250.       0.     250.       0.       0.      69.       0.       8.       3.   349.89
     .14      .00     3.60      .00     .030     .018     .030     .000   344.05    86.63
  .000579     25.      25.      25.       0        0        0      .00    26.75   113.37

*SECNO 10700.000
 10700.00     3.26   347.56      .00      .00   347.79      .23      .02      .01   350.68
    250.       0.     250.       0.       0.      65.       0.       8.       4.   349.95
     .14      .00     3.84      .00     .030     .018     .030     .000   344.30    86.79
  .000704     25.      25.      25.       1        0        0      .00    26.42   113.21
0
*SECNO 10725.000
 10725.00     3.02   347.57      .00      .00   347.83      .27      .02      .02   350.68
    250.       0.     250.       0.       0.      60.       0.       8.       4.   350.01
     .14      .00     4.15      .00     .030     .018     .030     .000   344.55    86.95
  .000881     25.      25.      25.       1        0        0      .00    25.82   112.77
0
*SECNO 10750.000
 10750.00     2.77   347.57      .00      .00   347.88      .31      .02      .02   350.84
    250.       0.     250.       0.       0.      56.       0.       8.       4.   350.07
     .14      .00     4.45      .00     .030     .018     .030     .000   344.80    87.11
  .001100     25.      25.      25.       1        0        0      .00    25.77   112.89
0
*SECNO 10775.000
 10775.00     2.52   347.57      .00      .00   347.94      .37      .03      .03   351.00
    250.       0.     250.       0.       0.      51.       0.       8.       4.   350.13
     .14      .00     4.86      .00     .030     .018     .030     .000   345.05    87.29
  .001444     25.      25.      25.       2        0        0      .00    25.43   112.71
0
  ECNO 10800.000
```

```
3495 OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      349.10 ELREA=      349.10

 0800.00     2.19   347.49      .00      .00   348.11      .62      .05      .13   349.10
    250.       0.     250.       0.       0.      39.       0.       8.       4.   349.10
     .14      .00     6.33      .00     .018     .018     .018     .000   345.30    91.00
 .002750      25.      25.      25.        2        0        0      .00    18.00   109.00
0
1
 10-13-89    13:44:03                                                                PAGE   13


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


*SECNO 10801.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3593 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
       *******18' CONTROL STRUCTURE AND EMERGENCY SPILLWAY *****************
 10801.00     1.99   349.11   348.11      .00   349.02      .92      .00      .15   349.10
    250.       0.     250.       0.       0.      33.       0.       8.       4.   349.10
     .14      .00     7.98      .00     .018     .018     .018     .000   346.12    91.00
 .005019       1.       1.       1.       20       11        0      .00    18.00   109.00
0
*SECNO 10810.000

3301 HV CHANGED MORE THAN HVINS

 10810.00     2.93   349.05      .00      .00   349.25      .20      .01      .21   351.32
    250.       0.     250.       0.       0.      69.       0.       8.       4.   350.32
     .14      .00     3.61      .00     .030     .018     .030     .000   346.12    84.74
 .000684       9.       9.       9.        4        0        0      .00    30.84   115.57
0
*SECNO 10820.000
 10820.00     2.92   349.06      .00      .00   349.26      .20      .01      .00   351.33
    250.       0.     250.       0.       0.      69.       0.       8.       4.   350.33
     .14      .00     3.61      .00     .030     .018     .030     .000   346.13    84.75
 .000689      10.      10.      10.        2        0        0      .00    30.82   115.57
0
*SECNO 10830.000
 10830.00     2.91   349.06      .00      .00   349.27      .20      .01      .00   351.35
    250.       0.     250.       0.       0.      69.       0.       8.       4.   350.35
     .15      .00     3.62      .00     .030     .018     .030     .000   346.15    84.76
 .000694      10.      10.      10.        0        0        0      .00    30.79   115.55
0
*SECNO 10840.000
 10840.00     2.91   349.07      .00      .00   349.27      .21      .01      .00   351.36
    250.       0.     250.       0.       0.      69.       0.       8.       4.   350.36
     .15      .00     3.64      .00     .030     .018     .030     .000   346.16    84.78
 .000701      10.      10.      10.        0        0        0      .00    30.76   115.54
```

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


*SECNO 10850.000
 10850.00    2.90   349.09      .00      .00   349.28      .21      .01      .00   351.38
    250.      0.     250.       0.       0.      69.       0.       8.       4.    350.38
     .15     .00     3.65      .00     .030     .018     .030     .000   346.18    84.79
  .000708    10.      10.      10.        0        0        0      .00    30.73   115.52
0
*SECNO 10860.000
 10860.00    2.89   349.08      .00      .00   349.29      .21      .01      .00   351.39
    250.      0.     250.       0.       0.      68.       0.       8.       4.    350.39
     .15     .00     3.66      .00     .030     .018     .030     .000   346.19    84.81
  .000715    10.      10.      10.        0        0        0      .00    30.70   115.51
0
*SECNO 10870.000
 10870.00    2.89   349.09      .00      .00   349.30      .21      .01      .00   351.40
    250.      0.     250.       0.       0.      68.       0.       8.       4.    350.40
     .15     .00     3.67      .00     .030     .018     .030     .000   346.20    84.82
  .000723    10.      10.      10.        0        0        0      .00    30.67   115.49
0
*SECNO 10880.000
 10880.00    2.88   349.09      .00      .00   349.31      .21      .01      .00   351.42
    250.      0.     250.       0.       0.      68.       0.       8.       4.    350.42
     .15     .00     3.69      .00     .030     .018     .030     .000   346.22    84.84
  .000730    10.      10.      10.        0        0        0      .00    30.64   115.48
0
*SECNO 10890.000
 10890.00    2.87   349.10      .00      .00   349.31      .21      .01      .00   351.43
    250.      0.     250.       0.       0.      68.       0.       8.       4.    350.43
     .15     .00     3.70      .00     .030     .018     .030     .000   346.23    84.85
  .000737    10.      10.      10.        0        0        0      .00    30.61   115.47
0
*SECNO 10900.000
 10900.00    2.86   349.11      .00      .00   349.32      .21      .01      .00   351.45
    250.      0.     250.       0.       0.      67.       0.       8.       4.    350.45
     .15     .00     3.71      .00     .030     .018     .030     .000   346.25    84.87
  .000744    10.      10.      10.        0        0        0      .00    30.58   115.45
0
1
```


THIS RUN EXECUTED 10-13-89

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

T1   SECOND PROFILE
T2     Q=381CFS
T3   EMERGENCY SPILLWAY OVERFLOW

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

      0.        3.        0.        0. -1.000000      .00       .0        0.    336.500     .000

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

    15.000     .000    -1.000     .000      .000      .000      .000      .000      .000      .000

1
 10-13-89     13:44:03                                                                          PAGE   16

   SECND     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        QLOSS   BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA   LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

 PROF 2

CONV=    .100 CEHV=    .300
*SECND 117.460
3720 CRITICAL DEPTH ASSUMED
   117.46     1.94   336.44   336.44   336.50   337.41      .97      .00      .00   341.00
    1961.       0.    1961.       0.       0.     248.       0.       0.       0.   341.00
      .00      .00     7.91      .00     .015     .015     .015     .000   334.50  9936.00
  .002748       0.       0.       0.        0        7        0      .00   128.00 10064.00
0
*SECND 6737.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  6737.00     2.37   337.07   337.07      .00   338.11     1.04      .24      .02   341.00
    1961.       0.    1961.       0.       0.     240.       0.       0.       0.   341.00
      .00      .00     8.17      .00     .030     .030     .030     .000   334.70  9941.33
  .010535      20.      50.      80.       20       11        0      .00   117.35 10058.67
0
*SECND 117.460

3301 HV CHANGED MORE THAN HVINS

   117.49     3.24   338.04      .00      .00   338.35      .33      .19      .07   341.00
    1580.       0.    1580.       0.       0.     343.       0.       1.       0.   341.00
      .00      .00     4.50      .00     .030     .030     .030     .000   334.80  9939.53
```

```
  .002178     55.     42.     35.      3      0      0    .00   120.94 10060.47
0
 *SECNO 117.580
   117.58   2.23  339.24    .00    .00  339.38    .14   1.00    .02   343.00
    1590.     0.   1580.     0.     0.    522.     0.     6.     3.   343.00
      .05    .00    3.03    .00   .030    .030   .030   .000  337.01  9861.21
  .001533    500.    549.    575.      4      0      0    .00  267.27 10128.48
0
 *SECNO -8737.000
 START TRIB COMP
   -8737.000  8737.000   337.059
1
  10-13-89     13:44:03                                                          PAGE   17


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


 3301 HV CHANGED MORE THAN HVINS

 3720 CRITICAL DEPTH ASSUMED
        ******** CONFLUENCE OF DIVERSION CHANNEL AND SCATTER WASH *************
  -8737.00    3.16  338.34  338.34    .00  339.44    1.10    .00    .00   340.00
     381.      0.    351.     0.     0.     45.      0.     6.     3.   338.48
      .05    .00    8.42    .00   .030    .018    .030   .000  335.18    89.58
  .004005      0.      0.      0.      0     11       0    .00   20.64   110.32
0
 *SECNO 8800.000
 3280 CROSS SECTION   8800.00 EXTENDED      .02 FEET

   8800.00    2.40  338.78    .00    .00  339.68    .90    .22    .02   339.90
     381.      0.    381.     0.     0.     50.      0.     6.     3.   338.75
      .06    .00    7.62    .00   .030    .018    .030   .000  335.38    88.58
  .003137     62.     62.     62.      4      0      0    .00   22.12   110.70
0
 *SECNO 9000.000
 7185 MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
   9000.00    3.24  339.50  339.50    .00  340.60    1.10    .71    .06   339.64
     381.      0.    381.     0.     0.     45.      0.     6.     3.   339.64
      .06    .00    8.41    .00   .030    .018    .030   .000  336.26    89.83
  .003990    200.    200.    200.      3      8      0    .00   20.65   110.49
0
 *SECNO 9200.000
 7185 MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
   9200.00    3.24  340.38  340.38    .00  341.48    1.10    .80    .00   340.52
     381.      0.    381.     0.     0.     45.      0.     7.     3.   340.52
      .07    .00    8.43    .00   .030    .018    .030   .000  337.14    89.85
  .004021    200.    200.    200.      2      5      0    .00   20.63   110.47
```

```
*SECNO 9400.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
 9400.00     3.24   341.26   341.26     .00   342.36    1.10     .80     .00   341.40
    381.       0.     381.      0.       0.     45.      0.      7.      3.    341.40
     .08      .00     8.43     .00     .030    .018    .030    .000   338.02   89.84
  .004016     200.    200.     200.       2       5       0     .00    20.63  110.48
0
```



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


*SECNO 9466.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  9466.00     3.24   341.55   341.55     .00   342.55    1.10     .27     .00   341.69
    381.       0.     381.      0.       0.     45.      0.      7.      3.    341.69
     .08      .00     8.43     .00     .030    .018    .030    .000   338.31   89.94
  .004016     66.      66.      66.       2       5       0     .00    20.63  110.48
0
 *SECNO 9486.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
7692 PROBABLE MINIMUM SPECIFIC ENERGY
 720 CRITICAL DEPTH ASSUMED

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      342.47 ELREA=      342.47

  9486.00     3.03   341.50   341.50     .00   343.03    1.53     .09     .13   342.47
    381.       0.     381.      0.       0.     38.      0.      7.      3.    342.47
     .08      .00     9.93     .00     .030    .018    .030    .000   338.47   93.67
  .005559     20.      20.      20.      20      11       0     .00    12.66  106.33
0

SPECIAL BRIDGE

5227 DOWNSTREAM ELEV IS    341.01 ,NOT    341.50 HYDRAULIC JUMP OCCURS DOWNSTREAM (IF LOW FLOW CONTROLS)

SB  XK       XKOR     COFQ     RDLEN    BWC      BWP      BAREA    SS       ELCHU    ELCHD
     1.05     1.60     2.60      .00    12.67     .67    48.00     .00   338.67   338.47

*SECNO 9530.000

3301 HV CHANGED MORE THAN HVINS

CLASS B LOW FLOW

3420 BRIDGE W.S.=    341.72 BRIDGE VELOCITY=,     10.07     CALCULATED CHANNEL AREA=,      37.

 IOPRS     EGLWC      H3       OWEIR     QLOW     BAREA   TRAPEZOID     ELLC     ELTRD
```

```
                                                    AREA
   343.07    343.52      .00        0.      381.       48.       48.     342.67    344.94


10-13-89     13:44:03                                                                          PAGE   19


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


3495 OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      342.67 ELREA=      342.67

       ******** 2 - 6 X 4 CBC , ENTRANCE INTO STATE LAND ************
  9530.00     3.94   342.61      .00      .00   343.52      .90      .49      .00   344.67
     381.       0.     381.       0.       0.      50.       0.       7.       3.   344.67
      .08      .00     7.63      .00     .000     .012     .000     .000   339.67    93.67
  .001162      44.      44.      44.        0        0        0      .00    12.66   106.33
0
 *SECNO 9537.000
3280 CROSS SECTION   9537.00 EXTENDED       .54 FEET


3301 HV CHANGED MORE THAN HVINS

  9537.00     4.65   343.33      .00      .00   343.59      .26      .01      .05   342.79
     381.       0.     381.       0.       0.      94.       0.       7.       3.   342.79
      .08      .00     4.07      .00     .030     .018     .030     .000   339.68    86.30
  .000542       7.       7.       7.        3        0        0      .00    27.44   113.74
0
 *SECNO 9550.000
3280 CROSS SECTION   9550.00 EXTENDED       .20 FEET

  9550.00     4.57   343.25      .00      .00   343.64      .39      .01      .04   343.05
     381.       0.     381.       0.       0.      76.       0.       7.       3.   343.05
      .08      .00     5.00      .00     .030     .018     .030     .000   339.58    87.58
  .000948      13.      13.      13.        2        0        0      .00    25.15   112.74
0
 *SECNO 9600.000
  9600.00     4.35   343.26      .00      .00   343.71      .45      .05      .02   343.27
     381.       0.     381.       0.       0.      71.       0.       7.       3.   343.27
      .08      .00     5.38      .00     .030     .018     .030     .000   339.90    87.60
  .001179      50.      50.      50.        2        0        0      .00    25.12   112.72
0
 *SECNO 9700.000
  9700.00     3.95   343.29      .00      .00   343.90      .61      .14      .05   343.71
     381.       0.     381.       0.       0.      61.       0.       7.       3.   343.71
      .09      .00     6.25      .00     .030     .018     .030     .000   339.34    88.41
  .001773     100.     100.     100.        2        0        0      .00    23.49   111.91
0
```

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


*SECNO 9800.000
 9800.00     3.58   343.35      .00      .00   344.18      .82      .22      .06   344.15
    381.       0.     381.       0.       0.      53.       0.       7.       3.   344.15
     .09      .00     7.25      .00     .030     .018     .030     .000   339.78    89.16
  .002585    100.     100.     100.        2        0        0      .00    22.00   111.15
0
*SECNO 9900.000
 9900.00     3.29   343.51   343.45      .00   344.55     1.05      .31      .07   344.59
    381.       0.     381.       0.       0.      45.       0.       7.       3.   344.59
     .10      .00     8.22      .00     .030     .018     .030     .000   340.22    89.74
  .003754    100.     100.     100.        4       11        0      .00    20.85   110.58
0
*SECNO 10000.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
 10000.00     3.22   343.98   343.98      .00   345.00     1.13      .39      .02   345.03
    381.       0.     381.       0.       0.      45.       0.       7.       3.   345.03
     .10      .00     8.51      .00     .030     .018     .030     .000   340.66    89.89
  .004130    100.     100.     100.        0        5        0      .00    20.54   110.43

 SECNO 10100.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
 10100.00     3.24   344.34   344.34      .00   345.44     1.10      .41      .00   345.47
    381.       0.     381.       0.       0.      45.       0.       8.       3.   345.47
     .10      .00     8.43      .00     .030     .018     .030     .000   341.10    89.85
  .004023    100.     100.     100.        1        5        0      .00    20.53   110.47
0
*SECNO 10200.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
 10200.00     3.23   344.77   344.77      .00   345.88     1.11      .40      .00   345.91
    381.       0.     381.       0.       0.      45.       0.       8.       3.   345.91
     .11      .00     8.45      .00     .030     .018     .030     .000   341.54    89.86
  .004049    100.     100.     100.        2        5        0      .00    20.51   110.46
0
*SECNO 10300.000
7185 MINIMUM SPECIFIC ENERGY
1
```



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

```
3720 CRITICAL DEPTH ASSUMED
 9300.00     3.23   345.21   345.21      .00   345.32     1.11      .40      .00   346.35
    381.       0.     381.       0.       0.      45.       0.       8.       3.   346.35
     .11      .00     8.44      .00     .030     .018     .030     .000   341.98    89.85
  .004041     100.     100.     100.        2        5        0      .00    20.61   110.47
0
*SECND 10335.000

3301 HV CHANGED MORE THAN HVINS

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3593 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=     347.14 ELREA=     347.14

 10335.00     4.11   346.25   346.25      .00   348.33     2.08      .19      .29   347.14
    381.       0.     381.       0.       0.      33.       0.       8.       3.   347.14
     .11      .00    11.57      .00     .030     .018     .030     .000   342.14    96.00
  .007655      35.      35.      35.       20       11        0      .00     9.00   104.00
0
 CCHV=    .300 CEHV=    .500

SPECIAL BRIDGE

SB  XK       XKOR      CDFB      RDLEN     BWC       BWP       BAREA     SS        ELCHU     ELCHD
     .00      1.60      2.60       .00      8.00       .00     40.00       .00    342.30    342.14

*SECND 10499.000
PRESSURE FLOW


 EBPRS      EGLWC      HB        QWEIR     QPR       BAREA   TRAPEZOID     ELLC      ELTRD
                                                              AREA
    348.51    348.49      .00        0.      381.       40.       40.     347.30    348.70


3455 OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=     349.72 ELREA=     349.72

       ******* 1 - 8 X 5 CBC UNDER 35TH AV *********
 10499.00     4.36   346.66      .00      .00   348.51     1.85      .17      .00   349.72
    381.       0.     381.       0.       0.      35.       0.       8.       3.   349.72
     .11      .00    10.92      .00     .000     .012     .000     .000   342.30    96.00
  .002918     154.     154.     154.        5        0        0      .00     8.00   104.00
0
1
 10-13-89     13:44:03                                                                PAGE   22


   SECND    DEPTH    CWSEL    CRIWS    WSELK    EG       HV       HL       OLOSS    BANK ELEV
   Q        GLOB     QCH      QROB     ALOB     ACH      AROB     VOL      TWA    LEFT/RIGHT
   TIME     VLOB     VCH      VROB     XNL      XNCH     XNR      WTN      ELMIN      SSTA
```

```
   SLOPE    XLOBL    XLCH     XLOBR    ITRIAL   IDC      ICONT    CORAR    TOPWID    ENDST

 ECND 10514.000

3301 HV CHANGED MORE THAN HVINS

 10514.00    6.48   348.92     .00      .00   349.04     .12      .01      .52   349.50
    381.      0.     381.      0.       0.     138.      0.       8.       4.    349.50
     .12     .00     2.76     .00     .030     .018     .030     .000   342.44   82.85
  .000195    14.      14.      14.       4       0        0      .00    34.29  117.15
0
 *SECND 10525.000
 10525.00    6.37   348.92     .00      .00   349.04     .12      .00      .00   349.60
    381.      0.     381.      0.       0.     137.      0.       8.       4.    349.53
     .12     .00     2.79     .00     .030     .018     .030     .000   342.55   82.92
  .000202    11.      11.      11.       1       0        0      .00    34.17  117.08
0
 *SECND 10550.000
 10550.00    6.12   348.92     .00      .00   349.05     .13      .01      .00   349.73
    381.      0.     381.      0.       0.     132.      0.       8.       4.    349.59
     .12     .00     2.88     .00     .030     .018     .030     .000   342.80   83.08
  .000221    25.      25.      25.       0       0        0      .00    33.83  116.92
0
 *SECND 10575.000
 10575.00    5.87   348.92     .00      .00   349.06     .14      .01      .00   349.88
    381.      0.     381.      0.       0.     128.      0.       8.       4.    349.65
     .12     .00     2.98     .00     .030     .018     .030     .000   343.05   83.25
  .000242    25.      25.      25.       0       0        0      .00    33.50  116.75

 *SECND 10600.000
 10600.00    5.63   348.93     .00      .00   349.07     .15      .01      .00   350.04
    381.      0.       0.     381.      0.       0.     123.      8.       4.    400.04
     .12     .00      .00    3.09     .030     .018     .030     .000   343.30   83.42
  .000527    25.      25.      25.       0       0        0      .00    33.21  116.63
0
 *SECND 10625.000
 10625.00    5.38   348.93     .00      .00   349.09     .15      .01      .01   350.20
    381.      0.     381.      0.       0.     119.      0.       8.       4.    349.77
     .12     .00     3.20     .00     .030     .018     .030     .000   343.55   83.56
  .000298    25.      25.      25.       0       0        0      .00    32.89  116.44
0
1
  10-13-89    13:44:03                                                                PAGE   23

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


 *SECND 10650.000
 10650.00    5.13   348.93     .00      .00   349.10     .17      .01      .01   350.36
    381.      0.     381.      0.       0.     114.      0.       8.       4.    349.83
```

```
      .13      .00     3.33      .00     .030     .018     .030     .000   343.80    83.73
  .000335      25.      25.      25.        1        0        0      .00    32.55   116.27
0
 ECND 10675.000
 10675.00     4.89   348.93      .00      .00   349.12      .19      .01      .01   350.52
     381.       0.     381.       0.       0.     110.       0.       8.       4.   349.89
      .13      .00     3.47      .00     .030     .018     .030     .000   344.05    83.89
  .000379      25.      25.      25.        0        0        0      .00    32.22   116.11
0
 *SECND 10700.000
 10700.00     4.63   348.93      .00      .00   349.14      .20      .01      .01   350.68
     381.       0.     381.       0.       0.     105.       0.       8.       4.   349.95
      .13      .00     3.53      .00     .030     .018     .030     .000   344.30    84.05
  .000431      25.      25.      25.        0        0        0      .00    31.91   115.95
0
 *SECND 10725.000
 10725.00     4.39   348.93      .00      .00   349.16      .23      .01      .01   350.68
     381.       0.     381.       0.       0.      99.       0.       9.       4.   350.01
      .13      .00     3.84      .00     .030     .018     .030     .000   344.55    84.22
  .000506      25.      25.      25.        1        0        0      .00    31.16   115.38
0
 *SECND 10750.000
 10750.00     4.14   348.94      .00      .00   349.19      .25      .01      .01   350.84
     381.       0.     381.       0.       0.      95.       0.       9.       4.   350.07
      .14      .00     4.00      .00     .030     .018     .030     .000   344.80    84.38
  .000578      25.      25.      25.        0        0        0      .00    31.24   115.62
0
 *SECND 10775.000
 10775.00     3.89   348.94      .00      .00   349.22      .28      .02      .01   351.00
     381.       0.     381.       0.       0.      90.       0.       9.       4.   350.13
      .14      .00     4.23      .00     .030     .018     .030     .000   345.05    84.54
  .000681      25.      25.      25.        1        0        0      .00    30.92   115.46
0
1
 10-13-89     13:44:03                                                                PAGE   24

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


 *SECND 10800.000

 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      349.10 ELREA=      349.10

 10800.00     3.52   348.82      .00      .00   349.38      .56      .02      .14   349.10
     381.       0.     381.       0.       0.      63.       0.       9.       4.   349.10
      .14      .00     6.01      .00     .018     .018     .018     .000   345.30    91.00
  .001536      25.      25.      25.        2        0        0      .00    18.00   109.00
0
 *SECND 10901.000

  01 HV CHANGED MORE THAN HVINS
```

```
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
   CC CRITICAL DEPTH ASSUMED
        *******18' CONTROL STRUCTURE AND EMERGENCY SPILLWAY *****************
 10801.00     2.58   348.70   348.70      .00   349.91     1.21      .00      .32   349.10
    381.       0.     381.      0.        0.     43.       0.        9.       4.    349.10
     .14      .00     8.81     .00      .018    .018     .018     .000   346.12    91.00
  .004854      1.       1.      1.        20      11        0      .00    18.00   109.00
0
*SECNO 10810.000

3301 HV CHANGED MORE THAN HVINS

 10810.00     3.87   349.99     .00       .00   350.21     .23      .01      .29   351.32
    381.       0.     381.      0.        0.    100.       0.        9.       4.    350.32
     .14      .00     3.51     .00      .030    .018     .030     .000   346.12    82.78
  .000552      9.       9.      9.         4       0        0      .00    34.58   117.36
0
*SECNO 10820.000
 10820.00     3.85   349.99     .00       .00   350.22     .23      .01      .00   351.33
    381.       0.     381.      0.        0.    100.       0.        9.       4.    350.33
     .14      .00     3.82     .00      .030    .018     .030     .000   346.13    82.80
  .000555     10.      10.     10.         2       0        0      .00    34.55   117.35
0
*SECNO 10830.000
 10830.00     3.55   350.00     .00       .00   350.23     .23      .01      .00   351.35
    381.       0.     381.      0.        0.    100.       0.        9.       4.    350.35
     .14      .00     3.83     .00      .030    .018     .030     .000   346.15    82.81
  .000560     10.      10.     10.         0       0        0      .00    34.52   117.33
0
1
 10-13-89    13:44:03                                                                PAGE   25

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


*SECNO 10840.000
 10840.00     3.84   350.00     .00       .00   350.23     .23      .01      .00   351.36
    381.       0.     381.      0.        0.     99.       0.        9.       4.    350.36
     .14      .00     3.84     .00      .030    .018     .030     .000   346.16    82.83
  .000565     10.      10.     10.         0       0        0      .00    34.49   117.32
0
*SECNO 10850.000
 10850.00     3.83   350.01     .00       .00   350.24     .23      .01      .00   351.38
    381.       0.     381.      0.        0.     99.       0.        9.       4.    350.38
     .14      .00     3.85     .00      .030    .018     .030     .000   346.18    82.85
  .000570     10.      10.     10.         0       0        0      .00    34.45   117.30
0
*SECNO 10860.000
 10860.00     3.82   350.01     .00       .00   350.24     .23      .01      .00   351.39
```

```
     381.      0.     381.      0.      0.     99.      0.      9.      4.   350.39
      .14     .00     3.86     .00    .030    .018    .030    .000  346.19   82.87
  .000575     10.      10.     10.      0       0       0     .00   34.41  117.28

*SECNO 10870.000
 10870.00    3.81   350.02     .00     .00  350.25     .23     .01     .00  351.40
     381.      0.     381.      0.      0.     98.      0.      9.      4.   350.40
      .14     .00     3.88     .00    .030    .018    .030    .000  346.20   82.89
  .000580     10.      10.     10.      0       0       0     .00   34.38  117.26
0
*SECNO 10880.000
 10880.00    3.80   350.02     .00     .00  350.26     .23     .01     .00  351.42
     381.      0.     381.      0.      0.     98.      0.      9.      4.   350.42
      .14     .00     3.89     .00    .030    .018    .030    .000  346.22   82.91
  .000585     10.      10.     10.      0       0       0     .00   34.34  117.25
0
*SECNO 10890.000
 10890.00    3.80   350.03     .00     .00  350.26     .24     .01     .00  351.43
     381.      0.     381.      0.      0.     98.      0.      9.      4.   350.43
      .14     .00     3.90     .00    .030    .018    .030    .000  346.23   82.92
  .000590     10.      10.     10.      0       0       0     .00   34.31  117.23
0
1
 10-13-89    12:44:03                                                          PAGE   26

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

*SECNO 10900.000
 10900.00    3.79   350.03     .00     .00  350.27     .24     .01     .00  351.45
     381.      0.     381.      0.      0.     97.      0.      9.      4.   350.45
      .15     .00     3.91     .00    .030    .015    .030    .000  345.25   82.94
  .000596     10.      10.     10.      0       0       0     .00   34.27  117.21
0
1
 10-13-89    12:44:03                                                          PAGE   27

                                                                THIS RUN EXECUTED 10-13-89

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

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

STANLEY CONSULTANTS OF

MARY PRINTOUT TABLE 150

	SECND	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
*	117.480	.00	.00	.00	334.50	1830.00	336.35	336.35	337.28	28.08	7.75	236.17	345.37
*	117.480	.00	.00	.00	334.50	1961.00	336.44	336.44	337.41	27.48	7.91	247.91	374.10
*	8737.000	50.00	.00	.00	334.70	1830.00	336.97	336.97	337.97	107.50	8.00	228.88	175.50
*	8737.000	50.00	.00	.00	334.70	1961.00	337.07	337.07	338.11	105.95	8.17	239.95	190.51
	117.480	41.93	.00	.00	334.80	1580.00	337.97	.00	338.24	26.51	4.89	322.86	306.85
	117.480	41.93	.00	.00	334.80	1580.00	338.04	.00	338.35	21.78	4.60	343.35	338.59
	117.590	549.00	.00	.00	337.01	1580.00	339.22	.00	339.35	15.74	3.05	518.05	398.21
	117.590	549.00	.00	.00	337.01	1580.00	339.24	.00	339.38	15.33	3.03	522.21	403.49
*	-8737.000	.00	.00	.00	335.18	250.00	337.69	337.69	338.60	42.43	7.66	32.65	39.39
*	-8737.000	.00	.00	.00	335.18	381.00	338.34	338.34	339.44	40.06	8.42	45.25	60.20
	8500.000	62.00	.00	.00	335.38	250.00	338.08	.00	338.85	34.28	7.02	35.62	42.70
	8500.000	62.00	.00	.00	335.38	381.00	338.78	.00	339.58	31.37	7.62	49.98	68.02
*	9000.000	200.00	.00	.00	336.26	250.00	338.85	338.95	339.76	42.18	7.64	32.72	38.50
*	9000.000	200.00	.00	.00	336.26	381.00	339.50	339.50	340.50	39.90	8.41	45.32	60.31
*	9200.000	200.00	.00	.00	337.14	250.00	339.72	339.72	340.64	42.84	7.68	32.54	38.20
*	9200.000	200.00	.00	.00	337.14	381.00	340.38	340.38	341.48	40.21	8.43	45.20	60.08
*	9400.000	200.00	.00	.00	338.02	250.00	340.60	340.50	341.52	42.69	7.67	32.58	38.26
*	9400.000	200.00	.00	.00	338.02	381.00	341.26	341.26	342.36	40.16	8.43	45.22	60.12
*	9466.000	66.00	.00	.00	338.31	250.00	340.89	340.99	341.81	42.70	7.67	32.58	36.26
*	9466.000	66.00	.00	.00	338.31	381.00	341.55	341.55	342.55	40.16	8.43	45.22	60.12
	9486.000	20.00	.00	.00	338.47	250.00	340.91	.00	341.93	45.11	8.09	30.91	37.22
*	9486.000	20.00	.00	.00	338.47	381.00	341.50	341.50	343.03	55.59	9.93	38.36	51.10

PAGE 28

1

10-13-89 13:44:03

	SECND	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
*	9530.000	44.00	344.94	342.67	338.67	250.00	341.65	.00	342.33	11.18	6.63	37.71	74.76
*	9530.000	44.00	344.94	342.67	338.67	381.00	342.61	.00	343.52	11.62	7.63	49.94	111.79
	9537.000	7.00	.00	.00	338.68	250.00	342.12	.00	342.38	7.87	4.07	61.44	89.11
	9537.000	7.00	.00	.00	338.68	381.00	343.33	.00	343.59	5.42	4.07	93.70	163.65
	9550.000	13.00	.00	.00	338.68	250.00	342.01	.00	342.45	15.36	5.30	47.21	63.79
	9550.000	13.00	.00	.00	338.68	381.00	343.25	.00	343.64	9.48	5.00	76.15	123.71

9600.000	50.00	.00	.00	338.90	250.00	342.04	.00	342.56	19.58	5.79	43.21	56.50
9600.000	50.00	.00	.00	338.90	381.00	343.26	.00	343.71	11.79	5.38	70.68	110.96
9700.000	100.00	.00	.00	339.34	250.00	342.14	.00	342.86	31.04	6.84	36.55	44.88
9700.000	100.00	.00	.00	339.34	381.00	343.29	.00	343.90	17.73	6.25	60.59	90.48
9800.000	100.00	.00	.00	339.78	250.00	342.38	342.36	343.27	41.25	7.58	32.98	38.92
9800.000	100.00	.00	.00	339.78	381.00	343.35	.00	344.18	26.65	7.25	52.53	73.81
* 9900.000	100.00	.00	.00	340.22	250.00	342.80	342.80	343.72	42.95	7.69	32.51	38.15
9900.000	100.00	.00	.00	340.22	381.00	343.51	343.45	344.56	37.54	8.22	46.34	62.19
* 10000.000	100.00	.00	.00	340.66	250.00	343.24	343.24	344.16	42.67	7.67	32.58	38.27
* 10000.000	100.00	.00	.00	340.66	381.00	343.88	343.88	345.00	41.30	8.51	44.76	59.29
* 10100.000	100.00	.00	.00	341.10	250.00	343.68	343.68	344.60	42.74	7.68	32.56	38.24
* 10100.000	100.00	.00	.00	341.10	381.00	344.34	344.34	345.44	40.23	8.43	45.19	60.07
* 10200.000	100.00	.00	.00	341.54	250.00	344.12	344.12	345.04	42.69	7.67	32.58	38.26
* 10200.000	100.00	.00	.00	341.54	381.00	344.77	344.77	345.88	40.49	8.45	45.08	59.88
* 10300.000	100.00	.00	.00	341.98	250.00	344.56	344.56	345.48	42.71	7.68	32.57	38.25
* 10300.000	100.00	.00	.00	341.98	381.00	345.21	345.21	346.32	40.41	8.44	45.12	59.94
* 10335.000	35.00	.00	.00	342.14	250.00	345.25	345.25	345.82	70.42	10.06	24.95	29.79
* 10335.000	35.00	.00	.00	342.14	381.00	346.25	346.25	346.33	76.55	11.57	32.92	43.55
10499.000	154.00	348.70	347.30	342.30	250.00	346.62	.00	347.43	12.80	7.22	34.64	69.97
10499.000	154.00	348.70	347.30	342.30	381.00	346.66	.00	348.51	29.18	10.92	34.89	70.54
10514.000	14.00	.00	.00	342.44	250.00	347.54	.00	347.65	2.32	2.64	94.82	164.25
10514.000	14.00	.00	.00	342.44	381.00	348.92	.00	349.04	1.95	2.76	138.21	272.99
10525.000	11.00	.00	.00	342.55	250.00	347.54	.00	347.65	2.42	2.68	93.33	160.55
10525.000	11.00	.00	.00	342.55	381.00	348.92	.00	349.04	2.02	2.79	136.56	258.39
10550.000	25.00	.00	.00	342.80	250.00	347.54	.00	347.67	2.74	2.79	89.47	151.11
10550.000	25.00	.00	.00	342.80	381.00	348.92	.00	349.05	2.21	2.88	132.19	256.33
10575.000	25.00	.00	.00	343.05	250.00	347.55	.00	347.68	3.12	2.92	85.54	141.59
10575.000	25.00	.00	.00	343.05	381.00	348.92	.00	349.06	2.43	2.98	127.79	244.26

1

10-18-89 13:44:03 PAGE 29

SECND	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
10600.000	25.00	.00	.00	343.30	250.00	347.55	.00	347.70	8.34	.00	81.81	86.56
10600.000	25.00	.00	.00	343.30	381.00	348.93	.00	349.07	6.27	.00	122.43	152.17
10625.000	25.00	.00	.00	343.55	250.00	347.56	.00	347.72	4.12	3.21	77.81	123.18
10625.000	25.00	.00	.00	343.55	381.00	348.93	.00	349.09	2.98	3.20	119.11	220.68

10550.000	25.00	.00	.00	343.80	250.00	347.56	.00	347.74	4.85	3.40	73.61	113.46
10550.000	25.00	.00	.00	343.80	381.00	348.93	.00	349.10	3.35	3.33	114.42	208.19
10575.000	25.00	.00	.00	344.05	250.00	347.56	.00	347.76	5.79	3.60	69.40	103.91
10575.000	25.00	.00	.00	344.05	381.00	348.93	.00	349.12	3.79	3.47	109.72	195.79
10700.000	25.00	.00	.00	344.30	250.00	347.56	.00	347.79	7.04	3.84	65.02	94.21
10700.000	25.00	.00	.00	344.30	381.00	348.93	.00	349.14	4.31	3.63	105.02	183.54
10725.000	25.00	.00	.00	344.55	250.00	347.57	.00	347.83	8.81	4.15	60.19	84.22
10725.000	25.00	.00	.00	344.55	381.00	348.93	.00	349.16	5.06	3.84	99.10	169.37
10750.000	25.00	.00	.00	344.80	250.00	347.57	.00	347.88	11.00	4.45	56.15	75.38
10750.000	25.00	.00	.00	344.80	381.00	348.94	.00	349.19	5.78	4.00	95.14	158.47
10775.000	25.00	.00	.00	345.05	250.00	347.57	.00	347.94	14.44	4.85	51.39	65.79
10775.000	25.00	.00	.00	345.05	381.00	348.94	.00	349.22	6.81	4.23	90.09	146.01
10800.000	25.00	.00	.00	345.30	250.00	347.49	.00	348.11	27.60	5.33	39.48	47.58
10800.000	25.00	.00	.00	345.30	381.00	348.82	.00	349.38	15.35	6.01	63.40	97.23
* 10801.000	1.00	.00	.00	346.12	250.00	348.11	348.11	349.02	50.19	7.68	32.54	35.29
* 10801.000	1.00	.00	.00	346.12	381.00	348.70	348.70	349.91	48.54	8.81	43.24	54.69
10810.000	9.00	.00	.00	346.12	250.00	349.05	.00	349.25	6.84	3.61	69.33	95.55
10810.000	9.00	.00	.00	346.12	381.00	349.99	.00	350.21	5.52	3.81	100.00	162.17
10820.000	10.00	.00	.00	346.13	250.00	349.06	.00	349.26	6.89	3.61	69.19	95.28
10820.000	10.00	.00	.00	346.13	381.00	349.99	.00	350.22	5.55	3.82	99.78	161.67
10830.000	10.00	.00	.00	346.15	250.00	349.06	.00	349.27	6.94	3.62	68.99	94.88
10830.000	10.00	.00	.00	346.15	381.00	350.00	.00	350.23	5.60	3.83	99.52	161.05
10840.000	10.00	.00	.00	346.16	250.00	349.07	.00	349.27	7.01	3.64	68.75	94.40
10840.000	10.00	.00	.00	346.16	381.00	350.00	.00	350.23	5.65	3.84	99.21	160.34
10850.000	10.00	.00	.00	346.18	250.00	349.08	.00	349.28	7.08	3.65	68.52	93.93
10850.000	10.00	.00	.00	346.18	381.00	350.01	.00	350.24	5.70	3.85	98.89	159.62
10860.000	10.00	.00	.00	346.19	250.00	349.08	.00	349.29	7.15	3.66	68.28	93.47
10860.000	10.00	.00	.00	346.19	381.00	350.01	.00	350.24	5.75	3.86	98.59	158.90
10870.000	10.00	.00	.00	346.20	250.00	349.09	.00	349.30	7.23	3.67	68.05	93.00
10870.000	10.00	.00	.00	346.20	381.00	350.02	.00	350.25	5.80	3.88	98.28	158.19

1

10-13-89 13:44:03 PAGE 30

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
10880.000	10.00	.00	.00	346.22	250.00	349.09	.00	349.31	7.30	3.69	67.82	92.55
10880.000	10.00	.00	.00	346.22	381.00	350.02	.00	350.26	5.85	3.89	97.97	157.49
10890.000	10.00	.00	.00	346.23	250.00	349.10	.00	349.31	7.37	3.70	67.60	92.10

10890.000	10.00	.00	.00	346.23	381.00	350.03	.00	350.26	5.90	3.90	97.67	156.79
10900.000	10.00	.00	.00	346.25	250.00	349.11	.00	349.32	7.44	3.71	67.37	91.65
10900.000	10.00	.00	.00	346.25	381.00	350.03	.00	350.27	5.96	3.91	97.37	156.10

1

STANLEY CONSULTANTS OF

SUMMARY PRINTOUT TABLE 150

	SECN3	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	117.460	1830.00	336.35	.00	.00	-.15	128.00	.00
*	117.460	1961.00	336.44	.09	.00	-.06	128.00	.00
*	8737.000	1930.00	336.97	.00	.63	.00	116.98	50.00
*	8737.000	1961.00	337.07	.09	.63	.00	117.35	50.00
	117.480	1580.00	337.87	.00	.89	.00	120.26	41.93
	117.480	1580.00	338.04	.17	.97	.00	120.94	41.93
	117.550	1580.00	339.22	.00	1.35	.00	267.21	549.00
	117.580	1580.00	339.24	.02	1.20	.00	267.27	549.00
-	-8737.000	250.00	337.69	.00	-1.53	.00	18.03	.00
	-8737.000	381.00	338.34	.65	-.90	.00	20.64	.00
	8800.000	250.00	338.08	.00	.40	.00	19.19	62.00
	8800.000	381.00	338.78	.69	.44	.00	22.12	62.00
*	9000.000	250.00	338.85	.00	.77	.00	18.05	200.00
*	9000.000	381.00	339.50	.65	.73	.00	20.65	200.00
*	9200.000	250.00	339.72	.00	.87	.00	18.01	200.00
*	9200.000	381.00	340.38	.66	.87	.00	20.63	200.00
*	9400.000	250.00	340.60	.00	.88	.00	18.01	200.00
*	9400.000	381.00	341.26	.65	.89	.00	20.63	200.00
*	9466.000	250.00	340.89	.00	.29	.00	18.01	66.00
*	9466.000	381.00	341.55	.65	.29	.00	20.63	66.00
	9465.000	250.00	340.91	.00	.02	.00	12.66	20.00
*	9486.000	381.00	341.50	.59	-.05	.00	12.66	20.00
*	9530.000	250.00	341.65	.00	.74	.00	12.66	44.00
*	9530.000	381.00	342.61	.97	1.11	.00	12.66	44.00
	9537.000	250.00	342.12	.00	.47	.00	24.77	7.00
	9537.000	381.00	343.33	1.21	.72	.00	27.44	7.00

9550.000	250.00	342.01	.00	-.11	.00	21.01	13.00
9550.000	381.00	343.25	1.24	-.08	.00	25.15	13.00
9600.000	250.00	342.04	.00	.03	.00	20.24	50.00
9600.000	381.00	343.25	1.22	.01	.00	25.12	50.00
9700.000	250.00	342.14	.00	.10	.00	18.88	100.00
9700.000	381.00	343.29	1.15	.03	.00	23.49	100.00

1

10-13-89 13:44:03 PAGE 32

	SECKS	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	9800.000	250.00	342.38	.00	.24	.00	18.10	100.00
	9800.000	381.00	343.35	.98	.07	.00	22.00	100.00
*	9900.000	250.00	342.90	.00	.42	.00	18.00	100.00
	9900.000	381.00	343.51	.71	.15	.00	20.85	100.00
*	10000.000	250.00	343.24	.00	.44	.00	18.02	100.00
*	10000.000	381.00	343.88	.63	.35	.00	20.54	100.00
*	10100.000	250.00	343.55	.00	.44	.00	18.01	100.00
*	10100.000	381.00	344.34	.65	.46	.00	20.63	100.00
*	10200.000	250.00	344.12	.00	.44	.00	18.01	100.00
	10200.000	381.00	344.77	.65	.43	.00	20.61	100.00
*	10300.000	250.00	344.55	.00	.44	.00	18.01	100.00
*	10300.000	381.00	345.21	.65	.44	.00	20.61	100.00
*	10335.000	250.00	345.25	.00	.68	.00	8.00	35.00
*	10335.000	381.00	346.25	1.01	1.04	.00	8.00	35.00
	10499.000	250.00	346.52	.00	1.38	.00	8.00	154.00
	10499.000	381.00	346.66	.03	.40	.00	8.00	154.00
	10514.000	250.00	347.54	.00	.92	.00	28.79	14.00
	10514.000	381.00	348.92	1.38	2.26	.00	34.29	14.00
	10525.000	250.00	347.54	.00	.00	.00	28.66	11.00
	10525.000	381.00	348.92	1.38	.00	.00	34.17	11.00
	10550.000	250.00	347.54	.00	.00	.00	28.34	25.00
	10550.000	381.00	348.92	1.37	.00	.00	33.83	25.00
	10575.000	250.00	347.55	.00	.00	.00	28.01	25.00
	10575.000	381.00	348.92	1.37	.00	.00	33.50	25.00
	10600.000	250.00	347.55	.00	.01	.00	27.71	25.00
	10600.000	381.00	348.93	1.37	.00	.00	33.21	25.00
	10625.000	250.00	347.55	.00	.01	.00	27.41	25.00

10625.000	381.00	348.93	1.37	.00	.00	32.89	25.00
10650.000	250.00	347.56	.00	.00	.00	27.07	25.00
10650.000	381.00	348.93	1.37	.00	.00	32.55	25.00
10675.000	250.00	347.56	.00	.00	.00	26.75	25.00
10675.000	381.00	348.93	1.37	.00	.00	32.22	25.00
10700.000	250.00	347.56	.00	.00	.00	26.42	25.00
10700.000	381.00	348.93	1.37	.00	.00	31.91	25.00

1
10-13-89 13:44:03

SECND	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
10725.000	250.00	347.57	.00	.00	.00	25.82	25.00
10725.000	381.00	348.93	1.37	.00	.00	31.16	25.00
10750.000	250.00	347.57	.00	.00	.00	25.77	25.00
10750.000	381.00	348.94	1.37	.00	.00	31.24	25.00
10775.000	250.00	347.57	.00	.00	.00	25.43	25.00
10775.000	381.00	348.94	1.37	.00	.00	30.92	25.00
10800.000	250.00	347.49	.00	-.05	.00	18.00	25.00
10800.000	381.00	348.82	1.33	-.12	.00	18.00	25.00
10801.000	250.00	348.11	.00	.62	.00	18.00	1.00
* 10801.000	381.00	348.70	.59	-.12	.00	18.00	1.00
10810.000	250.00	349.05	.00	.94	.00	30.84	9.00
10810.000	381.00	349.99	.94	1.29	.00	34.58	9.00
10820.000	250.00	349.06	.00	.01	.00	30.82	10.00
10820.000	381.00	349.99	.94	.01	.00	34.55	10.00
10830.000	250.00	349.06	.00	.01	.00	30.79	10.00
10830.000	381.00	350.00	.93	.00	.00	34.52	10.00
10840.000	250.00	349.07	.00	.01	.00	30.76	10.00
10840.000	381.00	350.00	.93	.00	.00	34.49	10.00
10850.000	250.00	349.08	.00	.01	.00	30.73	10.00
10850.000	381.00	350.01	.93	.00	.00	34.45	10.00
10860.000	250.00	349.08	.00	.01	.00	30.70	10.00
10860.000	381.00	350.01	.93	.00	.00	34.41	10.00
10870.000	250.00	349.09	.00	.01	.00	30.67	10.00
10870.000	381.00	350.02	.93	.01	.00	34.38	10.00
10880.000	250.00	349.09	.00	.01	.00	30.64	10.00
10880.000	381.00	350.02	.93	.01	.00	34.34	10.00

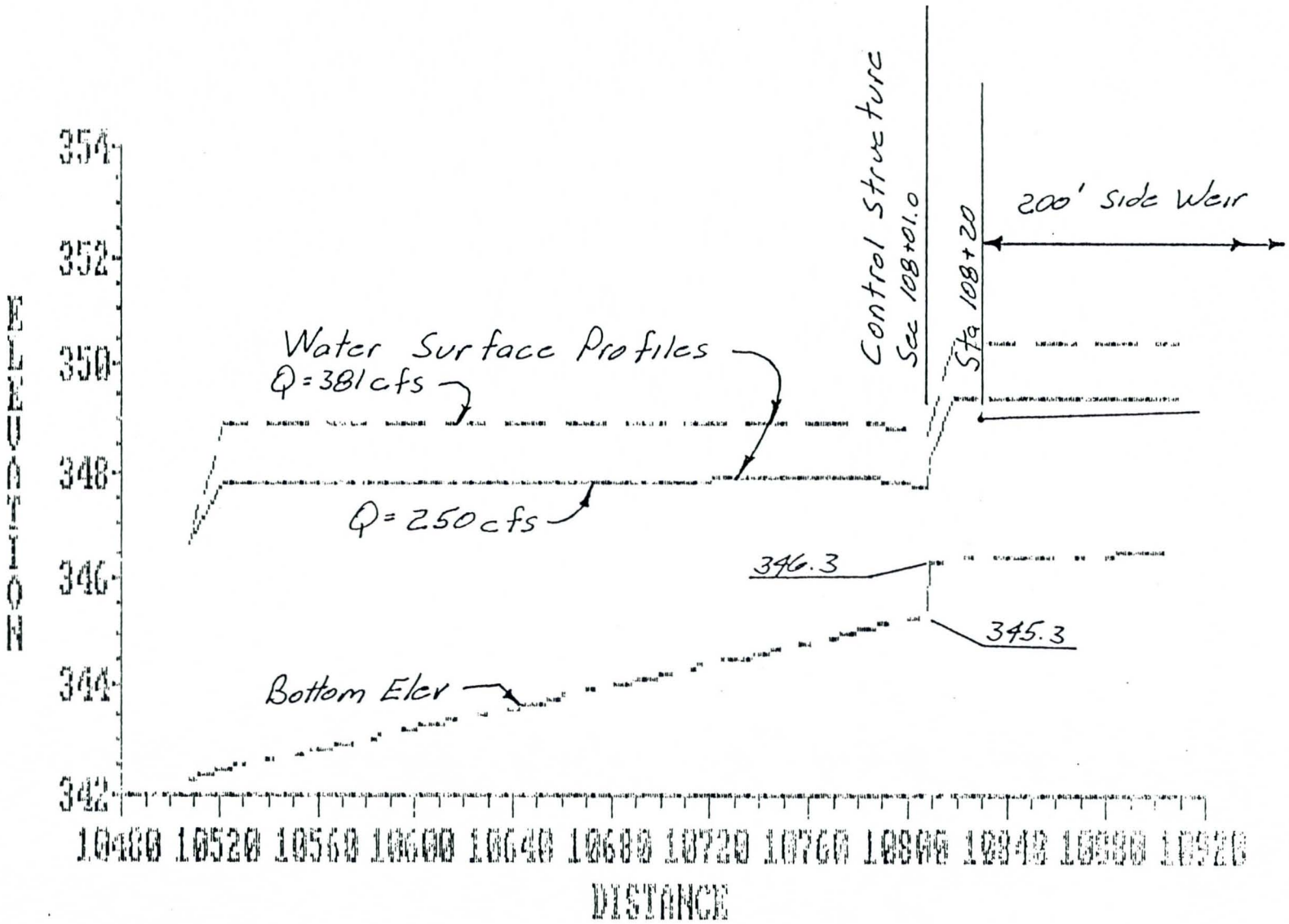
10890.000	250.00	349.10	.00	.01	.00	30.61	10.00
10890.000	381.00	350.03	.93	.01	.00	34.31	10.00
10900.000	250.00	349.11	.00	.01	.00	30.58	10.00
10900.000	381.00	350.03	.92	.01	.00	34.27	10.00

1

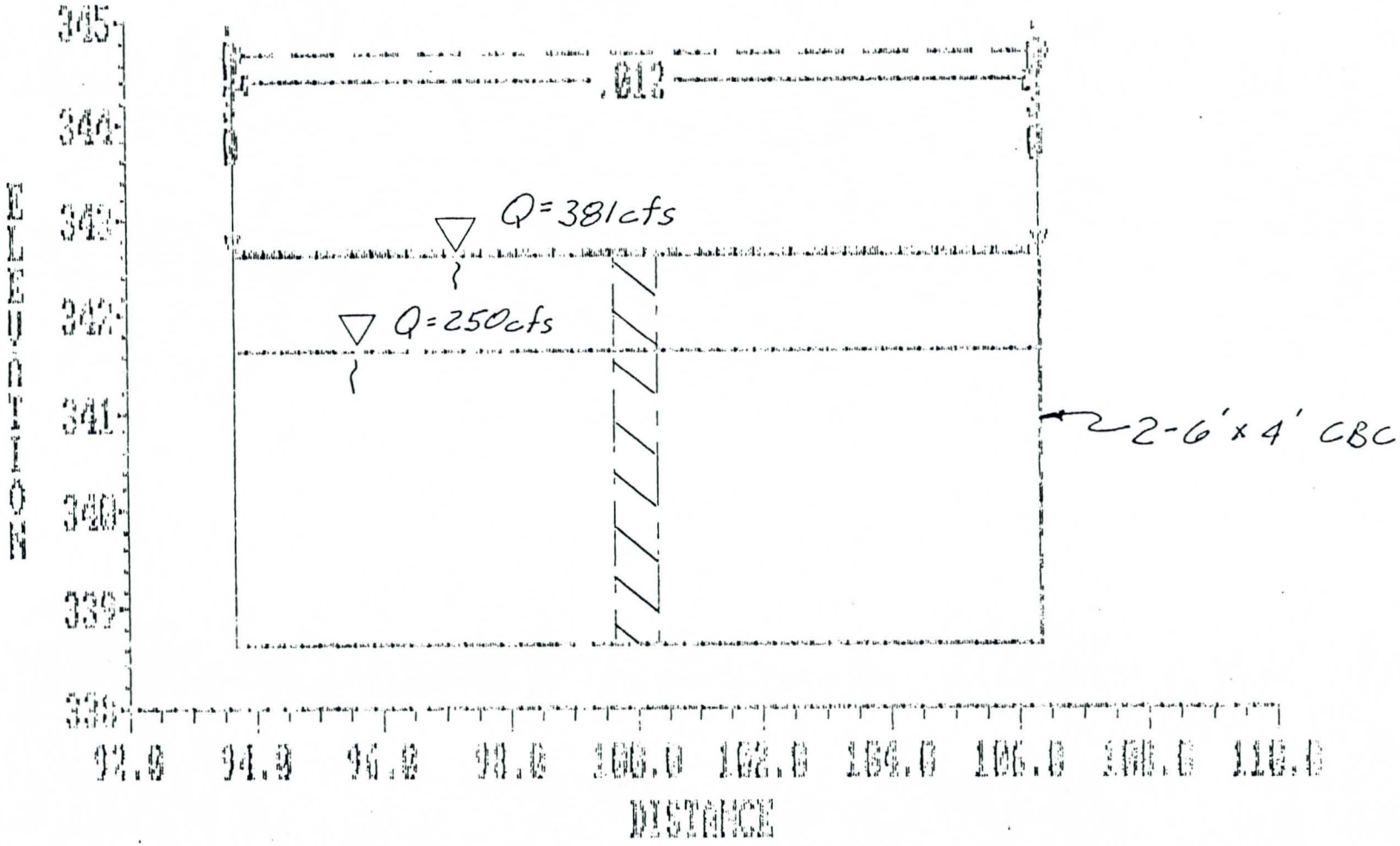
SUMMARY OF ERRORS AND SPECIAL NOTES

```
CAUTION  SECNO=   117.460  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=   117.460  PROFILE= 2  CRITICAL DEPTH ASSUMED

CAUTION  SECNO=  8737.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=  8737.000  PROFILE= 1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=  8737.000  PROFILE= 1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION  SECNO=  8737.000  PROFILE= 2  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=  8737.000  PROFILE= 2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=  8737.000  PROFILE= 2  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION  SECNO= -8737.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO= -8737.000  PROFILE= 2  CRITICAL DEPTH ASSUMED

CAUTION  SECNO=  9000.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=  9000.000  PROFILE= 1  MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=  9000.000  PROFILE= 2  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=  9000.000  PROFILE= 2  MINIMUM SPECIFIC ENERGY

CAUTION  SECNO=  9200.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=  9200.000  PROFILE= 1  MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=  9200.000  PROFILE= 2  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=  9200.000  PROFILE= 2  MINIMUM SPECIFIC ENERGY

CAUTION  SECNO=  9400.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=  9400.000  PROFILE= 1  MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=  9400.000  PROFILE= 2  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=  9400.000  PROFILE= 2  MINIMUM SPECIFIC ENERGY

CAUTION  SECNO=  9466.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=  9466.000  PROFILE= 1  MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=  9466.000  PROFILE= 2  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=  9466.000  PROFILE= 2  MINIMUM SPECIFIC ENERGY

CAUTION  SECNO=  9486.000  PROFILE= 2  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=  9486.000  PROFILE= 2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=  9486.000  PROFILE= 2  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION  SECNO=  9530.000  PROFILE= 1  HYDRAULIC JUMP D.S.
CAUTION  SECNO=  9530.000  PROFILE= 2  HYDRAULIC JUMP D.S.
```

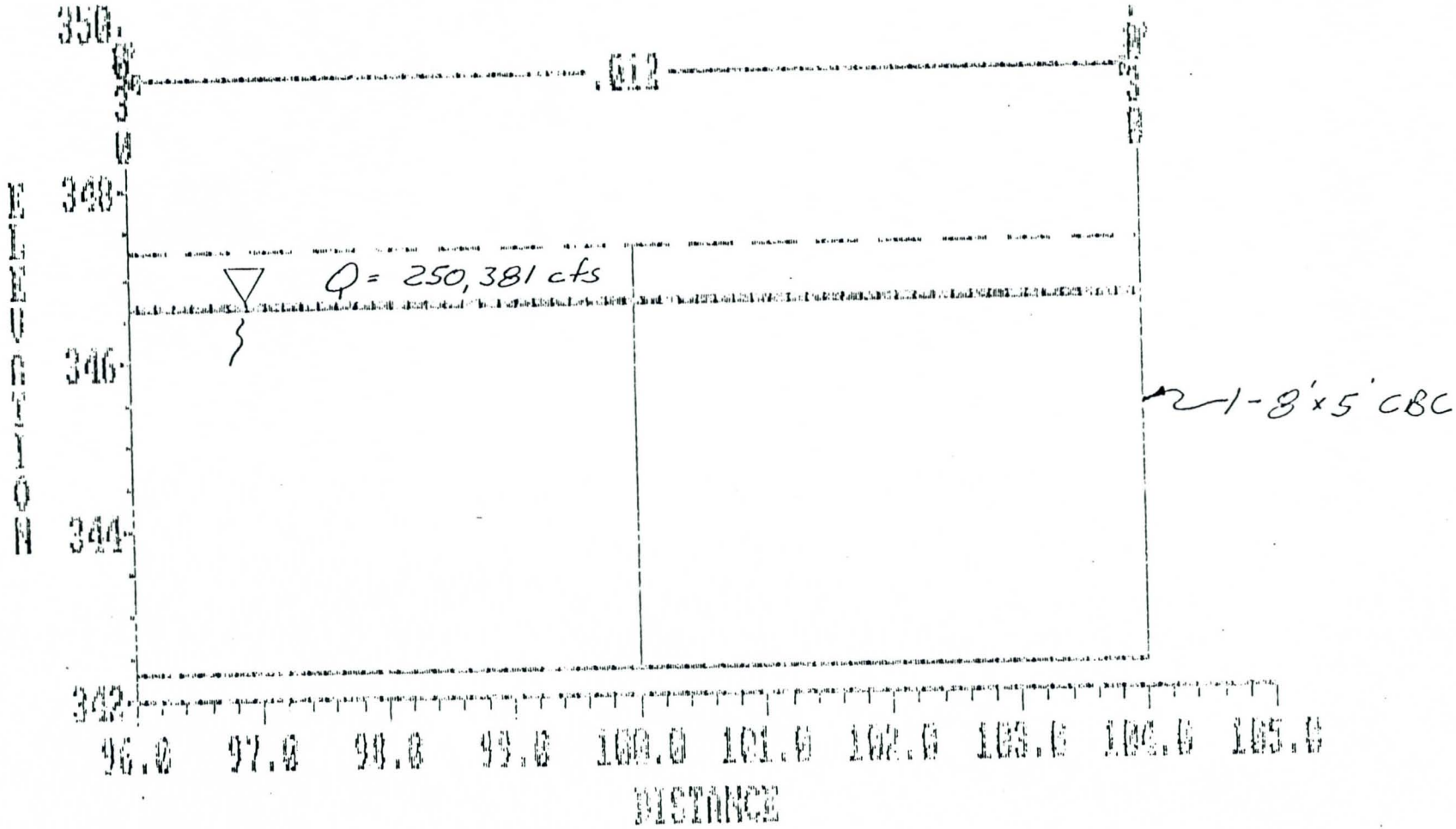
```
CAUTION  SECND=  9900.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECND=  9900.000  PROFILE= 1  MINIMUM SPECIFIC ENERGY

CAUTION  SECND= 10000.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECND= 10000.000  PROFILE= 1  MINIMUM SPECIFIC ENERGY
CAUTION  SECND= 10000.000  PROFILE= 2  CRITICAL DEPTH ASSUMED
CAUTION  SECND= 10000.000  PROFILE= 2  MINIMUM SPECIFIC ENERGY

CAUTION  SECND= 10100.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECND= 10100.000  PROFILE= 1  MINIMUM SPECIFIC ENERGY
CAUTION  SECND= 10100.000  PROFILE= 2  CRITICAL DEPTH ASSUMED
1                                                                    PAGE   35
 10-13-89     13:44:03


CAUTION  SECND= 10100.000  PROFILE= 2  MINIMUM SPECIFIC ENERGY

CAUTION  SECND= 10200.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECND= 10200.000  PROFILE= 1  MINIMUM SPECIFIC ENERGY
CAUTION  SECND= 10200.000  PROFILE= 2  CRITICAL DEPTH ASSUMED
CAUTION  SECND= 10200.000  PROFILE= 2  MINIMUM SPECIFIC ENERGY

CAUTION  SECND= 10300.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECND= 10300.000  PROFILE= 1  MINIMUM SPECIFIC ENERGY
CAUTION  SECND= 10300.000  PROFILE= 2  CRITICAL DEPTH ASSUMED
CAUTION  SECND= 10300.000  PROFILE= 2  MINIMUM SPECIFIC ENERGY

CAUTION  SECND= 10335.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECND= 10335.000  PROFILE= 1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECND= 10335.000  PROFILE= 1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION  SECND= 10335.000  PROFILE= 2  CRITICAL DEPTH ASSUMED
CAUTION  SECND= 10335.000  PROFILE= 2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECND= 10335.000  PROFILE= 2  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION  SECND= 10801.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECND= 10801.000  PROFILE= 1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECND= 10801.000  PROFILE= 1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION  SECND= 10801.000  PROFILE= 2  CRITICAL DEPTH ASSUMED
CAUTION  SECND= 10801.000  PROFILE= 2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECND= 10801.000  PROFILE= 2  20 TRIALS ATTEMPTED TO BALANCE WSEL

1                                                                    PAGE    1
 10-13-89     13:44:57


                                                   THIS RUN EXECUTED 10-13-89

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

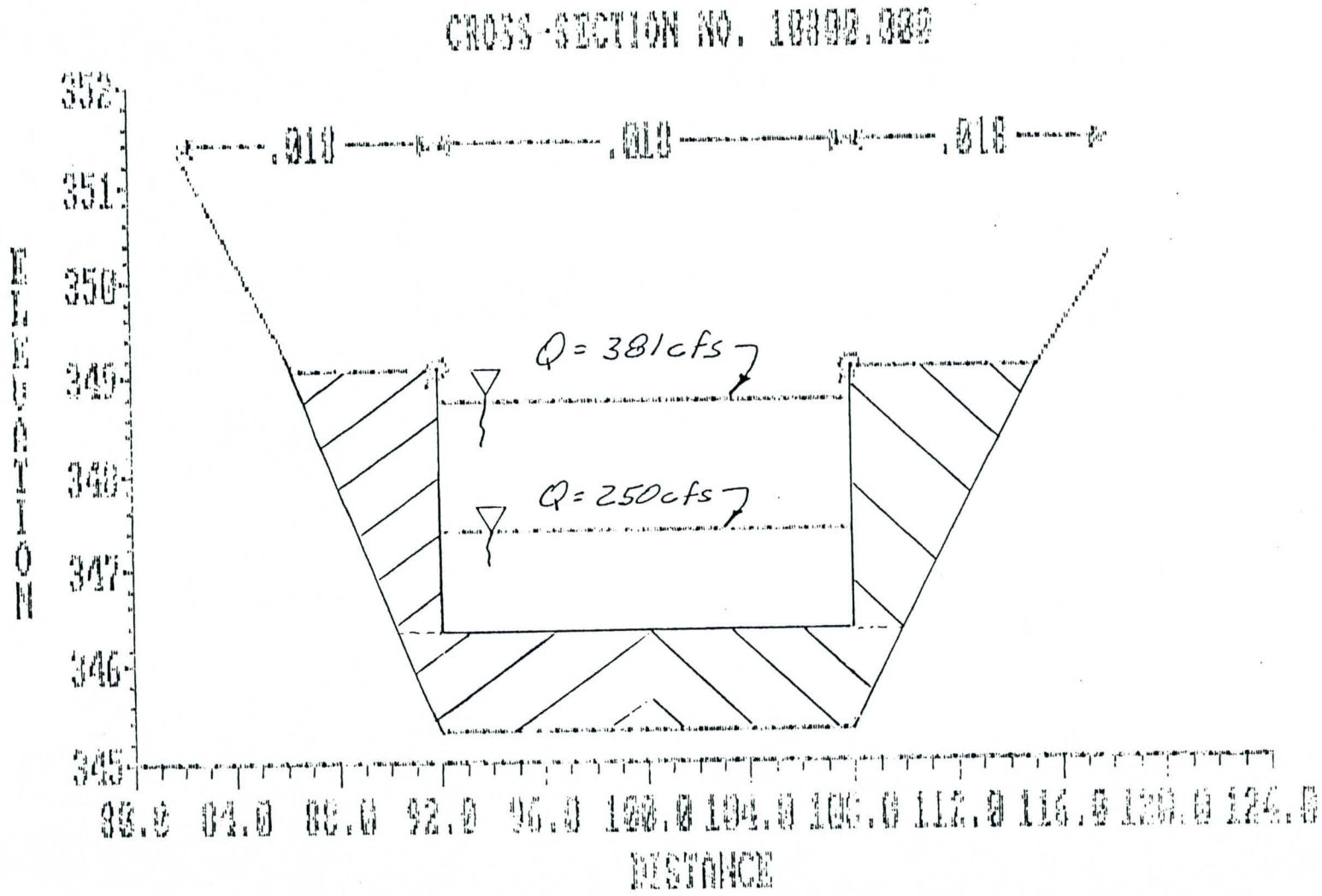

Control Structure
Sec 108+01.0
Sta 108+20
200' Side Weir
Water Surface Profiles
Q=381cfs
Q=250cfs
346.3
345.3
Bottom Elev
ELEVATION
354
352
350
348
346
344
342
10480 10520 10560 10600 10640 10680 10720 10760 10800 10840 10880 10920
DISTANCE

CROSS-SECTION NO. 9530.000

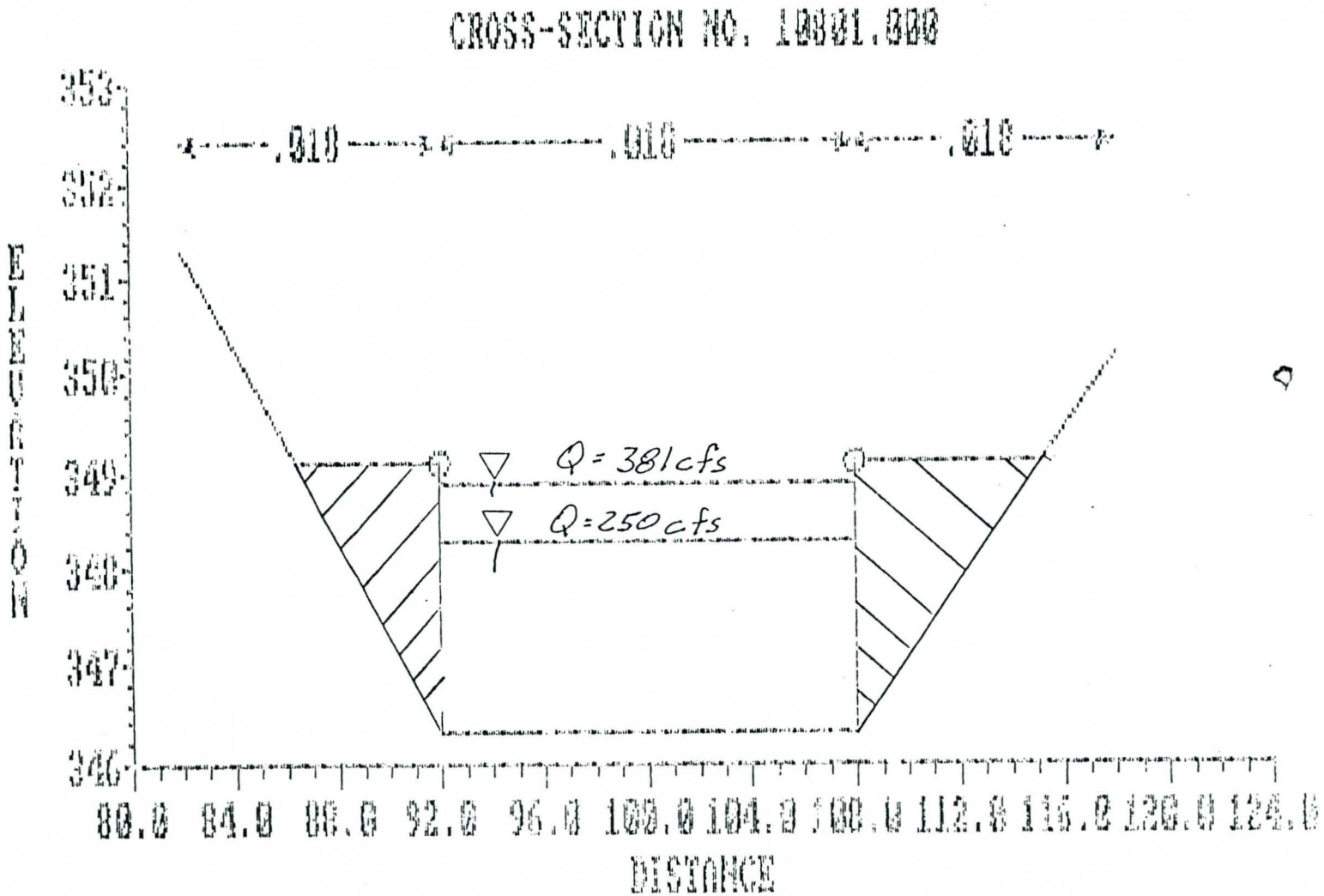


CROSS-SECTION NO. 10409.00?





Control Structure (Looking Upstream)



Control Structure (Looking Downstream)

TEST CASE


```
1
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 MODIFIED TO 35TH AVE BY DCCO(9/89)
  3           ID        SEPTEMBER 6, 1989              FILE: 35DI4.IN
  4           ID        36" OUTFALL LINE TO SCATTER WASH
  5           ID        LIMIT DIVERSION TO 300CFS AND UTILIZE CONTROL
  6           ID        STRUCTURE AS SPILLWAY
 339          KK    DVBC
 340          KM   DIVERT FLOW TO DETENTION BASIN C
 341          DT    DVSW
 342          DI       0     150     300     301     550
 343          DQ       0     150     300     300     300

 344          KK    RTBC
 345          KM   ROUTE FLOW THROUGH DETENTION BASIN C (36" OUTLET)
 346          KO       1       2
 347          RS       1    STOR      -1       0
*** FREE ***
 348          SV       0    4.50    9.33   14.64   20.30   25.37   32.87   36.33   39.90   43.44
 349          SE    1336    1338    1340    1342    1344    1346    1348    1349    1350    1351
 350          SQ   23.72   31.83   38.25   43.74   48.61   53.04   57.13   59.13  156.94  334.29
*** FIX ***

 351          KK    RVSW
 352          KM   RETRIEVE BASIN BYPASS FLOW DVSW
 353          DR    DVSW

 354          KK    CBSW
 355          KM   COMBINE TOTAL INFLOW TO SCATTER WASH
 356          KO       1
 357          HC       2
 358          ZZ
1
```

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

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+		CB11B	582.	13.08	310.	117.	117.	5.01		
	DIVERSION TO									
+		DVSW	300.	13.08	243.	100.	100.	5.01		
	HYDROGRAPH AT									
+		DVBC	282.	13.08	67.	17.	17.	5.01		
	ROUTED TO									
+		RTBC	52.	14.25	46.	30.	30.	5.01	1345.72	14.25

TEST CASE


```
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 MODIFIED TO 35TH AVE BY DCCO(9/89)
  3           ID       SEPTEMBER 6, 1989              FILE: 35DT3.IN
  4           ID       36" OUTFALL LINE TO SCATTER WASH
  5           ID       LIMIT DIVERSION TO 200CFS AND UTILIZE CONTROL
  6           ID       STRUCTURE AS SPILLWAY
 339          KK    DVBC
 340          KM   DIVERT FLOW TO DETENTION BASIN C
 341          DT    DVSW
 342          DI       0     150     200     201     550
 343          DQ       0     150     200     200     200

 344          KK    RTBC
 345          KM   ROUTE FLOW THROUGH DETENTION BASIN C (36" OUTLET)
 346          KO       1       2
 347          RS       1    STOR      -1       0
*** FREE ***
 348          SV       0    4.50    9.38   14.64   20.30   26.37   32.87   36.33   39.80   43.44
 349          SE    1336    1338    1340    1342    1344    1346    1348    1349    1350    1351
 350          SQ   23.72   31.83   38.25   43.74   48.61   53.04   57.13   59.13  156.94  334.29
*** FIX ***

 351          KK    RVSW
 352          KM   RETRIEVE BASIN BYPASS FLOW DVSW
 353          DR    DVSW

 354          KK    CBSW
 355          KM   COMBINE TOTAL INFLOW TO SCATTER WASH
 356          KO       1
 357          HC       2
 358          ZZ
```

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
+	2 COMBINED AT	CB11B	582.	13.08	310.	117.	117.	5.01		
+	DIVERSION TO	DVSW	200.	13.08	194.	88.	88.	5.01		
+	HYDROGRAPH AT	DVBC	382.	13.08	116.	29.	29.	5.01		
+	ROUTED TO	RTBC	143.	14.25	69.	39.	39.	5.01	1349.85	14.25

TAB 2

METTEE/McGILL/MURPHY
1450 EAST INDIAN SCHOOL ROAD
PHOENIX, ARIZONA 85014
(602) 279-0901

JOB Outer Loop
SHEET NO. ____ OF ____
CALCULATED BY MAL DATE 2-6-87
CHECKED BY MRC DATE 6-2-88
SCALE ____

Rainfall Intensities

TABLE 1

Return Period (Years)	Precipitation Values (inches)			
	6 hour duration		24 hour duration	
	Map Value	Corrected Value	Map Value	Corrected Value
2	1.2	1.18	1.4	1.4
5	1.7	1.68	2.0	1.98
10	2.0	2.0	2.3	2.35
25	2.4	2.41	2.8	2.84
50	2.8	2.80	3.2	3.29
100	3.0	3.19	3.8	3.74

$$Y_2 = -0.011 + 0.942 \ (X_1^2/X_2)$$

$$Y_{100} = 0.494 + 0.755 \ (X_3^2/X_4)$$

where Y_2 = 2 year 1 hour value
Y_{100} = 100 year 1 hour value
X_1 = 2 year 6 hour value from Table 1
X_2 = 2 year 24 hour value from Table 1
X_3 = 100 year 6 hour value from Table 1
X_4 = 100 year 24 hour value from Table 1

$$Y_2 = -0.011 + 0.942 \ ((1.18)^2 \div 1.4) = 0.93$$

$$Y_{100} = 0.494 + 0.755 \ ((3.19)^2 \div 3.74) = 2.55$$

METTEE/McGILL/MURPHY
1450 EAST INDIAN SCHOOL ROAD
PHOENIX, ARIZONA 85014
(602) 279-0901

JOB
SHEET NO. OF
CALCULATED BY MAL DATE 2-6-87
CHECKED BY MRC DATE 6-2-87
SCALE

Rainfall Intensities (cont'd)

2 hour = 0.341 (6 hour) + 0.659 (1 hour)
3 hour = 0.569 (6 hour) + 0.431 (1 hour)

P_{2yr} = .341 (1.18) + .659 (.93) = ~~.61~~ 1.02
$P_{25\ yr}$ = .341 (2.41) + .659 (1.93) = 2.09
$P_{50\ yr}$ = .341 (2.80) + .659 (2.25) = 2.44
$P_{100\ yr}$ = .341 (3.19) + .659 (2.55) = 2.77

12 Hour Precipitation

$P_{yr} = P_{24} - .51 (P_{24} - P_6) =$

P_{2yr} = 1.4 - .51(1.4 - 1.18) = 1.29
P_{25yr} = 2.84 - .51 (2.84 - 2.41) = 2.62
P_{50yr} = 3.29 - .51 (3.29 - 2.80) = 3.04
P_{100yr} = 3.74 - .51 (3.74 - 3.19) = 3.46

30 Minute Precipitation

$P_{X\ yr}$ = .79 (X yr 1 hr) =

P_2 = .79 (0.93) = 0.73
P_{25} = .79 (1.93) = 1.52
P_{50} = .79 (2.25) = 1.78
P_{100} = .79 (2.55) = 2.01

PRODUCT 204-1 NEBS Inc., Groton, Mass. 01471.

Project No. _____ Station _____

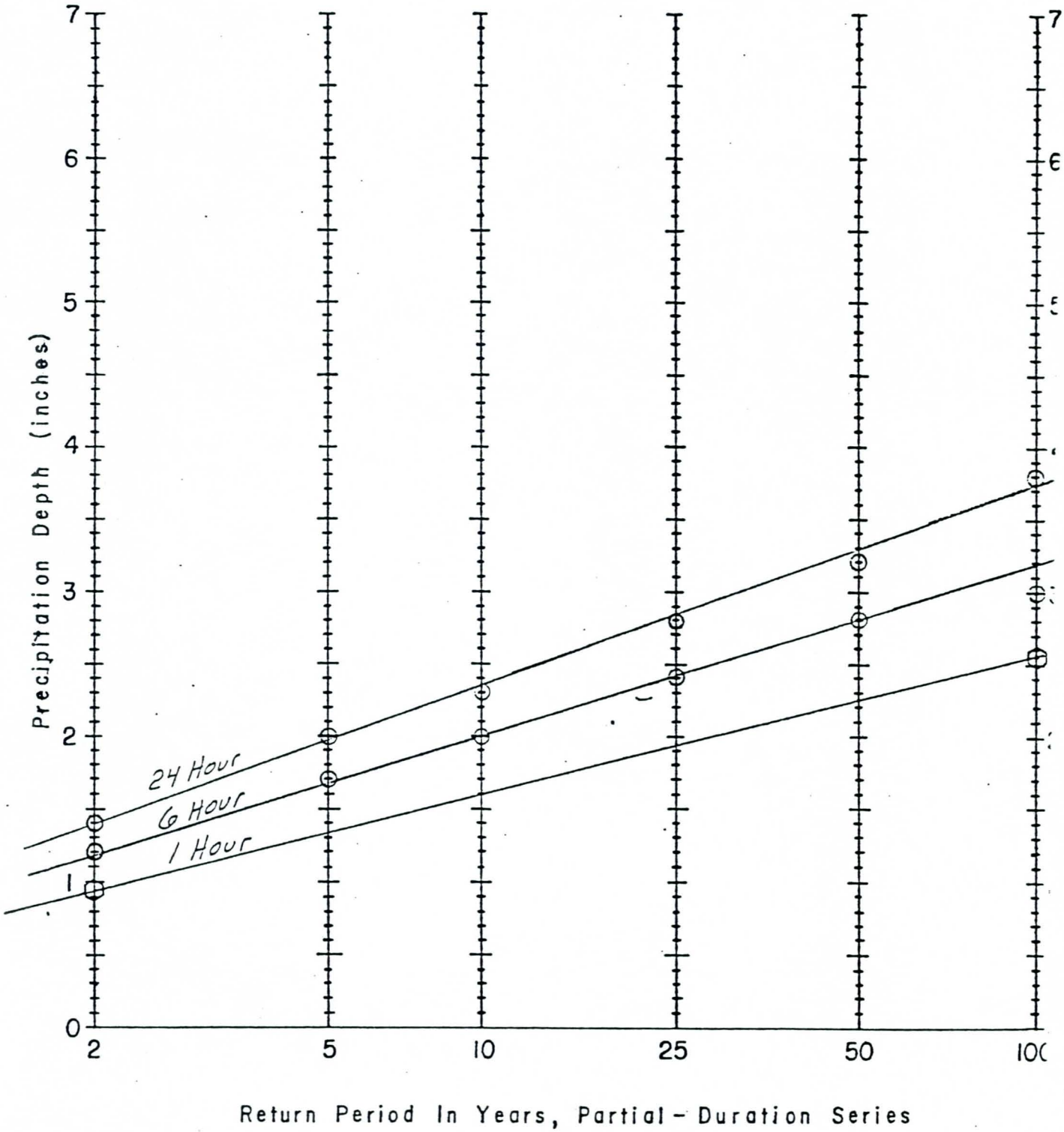
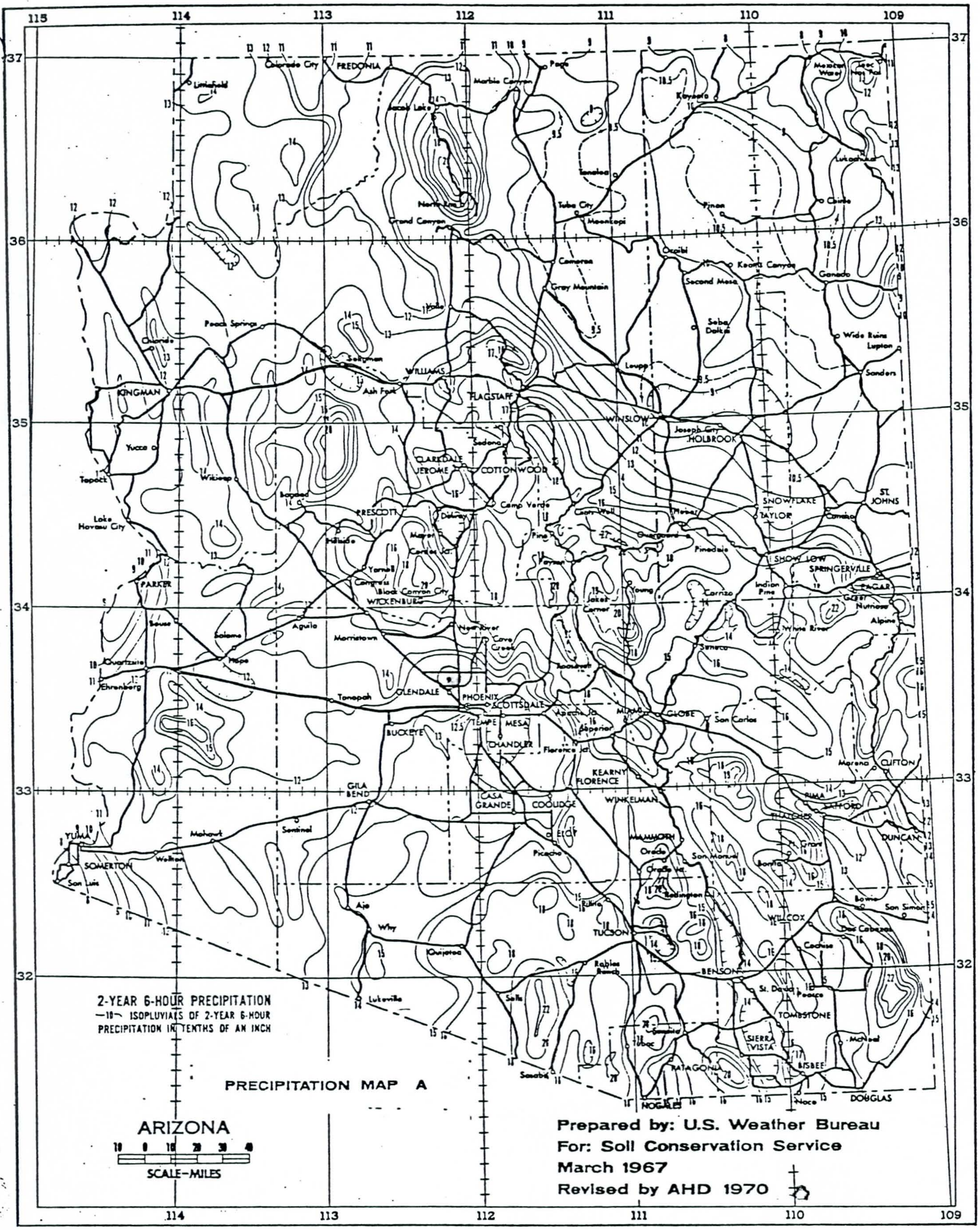
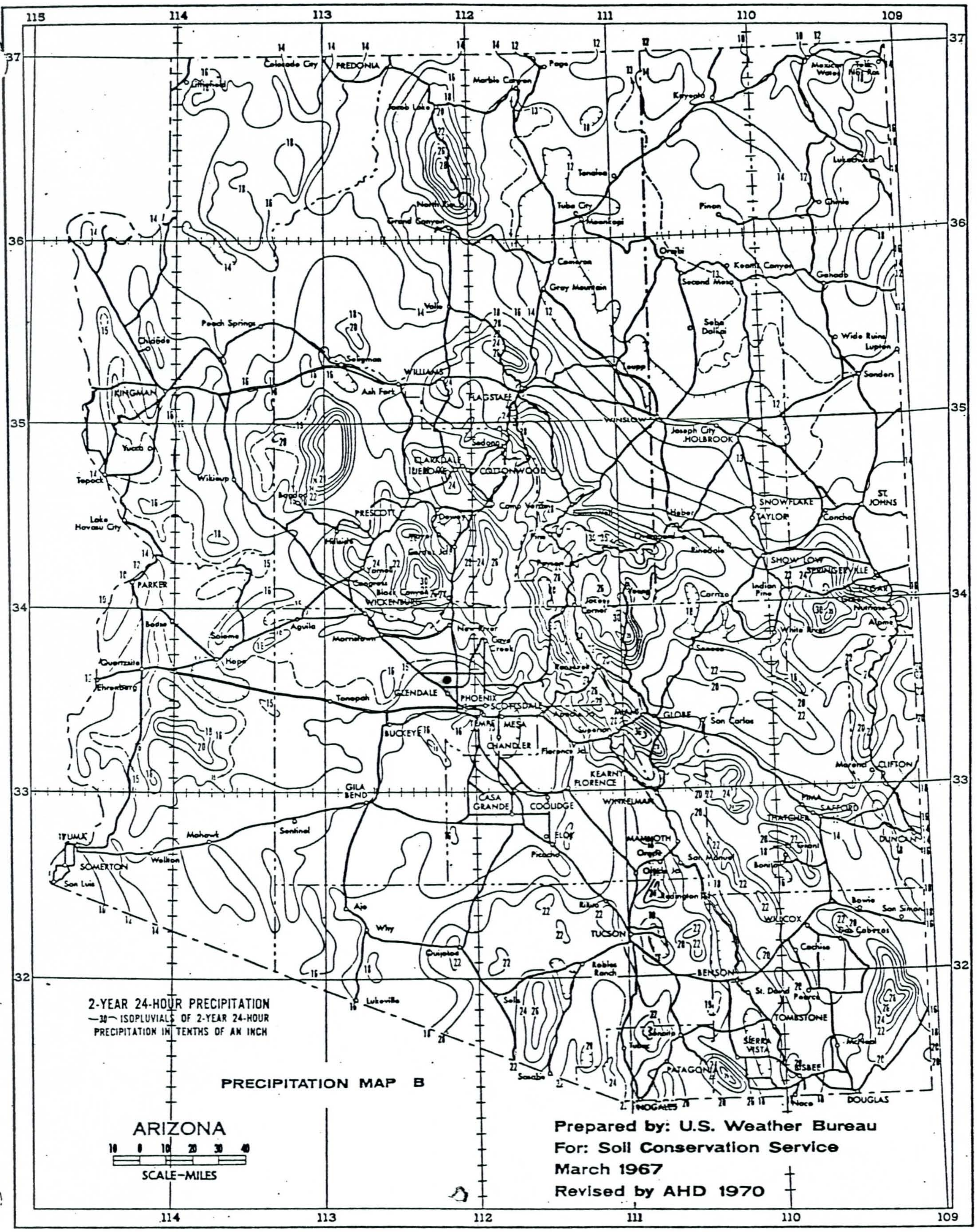
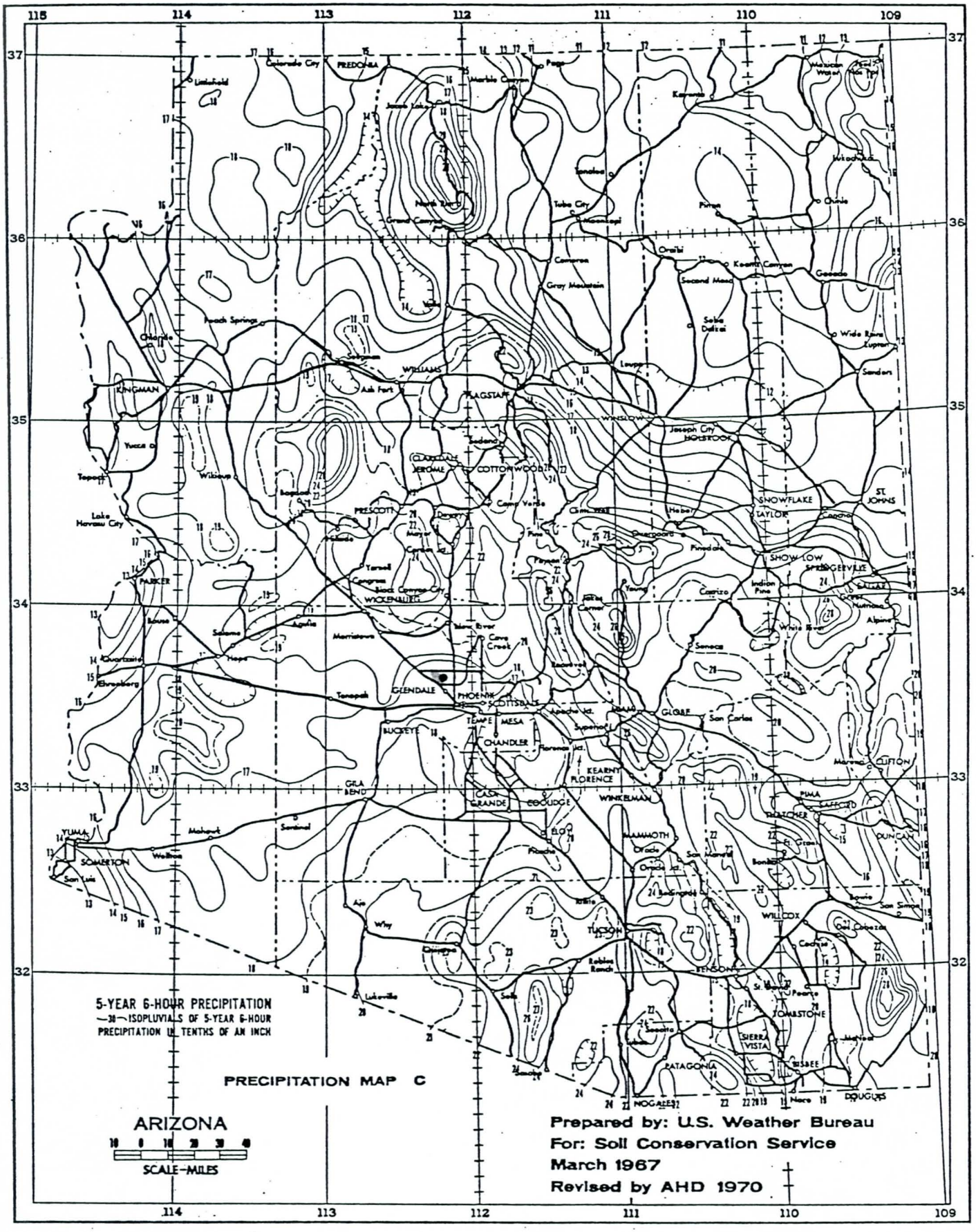
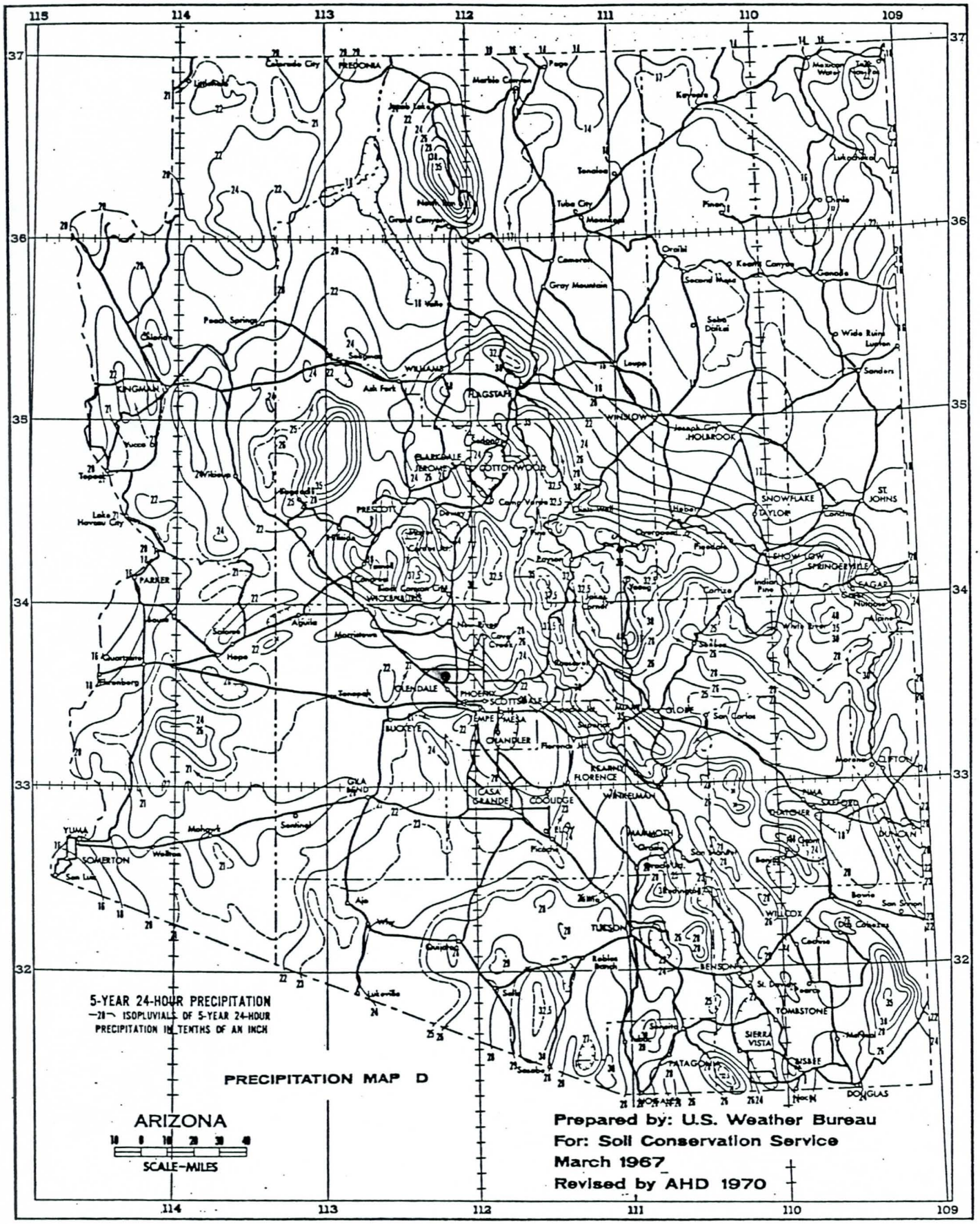


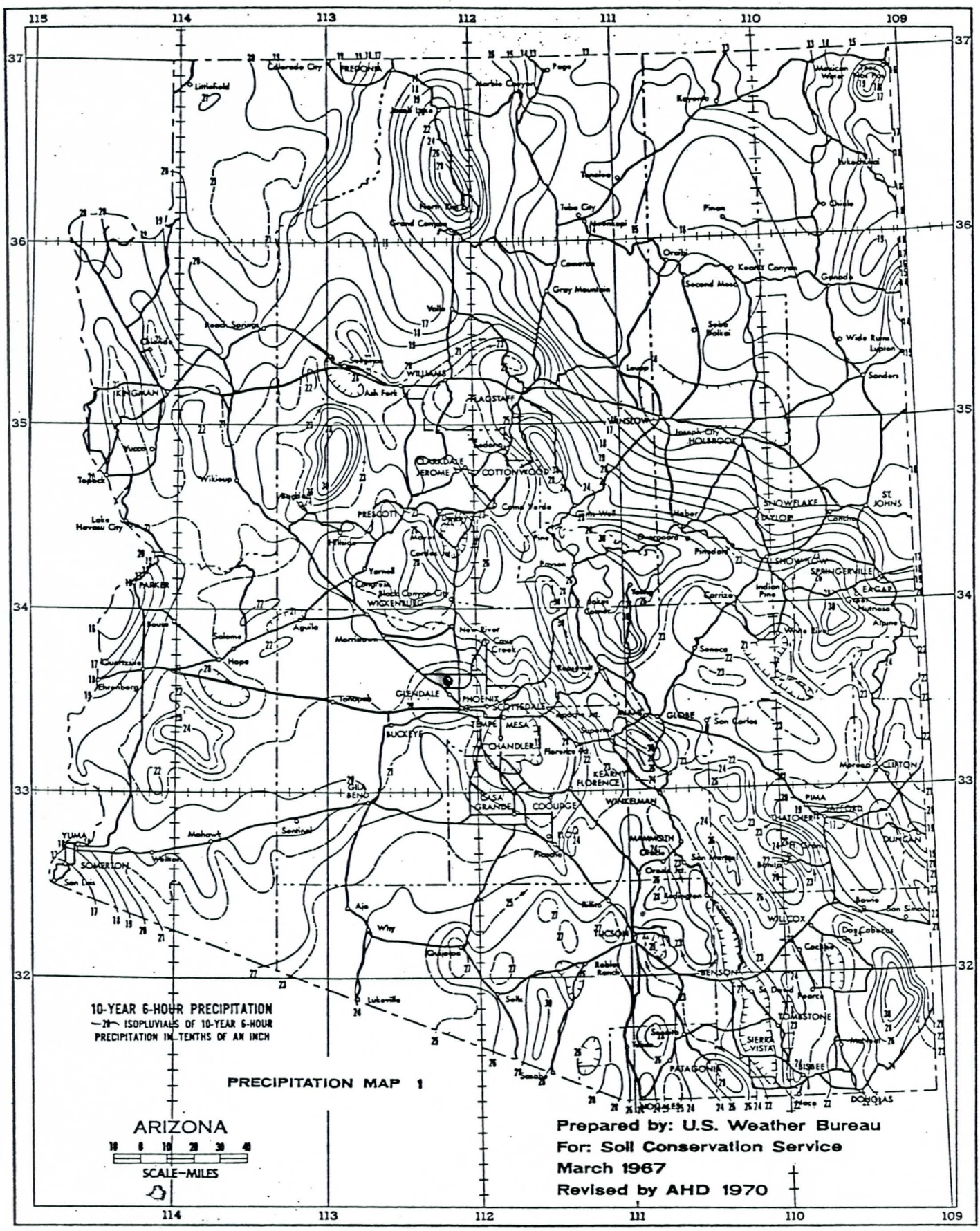
Figure 1 Precipitation Depth Versus Return Period for Partial-Duration Series

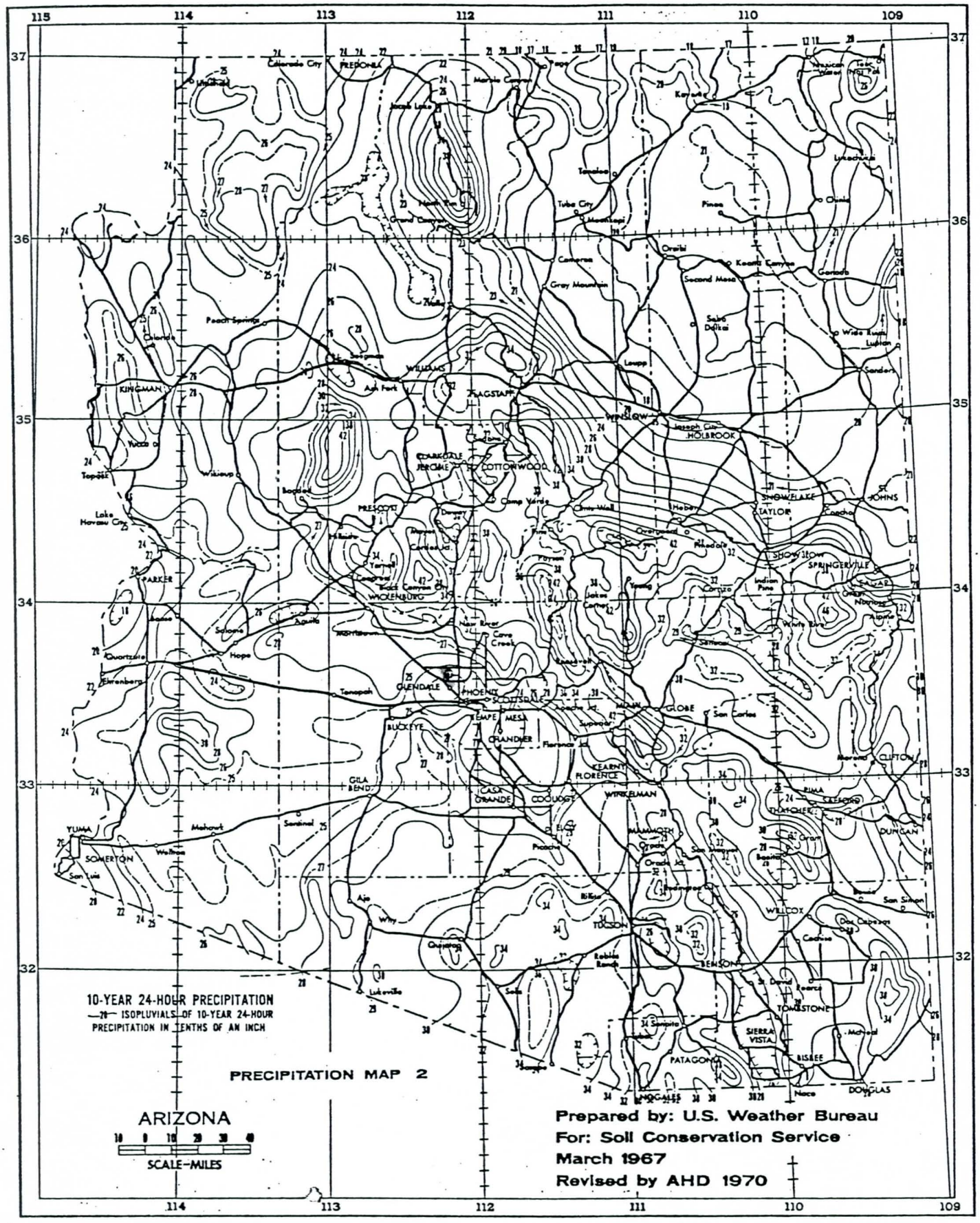

2-YEAR 6-HOUR PRECIPITATION
—10— ISOPLUVIALS OF 2-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP A
ARIZONA
SCALE–MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970

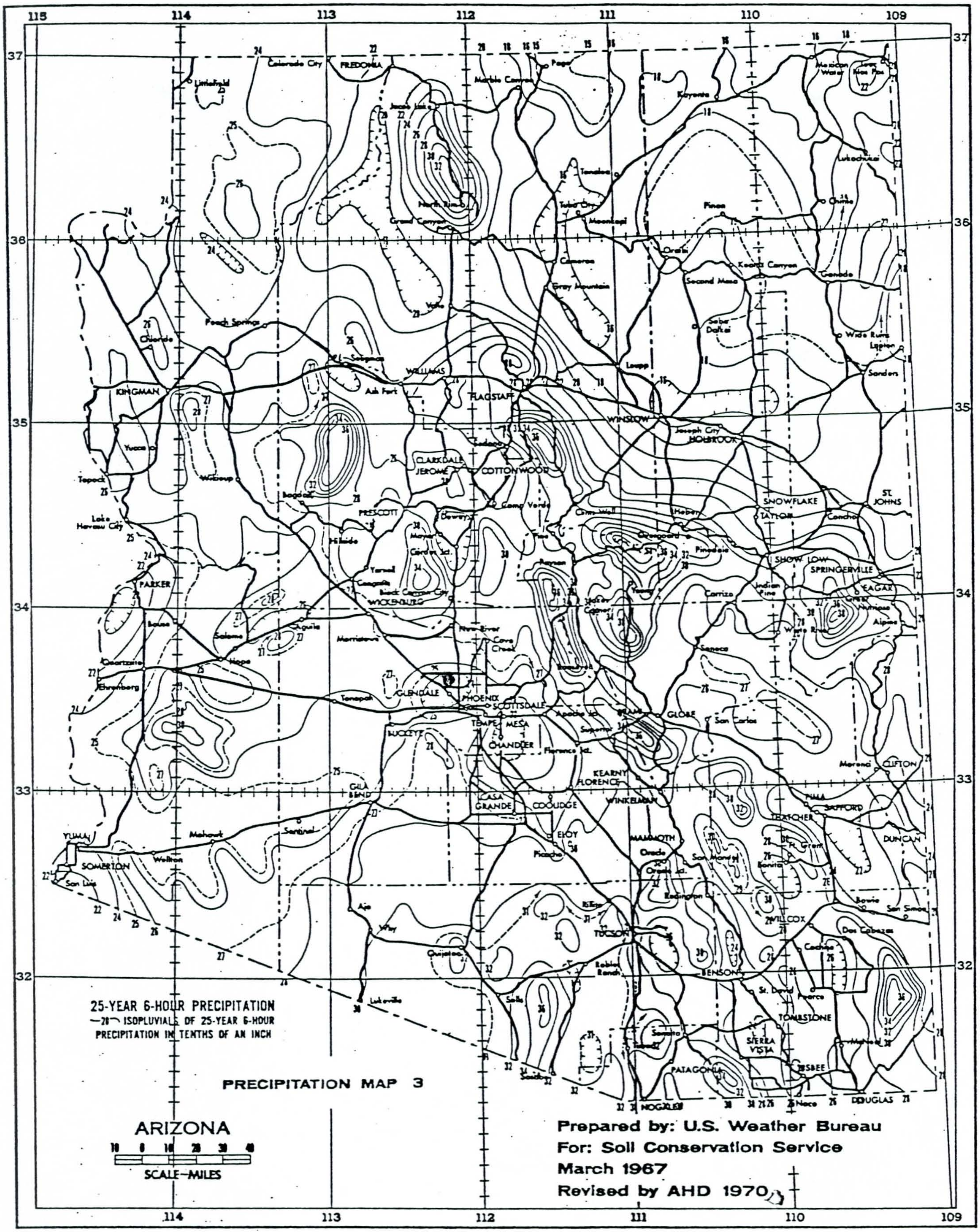

2-YEAR 24-HOUR PRECIPITATION
—30— ISOPLUVIALS OF 2-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP B
ARIZONA
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970

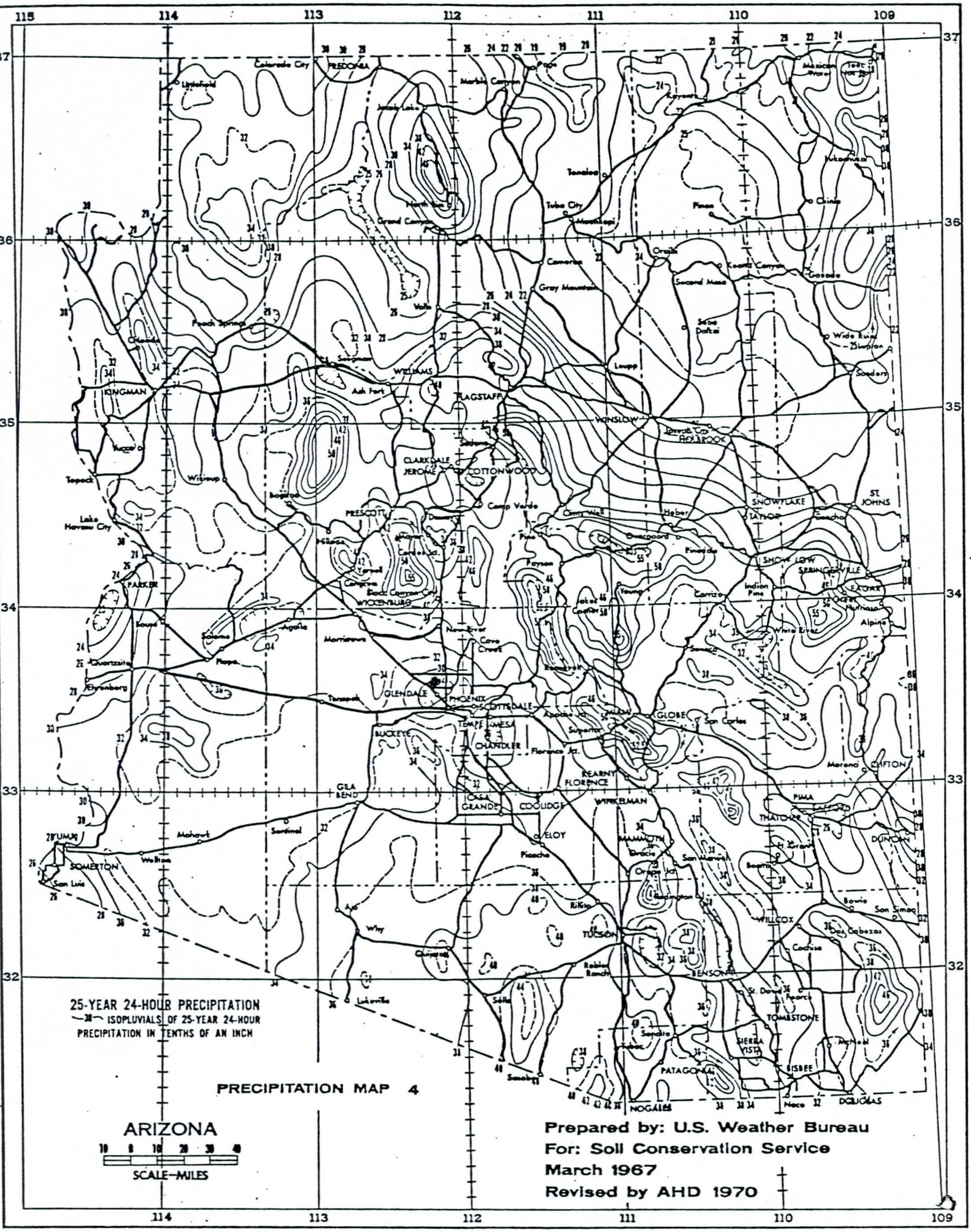

5-YEAR 6-HOUR PRECIPITATION
—30— ISOPLUVIALS OF 5-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP C
ARIZONA
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970
FLAGSTAFF
PRESCOTT
PHOENIX
TUCSON
YUMA
KINGMAN
WINSLOW
SHOW LOW
SPRINGERVILLE
ST. JOHNS
SNOWFLAKE
TAYLOR
COTTONWOOD
JEROME
GLOBE
SAFFORD
WILLCOX
TOMBSTONE
SIERRA VISTA
NOGALES
DOUGLAS
PATAGONIA
BISBEE
CLIFTON
MAMMOTH
KEARNY
FLORENCE
CASA GRANDE
COOLIDGE
GILA BEND
GLENDALE
SCOTTSDALE
TEMPE
MESA
CHANDLER
BUCKEYE
PARKER
SOMERTON
WICKENBURG
PAGE
TUBA CITY
HOLBROOK
PEACH SPRINGS
WILLIAMS
ASH FORK
SEDONA
CAMP VERDE
PAYSON
PINETOP
SAN CARLOS
SAN MANUEL
ELOY
MARICOPA
SELLS
SASABE
LUKEVILLE
AJO
WHITE RIVER
SENECA
ALPINE
GREER
EUPRAH
SANDERS
WIDE RUINS
GANADO
KEAMS CANYON
SECOND MESA
ORAIBI
CAMERON
GRAY MOUNTAIN
LEUPP
JOSEPH CITY
HOLSTOCK
PINEDALE
HEBER
OVERGARD
CONCHO
INDIAN PINE
CAMRIZO
YOUNG
PAYSON
MARYSVALE
CAMP VERDE
BLACK CANYON CITY
TONTO BASIN
MORRISTOWN
AGUILA
SALOME
HOPE
QUARTZSITE
BLYTHE
VICKSBURG
WELLTON
MOHAWK
SENTINEL
SAN LUIS
WHITE
TORTOLITA
ORACLE
BENSON
PEARCE
COCHISE
DUNCAN
MORENCO
LITCHFIELD
COLORADO CITY
FREDONIA
MARBLE CANYON
JACOB LAKE
NORTH RIM
GRAND CANYON
TOPOCK
LAKE HAVASU CITY
YUCCA
WIKIEUP
BAGDAD
TOLLESON
GILA
WAY
DIVIDE
ROBLES RANCH
SOLA
SAHUARITA
SAN SIMON
SAN JUAN
MAYER
CORDES JCT.
YARNELL
CONGRESS
BLACK CANYON CITY
MOUNT NUTHING
WHITE RIVER
APACHE JCT.
SUPERIOR
FLORENCE JCT.
ORACLE JCT.
BOWIE
MARANA
PIMA
THATCHER
EL CAPITAN
PEARCE
SAN SIMON
OAK CREEK
CAMERON
MOKI
PINEDALE
PAYSON
PINE
PINTO
KAYENTA
TUBA CITY
MOENKOPI
PINTO
OLJATO
WOODRUFF
CHINLE
GANADO
SAWMILL
SANDERS
WIDE RUINS
EUPRAH
ALPINE
GREER
MUNGINE
SENECA
WHITE RIVER
CAMRIZO
INDIAN PINE
OVERGARD
HEBER
PINEDALE
CONCHO
SAN CARLOS
GLOBE
MARANA
CLIFTON
DUNCAN
BOWIE
SAN SIMON
WILLCOX
COCHISE
PEARCE
TOMBSTONE
HUACHUCA
BISBEE
DOUGLAS
NOGALES
PATAGONIA
SIERRA VISTA
BENSON
SAHUARITA
TUCSON
ROBLES RANCH
SELLS
SASABE
LUKEVILLE
AJO
WAY
DIVIDE
BLYTHE
TORTOLITA
ORACLE
MAMMOTH
SAN MANUEL
ELOY
MARICOPA
FLORENCE
KEARNY
CASA GRANDE
COOLIDGE
GILA BEND
BUCKEYE
CHANDLER
TEMPE
MESA
SCOTTSDALE
PHOENIX
GLENDALE
TONOPAH
WICKENBURG
CAVE CREEK
BLACK CANYON CITY
YARNELL
CONGRESS
MAYER
CORDES JCT.
PARKER
BOUSE
VICKSBURG
QUARTZSITE
SALOME
HOPE
MORRISTOWN
AGUILA
WELLTON
MOHAWK
SENTINEL
SAN LUIS
SOMERTON
YUMA
LITCHFIELD
COLORADO CITY
FREDONIA
MARBLE CANYON
JACOB LAKE
NORTH RIM
GRAND CANYON
TOPOCK
LAKE HAVASU CITY
YUCCA
WIKIEUP
BAGDAD
TOLLESON
PEACH SPRINGS
SEDONA
CAMP VERDE
PAYSON
PINETOP
SAN CARLOS
SAN MANUEL
ELOY
MARICOPA
SELLS
SASABE
LUKEVILLE
AJO
WHITE RIVER
SENECA
ALPINE
GREER
EUPRAH
SANDERS
WIDE RUINS
GANADO
KEAMS CANYON
SECOND MESA
ORAIBI
CAMERON
GRAY MOUNTAIN
LEUPP
JOSEPH CITY
HOLSTOCK
PINEDALE
HEBER
OVERGARD
CONCHO
INDIAN PINE
CAMRIZO
YOUNG
PAYSON
MARYSVALE
CAMP VERDE
BLACK CANYON CITY
TONTO BASIN
MORRISTOWN
AGUILA
SALOME
HOPE
QUARTZSITE
BLYTHE
VICKSBURG
WELLTON
MOHAWK
SENTINEL
SAN LUIS
SOMERTON
YUMA
LITCHFIELD
COLORADO CITY
FREDONIA
MARBLE CANYON
JACOB LAKE
NORTH RIM
GRAND CANYON
TOPOCK
LAKE HAVASU CITY
YUCCA
WIKIEUP
BAGDAD
TOLLESON
PEACH SPRINGS
SEDONA
CAMP VERDE
PAYSON
PINETOP
SAN CARLOS
SAN MANUEL
ELOY
MARICOPA
SELLS
SASABE
LUKEVILLE
AJO
WHITE RIVER
SENECA
ALPINE
GREER
EUPRAH
SANDERS
WIDE RUINS
GANADO
KEAMS CANYON
SECOND MESA
ORAIBI
CAMERON
GRAY MOUNTAIN
LEUPP
JOSEPH CITY
HOLSTOCK
PINEDALE
HEBER
OVERGARD
CONCHO
INDIAN PINE
CAMRIZO
YOUNG
PAYSON
MARYSVALE
CAMP VERDE
BLACK CANYON CITY
TONTO BASIN
MORRISTOWN
AGUILA
SALOME
HOPE
QUARTZSITE
BLYTHE
VICKSBURG
WELLTON
MOHAWK
SENTINEL
SAN LUIS
SOMERTON
YUMA
LITCHFIELD
COLORADO CITY
FREDONIA
MARBLE CANYON
JACOB LAKE
NORTH RIM
GRAND CANYON
TOPOCK
LAKE HAVASU CITY
YUCCA
WIKIEUP
BAGDAD
TOLLESON
PEACH SPRINGS
SEDONA
CAMP VERDE
PAYSON
PINETOP
SAN CARLOS
SAN MANUEL
ELOY
MARICOPA
SELLS
SASABE
LUKEVILLE
AJO
WHITE RIVER
SENECA
ALPINE
GREER
EUPRAH
SANDERS
WIDE RUINS
GANADO
KEAMS CANYON
SECOND MESA
ORAIBI
CAMERON
GRAY MOUNTAIN
LEUPP
JOSEPH CITY
HOLSTOCK
PINEDALE
HEBER
OVERGARD
CONCHO
INDIAN PINE
CAMRIZO
YOUNG
PAYSON
MARYSVALE
CAMP VERDE
BLACK CANYON CITY
TONTO BASIN
MORRISTOWN
AGUILA
SALOME
HOPE
QUARTZSITE
BLYTHE
VICKSBURG
WELLTON
MOHAWK
SENTINEL
SAN LUIS
SOMERTON
YUMA

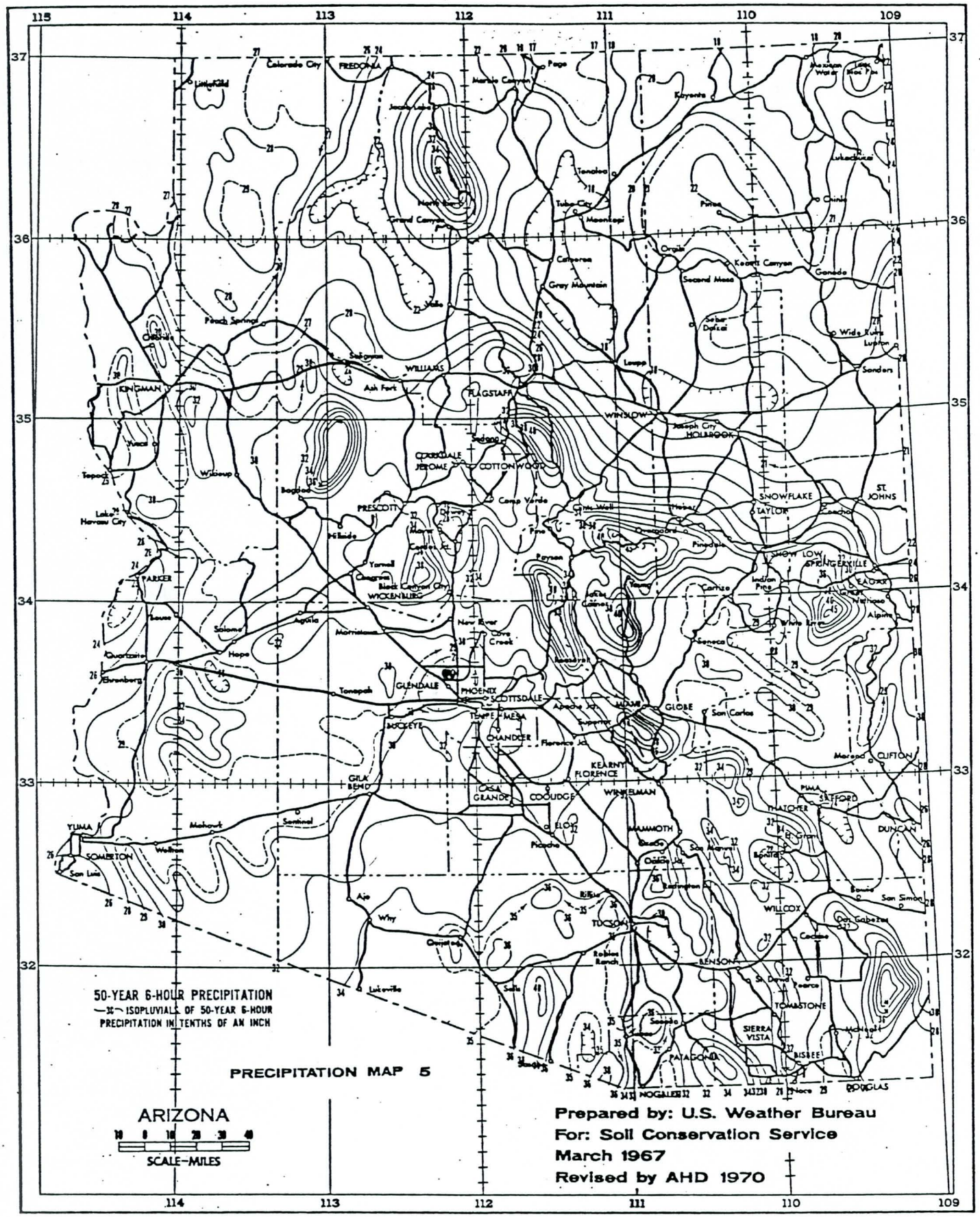

5-YEAR 24-HOUR PRECIPITATION
—28— ISOPLUVIALS OF 5-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP D
ARIZONA
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970
FLAGSTAFF
PRESCOTT
PHOENIX
TUCSON
YUMA
KINGMAN
WINSLOW
HOLBROOK
SNOWFLAKE
ST. JOHNS
SHOW LOW
SPRINGERVILLE
EAGAR
GLOBE
SAFFORD
WILLCOX
BENSON
TOMBSTONE
SIERRA VISTA
BISBEE
DOUGLAS
NOGALES
PATAGONIA
CASA GRANDE
COOLIDGE
FLORENCE
MARICOPA
GILA BEND
SOMERTON
PARKER
WICKENBURG
CLARKDALE
COTTONWOOD
JEROME
PRESCOTT
GLENDALE
SCOTTSDALE
TEMPE
MESA
CHANDLER
BUCKEYE
WILLIAMS
Ash Fork
Seligman
Peach Springs
Grand Canyon
Tuba City
Kayenta
Chinle
Ganado
Sanders
Lupton
Wide Ruins
Navajo
Concho
Springerville
Alpine
Morenci
Clifton
Duncan
Bowie
San Simon
Cochise
Dos Cabezas
Tonopah
Wickenburg
Hassayampa
Aguila
Salome
Hope
Quartzsite
Ehrenberg
Mohawk
Wellton
San Luis
Sentinel
Gila Bend
Ajo
Why
Lukeville
Sasabe
Nogales
Patagonia
Sonoita
Elgin
Pisinemo
Sahuarita
Rillito
Marana
Oracle
Mammoth
Winkelman
Superior
Miami
Globe
San Carlos
Cutter
Bylas
Pima
Thatcher
Safford
Duncan
Lordsburg
Rodeo
Cornerstone
Tombstone
Bisbee
Douglas
Naco
Nogales
Kingman
Yucca
Topock
Lake Havasu City
Parker
Bouse
Salome
Hope
Quartzsite
Ehrenberg
Wickenburg
Congress
Yarnell
Prescott
Dewey
Camp Verde
Cottonwood
Jerome
Clarkdale
Sedona
Oak Creek
Flagstaff
Winslow
Joseph City
Holbrook
Navajo
Leupp
Tuba City
Kayenta
Chinle
Ganado
Sanders
Lupton
Wide Ruins
Navajo
Concho
Springerville
Alpine
Eagar
Nutrioso
Indian Pine
Show Low
Snowflake
Taylor
St. Johns
Concho
Vernon
Springerville
Alpine
Morenci
Clifton
Duncan
Safford
Thatcher
Pima
Bowie
San Simon
Cochise
Dos Cabezas
Willcox
Benson
Tombstone
Sierra Vista
Bisbee
Douglas
Naco
Nogales
Patagonia
Sonoita
Elgin
Sahuarita
Rillito
Marana
Oracle
Mammoth
Winkelman
Superior
Miami
Globe
San Carlos
Cutter
Bylas
Pima
Thatcher
Safford
Duncan
Lordsburg
Rodeo
Cornerstone
Tombstone
Bisbee
Douglas
Naco
Nogales
Kingman
Yucca
Topock
Lake Havasu City
Parker
Bouse
Salome
Hope
Quartzsite
Ehrenberg
Wickenburg
Congress
Yarnell
Prescott
Dewey
Camp Verde
Cottonwood
Jerome
Clarkdale
Sedona
Oak Creek
Flagstaff
Winslow
Joseph City
Holbrook
Navajo
Leupp
Tuba City
Kayenta
Chinle
Ganado
Sanders
Lupton
Wide Ruins
Navajo
Concho
Springerville
Alpine
Eagar
Nutrioso
Indian Pine
Show Low
Snowflake
Taylor
St. Johns
Concho
Vernon
Springerville
Alpine
Morenci
Clifton
Duncan
Safford
Thatcher
Pima
Bowie
San Simon
Cochise
Dos Cabezas
Willcox
Benson
Tombstone
Sierra Vista
Bisbee
Douglas
Naco
Nogales
Patagonia
Sonoita
Elgin
Sahuarita
Rillito
Marana
Oracle
Mammoth
Winkelman
Superior
Miami
Globe
San Carlos
Cutter
Bylas
Pima
Thatcher
Safford
Duncan
Lordsburg
Rodeo
Cornerstone
Tombstone
Bisbee
Douglas
Naco
Nogales
Kingman
Yucca
Topock
Lake Havasu City
Parker
Bouse
Salome
Hope
Quartzsite
Ehrenberg
Wickenburg
Congress
Yarnell
Prescott
Dewey
Camp Verde
Cottonwood
Jerome
Clarkdale
Sedona
Oak Creek
Flagstaff
Winslow
Joseph City
Holbrook
Navajo
Leupp
Tuba City
Kayenta
Chinle
Ganado
Sanders
Lupton
Wide Ruins
Navajo
Concho
Springerville
Alpine
Eagar
Nutrioso
Indian Pine
Show Low
Snowflake
Taylor
St. Johns
Concho
Vernon
Springerville
Alpine
Morenci
Clifton
Duncan
Safford
Thatcher
Pima
Bowie
San Simon
Cochise
Dos Cabezas
Willcox
Benson
Tombstone
Sierra Vista
Bisbee
Douglas
Naco
Nogales
Patagonia
Sonoita
Elgin
Sahuarita
Rillito
Marana
Oracle
Mammoth
Winkelman
Superior
Miami
Globe
San Carlos
Cutter
Bylas
Pima
Thatcher
Safford
Duncan
Lordsburg
Rodeo
Cornerstone
Tombstone
Bisbee
Douglas
Naco
Nogales
Kingman
Yucca
Topock
Lake Havasu City
Parker
Bouse
Salome
Hope
Quartzsite
Ehrenberg
Wickenburg
Congress
Yarnell
Prescott
Dewey
Camp Verde
Cottonwood
Jerome
Clarkdale
Sedona
Oak Creek
Flagstaff
Winslow
Joseph City
Holbrook
Navajo
Leupp
Tuba City
Kayenta
Chinle
Ganado
Sanders
Lupton
Wide Ruins
Navajo
Concho
Springerville
Alpine
Eagar
Nutrioso
Indian Pine
Show Low
Snowflake
Taylor
St. Johns
Concho
Vernon
Springerville
Alpine
Morenci
Clifton
Duncan
Safford
Thatcher
Pima
Bowie
San Simon
Cochise
Dos Cabezas
Willcox
Benson
Tombstone
Sierra Vista
Bisbee
Douglas
Naco
Nogales
Patagonia
Sonoita
Elgin
Sahuarita
Rillito
Marana
Oracle
Mammoth
Winkelman
Superior
Miami
Globe
San Carlos
Cutter
Bylas
Pima
Thatcher
Safford
Duncan
Lordsburg
Rodeo
Cornerstone
Tombstone
Bisbee
Douglas
Naco
Nogales
Kingman
Yucca
Topock
Lake Havasu City
Parker
Bouse
Salome
Hope
Quartzsite
Ehrenberg
Wickenburg
Congress
Yarnell
Prescott
Dewey
Camp Verde
Cottonwood
Jerome
Clarkdale
Sedona
Oak Creek
Flagstaff
Winslow
Joseph City
Holbrook
Navajo
Leupp
Tuba City
Kayenta
Chinle
Ganado
Sanders
Lupton
Wide Ruins
Navajo
Concho
Springerville
Alpine
Eagar
Nutrioso
Indian Pine
Show Low
Snowflake
Taylor
St. Johns
Concho
Vernon
Springerville
Alpine
Morenci
Clifton
Duncan
Safford
Thatcher
Pima
Bowie
San Simon
Cochise
Dos Cabezas
Willcox
Benson
Tombstone
Sierra Vista
Bisbee
Douglas
Naco
Nogales
Patagonia
Sonoita
Elgin
Sahuarita
Rillito
Marana
Oracle
Mammoth
Winkelman
Superior
Miami
Globe
San Carlos
Cutter
Bylas
Pima
Thatcher
Safford
Duncan
Lordsburg
Rodeo
Cornerstone
Tombstone
Bisbee
Douglas
Naco
Nogales
Kingman
Yucca
Topock
Lake Havasu City
Parker
Bouse
Salome
Hope
Quartzsite
Ehrenberg
Wickenburg
Congress
Yarnell
Prescott
Dewey
Camp Verde
Cottonwood
Jerome
Clarkdale
Sedona
Oak Creek
Flagstaff
Winslow
Joseph City
Holbrook
Navajo
Leupp
Tuba City
Kayenta
Chinle
Ganado
Sanders
Lupton
Wide Ruins
Navajo
Concho
Springerville
Alpine
Eagar
Nutrioso
Indian Pine
Show Low
Snowflake
Taylor
St. Johns
Concho
Vernon
Springerville
Alpine
Morenci
Clifton
Duncan
Safford
Thatcher
Pima
Bowie
San Simon
Cochise
Dos Cabezas
Willcox
Benson
Tombstone
Sierra Vista
Bisbee
Douglas
Naco
Nogales
Patagonia
Sonoita
Elgin
Sahuarita
Rillito
Marana
Oracle
Mammoth
Winkelman
Superior
Miami
Globe
San Carlos
Cutter
Bylas
Pima
Thatcher
Safford
Duncan
Lordsburg
Rodeo
Cornerstone
Tombstone
Bisbee
Douglas
Naco
Nogales

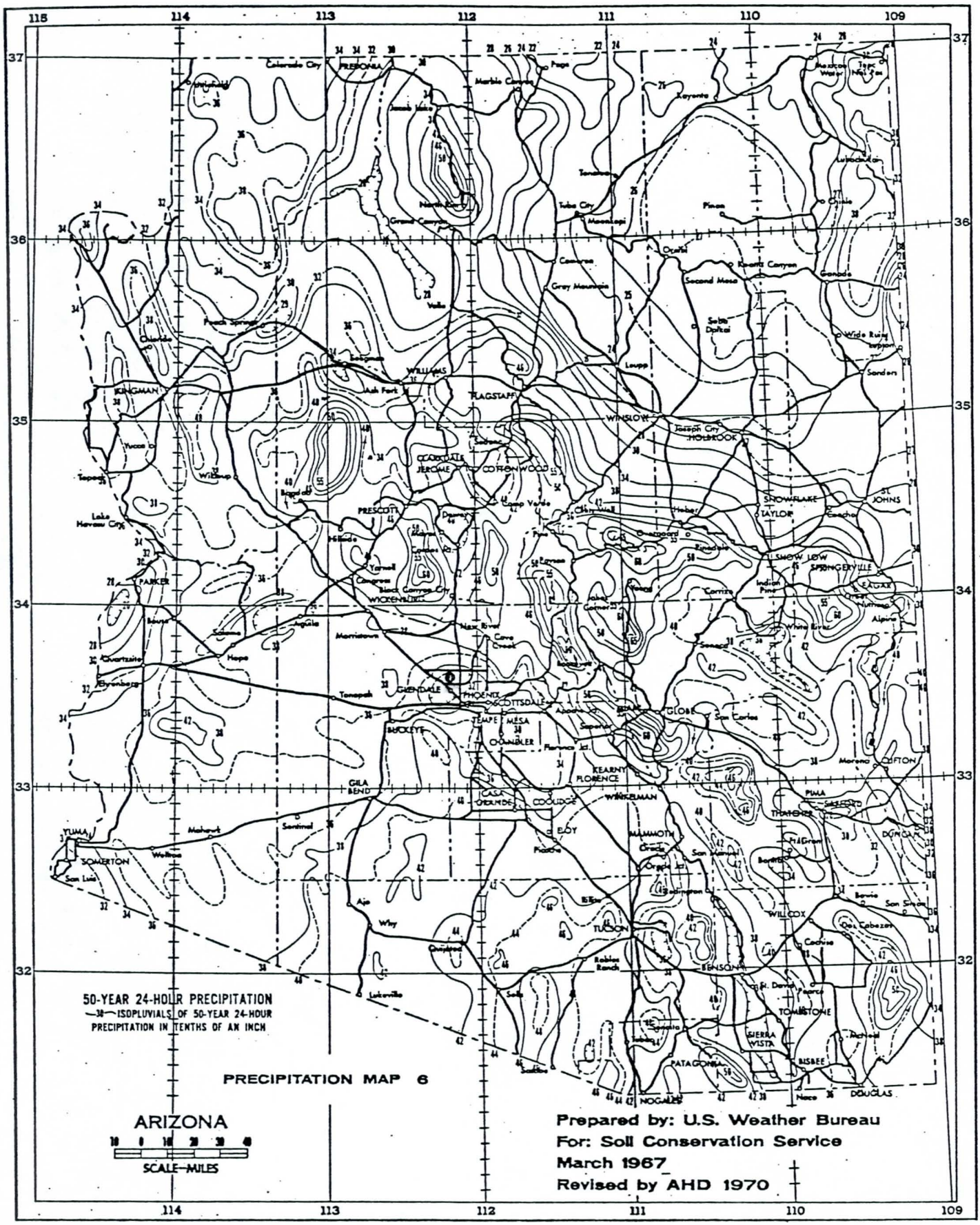

10-YEAR 6-HOUR PRECIPITATION
ISOPLUVIALS OF 10-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP 1
ARIZONA
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970
PRESCOTT
FLAGSTAFF
WINSLOW
HOLBROOK
SNOWFLAKE
PHOENIX
TUCSON
YUMA
GLOBE
SAFFORD
DOUGLAS
BISBEE
TOMBSTONE
SIERRA VISTA
PATAGONIA
BENSON
WILLCOX
DUNCAN
ST. JOHNS
SPRINGERVILLE
EAGAR
WICKENBURG
GLENDALE
SCOTTSDALE
TEMPE
MESA
CHANDLER
BUCKEYE
GILA BEND
CASA GRANDE
COOLIDGE
FLORENCE
KEARNY
WINKELMAN
MAMMOTH
SAN MANUEL
PIMA
CLIFTON
LITTLEFIELD
KINGMAN
WILLIAMS
COTTONWOOD
JEROME
CLARKDALE
PARKER
SOMERTON
SAN LUIS
AJO
WHITE RIVER
LAKE HAVASU CITY

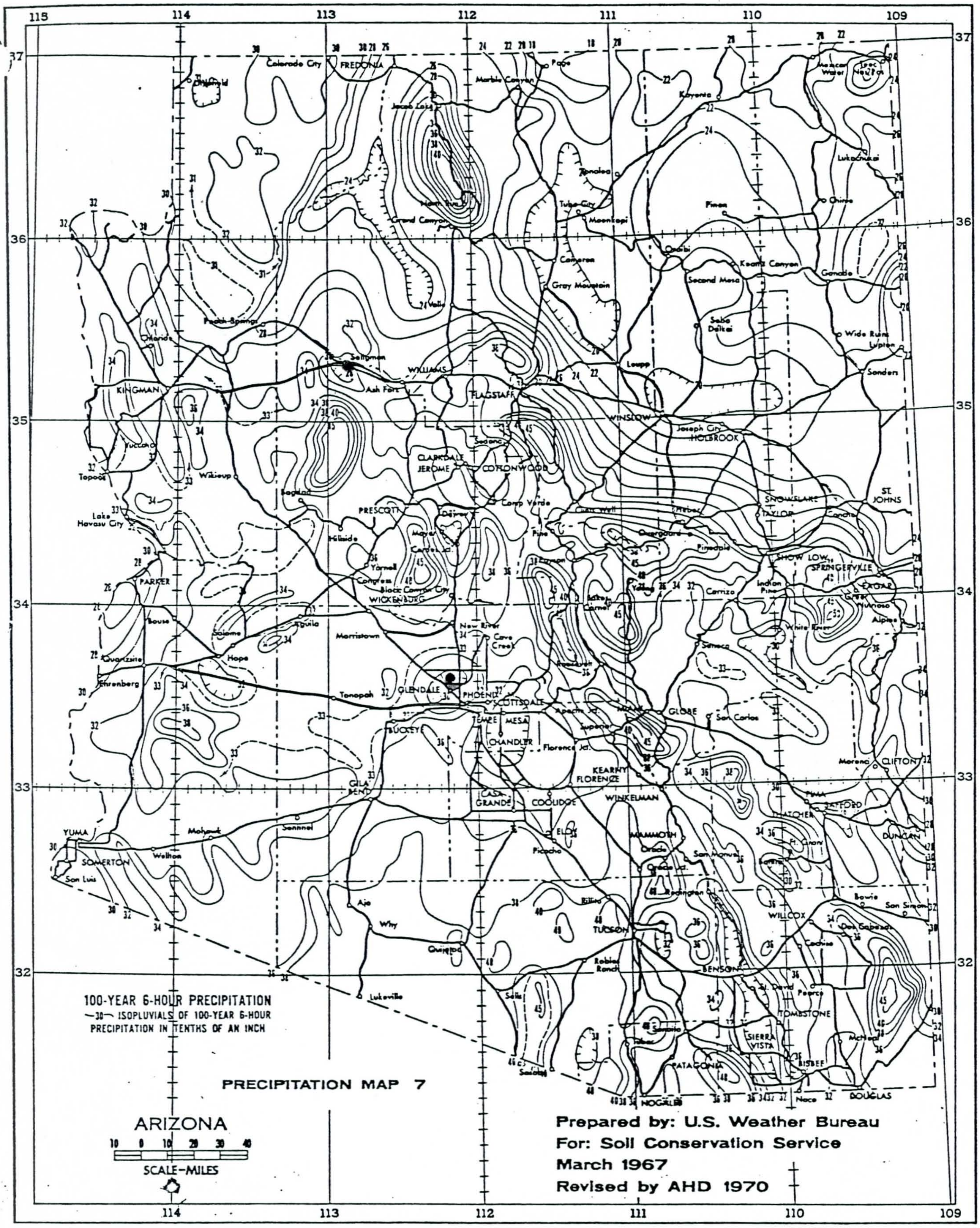

10-YEAR 24-HOUR PRECIPITATION
—20— ISOPLUVIALS OF 10-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP 2
ARIZONA
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970
KINGMAN
FLAGSTAFF
WINSLOW
HOLBROOK
COTTONWOOD
PRESCOTT
SNOWFLAKE
TAYLOR
SHOW LOW
SPRINGERVILLE
WICKENBURG
PHOENIX
GLENDALE
SCOTTSDALE
TEMPE
MESA
CHANDLER
BUCKEYE
GLOBE
KEARNY
FLORENCE
CASA GRANDE
COOLIDGE
WINKELMAN
MAMMOTH
TUCSON
WILLCOX
BENSON
TOMBSTONE
SIERRA VISTA
BISBEE
PATAGONIA
NOGALES
DOUGLAS
YUMA
SOMERTON
PARKER
GILA BEND
CLIFTON
DUNCAN
SAFFORD
THATCHER
PIMA
Colorado City
Fredonia
Page
Tuba City
Kayenta
Chinle
Ganado
Second Mesa
Keams Canyon
Oraibi
Cameron
Gray Mountain
Leupp
Peach Springs
Seligman
Williams
Ash Fork
Yucca
Topock
Wikieup
Bagdad
Lake Havasu City
Camp Verde
Cottonwood
Jerome
Clarkdale
Chino Valley
Prescott
Dewey
Mayer
Cordes Jct.
Yarnell
Congress
Wickenburg
Aguila
Salome
Hope
Quartzsite
Ehrenberg
Tonopah
Morristown
New River
Cave Creek
Rock Springs
Superior
Miami
Hayden
Winkelman
San Carlos
Bylas
Safford
Thatcher
Duncan
Willcox
Benson
Tombstone
Sierra Vista
Bisbee
Patagonia
Nogales
Douglas
Naco
Sonoita
Sasabe
Ajo
Why
Sells
Lukeville
Quijotoa
Robles Ranch
Pisinimo
Bitter
Mohawk
Wellton
Sentinel
San Luis
Tolleson
Mesa
Chandler
Florence Jct.
Coolidge Jct.
Casa Grande
Eloy
Picacho
Oracle Jct.
Mammoth
Orange Grove
Cochise
Dos Cabezas
Pearce
Dragoon
Moson
Sunsites
Cottonwood
Camp Verde
Chino Valley
Prescott
Dewey
Mayer
Cordes Jct.
Yarnell
Congress
Wickenburg
Aguila
Salome
Hope
Quartzsite
Ehrenberg
Tonopah
Morristown
New River
Cave Creek
Rock Springs
Superior
Miami
Hayden
Winkelman
San Carlos
Bylas
Safford
Thatcher
Duncan
Willcox
Benson
Tombstone
Sierra Vista
Bisbee
Patagonia
Nogales
Douglas
Naco
Sonoita
Sasabe
Ajo
Why
Sells
Lukeville
Quijotoa
Robles Ranch
Pisinimo
Bitter
Mohawk
Wellton
Sentinel
San Luis
Tolleson
Mesa
Chandler
Florence Jct.
Coolidge Jct.
Casa Grande
Eloy
Picacho
Oracle Jct.
Mammoth
Orange Grove
Cochise
Dos Cabezas
Pearce
Dragoon
Moson
Sunsites
Cottonwood
Camp Verde
Chino Valley
Prescott
Dewey
Mayer
Cordes Jct.
Yarnell
Congress
Wickenburg
Aguila
Salome
Hope
Quartzsite
Ehrenberg
Tonopah
Morristown
New River
Cave Creek
Rock Springs
Superior
Miami
Hayden
Winkelman
San Carlos
Bylas
Safford
Thatcher
Duncan
Willcox
Benson
Tombstone
Sierra Vista
Bisbee
Patagonia
Nogales
Douglas
Naco
Sonoita
Sasabe
Ajo
Why
Sells
Lukeville
Quijotoa
Robles Ranch
Pisinimo
Bitter
Mohawk
Wellton
Sentinel
San Luis
Tolleson
Mesa
Chandler
Florence Jct.
Coolidge Jct.
Casa Grande
Eloy
Picacho
Oracle Jct.
Mammoth
Orange Grove
Cochise
Dos Cabezas
Pearce
Dragoon
Moson
Sunsites
Cottonwood
Camp Verde
Chino Valley
Prescott
Dewey
Mayer
Cordes Jct.
Yarnell
Congress
Wickenburg
Aguila
Salome
Hope
Quartzsite
Ehrenberg
Tonopah
Morristown
New River
Cave Creek
Rock Springs
Superior
Miami
Hayden
Winkelman
San Carlos
Bylas
Safford
Thatcher
Duncan
Willcox
Benson
Tombstone
Sierra Vista
Bisbee
Patagonia
Nogales
Douglas
Naco
Sonoita
Sasabe
Ajo
Why
Sells
Lukeville
Quijotoa
Robles Ranch
Pisinimo
Bitter
Mohawk
Wellton
Sentinel
San Luis
Tolleson
Mesa
Chandler
Florence Jct.
Coolidge Jct.
Casa Grande
Eloy
Picacho
Oracle Jct.
Mammoth
Orange Grove
Cochise
Dos Cabezas
Pearce
Dragoon
Moson
Sunsites

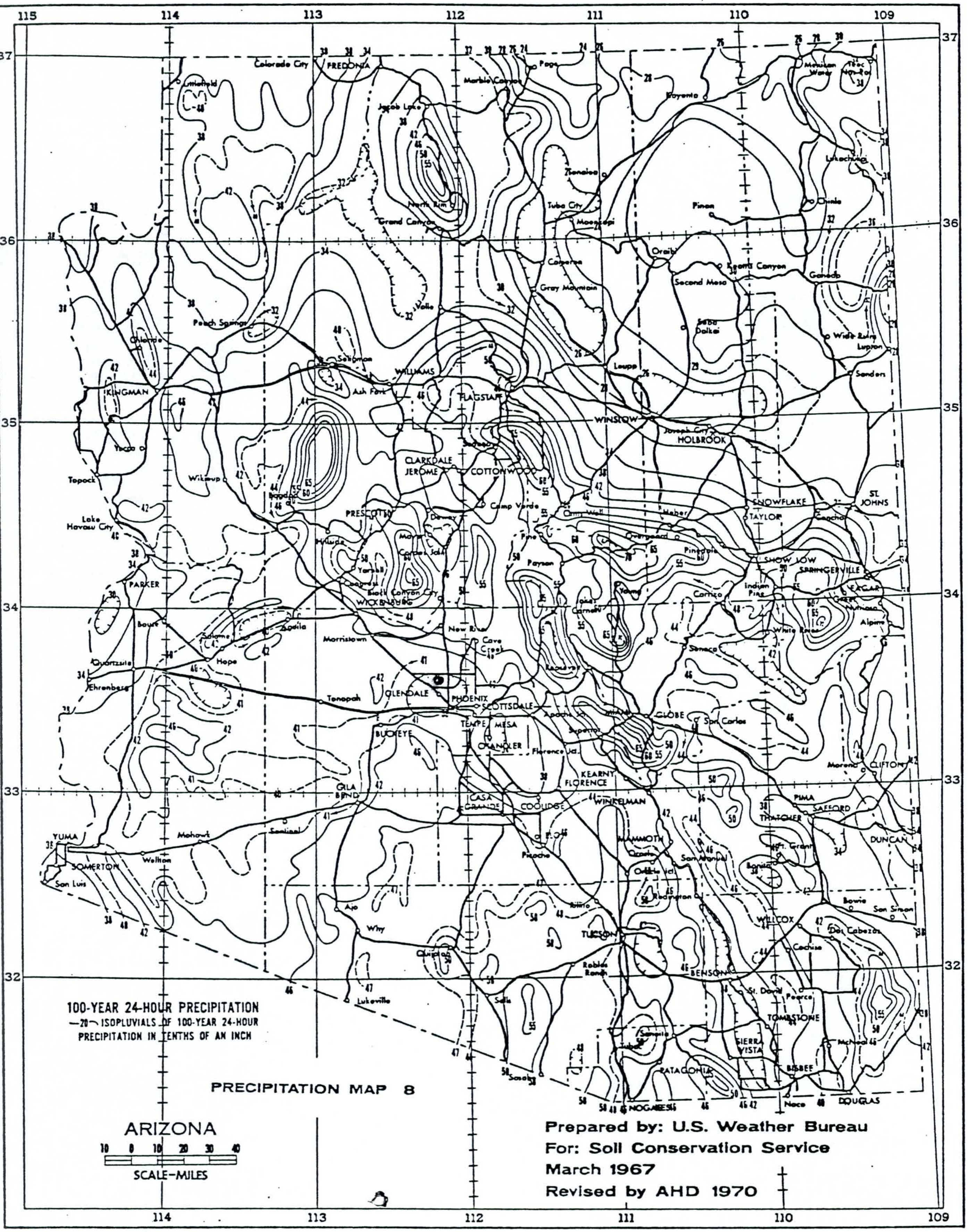

25-YEAR 6-HOUR PRECIPITATION
ISOPLUVIALS OF 25-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP 3
ARIZONA
SCALE–MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970
KINGMAN
FLAGSTAFF
WINSLOW
HOLBROOK
PRESCOTT
PHOENIX
YUMA
TUCSON
NOGALES
DOUGLAS
GLOBE
SNOWFLAKE
BENSON
TOMBSTONE
BISBEE


25-YEAR 24-HOUR PRECIPITATION
—38— ISOPLUVIALS OF 25-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP 4
ARIZONA
SCALE—MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970
KINGMAN
WILLIAMS
FLAGSTAFF
WINSLOW
HOLBROOK
PRESCOTT
WICKENBURG
PHOENIX
GLENDALE
SCOTTSDALE
TEMPE
MESA
CHANDLER
BUCKEYE
GLOBE
CASA GRANDE
COOLIDGE
ELOY
FLORENCE
WINKELMAN
TUCSON
BENSON
WILLCOX
TOMBSTONE
BISBEE
DOUGLAS
NOGALES
SOMERTON
PARKER
SNOWFLAKE
TAYLOR
SPRINGERVILLE
ST. JOHNS
CLIFTON
DUNCAN
SAFFORD
THATCHER
PIMA
MAMMOTH
PATAGONIA
SIERRA VISTA
GILA BEND
CLARKDALE
JEROME
COTTONWOOD


50-YEAR 6-HOUR PRECIPITATION
ISOPLUVIALS OF 50-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP 5
ARIZONA
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970
FLAGSTAFF
WILLIAMS
KINGMAN
PRESCOTT
WINSLOW
HOLBROOK
SNOWFLAKE
PHOENIX
TUCSON
YUMA
NOGALES
DOUGLAS


50-YEAR 24-HOUR PRECIPITATION
—30— ISOPLUVIALS OF 50-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP 6
ARIZONA
SCALE—MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970


115
114
113
112
111
110
109
37
36
35
34
33
32
Colorado City
FREDONIA
Marble Canyon
Page
Kayenta
Mexican Water
Lukachukai
Chinle
Tonalea
Tuba City
Moenkopi
Pinon
Grand Canyon
Valle
Cameron
Gray Mountain
Oraibi
Keams Canyon
Second Mesa
Ganado
Peach Springs
Seligman
WILLIAMS
Ash Fork
FLAGSTAFF
Leupp
Wide Ruins
Lupton
Sanders
KINGMAN
Chloride
Yucca
Topock
Wikieup
WINSLOW
Joseph City
HOLBROOK
Sedona
CLARKDALE
JEROME
COTTONWOOD
Camp Verde
ST. JOHNS
SNOWFLAKE
TAYLOR
Concho
Heber
Bagdad
PRESCOTT
Dewey
Mayer
Cordes Jct.
Pine
Overgaard
Pinedale
Lake Havasu City
Hillside
Yarnell
Congress
Black Canyon City
WICKENBURG
Payson
SHOW LOW
SPRINGERVILLE
EAGAR
PARKER
Bouse
Salome
Aguila
Morristown
New River
Cave Creek
Roosevelt
Carrizo
Indian Pine
White River
Alpine
Quartzsite
Hope
Ehrenberg
Tonopah
GLENDALE
PHOENIX
SCOTTSDALE
Apache Jct.
Superior
MIAMI
GLOBE
San Carlos
BUCKEYE
TEMPE
MESA
CHANDLER
Florence Jct.
KEARNY
FLORENCE
Morenci
CLIFTON
GILA BEND
CASA GRANDE
COOLIDGE
WINKELMAN
PIMA
SAFFORD
THATCHER
YUMA
Mohawk
Sentinel
ELOY
MAMMOTH
Ft. Grant
DUNCAN
SOMERTON
Wellton
Picacho
Oracle
San Manuel
Oracle Jct.
San Luis
Redington
Bowie
San Simon
Ajo
Why
Rillito
TUCSON
WILLCOX
Dos Cabezas
Cochise
Quijotoa
Robles Ranch
BENSON
St. David
Pearce
Lukeville
Sells
TOMBSTONE
Sasabe
SIERRA VISTA
McNeal
PATAGONIA
BISBEE
NOGALES
Naco
DOUGLAS
100-YEAR 6-HOUR PRECIPITATION
—30— ISOPLUVIALS OF 100-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP 7
ARIZONA
10 0 10 20 30 40
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970


100-YEAR 24-HOUR PRECIPITATION
—20— ISOPLUVIALS OF 100-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP 8
ARIZONA
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970

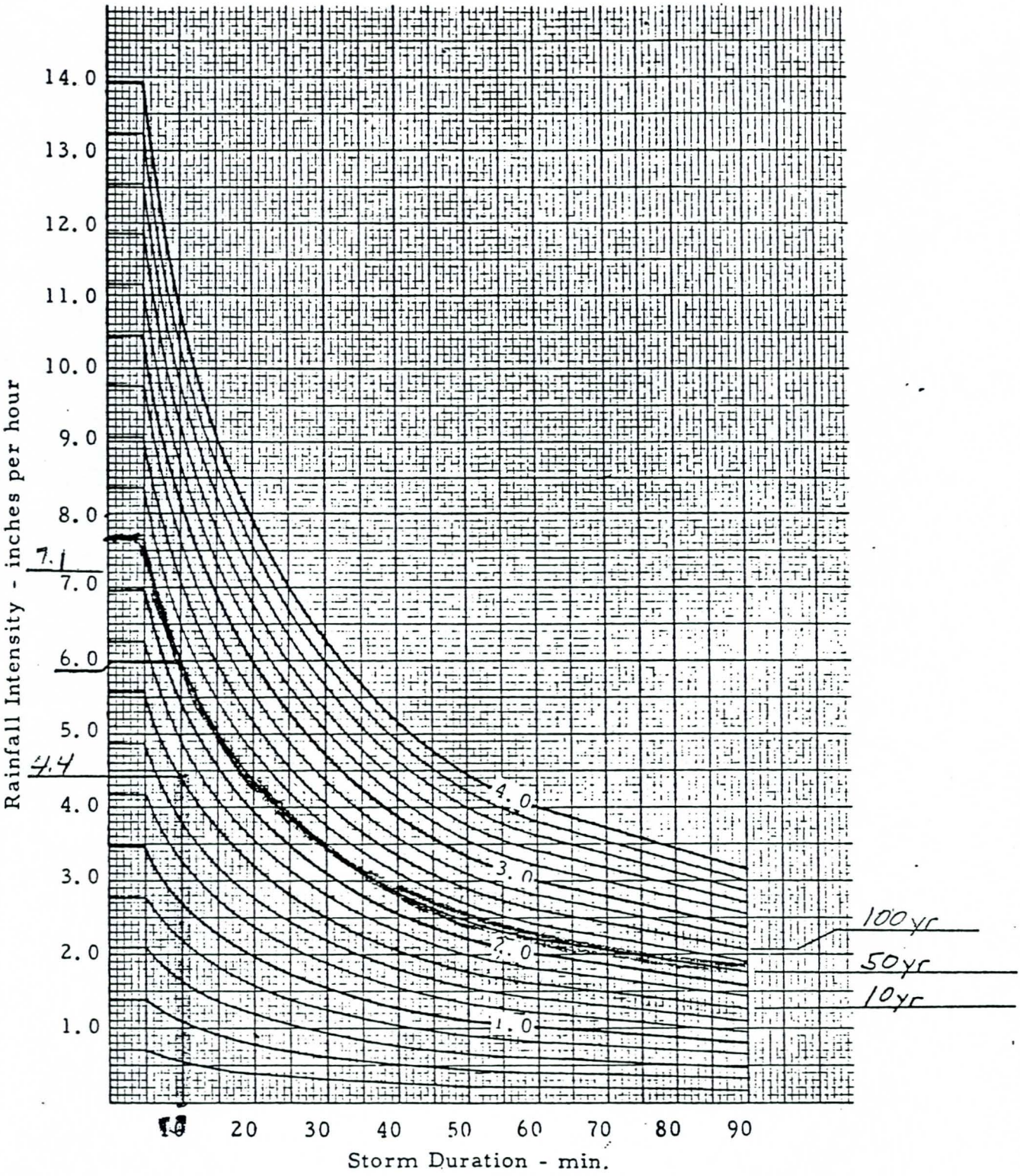


Fig. 3-2

STANDARD DURATION RAINFALL - INTENSITY CURVES

Based on:
Weather Bureau
Technical Paper No. 4

Tab 3

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

North Side
Infield

[redacted] DRAINAGE WORKSHEET

LOCATION DATA

Highway: Outer Loop
Location: 59th Av - 35th Av
Project No.: RRM 600-0-305

DESIGN DATA

Frequency: 10 years
P_6* = 2.0 in. P_{24}* = 2.35 in. P_1* = 1.6 in.
AHW = _____

RUNOFF CALCULATIONS

From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Channel Type	S_o ft/ft	Z	n	D ft.	V fps
1186+35	1168+00	1835		4.9		12	4.1	20			4/6	.035	1.6	2.5
1168+00	1159+50	850		1.9		10	4.4	8.4		.002	4/6	.035	1.3	1.9
1150+50	1159+50	900		1.8		10	4.4	7.9		.002	4/6	.035	1.2	1.9
								16.3						
1099+00	1112+00			3.8	—	10	4.4	17						

INLET CALCULATIONS

	Station	Inlet Type	Q cfs	HW ft.	DHW Elev.	Dike Elev.
14	1168+00	C15.30 (dbl)	20	.76	1330.96	1331.20
9	1158+50	C15.30 (dbl)	16.3	.71	1329.50	1330.0
55	1101+50	C15.30 (dbl)	17	.71	1300.61	—

sump

Channel Type: Trapezoidal, Triangular

Inlet Type: C-15.08, C-15.09, C-15.10, Pipe Culvert

Computed by: M Lopez Checked by: MRC Date: 11/21/89

* Utimate Section

C9

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

Infield

[redacted] DRAINAGE WORKSHEET

South Side 1153+00 – 1083+00

LOCATION DATA

Highway: Outer Loop
Location: 59th Av – 35th Av
Project No.: RBM 600-0-305

DESIGN DATA

Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
AHW = _____

RUNOFF CALCULATIONS

	From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Channel Type	S_o ft/ft	Z	n	D ft.	V fps
M.L.	1153+00	1143+00	1000	*138	3.2	.78	10	4.4	11	Tria.	.006	4	.035	1.0	2.2
"	1143+00	1133+00	1000	*138	3.2	.78	↓	↓	11	↓	.006	4	.035	1.0	2.2
	1133+00	1124+00	900	*138	2.9	.78			10		.005	4	.035		
	1124+00	1116+00	800	131	2.4	.82			8.7		.002	4	.035	.9	2.0
	1112+00	1116+00	400	131	1.2	.86			4.5		.002	4	.035	.7	1.6
	1099+00	1112+00	1200	94	2.6	.65			7.5		.006	4	.035	1.0	2.0
	1083+00	1097+80			**2.2	–			9.7		.002	4	.035	1.2	1.3

C-9

INLET CALCULATIONS

	Station	Inlet Type	Q cfs	HW ft.	DHW Elev.	Dike Elev. (Min)	
29	1142+46, 32Lt	C 15.30, Dbl	11	.51	1322.41	1322.75	
26	1133+00, 90Rt	C 15.30, Dbl	11	.51	1315.51	1316.0	
23	1123+45, 47Lt	C 15.30, Dbl	10	.51	1311.11	1311.6	
21	1117+50, 42Lt	C 15.30	8.7	.8	1308.4	1308.6	
19	1113+50, 34Lt	C 15.30	4.5	.5	1307.3	—	sump
54	1101+30, 40Lt	C 15.30, Dbl	9.7	.5	1301.30	—	sump

Channel Type: Trapezoidal, Triangular

Inlet Type: C-15.08, C-15.09, C-15.10, Pipe Culvert

Computed by: M Lopez Checked by: MRC Date: 11/21/89

* Ultimate Section Controls
** Planimetered

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

PAVEMENT DRAINAGE WORKSHEET

Main Line E.B.
Sta 1102+50 - 1073+00

LOCATION DATA
Highway: Outer Loop
Location:
Project No.: RBM 600-0-305

DESIGN DATA
Frequency: 10 years
P_6= 2.0 in. P_{24}= 2.35 in. P_1= 1.6 in.
T_{all} = 14' n = .016
Curb Height =

RUNOFF CALCULATIONS

From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Q_c cfs	Q_T cfs	S_o ft/ft	S_x ft/ft	z/n	D ft.	T ft.
1102+50	1104+00	150	*71	*.25	.95	10	4.4	1.0	—	1.0	.0228	.017			8
1096+24	1088+50	774	*71	1.3	.95			5.3	—	5.3	.0172	.02		.24	12
1088+50	1085+00	350	*71	.57	.95			2.4	.8	3.2	.027	.02		.19	9.2
1085+00	1082+70	230	*71	.37	.95			1.6	.5	2.1	.027	.02		.16	8
					.95										
					.95										
					.95										

9-P

INLET CALCULATIONS

	Station	Inlet Type	D ft.	Q_i cfs	$Q_c = Q_T - Q_i$
**	1104+00	UC-07 w/40 SD		1.4	—
(62)	1088+50	UC-07 w/44' SD		4.5	.8
(68)	1085+00	UC-07 w/40' SD		2.7	.5
(69)	1083+00	UC-07 w/40' SD		2.1	—

Computed by: M Lopez Checked by: _____ Date: _____

* Ultimate
** Pipe sleeve

PROJECT 703-1
HC12 Version: V70112.2 User S/N: 77010035 Run Date: 08-04-1988

==========

INLET NUMBER 62 LENGTH 29.5 STATION 1088+50 EB

TOTAL PEAK DISCHARGE = 5.30 (cfs)

GUTTER SLOPE = 0.0172 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
12.23	0.0	0.00	0.0200	1.0	0.00	0.0	0.000	0.020

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 44.7 EFFICIENCY= 0.86
CFS INTERCEPTED= 4.54 CFS CARRYOVER= 0.76

==========

INLET NUMBER 68 LENGTH 26.8 STATION 1085+00 EB

TOTAL PEAK DISCHARGE = 3.20 (cfs)

GUTTER SLOPE = 0.0270 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
9.30	0.0	0.00	0.0200	1.0	0.00	0.0	0.000	0.020

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 41.4 EFFICIENCY= 0.85
CFS INTERCEPTED= 2.71 CFS CARRYOVER= 0.49

==========

INLET NUMBER 69 LENGTH 29.5 STATION 1083+00 EB

TOTAL PEAK DISCHARGE = 2.10 (cfs)

GUTTER SLOPE = 0.0270 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
7.94	0.0	0.00	0.0200	1.0	0.00	0.0	0.000	0.020

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 34.7 EFFICIENCY= 0.97
CFS INTERCEPTED= 2.03 CFS CARRYOVER= 0.07

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

PAVEMENT DRAINAGE WORKSHEET

Main line E.B.
Sta 1210+00 - Sta 1096+24

LOCATION DATA
Highway: Outer Loop
Location:
Project No.: RBM 600-0-305

DESIGN DATA
Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
T_{all} = 14 n = .016
Curb Height = 6"

RUNOFF CALCULATIONS

From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Q_c cfs	Q_T cfs	S_o ft/ft	S_x ft/ft	z/n	D ft.	T ft.
1210+00	1206+50	350	*71	*.57	.95	10	4.4	2.4	—	2.4	.0060	.021			*11
			*71		.95										
1206+50	1200+00	650	*71	*1.0	.95			4.4			.0116	.04		.30	*7.5
1200+00	1196+00	400	*71	*.65	.95			2.7	.1	2.8	.021	.04		.24	*6.0
1104+00	1109+00	500	*71	*.82	.95			3.4	—	3.4	.014	.02		.22	*11
1096+24	1100+00	376	*71	*.62	.95			2.5	—	2.5	.0084	.04		.26	6.5
1100+00	1104+00	400	*71	*.65	.95			2.7	—	2.7	.0228	.02		.18	9

INLET CALCULATIONS

	Station	Inlet Type	D ft.	Q_i cfs	$Q_c = Q_T - Q_i$
	1206+50	Pipe Sleeve		2.4	
38	1200+00	C15.30, SD: 36		4.3	.1
36	1196+00	C15.30, SD = 36		2.8	—
32	1109+00	C15.30, L = 48		3.4	—
**	1100+00	Pipe Sleeve			
**	1104+00	Pipe Sleeve			

Computed by: M Lopez Checked by: _____ Date: _____

* Ultimate
** pipe sleeve

==========

INLET NUMBER 38 LENGTH 24.0 STATION 1200+00 EB

TOTAL PEAK DISCHARGE = 4.40 (cfs)

GUTTER SLOPE = 0.0160 FT/FT PAVEMENT CROSS SLOPE = 0.0400 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
7.49	0.0	0.00	0.0400	1.0	0.00	0.0	0.000	0.040

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 26.7 EFFICIENCY= 0.98
CFS INTERCEPTED= 4.33 CFS CARRYOVER= 0.07

==========

INLET NUMBER 36 LENGTH 24.0 STATION 1196+00 EB

TOTAL PEAK DISCHARGE = 2.80 (cfs)

GUTTER SLOPE = 0.0210 FT/FT PAVEMENT CROSS SLOPE = 0.0400 FT/FT

READ	W	W/T	SW	SW/SX	Eo	a	S'W	SE
6.01	0.0	0.00	0.0400	1.0	0.00	0.0	0.000	0.040

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 23.9 EFFICIENCY= 1.00
CFS INTERCEPTED= 2.80 CFS CARRYOVER= 0.00

==========

INLET NUMBER 32 LENGTH 48.0 STATION 1109+00 EB

TOTAL PEAK DISCHARGE = 3.00 (cfs)

GUTTER SLOPE = 0.0140 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
10.27	0.0	0.00	0.0200	1.0	0.00	0.0	0.000	0.020

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 33.1 EFFICIENCY= 1.00
CFS INTERCEPTED= 3.00 CFS CARRYOVER= 0.00

```
==============================================================================
INLET NUMBER 32                LENGTH  48.0          STATION  1109+00 EB

  TOTAL PEAK DISCHARGE =  3.40 (cfs)

GUTTER SLOPE = 0.0140 FT/FT        PAVEMENT CROSS SLOPE =  0.0200 FT/FT

SPREAD      W      W/T     SW        SW/SX      Eo      a      S'W     SE
 10.76     0.0     0.00   0.0200     1.0       0.00    0.0    0.000  0.020

    XXXXXXXXXX  SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
     REQUIRED LENGTH= 34.8                EFFICIENCY= 1.00
     CFS INTERCEPTED=  3.40            CFS CARRYOVER=  0.00


==============================================================================
INLET NUMBER PS                LENGTH  24.0          STATION  1100+00 EB

  TOTAL PEAK DISCHARGE =  2.20 (cfs)

GUTTER SLOPE = 0.0084 FT/FT        PAVEMENT CROSS SLOPE =  0.0400 FT/FT

 READ       W      W/T     SW        SW/SX      Eo      a      S'W     SE
 6.52      0.0     0.00   0.0400     1.0       0.00    0.0    0.000  0.040

    XXXXXXXXXX  SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
     REQUIRED LENGTH= 16.4                EFFICIENCY= 1.00
     CFS INTERCEPTED=  2.20            CFS CARRYOVER=  0.00


==============================================================================
INLET NUMBER PS                LENGTH  60.0          STATION  1104+00 EB

  TOTAL PEAK DISCHARGE =  2.70 (cfs)

GUTTER SLOPE = 0.0228 FT/FT        PAVEMENT CROSS SLOPE =  0.0200 FT/FT

SPREAD      W      W/T     SW        SW/SX      Eo      a      S'W     SE
  9.01     0.0     0.00   0.0200     1.0       0.00    0.0    0.000  0.020

    XXXXXXXXXX  SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
     REQUIRED LENGTH= 36.6                EFFICIENCY= 1.00
     CFS INTERCEPTED=  2.70            CFS CARRYOVER=  0.00
```

```
==========================================================================
INLET NUMBER                    LENGTH  30.0        STATION  1102+50

  TOTAL PEAK DISCHARGE =  1.70 (cfs)

GUTTER SLOPE = 0.0228 FT/FT       PAVEMENT CROSS SLOPE =  0.0400 FT/FT

SPREAD      W      W/T     SW        SW/SX      Eo      a      S'W     SE
  4.91     0.0    0.00   0.0400     1.0       0.00    0.0    0.000  0.040

    XXXXXXXXXX  SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
     REQUIRED LENGTH= 19.9                EFFICIENCY= 1.00
     CFS INTERCEPTED=  1.70            CFS CARRYOVER=  0.00


==========================================================================
INLET NUMBER  PS                LENGTH  26.8        STATION  1104+50 EB

  TOTAL PEAK DISCHARGE =  1.40 (cfs)

GUTTER SLOPE = 0.0228 FT/FT       PAVEMENT CROSS SLOPE =  0.0170 FT/FT

SPREAD      W      W/T     SW        SW/SX      Eo      a      S'W     SE
  7.80     0.0    0.00   0.0170     1.0       0.00    0.0    0.000  0.017

    XXXXXXXXXX  SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
     REQUIRED LENGTH= 30.6                EFFICIENCY= 0.98
     CFS INTERCEPTED=  1.37            CFS CARRYOVER=  0.03


==========================================================================
INLET NUMBER                    LENGTH  10.4        STATION  1109+00 EB

  TOTAL PEAK DISCHARGE =  3.00 (cfs)

GUTTER SLOPE = 0.0140 FT/FT       PAVEMENT CROSS SLOPE =  0.0200 FT/FT

SPREAD      W      W/T     SW        SW/SX      Eo      a      S'W     SE
  9.07     2.0    0.22   0.0833     4.2       0.62    3.0    0.126  0.098

       XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
     REQUIRED LENGTH= 12.7                EFFICIENCY= 0.95
     CFS INTERCEPTED=  2.86            CFS CARRYOVER=  0.14
```

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

PAVEMENT DRAINAGE WORKSHEET

West Bound
2106+00 → 1080+00

LOCATION DATA
Highway: Outer Loop
Location:
Project No.: RBM 600-0-305

DESIGN DATA
Frequency: 10 years
P_6= 2.0 in. P_{24}= 2.35 in. P_1= 1.6 in.
T_{all} = 14 n = .016
Curb Height =

RUNOFF CALCULATIONS

From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Q_c cfs	Q_T cfs	S_o ft/ft	S_x ft/ft	z/n	D ft.	T ft.
1100+00	2106+00	600	*72	1.0	.95	10	4.4	4.2	.	4.2	.0228	.02		.21	11
2106+00	2109+00	300	*72	.5	.95	↓	↓	2.1	.8	2.9	.0141	.02		.20	10
1096+24	1090+00	624	*71	1.0	.95	↓	↓	4.2	—	4.2	.014	.02		.23	11.3
1090+00	1086+00	400	*71	.65	.95	↓	↓	2.7	.3	3.0	.0227	.02		.18	9
					.95	↓	↓								
1083+[illegible]	1080+00	350	*71	**.91	.95	↓	↓	3.8	4.4	5.2	.018	.02		.22	11
5+45	0+00	545	25	.3	.95	↓	↓	1.4							

INLET CALCULATIONS

	Station	Inlet Type	D ft.	Q_i cfs	$Q_c = Q_T - Q_i$
35	2106+00	C15.30, L=40		3.5	.8
34	2109+00	C15.30, L=48		2.9	—
64	1090+00	UC-07, L=36		3.9	.3
70	1086+00	UC-07, L=40		3.0	—
73	1080+00	UC-01 w/3D'SD		5.2	—

Computed by: M Lopez Checked by: Date:

* Ultimate
** Includes R51-A Sta 0+00-5+45

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

Main Line West Bound
Sta 1210+00 –

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA
Highway: Outer Loop
Location:
Project No.: RBM 600-0-305

DESIGN DATA
Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
T_{all} = 14 n = .016
Curb Height =

RUNOFF CALCULATIONS

From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Q_c cfs	Q_T cfs	S_o ft/ft	S_x ft/ft	z/n	D ft.	T ft.
					.95	10	4.4								
—	1208+38	350	*71	*.57	.95			2.4	—	2.4	.006	.021		.21	10
1206+50	1203+00	350	*73	*.59	.95			2.5	—	2.5	.0098	.022		.22	10
1203+00	1198+00	500	*71	.82	.95			3.4	—	3.4	.0193	.04		.28	7
1198+00	1193+00	500	*71	.82	.95			3.4	.2	3.6	.0212	.02		.20	10.2
1151+00	1146+00	500	*71	.82	.95			3.4	—	3.4	.0048	.02		.24	12
1096+24	1100+00	376	*72	.62	.95			2.6	—	2.6	.0083	.04		.22	7

INLET CALCULATIONS

	Station	Inlet Type	D ft.	Q_i cfs	$Q_c = Q_T - Q_i$
46	1208+38	C15.10, L=18		2.4	—
**	1203+00	UC-07 w/40'SD		2.5	—
**	1198+00	UC-07 w/30'SD		3.2	.2
**	1193+00	UC-07 w/60'SD		3.6	—
30	1146+00	UC-01 w/24'SD		3.4	—
60	1100+00	C15.30, 26'SD		2.6	

Computed by: M Lopez Checked by: _____ Date: _____

* Ultimate
** pipe sleeve

==========

INLET NUMBER 46 LENGTH 18.0 STATION 1208+38 WB

TOTAL PEAK DISCHARGE = 2.40 (cfs)

GUTTER SLOPE = 0.0060 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
9.96	2.0	0.20	0.0833	4.2	0.57	1.5	0.063	0.056

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH= 12.5 EFFICIENCY= 1.00

CFS INTERCEPTED= 2.40 CFS CARRYOVER= 0.00

==========

INLET NUMBER PS LENGTH 60.0 STATION 1193+00

TOTAL PEAK DISCHARGE = 3.60 (cfs)

GUTTER SLOPE = 0.0212 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
10.17	0.0	0.00	0.0200	1.0	0.00	0.0	0.000	0.020

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 40.4 EFFICIENCY= 1.00
CFS INTERCEPTED= 3.60 CFS CARRYOVER= 0.00

==========

INLET NUMBER 30 LENGTH 24.0 STATION 1146+00 WB

TOTAL PEAK DISCHARGE = 3.40 (cfs)

GUTTER SLOPE = 0.0048 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
12.10	2.5	0.21	0.0667	3.3	0.55	1.4	0.047	0.046

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 15.4 EFFICIENCY= 1.00
CFS INTERCEPTED= 3.40 CFS CARRYOVER= 0.00

==========

INLET NUMBER LENGTH 7.2 STATION 1100+00 WB

TOTAL PEAK DISCHARGE = 2.60 (cfs)

GUTTER SLOPE = 0.0083 FT/FT PAVEMENT CROSS SLOPE = 0.0400 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
6.40	2.0	0.31	0.0833	2.1	0.70	3.0	0.127	0.128

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 8.7 EFFICIENCY= 0.96
CFS INTERCEPTED= 2.49 CFS CARRYOVER= 0.11

==========

INLET NUMBER LENGTH 13.0 STATION 1206+50 WB

TOTAL PEAK DISCHARGE = 2.40 (cfs)

GUTTER SLOPE = 0.0060 FT/FT PAVEMENT CROSS SLOPE = 0.0210 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
9.67	2.0	0.21	0.0833	4.0	0.55	3.0	0.125	0.090

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH= 9.5 EFFICIENCY= 1.00

CFS INTERCEPTED= 2.40 CFS CARRYOVER= 0.00

==========

INLET NUMBER PS LENGTH 40.0 STATION 1203+00 WB

TOTAL PEAK DISCHARGE = 2.50 (cfs)

GUTTER SLOPE = 0.0098 FT/FT PAVEMENT CROSS SLOPE = 0.0220 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
9.66	0.0	0.00	0.0220	1.0	0.00	0.0	0.000	0.022

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH= 26.0 EFFICIENCY= 1.00

CFS INTERCEPTED= 2.50 CFS CARRYOVER= 0.00

==========

INLET NUMBER PS LENGTH 20.0 STATION 1198+00 WB

TOTAL PEAK DISCHARGE = 3.40 (cfs)

GUTTER SLOPE = 0.0193 FT/FT PAVEMENT CROSS SLOPE = 0.0400 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
6.56	0.0	0.00	0.0400	1.0	0.00	0.0	0.000	0.040

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH= 25.3 EFFICIENCY= 0.94

CFS INTERCEPTED= 3.20 CFS CARRYOVER= 0.20

PROJECT 703-1
HEC12 Version: V70112.2 User S/N: 77010035 Run Date: 06-21-1988
PRINTER OFF
** PRINTER HAS BEEN TURNED OFF

==========

INLET NUMBER 35 LENGTH 26.8 STATION 2106+00 LT

TOTAL PEAK DISCHARGE = 4.30 (cfs)

GUTTER SLOPE = 0.0228 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
10.72	2.0	0.19	0.0200	1.0	0.42	0.0	0.000	0.020

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 44.5 EFFICIENCY= 0.81
CFS INTERCEPTED= 3.48 CFS CARRYOVER= 0.82

==========

INLET NUMBER 34 LENGTH 32.0 STATION 2109+00 WB

TOTAL PEAK DISCHARGE = 2.90 (cfs)

GUTTER SLOPE = 0.0141 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
10.12	2.0	0.20	0.0200	1.0	0.44	0.0	0.000	0.020

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 32.7 EFFICIENCY= 1.00
CFS INTERCEPTED= 2.90 CFS CARRYOVER= 0.00

PROJECT 703-1
HEC12 Version: V70112.2 User S/N: 77010035 Run Date: 06-30-1988

==========

INLET NUMBER 64 LENGTH 20.0 STATION 1090+00 WB

TOTAL PEAK DISCHARGE = 4.20 (cfs)

GUTTER SLOPE = 0.0141 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
11.29	2.0	0.18	0.0400	2.0	0.44	0.5	0.020	0.029

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 30.6 EFFICIENCY= 0.85
CFS INTERCEPTED= 3.58 CFS CARRYOVER= 0.62

==========

INLET NUMBER 70 LENGTH 26.8 STATION 1086+00 WB

TOTAL PEAK DISCHARGE = 3.00 (cfs)

GUTTER SLOPE = 0.0227 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
8.98	2.0	0.22	0.0400	2.0	0.54	0.5	0.020	0.031

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 29.5 EFFICIENCY= 0.99
CFS INTERCEPTED= 2.96 CFS CARRYOVER= 0.04

==========

INLET NUMBER 64 LENGTH 24.0 STATION 1090+00 WB

TOTAL PEAK DISCHARGE = 4.20 (cfs)

GUTTER SLOPE = 0.0141 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
11.29	2.0	0.18	0.0400	2.0	0.44	0.5	0.020	0.029

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 30.6 EFFICIENCY= 0.94
CFS INTERCEPTED= 3.93 CFS CARRYOVER= 0.27

==========

INLET NUMBER 73 LENGTH 30.0 STATION 1080+00

TOTAL PEAK DISCHARGE = 3.80 (cfs)

GUTTER SLOPE = 0.0180 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
9.40	2.5	0.27	0.0670	3.4	0.67	2.8	0.094	0.083

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 16.8 EFFICIENCY= 1.00
CFS INTERCEPTED= 3.80 CFS CARRYOVER= 0.00

==========

INLET NUMBER 60 LENGTH 26.0 STATION 1100+00 WB

TOTAL PEAK DISCHARGE = 2.60 (cfs)

GUTTER SLOPE = 0.0083 FT/FT PAVEMENT CROSS SLOPE = 0.0400 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
6.95	2.0	0.29	0.0400	1.0	0.60	0.0	0.000	0.040

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 17.6 EFFICIENCY= 1.00
CFS INTERCEPTED= 2.60 CFS CARRYOVER= 0.00

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

Main Line @ 53th Ave Drainageway

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA
Highway: Outer Loop
Location:
Project No.: RBM 600-0-305

DESIGN DATA
Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
T_{all} = 12 n = .016

RUNOFF CALCULATIONS
Curb Height = 7

	From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Q_c cfs	Q_T cfs	S_o ft/ft	S_x ft/ft	z/n	D ft.	T ft.
WB	1070+76	1074+64	388	71	.63	.95	10	4.4	2.6	—		.0047	.02		.24	12
						.95										
EB	1068+26	1072+14	388	71	.63	.95	10	4.4	2.6			.0047	.02		.24	12
						.95										
						.95										
						.95										
						.95										

INLET CALCULATIONS

	Station	Inlet Type	D ft.	Q_i cfs	$Q_c = Q_T - Q_i$
WB 81	1070+785	C15.30/S=32		2.6	—
EB 80	1068+28	C15.30/S=32		2.6	—

Computed by: M Lopez Checked by: _____ Date: _____

PROJECT 703-1
C12 Version: V70112.2 User S/N: 77010035 Run Date: 07-27-1988

==========

INLET NUMBER 80 LENGTH 32.0 STATION 1068+28 RT

TOTAL PEAK DISCHARGE = 2.60 (cfs)

GUTTER SLOPE = 0.0047 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
11.94	2.0	0.17	0.0200	1.0	0.39	0.0	0.000	0.020

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 22.4 EFFICIENCY= 1.00
CFS INTERCEPTED= 2.60 CFS CARRYOVER= 0.00

==========

INLET NUMBER 81 LENGTH 32.0 STATION 1070+78.5 LT

TOTAL PEAK DISCHARGE = 2.60 (cfs)

GUTTER SLOPE = 0.0047 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
11.94	2.0	0.17	0.0200	1.0	0.39	0.0	0.000	0.020

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 22.4 EFFICIENCY= 1.00
CFS INTERCEPTED= 2.60 CFS CARRYOVER= 0.00

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

Ramps

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA
Highway: Outer Loop
Location:
Project No.: RBM 600-0-305

DESIGN DATA
Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
T_{all} =
n = .016
Curb Height =

RUNOFF CALCULATIONS

	From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Q_c cfs	Q_T cfs	S_o ft/ft	S_x ft/ft	z/n	D ft.	T ft.
51-B	1080+17	1082+05	251	71	.4	.95	10	4.4	1.7							
	7+95	3+75	420	25	.24	.95			1.0	1.7	2.7	.02	.02		.16	8
	7+95	12+10	415	25	.24	.95			1.0	—	1.0	.016	.02		.09	4
51-A	5+45	11+68	623	25	.4	.95			1.7	—	1.7	.0096	.02		.16	8
						.95										
35-A	3+30	11			*1.0	.95			4.2	—	4.2	.003	.02		.18	9'
						.95										

INLET CALCULATIONS

	Station	Inlet Type	D ft.	Q_i cfs	$Q_c = Q_T - Q_i$
(72)	3+79	UC-01, w/30'SD		3.0	—
(63)	12+10	UC-01, w/16'SD		1.0	—
(67)	11+51.5	UC-01, w/18'SD		1.7	—
35-A	9+91	Over tops Curb			

Computed by: M Lopez Checked by: Date:

* By Planimeter

==========

INLET NUMBER 72 LENGTH 30.0 STATION R 51-B 3+80

TOTAL PEAK DISCHARGE = 3.00 (cfs)

GUTTER SLOPE = 0.0200 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
8.14	2.5	0.31	0.0670	3.4	0.74	1.4	0.047	0.055

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 20.1 EFFICIENCY= 1.00
CFS INTERCEPTED= 3.00 CFS CARRYOVER= 0.00

==========

INLET NUMBER 63 LENGTH 16.0 STATION R 51-B 12+00

TOTAL PEAK DISCHARGE = 1.00 (cfs)

GUTTER SLOPE = 0.0160 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
4.41	2.5	0.57	0.0670	3.4	0.96	1.4	0.047	0.065

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 10.7 EFFICIENCY= 1.00
CFS INTERCEPTED= 1.00 CFS CARRYOVER= 0.00

==========

INLET NUMBER LENGTH 14.0 STATION R 51-A 7+48

TOTAL PEAK DISCHARGE = 0.50 (cfs)

GUTTER SLOPE = 0.0246 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
2.21	2.5	1.13	0.0670	3.4	1.00	1.4	0.047	0.067

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 8.9 EFFICIENCY= 1.00
CFS INTERCEPTED= 0.50 CFS CARRYOVER= 0.00

==========

INLET NUMBER 67 LENGTH 18.0 STATION 11+68.75 R51A

TOTAL PEAK DISCHARGE = 1.80 (cfs)

GUTTER SLOPE = 0.0096 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
7.56	2.5	0.33	0.0667	3.3	0.77	1.4	0.047	0.056

XXXXXXXXXX SLOTTED DRAIN INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH= 12.8 EFFICIENCY= 1.00

CFS INTERCEPTED= 1.80 CFS CARRYOVER= 0.00

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

PAVEMENT DRAINAGE WORKSHEET

NORTH FRONTAGE ROAD
Sta 1104+00 to Sta 1204+08

LOCATION DATA

Highway: Outer Loop
Location:
Project No.: [illegible]

DESIGN DATA

Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
T_{all} = 14 n = .016
Curb Height = 6"

RUNOFF CALCULATIONS

From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Q_c cfs	Q_T cfs	S_o ft/ft	S_x ft/ft	z/n	D ft.	T ft.
1104+00	1099+40	*460	45	.47	.95	10	4.4	2.0	.1	2.1	.0055	.02		.20	10
1099+00	1093+00	400	52	.48	.95			2.0	-	2.0	.0040	.02		.20	10
1204+07	1201+00	309	14	.10	.95			.5	—	.5	.0057	.02		.08	4
1110+06	1104+00	606	46	.65	.95			2.7		2.7	.0055	.02		.22	11
1210+00	1204+08	592		.63	.95			2.6	.6	3.2	SUMP	.02		.25	13
					.95										
					.95										

INLET CALCULATIONS

	Station	Inlet Type	D ft.	Q_i cfs	$Q_c = Q_T - Q_i$
(52)	1104+00	C 15.20, L=10		2.6	.1
(53)	1099+57.79	C 15.20, L=10		2.1	—
(66)	1093+00	C 15.20, L=6		2.0	—
(71)	1201+00	C 15.20, L=3		.5	—
(43)	1204+03.78	C 15.20, L=3		3.2	—

Inlet Type: C-4.01 Single
Double

C-4.02 Single
Double

Computed by: M Lopez Checked by: _____ Date: _____

* Average

PROJECT 703-1
HEC12 Version: V70112.2 User S/N: 77010035 Run Date: 08-25-1988

==========

INLET NUMBER 52 LENGTH 13.0 STATION 1104+00 NFR

TOTAL PEAK DISCHARGE = 2.70 (cfs)

GUTTER SLOPE = 0.0055 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
10.72	2.0	0.19	0.0833	4.2	0.54	2.5	0.105	0.077

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 10.7 EFFICIENCY= 1.00
CFS INTERCEPTED= 2.70 CFS CARRYOVER= 0.00

==========

INLET NUMBER 53 LENGTH 13.0 STATION 1099+51.79 NF

TOTAL PEAK DISCHARGE = 2.10 (cfs)

GUTTER SLOPE = 0.0055 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
9.55	2.0	0.21	0.0833	4.2	0.59	2.5	0.105	0.082

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 9.2 EFFICIENCY= 1.00
CFS INTERCEPTED= 2.10 CFS CARRYOVER= 0.00

PROJECT 703-1
HEC12 Version: V70112.2 User S/N: 77010035 Run Date: 07-20-1988

==========

INLET NUMBER 47 LENGTH 6.0 STATION 1201+00

TOTAL PEAK DISCHARGE = 0.50 (cfs)

GUTTER SLOPE = 0.0057 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
4.06	2.0	0.49	0.0833	4.2	0.94	3.0	0.126	0.139

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 3.7 EFFICIENCY= 1.00
CFS INTERCEPTED= 0.50 CFS CARRYOVER= 0.00

PROJECT 703-1
HEC12 Version: V70112.2 User S/N: 77010035 Run Date: 06-28-1988

==========

INLET NUMBER 66 LENGTH 7.2 STATION NFR 1093+00

TOTAL PEAK DISCHARGE = 2.00 (cfs)

GUTTER SLOPE = 0.0040 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
10.06	2.0	0.20	0.0830	4.2	0.57	3.0	0.125	0.091

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH= 7.7 EFFICIENCY= 0.99

CFS INTERCEPTED= 1.99 CFS CARRYOVER= 0.01

PROJECT 703-1
I 12 Version: V70112.2 User S/N: 77010035 Run Date: 04-08-1988

==========

INLET NUMBER NFR (43) LENGTH 7.2 STATION NFR 1205+03.9

TOTAL PEAK DISCHARGE = 3.20 (cfs)

GUTTER SLOPE = 0.0032 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD AT A SLOPE OF .003 (ft./ft.) IS 11.88 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH = 10.80 H = 0.500
DEPTH OF WATER = 0.25 SPREAD = 12.74

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

PAVEMENT DRAINAGE WORKSHEET — South Frontage Road

LOCATION DATA
Highway: Outer Loop
Location:
Project No.: RBM 600-0-305

DESIGN DATA
Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
T_{all} = 14' n = .016
Curb Height = 6"

RUNOFF CALCULATIONS

From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Q_c cfs	Q_T cfs	S_o ft/ft	S_x ft/ft	z/n	D ft.	T ft.
1067+74	1062+50	544	28	.35	.95	10	4.4	1.5	—	1.5	.0087	.02		.14	7.2'
1062+50	1055+75	675	28	.43	.95			1.8	.3	2.1	.0237	.02		.17	8.6'
1055+75	1051+00	475	51	.56	.95			2.3	.2	2.5	.0025	.02		.24	12
1078+42	1075+85	257	68	.11	.95			1.7	—	1.7	.004	.02		.19	9.3'
1088+68	1075+85	[illegible]		.3	.95			[illegible]		[illegible]	Sump	.02		.22	
					.95										
					.95										

INLET CALCULATIONS

	Station	Inlet Type	D ft.	Q_i cfs	$Q_c = Q_T - Q_i$
6	1062+50	C 15.20. L = 3		1.2	.3
5	1055+75	" L = 6		1.9	.2
4	1051+00	" L = 6		2.4	.1 → Section 5b
58	1075+85	" L = 6		1.7	—
59	1091+08	" L = 10		3.3	—

Computed by: M Lopez Checked by: _____ Date: _____

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

South Frontage Road

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA
Highway: Outer Loop
Location:
Project No.: RBM 600-0-305

DESIGN DATA
Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
T_{all} = 14 n = .016
Curb Height = 6"

RUNOFF CALCULATIONS

From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Q_c cfs	Q_T cfs	S_o ft/ft	S_x ft/ft	z/n	D ft.	T ft.
1125+50	1118+90	660	28	.48	.95	10	4.0	1.8	—	1.8	.006	.024		.19	7.8
1118+90	1112+30	630	28	.48	.95			1.8	.1	1.9	.0052	.02		.18	9.6
1112+30	1105+60	670	28	.82	.95			3.0	—	3.6	.0052	.02		.25	12.5
1195+93	1199+48	355		.52	.95			2.2							
1204+55	1199+48	507		.52	.95			2.2	2.2	4.4	Sump	.02		.21	10.6
1211+50	1206+70	480	28	.31	.95			1.3	—	1.3	.0052	.02		.15	7.7
					.95										

INLET CALCULATIONS

	Station	Inlet Type	D ft.	Q_i cfs	$Q_c = Q_T - Q_i$
(33)	1118+90	C-1520, L=6		1.7	.1
(48)	1112+30	" , L=6		1.8	—
(51)	1105+60	" , L=10		3.6	—
(37)	1199+48	C-1520, L=17		4.4	—
(38)	1206+70	C-1520, L=6		1.3	—

Computed by: M Lopez Checked by: _____ Date: _____

```
==============================================================================
INLET NUMBER 6                LENGTH   4.8        STATION  1062+50 SFR

  TOTAL PEAK DISCHARGE =  1.50 (cfs)

GUTTER SLOPE = 0.0087 FT/FT       PAVEMENT CROSS SLOPE =  0.0200 FT/FT

SPREAD      W      W/T     SW        SW/SX      Eo      a      S'W     SE
  7.21     2.0     0.28   0.0833     4.2       0.73    2.5    0.105  0.097

      XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
    REQUIRED LENGTH=  8.3                EFFICIENCY= 0.79
    CFS INTERCEPTED=  1.18            CFS CARRYOVER=  0.32


==============================================================================
INLET NUMBER 5                LENGTH   7.2        STATION  1055+75 SFR

  TOTAL PEAK DISCHARGE =  2.10 (cfs)

GUTTER SLOPE = 0.0087 FT/FT       PAVEMENT CROSS SLOPE =  0.0200 FT/FT

 READ       W      W/T     SW        SW/SX      Eo      a      S'W     SE
 8.56      2.0     0.23   0.0833     4.2       0.65    2.5    0.105  0.088

      XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
    REQUIRED LENGTH= 10.1                EFFICIENCY= 0.89
    CFS INTERCEPTED=  1.87            CFS CARRYOVER=  0.23


==============================================================================
INLET NUMBER 4                LENGTH   7.2        STATION  1051+00 SFR

  TOTAL PEAK DISCHARGE =  2.50 (cfs)

GUTTER SLOPE = 0.0025 FT/FT       PAVEMENT CROSS SLOPE =  0.0200 FT/FT

SPREAD      W      W/T     SW        SW/SX      Eo      a      S'W     SE
 12.32     2.0     0.16   0.0833     4.2       0.48    2.5    0.105  0.070

      XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
    REQUIRED LENGTH=  8.6                EFFICIENCY= 0.96
    CFS INTERCEPTED=  2.40            CFS CARRYOVER=  0.10
```

==========

INLET NUMBER 58 LENGTH 7.2 STATION 1095+85 SFR

TOTAL PEAK DISCHARGE = 1.70 (cfs)

GUTTER SLOPE = 0.0040 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
9.32	2.0	0.21	0.0833	4.2	0.61	2.5	0.105	0.084

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 7.6 EFFICIENCY= 1.00
CFS INTERCEPTED= 1.69 CFS CARRYOVER= 0.01

==========

INLET NUMBER 59 LENGTH 10.4 STATION 1091+08 SFR

TOTAL PEAK DISCHARGE = 3.30 (cfs)

GUTTER SLOPE = 0.0040 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD AT A SLOPE OF .004 (ft./ft.) IS 12.54 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH = 14.00 H = 0.500
DEPTH OF WATER = 0.22 SPREAD = 10.94

==========

INLET NUMBER 39 LENGTH 16.0 STATION SFR 1199+48.

TOTAL PEAK DISCHARGE = 4.40 (cfs)

GUTTER SLOPE = 0.0027 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD AT A SLOPE OF .003 (ft./ft.) IS 11.46 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH = 19.60 H = 0.500
DEPTH OF WATER = 0.21 SPREAD = 10.59

PROJECT 703-1
HEC12 Version: V70112.2 User S/N: 77010035 Run Date: 06-21-1988
PRINTER OFF
** PRINTER HAS BEEN TURNED OFF

==========

INLET NUMBER 49 LENGTH 7.2 STATION 1118+90

TOTAL PEAK DISCHARGE = 1.80 (cfs)

GUTTER SLOPE = 0.0060 FT/FT PAVEMENT CROSS SLOPE = 0.0240 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
7.81	2.0	0.26	0.0830	3.5	0.65	2.4	0.101	0.090

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 8.4 EFFICIENCY= 0.97
CFS INTERCEPTED= 1.75 CFS CARRYOVER= 0.05

==========

INLET NUMBER 48 LENGTH 7.2 STATION 1112+30

TOTAL PEAK DISCHARGE = 1.90 (cfs)

GUTTER SLOPE = 0.0052 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
9.24	2.0	0.22	0.0830	4.2	0.61	3.0	0.125	0.097

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 7.9 EFFICIENCY= 0.99
CFS INTERCEPTED= 1.88 CFS CARRYOVER= 0.02

==========

INLET NUMBER 51 LENGTH 10.4 STATION 1105+60 RT

TOTAL PEAK DISCHARGE = 3.60 (cfs)

GUTTER SLOPE = 0.0052 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
12.31	2.0	0.16	0.0830	4.2	0.48	3.0	0.125	0.080

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 11.6 EFFICIENCY= 0.98
CFS INTERCEPTED= 3.54 CFS CARRYOVER= 0.06

==========

INLET NUMBER 88 LENGTH 7.2 STATION 1206+70 SFR

TOTAL PEAK DISCHARGE = 1.30 (cfs)

GUTTER SLOPE = 0.0052 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
7.66	2.0	0.26	0.0833	4.2	0.70	2.5	0.105	0.094

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH= 6.8 EFFICIENCY= 1.00

CFS INTERCEPTED= 1.30 CFS CARRYOVER= 0.00

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

51st Avenue

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA
Highway: Outer Loop
Location:
Project No.: RBM 600-0-305

DESIGN DATA
Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
T_{all} = 12 n = .016
Curb Height = 7

RUNOFF CALCULATIONS

From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Q_c cfs	Q_T cfs	S_o ft/ft	S_x ft/ft	z/n	D ft.	T ft.
22+00	18+30	*228	52	.3	.95	10	4.4	1.3	—	1.3	.002	.02		.2	10
					.95										
					.95										
					.95										
					.95										
					.95										
					.95										

INLET CALCULATIONS

Station	Inlet Type	D ft.	Q_i cfs	$Q_c = Q_T - Q_i$
(56) 18+28.68 Lt	C 15.20, L=6	1.3	1.3	—
(57) 18+34.53 Rt	" , L=6	1.3	1.3	—

Computed by: M Lopez Checked by: Date:

* Covered by TI

9-P

PROJECT 703-1
D12 Version: V70112.2 User S/N: 77010035 Run Date: 08-08-1988

MRC 11/1/89

==========

INLET NUMBER 56 LENGTH 7.2 STATION 18+28.68 51 A

TOTAL PEAK DISCHARGE = 1.30 (cfs)

GUTTER SLOPE = 0.0020 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
9.67	2.0	0.21	0.0833	4.2	0.59	2.5	0.105	0.082

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 5.6 EFFICIENCY= 1.00
CFS INTERCEPTED= 1.30 CFS CARRYOVER= 0.00

==========

INLET NUMBER 57 LENGTH 7.2 STATION 18+34.53 ,51

TOTAL PEAK DISCHARGE = 1.30 (cfs)

TTER SLOPE = 0.0020 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
9.67	2.0	0.21	0.0833	4.2	0.59	2.5	0.105	0.082

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 5.6 EFFICIENCY= 1.00
CFS INTERCEPTED= 1.30 CFS CARRYOVER= 0.00

35th Ave

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA
Highway: Outer Loop
Location:
Project No.: RBM 600-0-305

DESIGN DATA
Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
T_{all} = 14 n = .016
Curb Height = 7"

RUNOFF CALCULATIONS

From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Q_c cfs	Q_T cfs	S_o ft/ft	S_x ft/ft	z/n	D ft.	T ft.
17+00	16+60	260	55	0.33	.95	10	4.4	1.4	—	1.4	.002	.02		.20	10
14+00	17+02	302	55	0.38	.95			1.6	—	1.6	.002	.02		.21	10.6
18+00	21+93	650	60	0.34	.95			1.4	—	1.4	.002	.02		.20	10
17+75	21+50	240	60	.33	.95			1.4	—	1.4	.002	.02		.20	10
12+60	12+05+11	159	28	.10	.95			.4							
21+93	24+31	238	50	.30	.95			1.3	.4	1.7	sump	.02		.22	11
					.95	*	*								

INLET CALCULATIONS

	Station	Inlet Type	D ft.	Q_i cfs	$Q_c = Q_T - Q_i$
41	16+60.53	C 15.20, L=3		1.4	—
42	17+01.74	C 15.20,		1.0	.6 → to CB# 43 (SEE NFR)
50	21+93.79	C 15.20, L=6		1.4	—
40	21+46.71	C 15.20, L=6		1.4	—
74	23+37.88	C 15.20, L=10		1.7	—

Computed by: M Lopez Checked by: _____ Date: _____

* Planimeter

PROJECT 703-1
HEC12 Version: V70112.2 User S/N: 77010035 Run Date: 04-07-1988

==========

INLET NUMBER 35TH AV (41) LENGTH 4.8 STATION 16+60.53

TOTAL PEAK DISCHARGE = 1.40 (cfs)

GUTTER SLOPE = 0.0020 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
10.01	2.0	0.20	0.0833	4.2	0.57	3.0	0.126	0.092

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 5.4 EFFICIENCY= 0.98
CFS INTERCEPTED= 1.38 CFS CARRYOVER= 0.02

PROJECT 703-1
HEC12 Version: V70112.2 User S/N: 77010035 Run Date: 04-07-1988

==========

INLET NUMBER 35th AV (42) LENGTH 2.4 STATION 17+01.74 LT

TOTAL PEAK DISCHARGE = 1.60 (cfs)

GUTTER SLOPE = 0.0020 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
10.63	2.0	0.19	0.0833	4.2	0.54	3.0	0.126	0.088

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH= 5.8 EFFICIENCY= 0.62
CFS INTERCEPTED= 0.99 CFS CARRYOVER= 0.61

==========

INLET NUMBER 50 LENGTH 7.2 STATION 21+93.79 35AV

TOTAL PEAK DISCHARGE = 1.40 (cfs)

GUTTER SLOPE = 0.0020 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
10.01	2.0	0.20	0.0833	4.2	0.57	2.5	0.105	0.080

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH= 5.8 EFFICIENCY= 1.00

CFS INTERCEPTED= 1.40 CFS CARRYOVER= 0.00

==========

INLET NUMBER 40 LENGTH 7.2 STATION 21+46.71

TOTAL PEAK DISCHARGE = 1.40 (cfs)

GUTTER SLOPE = 0.0020 FT/FT PAVEMENT CROSS SLOPE = 0.0200 FT/FT

READ	W	W/T	SW	SW/SX	Eo	a	S'W	SE
10.01	2.0	0.20	0.0833	4.2	0.57	2.5	0.105	0.080

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX

REQUIRED LENGTH= 5.8 EFFICIENCY= 1.00

CFS INTERCEPTED= 1.40 CFS CARRYOVER= 0.00

```
==============================================================================
INLET NUMBER 74                LENGTH  10.4        STATION  23+37.88

  TOTAL PEAK DISCHARGE =  1.70 (cfs)

GUTTER SLOPE = 0.0020 FT/FT        PAVEMENT CROSS SLOPE =  0.0200 FT/FT


     SPREAD AT A SLOPE OF .002 (ft./ft.) IS 10.92 (ft.)

       XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
      P EFFEC. LENGTH = 14.00                    H = 0.500
      DEPTH OF WATER  = 0.14               SPREAD =  7.03
```

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

South Infield

[redacted] DRAINAGE WORKSHEET

LOCATION DATA
Highway: Outer Loop Highway
Location:
Project No.: RBM 600-0-305

DESIGN DATA
Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
AHW = _____

RUNOFF CALCULATIONS

From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Channel Type	S_o ft/ft	Z	n	D ft.	V fps
1070+00	1061+75	840		3.2	.8	10	4.4	11	sheet	sump		.035	.81	
1061+75	1054+00	760		2.3	.78	"	"	8.0	Tria	Sump		.035	.66	

C-9

INLET CALCULATIONS

	Station	Inlet Type	Q cfs	HW ft.	DHW Elev.	Dike Elev.
7	1062+00, 42'Lt	C 15.30	11	.81	1283.81	1284.5
3	1056+50, 49'Lt	C 15.30	8.0	.66		—

Channel Type: Trapezoidal
Triangular

Inlet Type: C-15.08
C-15.09
C-15.10
Pipe Culvert

Computed by: M Lopez Checked by: MRC Date: 11/21/89

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

[redacted] DRAINAGE WORKSHEET

North Infield

LOCATION DATA
Highway: Outer Loop
Location:
Project No.: R&M 600-0-305

DESIGN DATA
Frequency: 10 years
P_6= 2.0 in. P_{24}= 2.25 in. P_1= 1.6 in.
AHW = _____

RUNOFF CALCULATIONS

From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Channel Type	S_o ft/ft	Z	n	D ft.	V fps
1070+00	1052+00	1600	—	5.8	—	10	4.4	25	Tria	.0060	4	.035	1.6'	

C-9

INLET CALCULATIONS

Station	Inlet Type	Q cfs	HW ft.	DHW Elev.	Dike Elev.
① 1054+00 42'Rt	C 15.30 (dbl)	25	1.03	1275.23	—

Channel Type: Trapezoidal
Triangular

Inlet Type: C-15.08
C-15.09
C-15.10
Pipe Culvert

Computed by: M Lopez Checked by: MRC Date: 11/21/89

PROJECT 703-1
HEC12 Version: V70112.1 User S/N: 77010035 Run Date: 06-07-1988

==========

INLET NUMBER 1 LENGTH 0.0 STATION NFR 1054+00,

TOTAL PEAK DISCHARGE = 25.00 (cfs)

XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 1.03 PERIMETER OF GRATE = 8.00 AREA = 4.90

==========

INLET NUMBER 7 LENGTH 0.0 STATION SFR 1062+00,

TOTAL PEAK DISCHARGE = 11.00 (cfs)

XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 0.81 PERIMETER OF GRATE = 5.00 AREA = 2.40

```
==============================================================================
INLET NUMBER 3                LENGTH   0.0        STATION  SFR 1056+60,

  TOTAL PEAK DISCHARGE =  8.00 (cfs)

     XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 0.66     PERIMETER OF GRATE =  5.00      AREA =  2.40
```

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

MEDIAN DRAINAGE WORKSHEET

LOCATION DATA

Highway: Outer Loop Highway
Location: 59th Av - 35th Av
Project No.: RBM 600-0-305

DESIGN DATA

Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
AHW = _____

RUNOFF CALCULATIONS

From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Channel Type	S_o ft/ft	Z	n	D ft.	V fps
1083+50	1086+00	250	69	0.40	.95	10	4.4	1.7						
				*2.6	.6	10	4.4	6.9						
								8.6	sump	—	—	—	—	—

C-9

INLET CALCULATIONS

Station	Inlet Type	Q cfs	HW ft.	DHW Elev.	Dike Elev.
(65) 13+10 R51A	C15.30, D61	8.6	.48	1300.98	—

Channel Type: Trapezoidal, Triangular, sump

Inlet Type: C-15.08, C-15.09, C-15.10, Pipe Culvert

Computed by: MAL Checked by: MRC Date: 11/21/89

* planimetered

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

MEDIAN DRAINAGE WORKSHEET

LOCATION DATA
Highway: Outer Loop
Location:
Project No.: RBM 600-0-305

DESIGN DATA
Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
AHW =

RUNOFF CALCULATIONS

From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Channel Type	S_o ft/ft	Z	n	D ft.	V fps
1161+00	1152+00	900	46	1.0	.72	10	4.4	3.2						

C-9

INLET CALCULATIONS

Station	Inlet Type	Q cfs	HW ft.	DHW Elev.	Dike Elev.
(31) 1152+80	C 15.80	3.2	.35	1330.87	1331.5

Channel Type: Trapezoidal
Triangular

Inlet Type: C-15.08
C-15.09
C-15.10
Pipe Culvert

Computed by: M Lopez Checked by: [illegible] Date: [illegible]

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

MEDIAN DRAINAGE WORKSHEET

LOCATION DATA
Highway: Outer Loop
Location:
Project No.: RBM 600-0-305

DESIGN DATA
Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
AHW = _____

RUNOFF CALCULATIONS

From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Channel Type	S_o ft/ft	Z	n	D ft.	V fps
*1218+17	1206+17	*1200	86	*2.4	.83	10	4.4	8.8						
1206+17 -	1204+10	207	71	0.3	.95			1.3						
1204+10	1191+57	1253	86	2.5	.83			9.1						
1191+57	1188+00	357	46	.4	.72			1.3						
1188+00	1185+65	235	46	.3	.72			1.						
1185+65	1173+00	1265	46	1.3	.72			4.1						
1173+00	1161+00	1200	46	1.3	.72			4.1						

INLET CALCULATIONS

	Station	Inlet Type	Q cfs	HW ft.	DHW Elev.	Dike Elev.
45	1206+50	C 15.80, dbl	8.8	.5	1371.30	sump
82	1189+00	C 15.80, dbl	11.7	.6	1344.32	1344.7
77	1185+91.28	C 15.90	10	—	—	sump
15	1173+00	C-15.80	4.1	.4	1337.0	1337.6
10	1161+00	C-15.80	4.1	.4	1333.2	1333.8

Channel Type: Trapezoidal
Triangular

Inlet Type: C-15.08
C-15.09
C-15.10
Pipe Culvert

Computed by: M Lopez Checked by: MPC Date: 10-1-89

* Extended into East Section RBM 6 [illegible]

C-9

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

MEDIAN DRAINAGE WORKSHEET

LOCATION DATA

Highway: Outer Loop
Location:
Project No.: RBM 600-0-205

DESIGN DATA

Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
AHW = _____

RUNOFF CALCULATIONS

From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Channel Type	S_o ft/ft	Z	n	D ft.	V fps
1097+18	1099+36	218	71	.4	.95	10	4.4	1.7						
1099+36	1105+80	644	56	.8	.95	↓	↓	3.3						
1099+36	1107+00	964	26	.6	.6	↓	↓	1.6			6	.02		
1097+18	1094+94	224	48	.3	.95	↓	↓	1.3						
1097+18	1080+14	1704	46	1.8	.72	↓	↓	1.3						
1080+14	1072+00	814	46	.9	.72	↓	↓	2.9						
1072+00	1062+00	1000	46	1.0	.72	↓	↓	3.2						

C-9

INLET CALCULATIONS

	Station	Inlet Type	Q cfs	HW ft.	DHW Elev.	Dike Elev.
33	1109+00	C-15.80	6.6	.6	1310.3	1310.70
71	1080+14	C-15.80	2.6	.3	1300.9	1301.6
78	1072+00	C-15.80	2.9	.34	1293.45	1294.1
8	1062+00	C-15.80	3.2	.34	1285.69	1286.3

Channel Type: Trapezoidal
Triangular

Inlet Type: C-15.08
C-15.09
C-15.10
Pipe Culvert

Computed by: M Lopez Checked by: MRC Date: 10-1-89

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

MEDIAN DRAINAGE WORKSHEET

LOCATION DATA
Highway: Outer Loop
Location:
Project No.: RBM 600-0-205

DESIGN DATA
Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
AHW = _____

RUNOFF CALCULATIONS

From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Channel Type	S_o ft/ft	Z	n	D ft.	V fps
1153+00	1143+00	1000	46	1.1	.72	10	4.4	3.5		.0032	6	.02	.6	1.8
1143+00	1137+00	600	46	0.6	.72			2.0		.0112	6	.02		
1137+00	1133+00	400	46	0.4	.72			1.3		.0081	6	.02		
1133+00	1124+00	900	46	1.0	.72			3.2		.005	6	.02		
2125+75	2123+30	245	46	.3	.95			1.3						
1124+00	1109+00	1500	47	1.6	.6			4.2						
2123+30	2111+31	1200	54	1.5	.95			6.3		Sump				

INLET CALCULATIONS

	Station	Inlet Type	Q cfs	HW ft.	DHW Elev.	Dike Elev.
28	1143+00	C-15.80	3.5	.4	1326.8	1327.40
79	1137+10	"	2.0	.3	1321.4	1322.1
25	1133+00	"	1.3	.2	1316.8	1318.6
22	1124+00	"	4.5	.5	1311.0	1311.5
18	1114+33	C-15.80, dbl	10.5	.8	1306.3	Sump

Channel Type: Trapezoidal, Triangular

Inlet Type: C-15.08, C-15.09, C-15.10, Pipe Culvert

Computed by: M Lopez Checked by: MC Date: 10-1-91

50% Clogging
(Sump)

PROJECT 703-1
HEC12 Version: V70112.2 User S/N: 77010035 Run Date: 06-16-1988

```
==============================================================================
INLET NUMBER C-15.80          LENGTH   0.0          STATION

  TOTAL PEAK DISCHARGE =  1.00 (cfs)

     XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 0.16      PERIMETER OF GRATE =  5.00       AREA =  2.40


==============================================================================
INLET NUMBER C-15.80          LENGTH   0.0          STATION

  TOTAL PEAK DISCHARGE =  2.00 (cfs)

     XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 0.26      PERIMETER OF GRATE =  5.00       AREA =  2.40


==============================================================================
INLET NUMBER C-15.80          LENGTH   0.0          STATION

  TOTAL PEAK DISCHARGE =  3.00 (cfs)

     XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 0.34      PERIMETER OF GRATE =  5.00       AREA =  2.40


==============================================================================
INLET NUMBER C-15.80          LENGTH   0.0          STATION
 8,
  TOTAL PEAK DISCHARGE =  4.00 (cfs)

     XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 0.41      PERIMETER OF GRATE =  5.00       AREA =  2.40


==============================================================================
INLET NUMBER C-15.80          LENGTH   0.0          STATION

  TOTAL PEAK DISCHARGE =  5.00 (cfs)

     XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 0.48      PERIMETER OF GRATE =  5.00       AREA =  2.40


==============================================================================
INLET NUMBER C-15.80          LENGTH   0.0          STATION

  TOTAL PEAK DISCHARGE =  6.00 (cfs)
```

```
DEPTH OF WATER = 0.54     PERIMETER OF GRATE =  5.00      AREA =  2.40


==============================================================================
INLET NUMBER C-15.80        LENGTH   0.0        STATION

  TOTAL PEAK DISCHARGE =  7.00 (cfs)

     XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 0.60     PERIMETER OF GRATE =  5.00      AREA =  2.40


==============================================================================
INLET NUMBER C-15.80        LENGTH   0.0        STATION

  TOTAL PEAK DISCHARGE =  8.00 (cfs)

     XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 0.66     PERIMETER OF GRATE =  5.00      AREA =  2.40


==============================================================================
INLET NUMBER C-15.80        LENGTH   0.0        STATION

  TOTAL PEAK DISCHARGE =  9.00 (cfs)

     XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 0.71     PERIMETER OF GRATE =  5.00      AREA =  2.40


==============================================================================
INLET NUMBER C-15.80        LENGTH   0.0        STATION

  TOTAL PEAK DISCHARGE = 10.00 (cfs)

     XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 0.76     PERIMETER OF GRATE =  5.00      AREA =  2.40


==============================================================================
INLET NUMBER C-15.80        LENGTH   0.0        STATION

  TOTAL PEAK DISCHARGE = 11.00 (cfs)

     XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 0.81     PERIMETER OF GRATE =  5.00      AREA =  2.40


==============================================================================
INLET NUMBER C-15.80        LENGTH   0.0        STATION

  TOTAL PEAK DISCHARGE = 12.00 (cfs)

     XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 0.86     PERIMETER OF GRATE =  5.00      AREA =  2.40
```

TOTAL PEAK DISCHARGE = 13.00 (cfs)

XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 1.01 PERIMETER OF GRATE = 5.00 AREA = 2.40

==========

INLET NUMBER C-15.80 LENGTH 0.0 STATION

TOTAL PEAK DISCHARGE = 15.00 (cfs)

XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 1.35 PERIMETER OF GRATE = 5.00 AREA = 2.40

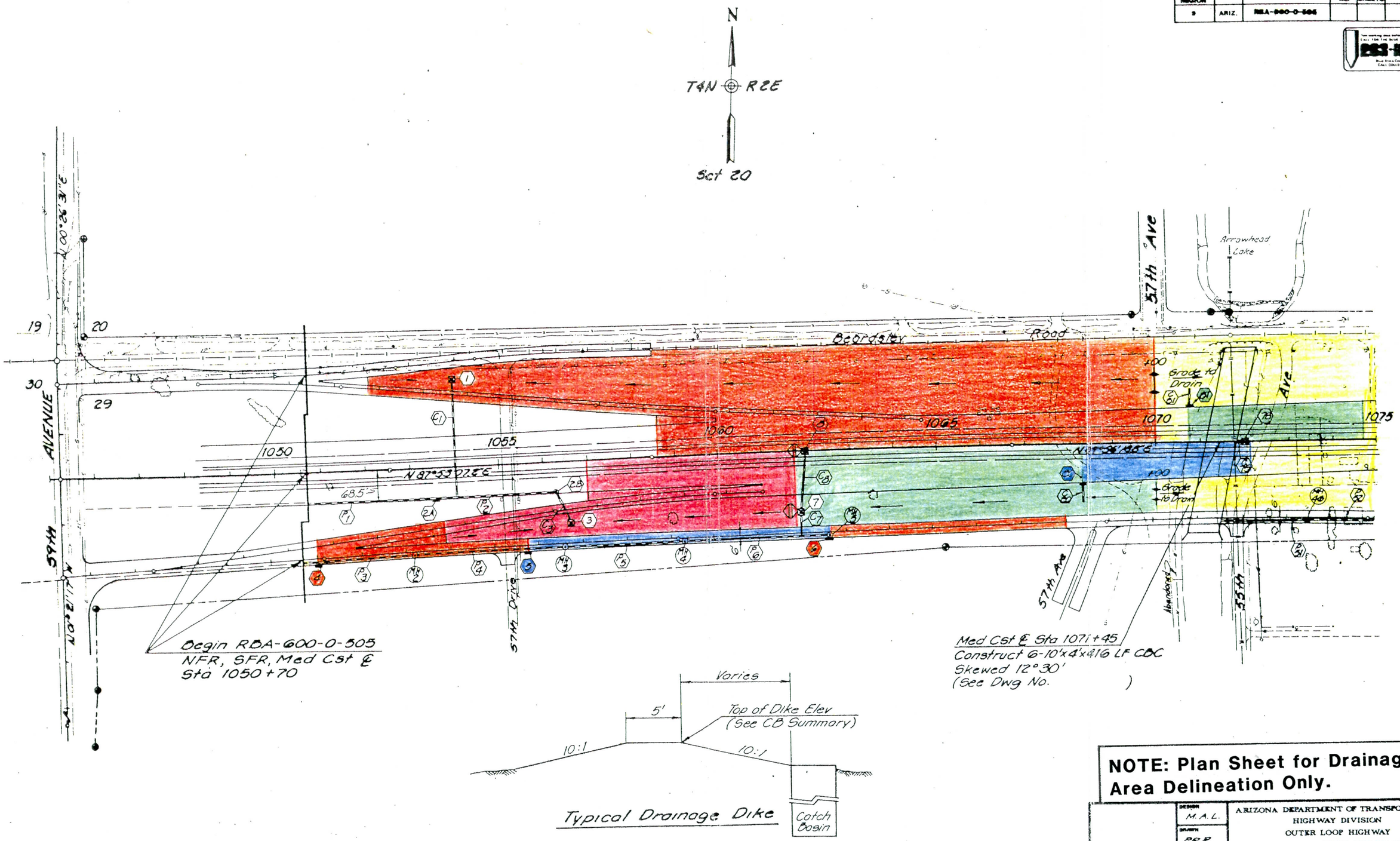
C-15.30 (Double Grate)

50% Clogging

PROJECT 703-1
HEC12 Version: V70112.2 User S/N: 77010035 Run Date: 06-20-1988

```
==============================================================================
INLET NUMBER  (15.30)        LENGTH   0.0        STATION

  TOTAL PEAK DISCHARGE = 10.00 (cfs)

     XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 0.48     PERIMETER OF GRATE = 10.00      AREA =  4.84


==============================================================================
INLET NUMBER  (15.30)        LENGTH   0.0        STATION

  TOTAL PEAK DISCHARGE = 15.00 (cfs)

     XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 0.63     PERIMETER OF GRATE = 10.00      AREA =  4.84


==============================================================================
INLET NUMBER  (15.30)        LENGTH   0.0        STATION

  TOTAL PEAK DISCHARGE = 18.00 (cfs)

     XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 0.71     PERIMETER OF GRATE = 10.00      AREA =  4.84


==============================================================================
INLET NUMBER  (15.30)        LENGTH   0.0        STATION

  TOTAL PEAK DISCHARGE = 20.00 (cfs)

     XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 0.76     PERIMETER OF GRATE = 10.00      AREA =  4.84


==============================================================================
INLET NUMBER  (15.30)        LENGTH   0.0        STATION

  TOTAL PEAK DISCHARGE = 25.00 (cfs)

     XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER = 0.89     PERIMETER OF GRATE = 10.00      AREA =  4.84
```

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RBA-600-0-505			



NOTE: Plan Sheet for Drainage Area Delineation Only.

DESIGN	M.A.L.
DRAWN	P.R.R.
CHECKED	
APPROVED	

STANLEY/METTEE-McBILL-MURPHY, INC.

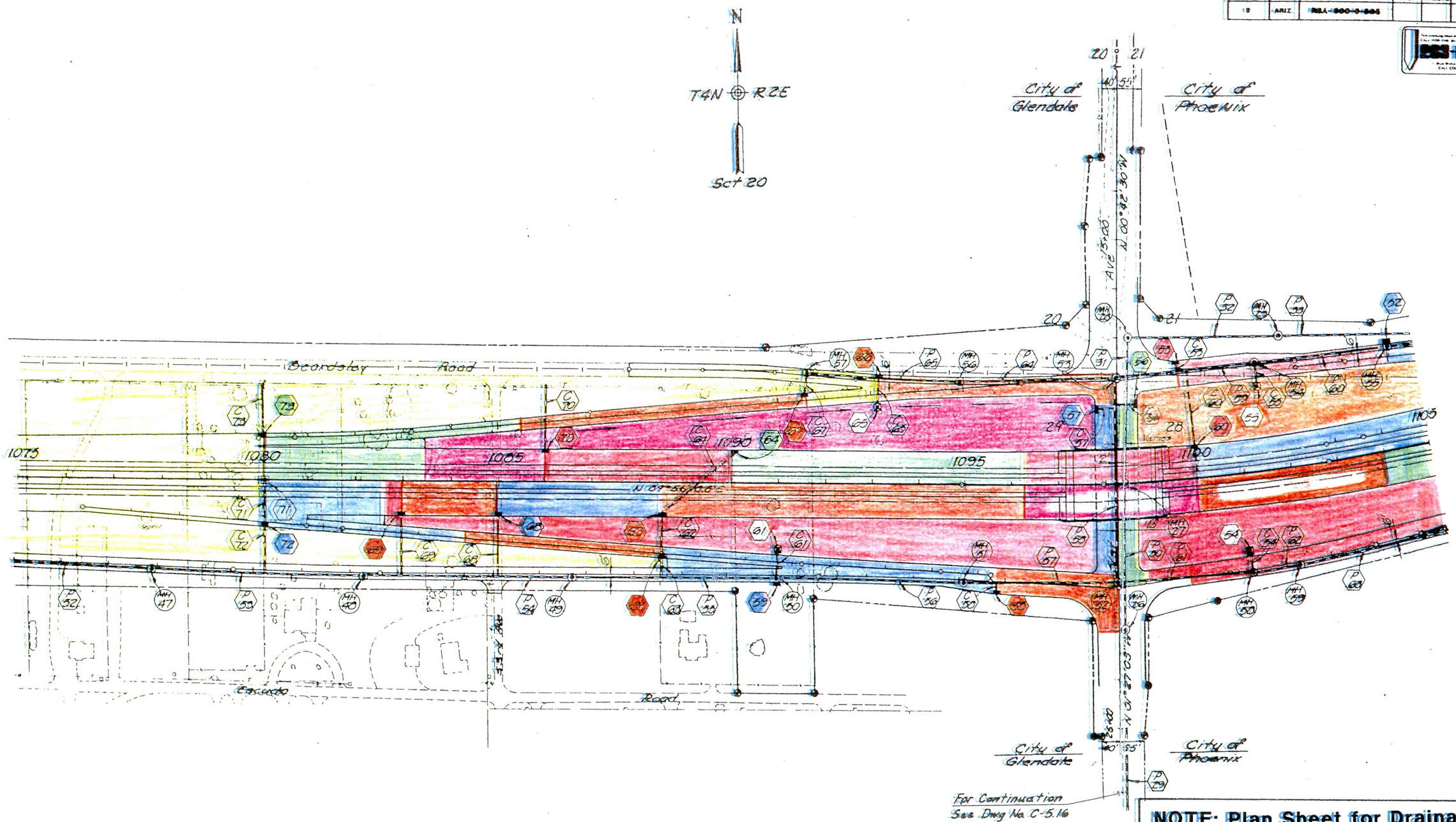
ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
OUTER LOOP HIGHWAY
RBA-600-0-505 59TH AVE TO 35TH AVE

DRAINAGE PLAN

STA 1050+70 TO STA 1075+00

DATE	DESIGNER	LOCATION OR STRUCTURE NO.	DWG. NO.
			C-5.1

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RSA-[illegible]			



NOTE: Plan Sheet for Drainage Area Delineation Only.

DESIGN	M.A.L.
DRAWN	P.R.R.
CHECKED	
APPROVED	

STANLEY/WETTBE-McGILL-MURPHY, INC.

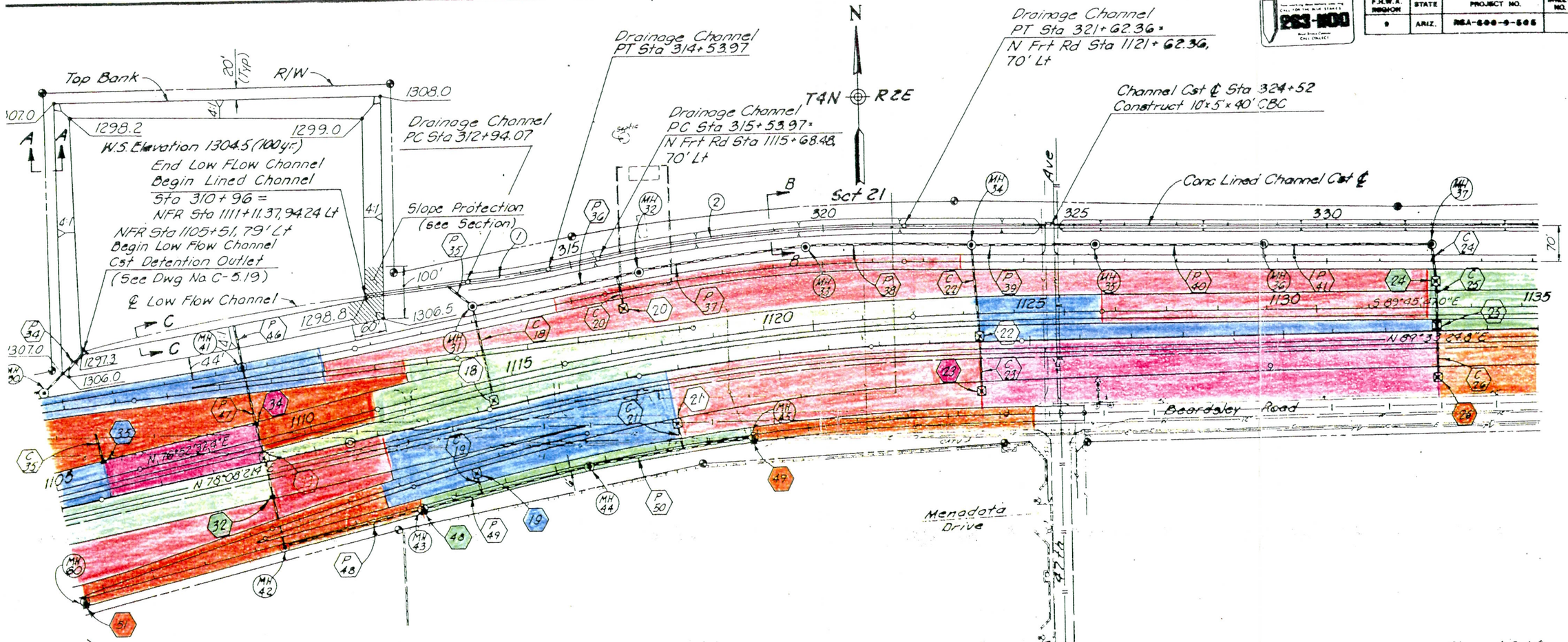
ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
OUTER LOOP HIGHWAY
RSA-[illegible]-0-505 59TH AVE TO 35TH AVE

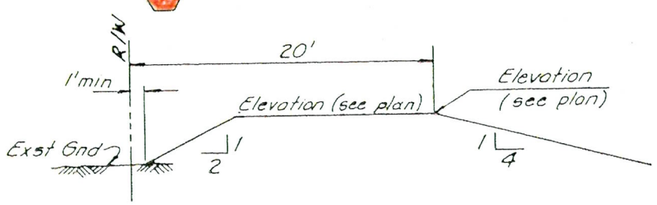
DRAINAGE PLAN

STA 1075+00 TO STA 1105+00

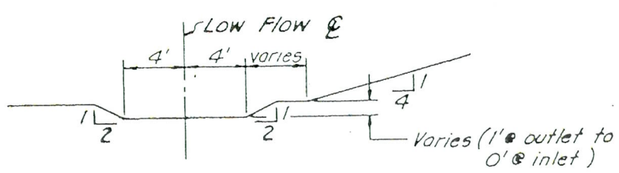
DATE	BR./DIST.	LOCATION OR STRUCTURE NO.	DWG. NO.
			C-5.3

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RSA-600-0-505			

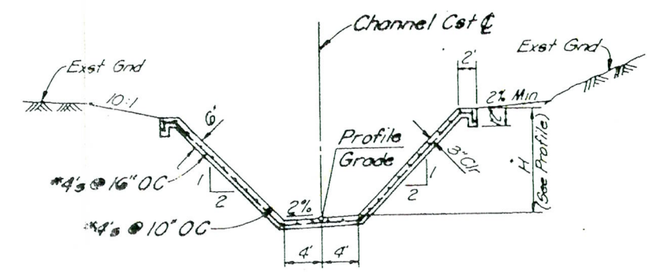




Section A-A (N.T.S.)



Section C-C (N.T.S.)



SECTION B-B
(NTS)

CHANNEL CURVE DATA

No.	R	Δ	T	L
1	1032.30	5° 00' 00"	80.00'	159.90
2	2934.79'	11° 52' 40"	305.29'	608.39'

NOTE: Plan Sheet for Drainage Area Delineation Only.

DESIGN MAL
DRAWN P.R.R.
CHECKED
APPROVED

STANLEY/METTRE-McGILL-MURPHY, INC.
ENGINEERS • PLANNERS • SURVEYORS
1008 EAST INDIAN SCHOOL ROAD
PHOENIX, ARIZONA 85014
(602) 279-1024

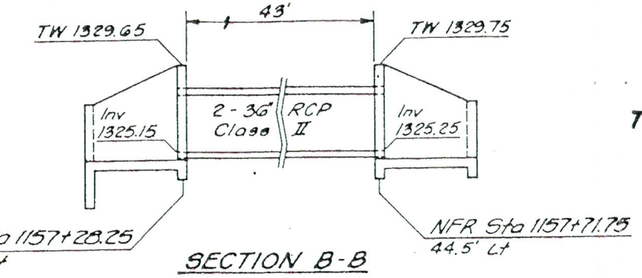
ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
OUTER LOOP HIGHWAY
RSA-600-0-505 59TH AVE TO 35TH AVE

DRAINAGE PLAN

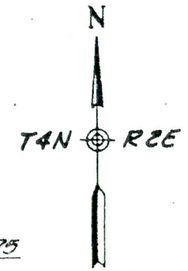
STA 1105+00 TO STA 1135+00

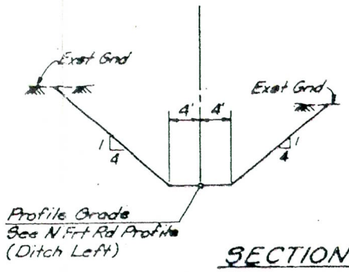
ROUTE	MILEPOST	LOCATION OR STRUCTURE NO.	DWG. NO.
			C-5.5

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RSA-000-0-505			

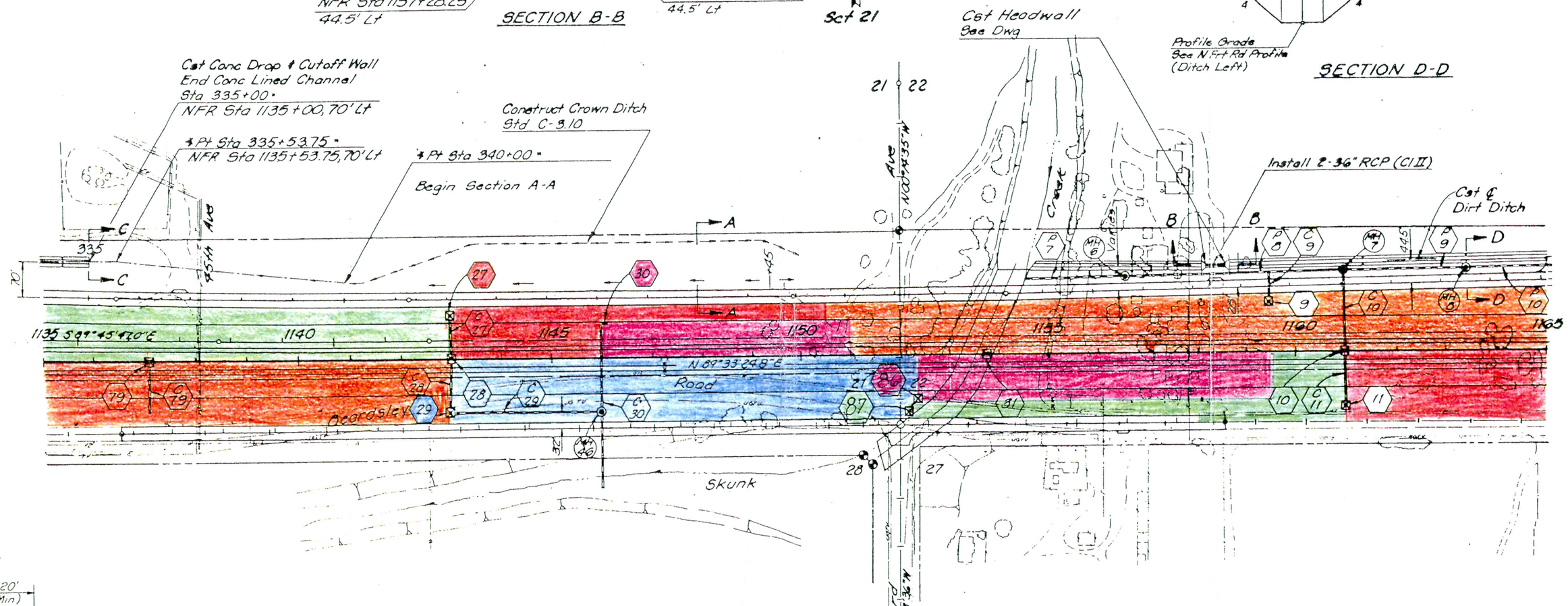


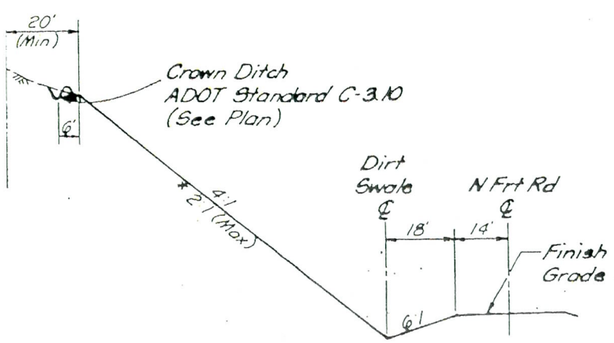
SECTION B-B





SECTION D-D

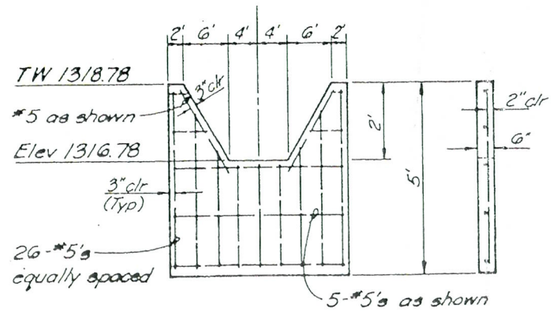




SECTION A-A

Sta 340+00 to Skunk Creek

* Slope may vary to meet 20' min offset from R/W



SECTION C-C

NOTE: Plan Sheet for Drainage Area Delineation Only.

DESIGN	M.A.L.
DRAWN	P.R.R.
CHECKED	
APPROVED	

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
OUTER LOOP HIGHWAY
RSA-000-0-505 59TH AVE TO 35TH AVE

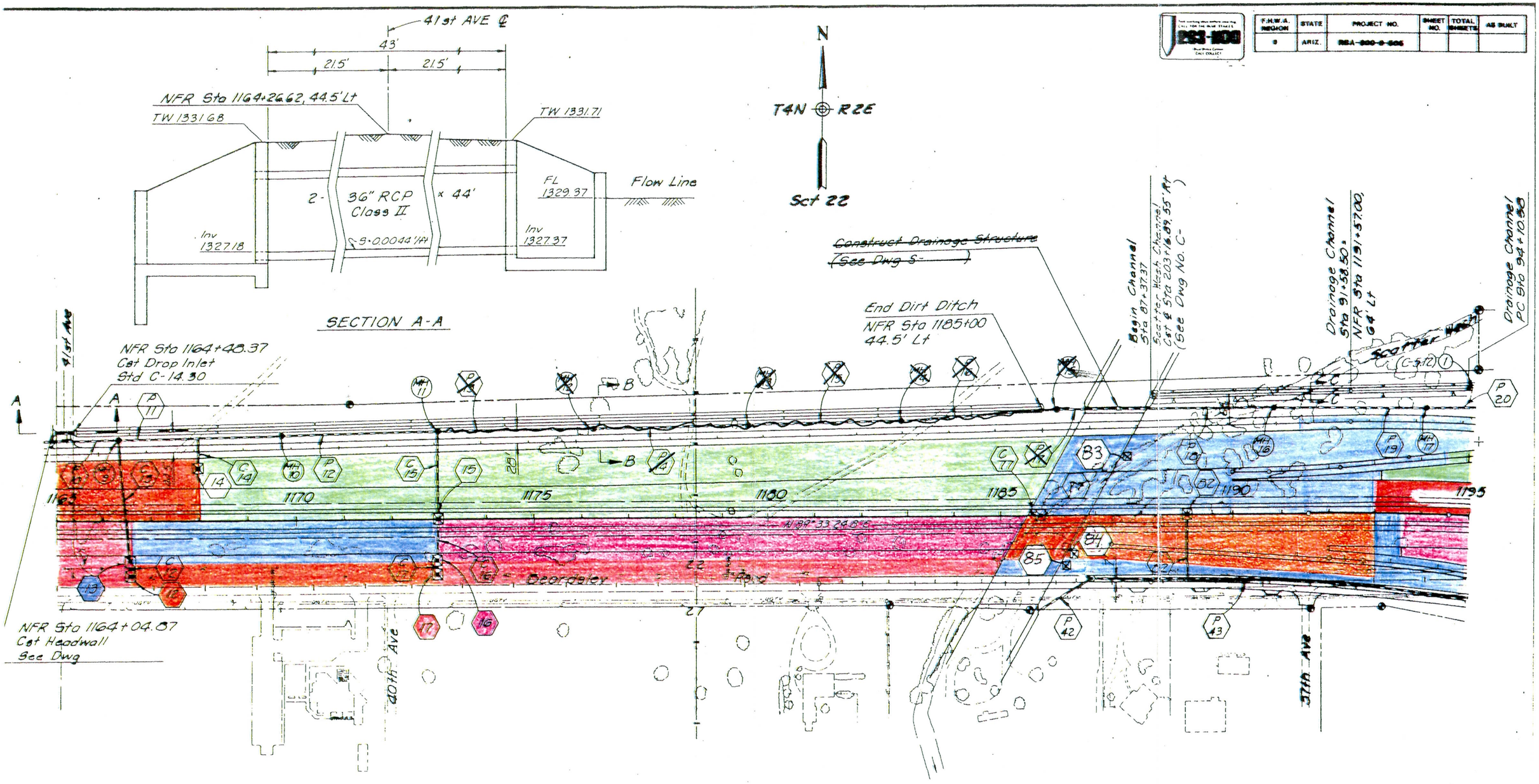
STANLEY/METTEE-McDILL-MURPHY, INC.

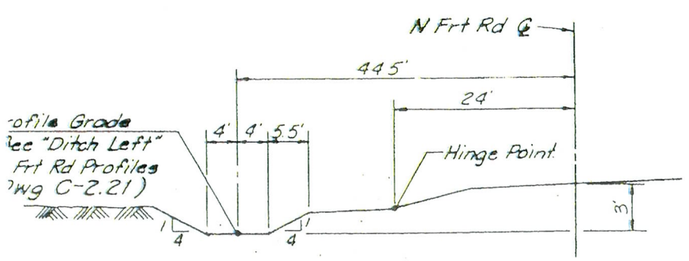
DRAINAGE PLAN

STA 1135+00 TO STA 1165+00

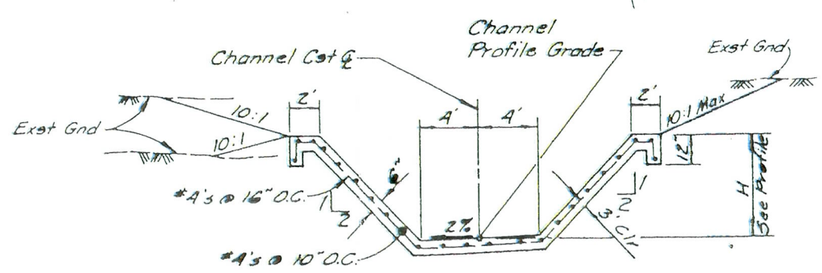
ROUTE	MILEPOST	LOCATION OR STRUCTURE NO.	DWG. NO.
			C-5.9

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RSA-600-0-505			





SECTION B-B



SECTION C-C

NOTE: Plan Sheet for Drainage Area Delineation Only.

DESIGN	M.A.L.
DRAWN	P.R.R.
CHECKED	
APPROVED	

STANLEY/MEETTIE-McGILL-MURPHY, INC.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
OUTER LOOP HIGHWAY
RSA-600-0-505 59TH AVE TO 35TH AVE

DRAINAGE PLAN

STA 1165+00 TO STA 1195+00

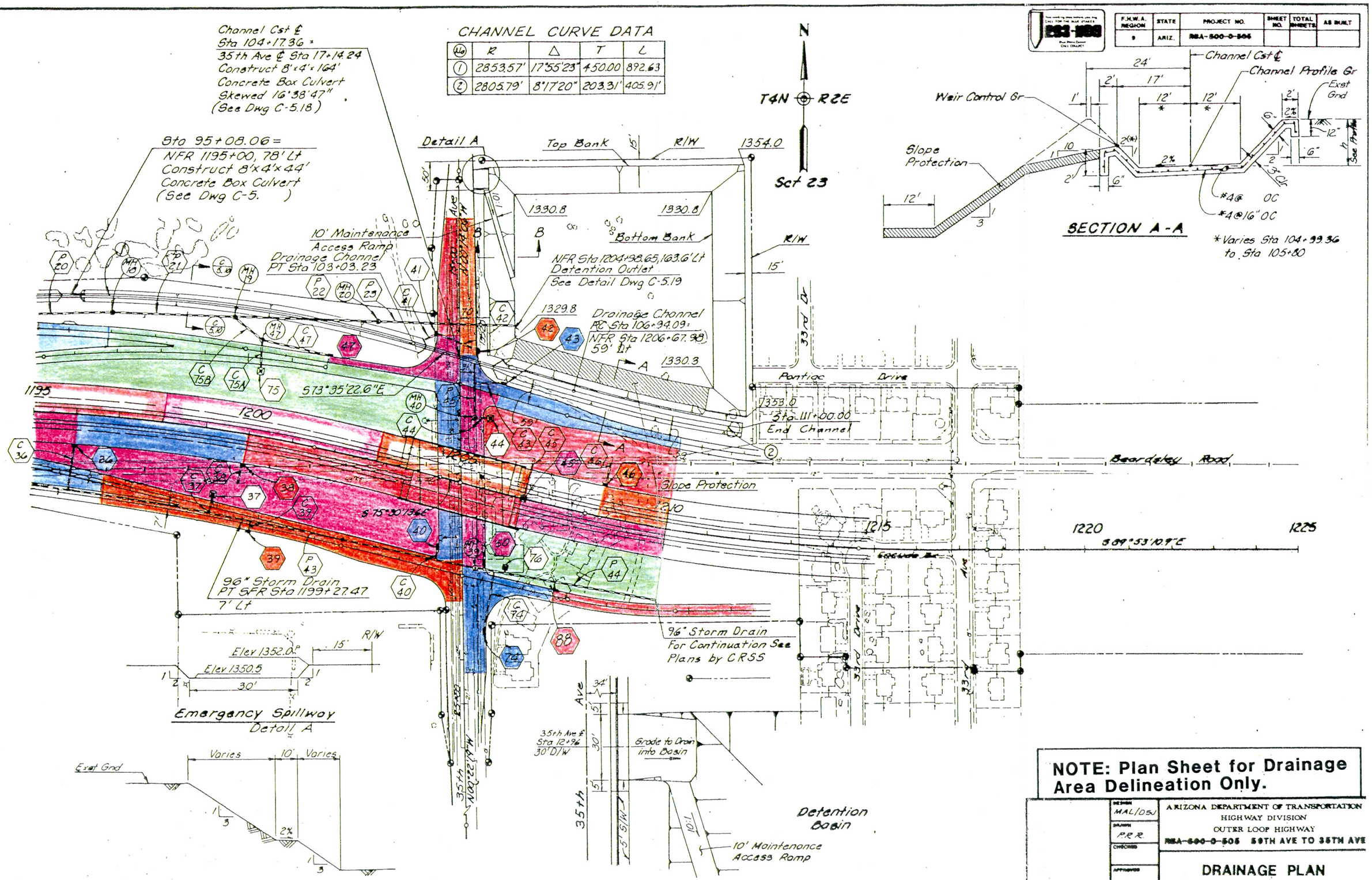
ROUTE	MILEPOST	LOCATION OR STRUCTURE NO.	DWG. NO.
			C-5.11

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RSA-500-0-505			

CALL FOR THE BLUE STAKES 263-1000

CHANNEL CURVE DATA

(No)	R	Δ	T	L
(1)	2853.57'	17°55'23"	450.00	892.63
(2)	2805.79'	8°17'20"	203.31'	405.91'



NOTE: Plan Sheet for Drainage Area Delineation Only.

DESIGN	MAL/DSJ
DRAWN	P.R.R.
CHECKED	
APPROVED	

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
OUTER LOOP HIGHWAY
RSA-500-0-505 59TH AVE TO 35TH AVE

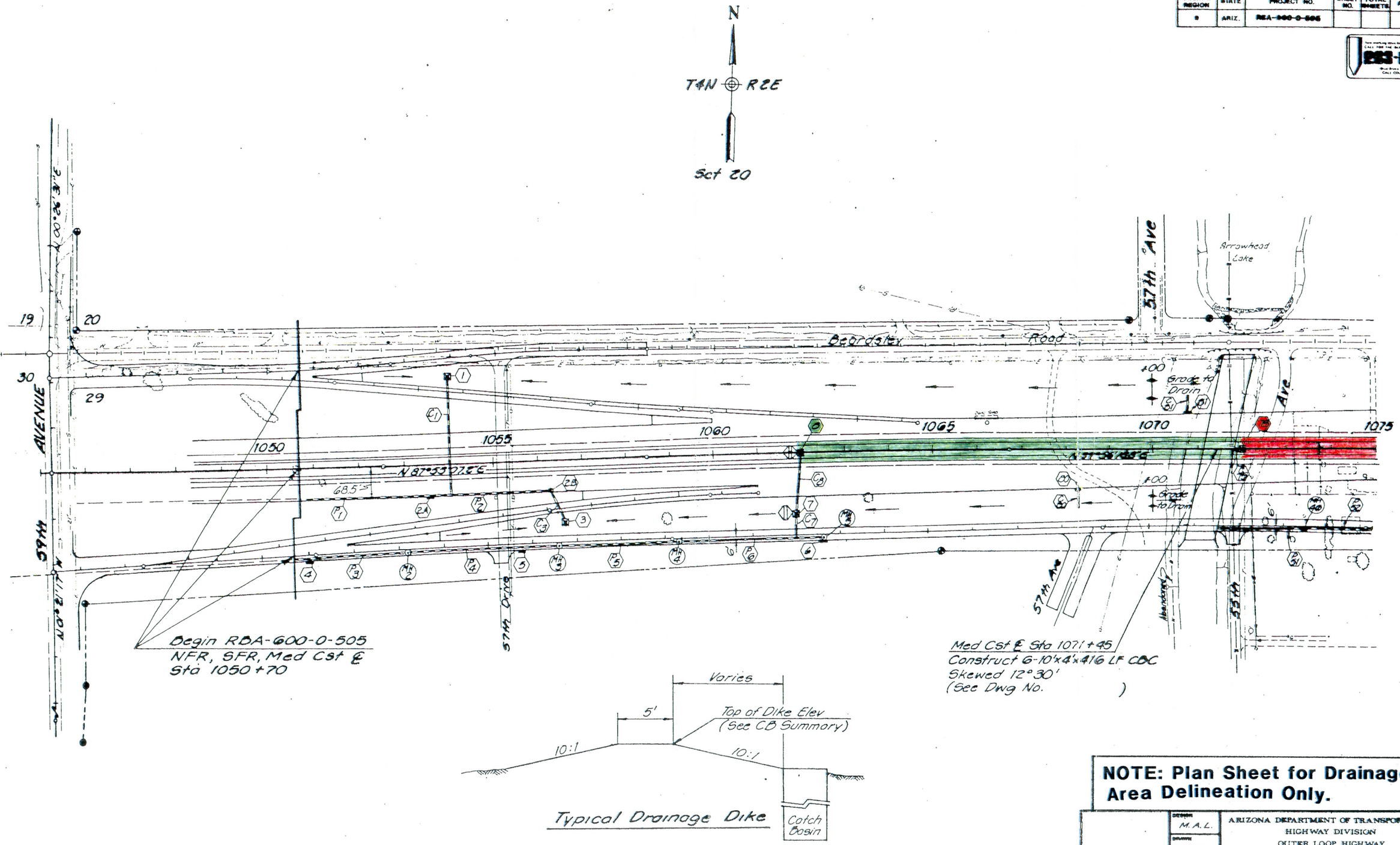
DRAINAGE PLAN

STA 1195+00 TO STA 1210+00

STANLEY/METTS-McGILL-MURPHY, INC.

DATE	BRIDGE NO.	LOCATION OR STRUCTURE NO.	DWG. NO.
			C-5.14

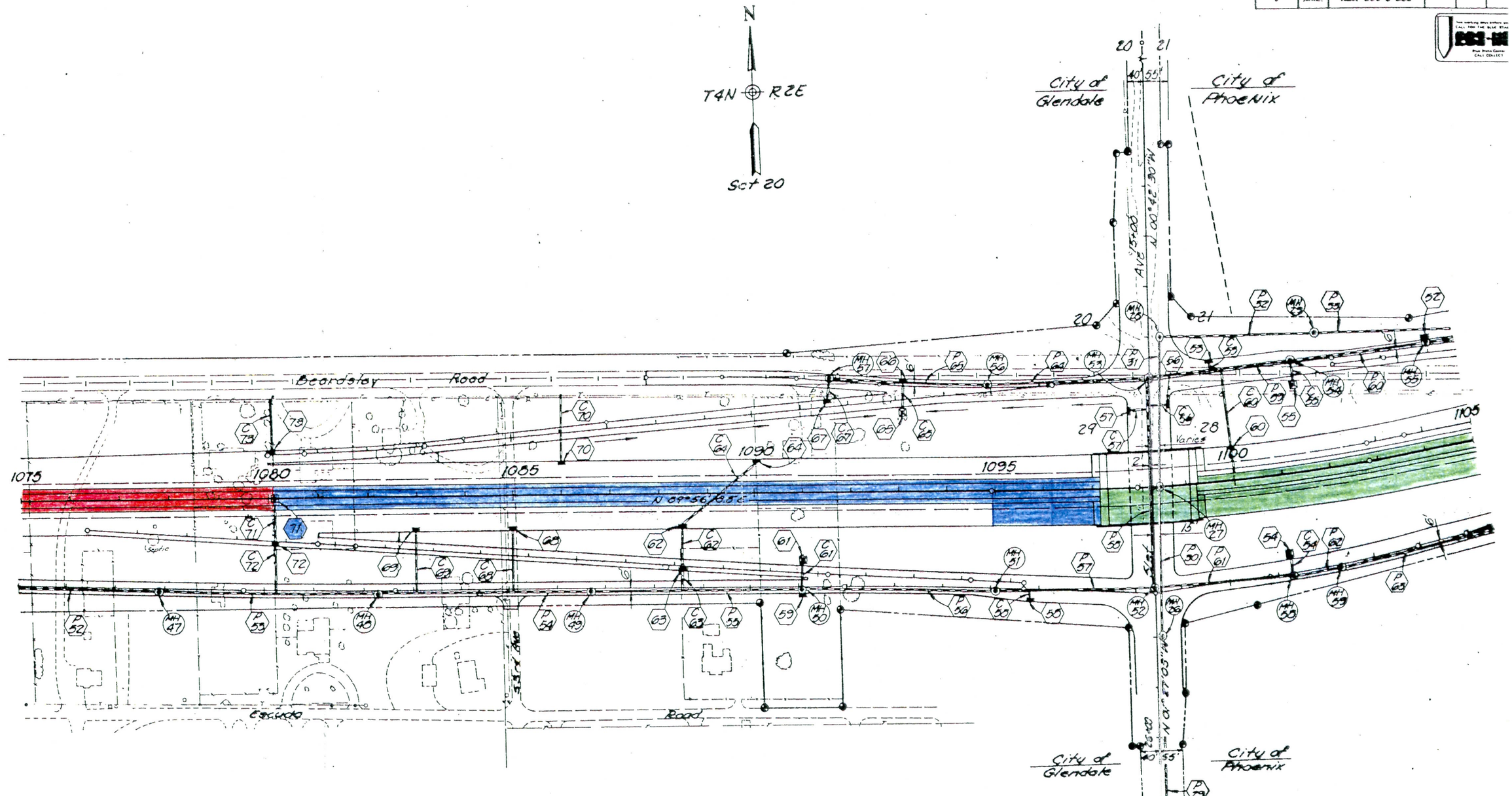
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RBA-600-0-505			



NOTE: Plan Sheet for Drainage Area Delineation Only.

DESIGN M.A.L.	ARIZONA DEPARTMENT OF TRANSPORTATION	
DRAWN P.R.R.	HIGHWAY DIVISION	
CHECKED	OUTER LOOP HIGHWAY	
APPROVED	RBA-600-0-505 59TH AVE TO 35TH AVE	
STANLEY/METTIE-McGILL-MURPHY, INC.	DRAINAGE PLAN	
	STA 1050+70 TO STA 1075+00	
	DATE / SH. SPEC. / LOCATION OR STRUCTURE NO.	DWG. NO. C-5.1

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AB
9	ARIZ.	RSA-[illegible]-0-505			



NOTE: Plan Sheet for Draina Area Delineation Only.

DESIGN: M.A.L.
DRAWN: P.R.R.
CHECKED:
APPROVED:

ARIZONA DEPARTMENT OF TRANSPOR
HIGHWAY DIVISION
OUTER LOOP HIGHWAY
RSA-[illegible]-0-505 59TH AVE TO 35

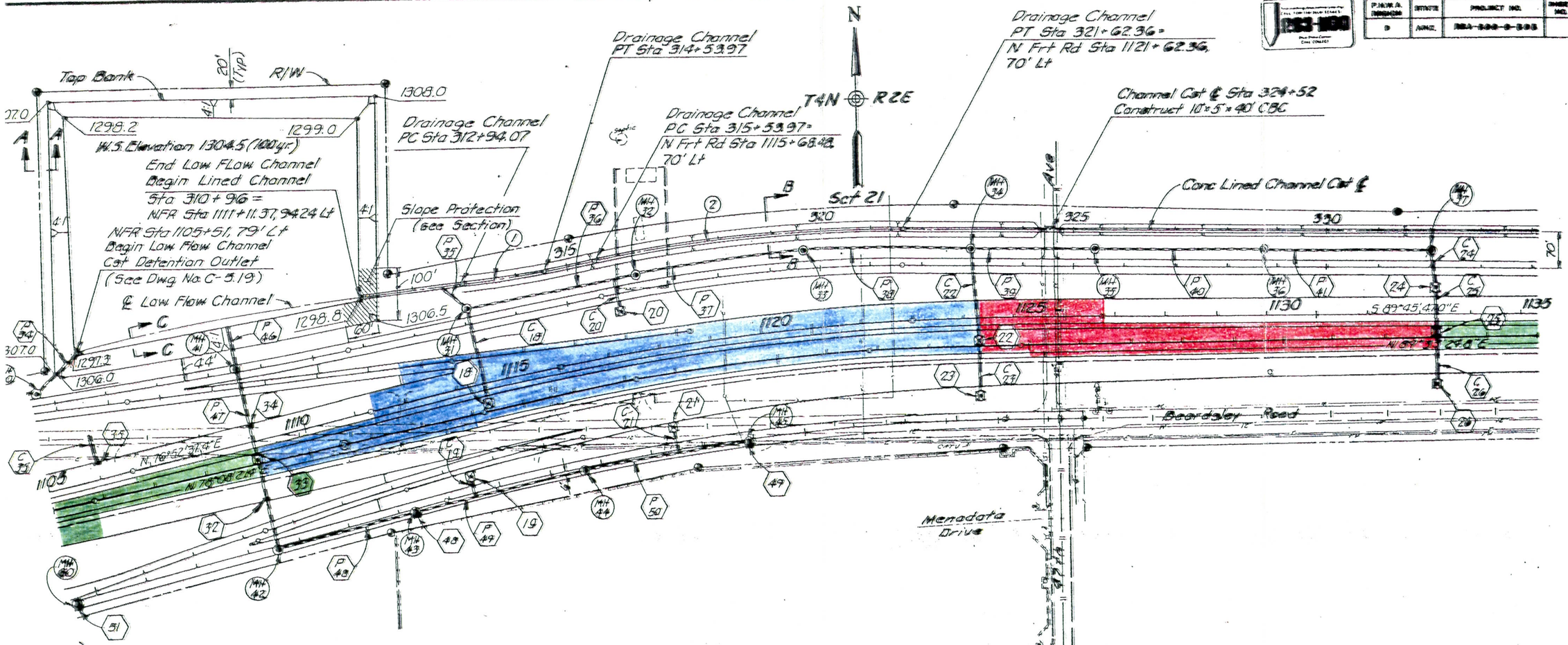
DRAINAGE PLAN

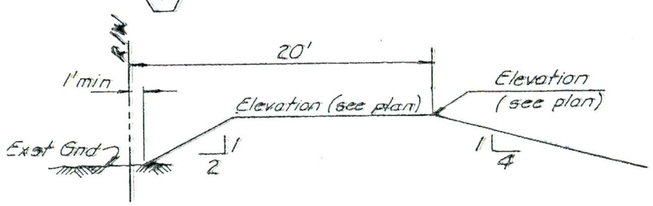
STA 1075+00 TO STA 110

STANLEY/METTTIE-McGILL-MURPHY, INC.

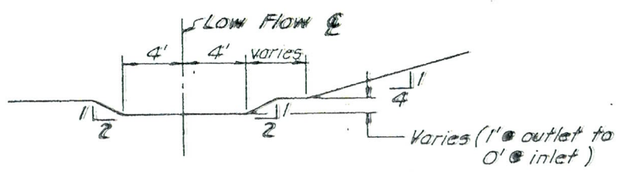
DATE | SHEET | LOCATION OR STRUCTURE NO.

P.M.O.A. DIVISION	DISTRICT	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
D	MARC.	RSA-500-0-505			

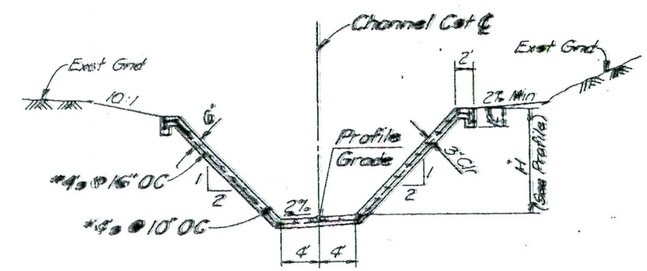




Section A-A (N.T.S.)



Section C-C (N.T.S.)



SECTION B-B
(NTS)

CHANNEL CURVE DATA

No.	R	Δ	T	L
1	1032.30	5° 00' 00"	80.00'	159.90
2	2934.79'	11° 52' 40"	305.29'	608.39'

NOTE: Plan Sheet for Drainage Area Delineation Only.

DESIGN MAL
DRAWN P.R.R.
CHECKED
APPROVED

STANLEY WITTER-HAGRILL-MURPHY, INC.

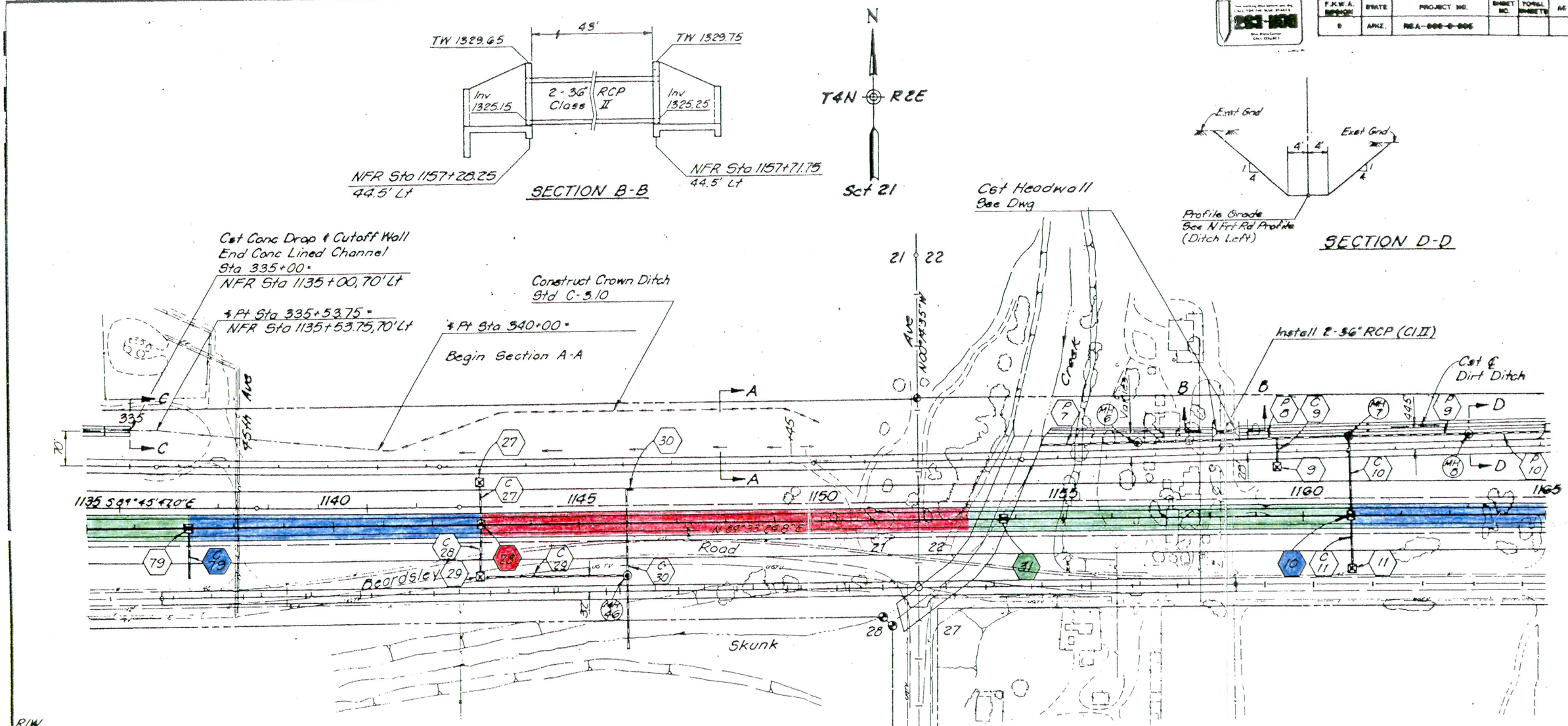
ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
OUTER LOOP HIGHWAY
RSA-500-0-505 59TH AVE TO 35TH AVE

DRAINAGE PLAN

STA 1105+00 TO STA 1135+00

DATE | BILL SHEET | LOCATION OR STRUCTURE NO. | DWG. NO. C-5.5

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RSA-000-0-000			

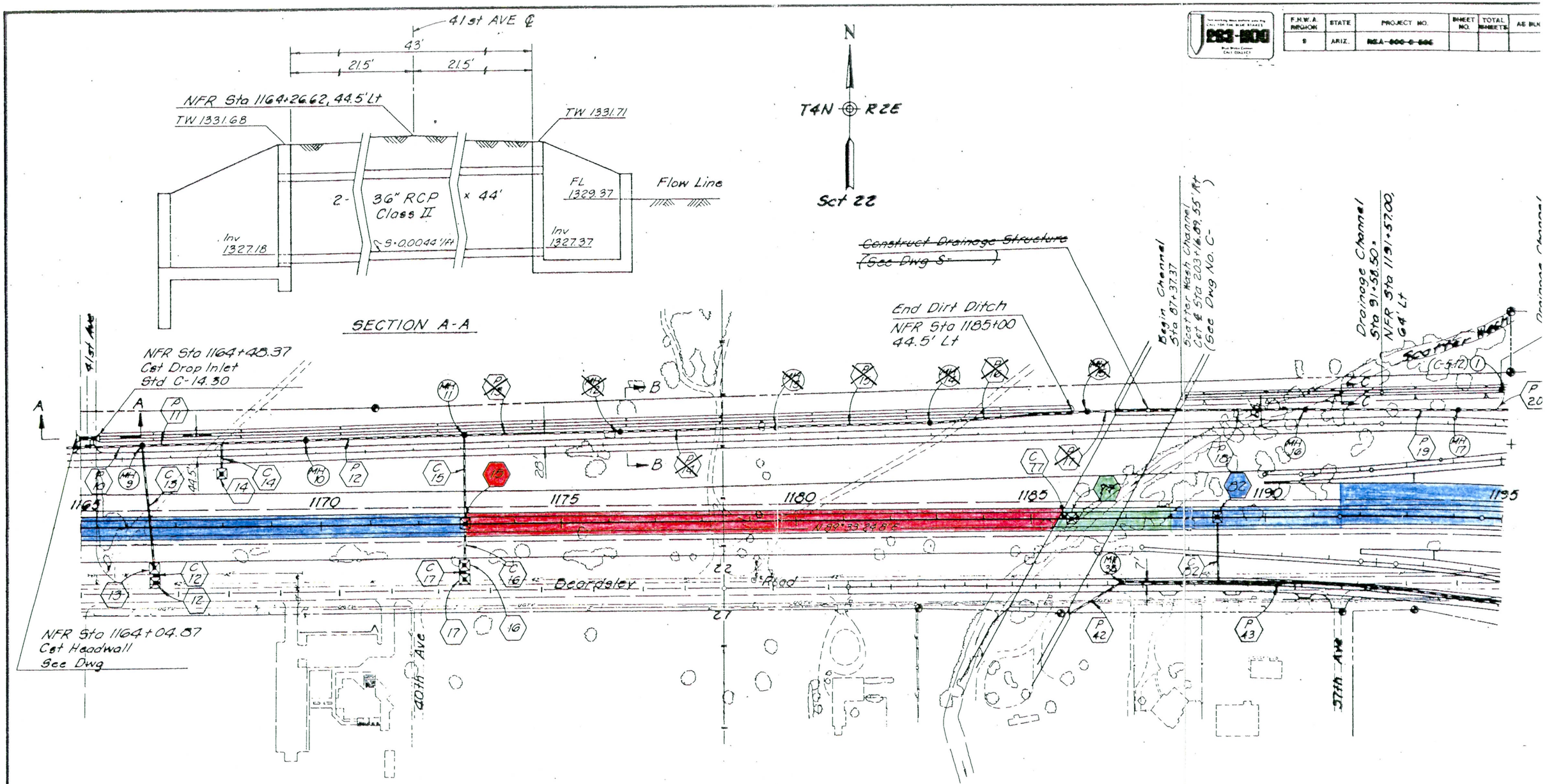


NOTE: Plan Sheet for Drainage Area Delineation Only.

	DESIGN: M.A.L.	ARIZONA DEPARTMENT OF TRANSPORTATION
	DRAWN: P.R.R.	HIGHWAY DIVISION
	CHECKED	OUTER LOOP HIGHWAY
	APPROVED	RSA-000-0-000 59TH AVE TO 35TH AVE
STANLEY/METTEE-McGILL-MURPHY, INC.		DRAINAGE PLAN
		STA 1135+00 TO STA 1165+00

ROUTE	MILEPOST	LOCATION OF STRUCTURE INC.	DWG. NO.
			C-5

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RSA-600-0-505			



NOTE: Plan Sheet for Drainage Area Delineation Only.

DESIGN	M.A.L.
DRAWN	P.R.R.
CHECKED	
APPROVED	

ARIZONA DEPARTMENT OF TRANSPORTAT
HIGHWAY DIVISION
OUTER LOOP HIGHWAY
RSA-600-0-505 59TH AVE TO 35TH

STANLEY/WETTBE-McGILL-MURPHY, INC.
ENGINEERS • PLANNERS • SURVEYORS
1401 EAST VERNON SCHOOL ROAD
PHOENIX, ARIZONA 85014
(602) 993-4001

DRAINAGE PLAN

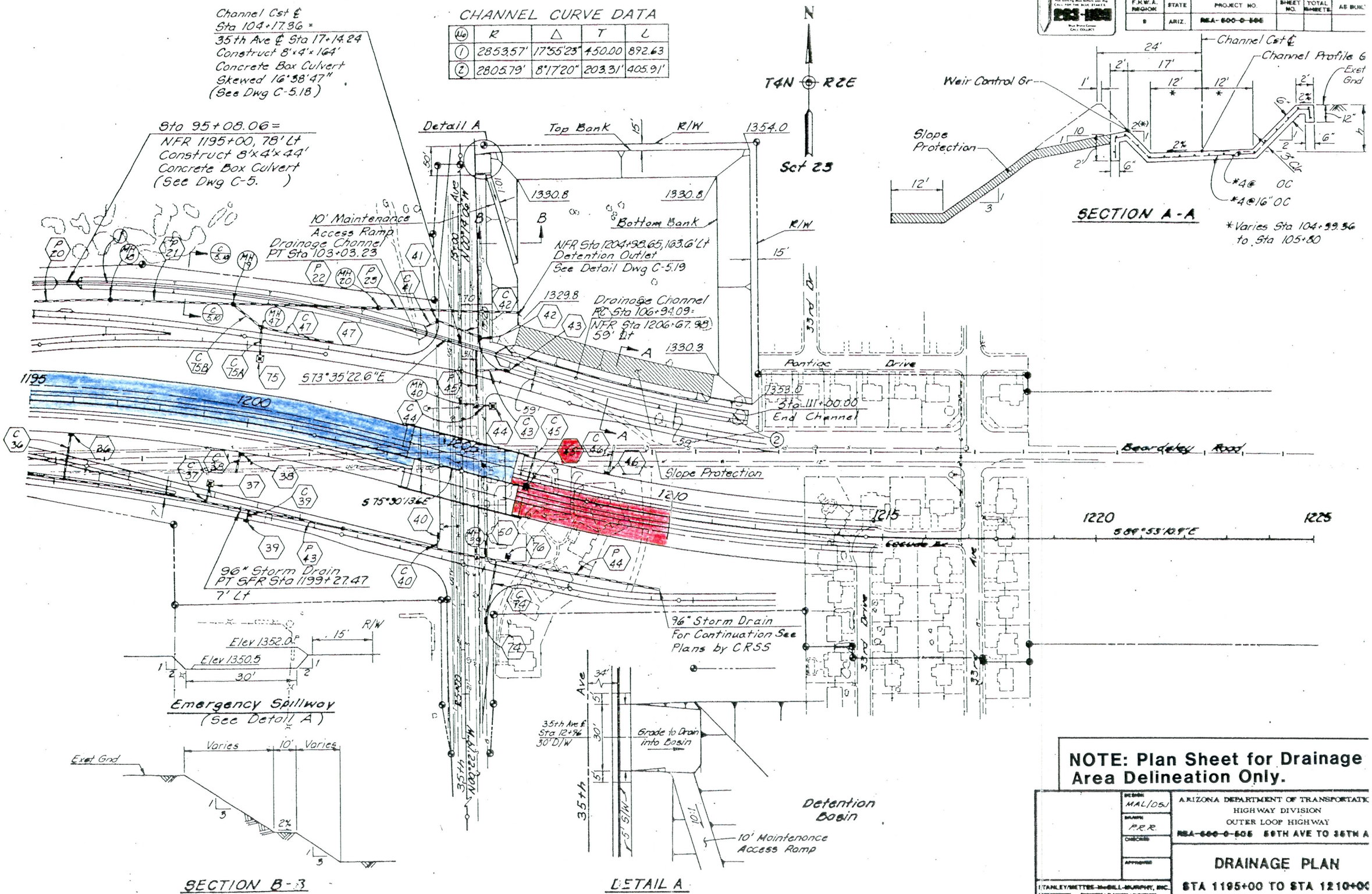
STA 1165+00 TO STA 1195+0

ROUTE	MILEPOST	LOCATION OR STRUCTURE NO.	SHEET NO.
			C-[illegible]

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RSA-600-0-505			

CHANNEL CURVE DATA

No	R	Δ	T	L
1	2853.57'	17°55'23"	450.00	892.63
2	2805.79'	8°17'20"	203.31'	405.91'



NOTE: Plan Sheet for Drainage Area Delineation Only.

DESIGNED MAL/DSJ
DRAWN P.R.R.
CHECKED
APPROVED

STANLEY/BETTES-McGILL-MURPHY, INC.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
OUTER LOOP HIGHWAY
RSA-600-0-505 59TH AVE TO 35TH A

DRAINAGE PLAN

STA 1195+00 TO STA 1210+00

ROUTE	MILEPOST	LOCATION OR STRUCTURE NO.	DWG. NO.
			C-5.

TAB 4

TABLE III: Circular Concrete and Corrugated Metal Pipe

$Q = KS^{1/2}$

Pipe Dia. (Inch)	A Area (Square Feet)	R Hydraulic Radius (Feet)	K = Values of $1.486/n \times A \times R^{2/3}$					
			Concrete Pipe			Corrugated Metal Pipe		
			n = 0.011	n = 0.012	n = 0.013	2-2/3" x 1/2" n = 0.024	3" x 1" n = 0.027	6" x 2" n = 0.033
8	0.349	0.167	14.3	13.1	12.1	6.5		
10	0.545	0.208	25.8	23.6	21.8	11.8		
12	0.785	0.250	42.1	38.6	35.7	19.3		
15	1.227	0.312	76.5	70.1	64.7	35.0		
18	1.767	0.375	124.2	113.8	105.1	56.9		
21	2.405	0.437	187.1	171.5	158.3	85.7		
24	3.142	0.500	267.4	245.1	226.2	122.5		
27	3.976	0.562	365.8	335.3	309.6	167.7		
30	4.909	0.625	484.7	444.3	410.1	222.2		
33	5.940	0.688	623.6	573.7	529.6	286.9		
36	7.069	0.750	788	722	666	361	321	
42	9.621	0.875	1189	1090	1006	545	484	
48	12.566	1.000	1698	1556	1436	778	692	
54	15.904	1.125	2325	2131	1967	1065	947	
60	19.635	1.250	3077	2821	2604	1410	1254	1026
66	23.758	1.375	3967	3636	3357	1818	1616	1323
72	28.274	1.500	5004	4587	4234	2293	2039	1668
78	33.183	1.625	6195	5679	5242	2839	2524	2065
84	38.485	1.750	7549	6920	6388	3460	3075	2517
90	44.179	1.875	9078	8321	7681		3698	3026
96	50.266	2.000	10776	9878	9119		4390	3592
102	56.745	2.125	12671	11615	10722			4224
108	63.617	2.250	14756	13526	12486			4919
114	70.882	2.375	17044	15624	14422			5682
120	78.540	2.500	19544	17915	16537			6515
126	86.590	2.625	22255	20397	18829			7417
132	95.030	2.750	25200	23104	21327			8401
138	103.870	2.875	28372	26009	24011			9459
144	113.100	3.000	31780	29133	26894			10594
150	122.720	3.125						11810
156	132.730	3.250						13115
162	143.140	3.375						14504
168	153.940	3.500						16160
174	165.130	3.625						17551
180	176.710	3.750						19212

FIGURE 3d

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

STORM SEWER SYSTEM DESIGN: SEWER CALCULATION SHEET

LOCATION DATA
Highway Outer Loop Highway
Location 59th Av to 35th Av
Project No. RBM 600-0-305

DESIGN DATA
Frequency 10 years
P_6= 2.0 in. P_{24}= 2.35 in. P_1= 1.6 in.
Outlet TW Elev. = 1273.21
Pipe n = 0.12

SEWER CALCULATIONS

Location		Drainage Area			Time of Flow, Min.			I	Q	Sewer Profile				Sewer Design			Hydraulic Grade Line				
Line No.	From - To SFR STA's	No.	Increm. CA	ΣCA	Inlet	Sewer	Design	in./hr	cfs	Crown Elevation Inlet	Crown Elevation Outlet	Length ft.	Slope ft./ft.	Diam. In.	Q_{full} cfs	V f.p.s.	S_f ft./ft.	h_L ft.	Elevation * Inlet	Elevation * Outlet	
P6	1062+00 1059+30		.33	.33	10	—	10	4.4	1.5	1281.66	1279.29	270	.0088	24	23	3.6	.00004	—	1280.06	1277.69	.2
P5	1059+30 1056+60		—	.33		1	11	4.3	1.4	1279.29	1276.91	270	.0088	24	23	3.6	.00004	.01	1277.62	1275.31	.2
P4	1056+60 1053+20		.41	.74		1	12	4.1	3.0	1276.91	1273.92	340	.0088	30	42	4.6	.00005	.02	1275.3	1273.24	.2
P3	1053+20 1050+67.45		.53	1.27		1	13	3.9	5.0	1273.92	1273.21	252	.0028	30	24	3.8	.00013	.03	1273.24	1273.21	.3

Computed by: MAL Checked by: MRC Date: 11/30/97

F-45

* HGL controlled by partial flow depth

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

STORM SEWER SYSTEM DESIGN: SEWER CALCULATION SHEET

LOCATION DATA
Highway: Outer Loop Highway
Location: 59th Av to 35th Av
Project No.: RRM 600-0-305

DESIGN DATA
Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
Outlet TW Elev. = 1296.38
Pipe n = .012

SEWER CALCULATIONS

Location		Drainage Area			Time of Flow, Min.			I	Q	Sewer Profile				Sewer Design			Hydraulic Grade Line			
Line No.	From - To	No.	Increm. CA	Σ CA	Inlet	Sewer	Design	in./hr	cfs	Crown Elevation Inlet	Crown Elevation Outlet	Length ft.	Slope ft./ft.	Diam. In.	Q_{full} cfs	V f.p.s.	S_f ft./ft.	h_L ft.	Elevation * Inlet	Elevation * Outlet
P 63		(61)	.81	.81	10		10	4.4	3.6	1301.21	1298.70	330	.0076	24	21.4	6.8	.0002	.07	1299.75	1297.25
P 62				.81		2.5	12	4.1	3.3	1298.70	1298.0	100	.0070	24	20.5	6.5	.0002	.02	1297.25	1296.87
P 61		(54)	1.7	2.5		.2	12	4.1	10.2	1298.0	1297.08	288	.0032	24	14	4.8	.0017	.49	1296.87	1296.38
						1.0	13													

Computed by: MAL Checked by: MRC Date: 11/21/59

F-45

* Pipe is flowing less than full
Hydraulic Grade Line determined by
y/d ratio from Hydraulic wheel

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

NFR 1104+00 to SFR 1071+50

STORM SEWER SYSTEM DESIGN: SEWER CALCULATION SHEET

LOCATION DATA
Highway Outer Loop Highway
Location 59th Ave
Project No. FRM 603-9-285

DESIGN DATA
Frequency 10 years
P_6= 2.0 in. P_{24}= 2.35 in. P_1= 1.6 in.
Outlet TW Elev. = 1287.05
Pipe n = .012

SEWER CALCULATIONS

Location		Drainage Area			Time of Flow, Min.			I	Q	Sewer Profile				Sewer Design			Hydraulic Grade Line			
Line No.	From - To	No.	Increm. CA	Σ CA	Inlet	Sewer	Design	in./hr	cfs	Crown Elevation Inlet	Crown Elevation Outlet	Length ft.	Slope ft./ft.	Diam. in.	Q_{full} cfs	V f.p.s.	S_f ft./ft.	h_L ft.	Elevation Inlet	Elevation Outlet
P-60	NFR 1104+00 - NFR 1101+15		0.7	0.7	10	0	10	4.4	3.1	1297.05	1298.6	285	.0016	24	9.8	2.6	.0002	.06	1301.[illegible]	1299.94
P-59	1101+15 - SFR 17+83		4.3	5.0	10	1.8	12	4.2	21	1298.6	1296.80	299	.002	24	11	6.6	.0073	2.18	1299.[illegible]	1297.[illegible]
P-58	17+83 - 21+91.18		3.3	8.3	10	.8	13	4.0	33	1296.50	1295.52	409	.0024	30	22	6.7	.0055	2.26	1297.[illegible]	1295.33
P-57	21+91.18 - SFR 1077+50		3.0	11.3	10	1.0	14	3.8	43	1295.50	1294.84	330	.0020	36	34	6.1	.0035	1.17	1295.26	1294.09
P-56	1085+10 - 1081+08		.4	11.7	10	.9	15	3.7	43	1294.84	1293.45	402	.0034	42	63	7.0	.0016	0.63	1294.[illegible]	1293.41
P-55	1081+08 - 1086+70		4.8	16.5	10	1.0	16	3.6	59	1293.47	1291.98	438	.0034	42	63	7.5	.0029	1.28	1293.53	1292.05
P-54	1086+70 - 1082+28		.9	17.4	10	1.6	17	3.5	61	1291.98	1290.48	440	.0034	42	63	7.5	.0031	1.36	1293.[illegible]	1292.13
P-53	1082+28 - 1077+88		.7	18.1	10	1.0	18	3.4	61	1290.48	1288.98	440	.0034	42	63	7.5	.0030	1.33	1292.[illegible]	1291.1[illegible]
P-52	1077+88 - 1073+48		—	18.1	10	1.0	19	3.3	60	1288.98	1287.48	440	.0034	42	63	7.5	.0030	1.33	1291.[illegible]	1289.70
P-51	1073+48 - 1071+50			18.1	10	1.0	20	3.2	58	1287.48	1286.10	198	.0069	42	68	8.0	.0035	0.56	1289.[illegible]	1287.05

Computed by: [illegible] Checked by: MRC Date: 11/10/89

F-45

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

35th Ave Detention Outfall Line

STORM SEWER SYSTEM DESIGN: SEWER CALCULATION SHEET

LOCATION DATA
Highway: Outer Loop Highway
Location: 59th Av - 35th Av
Project No.: RBM 600-0-305

DESIGN DATA
Frequency: 10 yr years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
Outlet TW Elev. = 1335.0
Pipe n = .012

SEWER CALCULATIONS

← Max from 35th Ave Det. Basin (See Section 5.4)

Location Line No.	From	To	Drainage Area No.	Increm. CA	Σ CA	Time of Flow, Min. Inlet	Sewer	Design	I in./hr	Q cfs	Sewer Profile Crown Elevation Inlet	Outlet	Length ft.	Slope ft./ft.	Sewer Design Diam. in.	Q full cfs	V f.p.s.	Hydraulic Grade Line S_f ft./ft.	h_L ft.	Elevation Inlet	Outlet
P-76	31+66	31+97.8								58	1339.91	1339.85	47	.0012	36	25	8.2	.0065	0.31	*1351.2	1350.9
P-75	28+31	31+46								↑	1339.85	1339.42	280	.0012	36	25	↑	.0065	1.82	1350.9	1349.0
P-74	27+53	28+31									1339.42	1339.33	78	.0016	36	29		.0065	0.51	1349.0	1348.5
P-23	25+50	27+53									1339.33	1338.51	203	.0012	29x45	25		.0065	1.32	1348.5	1347.4
P-22	22+20	25+50									1338.59	1337.43	330	.0020	36	32		.0065	2.14	1347.4	1345.1
P-21	19+42	22+20									1337.43	1336.87	278	.0020	36	32		.0065	1.81	1345.1	1343.3
P-20	16+60	19+42									1336.87	1336.31	282	.0020	36	32		.0065	1.83	1343.3	1341.4
P-19	13+30	16+60									1336.31	1335.65	330	.0020	36	32		.0065	2.14	1341.4	1339.3
P-18	10+53	13+30								↓	1335.65	1333.99	277	.0024	36	35	✓	.0065	1.8	1339.3	1337.50

F-45

Computed by: MAL Checked by: MRC Date: [illegible]

* Detention Basin reaches capacity @ Elev 1351.0, Neglecting MH losses a discharge close to 58cfs can be obtained. Due to clearances and cost a 42" or larger line was not used.

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

51st Ave Detention Outfall Line

STORM SEWER SYSTEM DESIGN: SEWER CALCULATION SHEET

LOCATION DATA
Highway: Outer Loop Highway
Location: 59th Av - 35th Av
Project No.: RPM 600-0-305

DESIGN DATA
Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
Outlet TW Elev. = 1295.0
Pipe n = .012

SEWER CALCULATIONS

51st Ave Detention Discharge

Location Line No.	From - To	Drainage Area No.	Drainage Area Increm. CA	Drainage Area ΣCA	Time of Flow, Min. Inlet	Time of Flow, Min. Sewer	Time of Flow, Min. Design	I in./hr	Q cfs	Sewer Profile Crown Elevation Inlet	Sewer Profile Crown Elevation Outlet	Sewer Profile Length ft.	Sewer Profile Slope ft./ft.	Sewer Design Diam. In.	Sewer Design Q full cfs	Sewer Design V f.p.s.	Hydraulic Grade Line S_f ft./ft.	Hydraulic Grade Line h_L ft.	Hydraulic Grade Line Elevation Inlet	Hydraulic Grade Line Elevation Outlet
P34									20	1297.30	1297.12	100	.0018	24	10.4	6.4	.0067	0.67	1305.84	1305.17
P33									↑	1297.12	1296.56	300	.0018	24	10.4	6.4	.0067	2.01	1305.17	1303.16
P32										1296.59	1296.0	322	.0018	30	18.8	4.1	.0020	0.64	1303.16	1302.52
P31									↓	1294.99	1294.51	300	.0016	30	17.8	4.1	.0020	0.60	1302.52	1301.92
P30									20	1294.51	1294.03	330	.0016	30	17.8	4.1	.0020	0.66	1301.92	1301.26
P29									37.7	1294.03	1293.50	330	.0016	30	17.8	5.3	.0072	2.38	1301.26	1298.88
P28									↑	1293.51	1293.11	330	.0012	36	25.0	5.3	.0027	0.89	1298.88	1297.99
P27										1293.11	1292.72	330	.0012	36	25.0	5.3	.0027	0.89	1297.99	1297.10
P26										1292.72	1292.32	330	.0012	36	25.0	5.3	.0027	0.89	1297.10	1296.21
P25									↓	1292.32	1291.93	330	.0012	36	25.0	5.3	.0027	0.89	1296.21	1295.32
P24									37.7	1291.93	1291.79	117	.0012	36	25.0	5.3	.0027	0.32	1295.32	1295.0

Computed by: MAE Checked by: MRC Date: 11/21/89

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

STORM SEWER SYSTEM DESIGN: SEWER CALCULATION SHEET

LOCATION DATA
Highway: Outer Loop Highway
Location: 59th Ave - 35th Ave
Project No.: RBM 600-0-305

DESIGN DATA
Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
Outlet TW Elev. = 1297.75
Pipe n = .012

SEWER CALCULATIONS

Location		Drainage Area			Time of Flow, Min.			I	Q	Sewer Profile				Sewer Design			Hydraulic Grade Line			
Line No.	From - To	No.	Increm. CA	Σ CA	Inlet	Sewer	Design	in./hr	cfs	Crown Elevation Inlet	Crown Elevation Outlet	Length ft.	Slope ft./ft.	Diam. In.	Q_{full} cfs	V f.p.s.	S_f ft./ft.	h_L ft.	Elevation Inlet	Elevation Outlet
P66	CB67 - CB65		.38	.38	10	0	10	4.4	1.7	1297.65	1297.42	160	.0014	24	9.2	.5	—	—	1298.6	1298.60
P65	CB65 - MH56		2.4	2.8		5	15	3.7	10	1297.42	1297.19	187	.0012	24	8.5	3.2	.0017	.32	1298.10	1298.28
P64	MH56 - MH53		—	2.8		2	17	3.5	9.8	1297.19	1296.80	330	.0012	24	8.5	3.1	.0016	.53	1298.28	1297.75

Computed by: MAL Checked by: MRS Date: 11/21/87

F-45

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

STORM SEWER SYSTEM DESIGN: SEWER CALCULATION SHEET

SFR Sta. 1118+90 - 51st Av Detention Basin

LOCATION DATA
Highway Outer Loop Highway
Location 59th Av to 35th Av
Project No. RRM 60-0-305

DESIGN DATA
Frequency 10 years
P_6= 2.0 in. P_{24}= 2.35 in. P_1= 1.6 in.
Outlet TW Elev. = 1304.3
Pipe n = .012

SEWER CALCULATIONS

Location		Drainage Area			Time of Flow, Min.			I	Q	Sewer Profile				Sewer Design			Hydraulic Grade Line			
Line No.	From - To	No.	Increm. CA	Σ CA	Inlet	Sewer	Design	in./hr	cfs	Crown Elevation Inlet	Crown Elevation Outlet	Length ft.	Slope ft./ft.	Diam. in.	Q_{full} cfs	V f.p.s.	S_f ft./ft.	h_L ft.	Elevation Inlet	Elevation Outlet
P-(47-5)	1113+90 1112+30		2.4	2.4	10	—	10	4.4	10.6	1307.34	1303.38	660	.0060	24	19	6.4	.0019	1.23	1305.45	1307.20
P 48	1112+30 1107+53		1.7	4.1	10	1.7	12	4.2	17	1303.38	1301.72	277	.0060	24	19	5.4	.0048	1.33	1307.14	1305.61
P 47	1107+53 - 1102+50		2.5	6.6	10	0.9	13	4.0	26	1301.72	1300.70	352	.0029	30	24	5.3	.0034	1.20	1305.76	1304.56
P 46	1102+50 - Out Box		—	6.6		1.1	14	3.8	25	1300.70	1300.50	71	.0029	30	24	5.1	.0032	0.22	1305.52	1304.30

Computed by: M Lopez Checked by: MRC Date: 11/20/89

F-45

Storm Sewer System

Sta 1186+60 to Sta 1153+63.9

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

STORM SEWER SYSTEM DESIGN: SEWER CALCULATION SHEET

LOCATION DATA
Highway: Outer Loop Highway
Location: 59th Av to 35th
Project No.: RPM 600-0-305

DESIGN DATA
Frequency: 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
Outlet TW Elev. = ** 1322.68
Pipe n = .012

SEWER CALCULATIONS

Location		Drainage Area			Time of Flow, Min.			I	Q	Sewer Profile				Sewer Design			Hydraulic Grade Line ▲			
Line No.	From - To	No.	Increm. CA	Σ CA	Inlet	Sewer	Design	in./hr	cfs	Crown Elevation Inlet	Crown Elevation Outlet	Length ft.	Slope ft./ft.	Diam. in.	Q full cfs	V f.p.s.	S_f ft./ft.	h_L ft.	Elevation Inlet	Elevation Outlet
	NFR STATIONS																			
	F Sat Wsh																			
P-(3-17)	1186+60 1172+10								*5	1327.5	1326.34	1450	.0008	24	6.9	2.2	.0004	.58	1332.90	1331.31
P-12	1172+10 1168+80		2.9	2.9	10	—	10	4.4	17.8	1326.34	1325.42	330	.0028	24	13	5.7	.0053	1.74	1333.55	1329.56
P-11	1168+80 1165+50		4.9	7.8	10	1	11	4.3	38.5	1325.42	1324.36	330	.0032	30	25	7.8	.0075	2.48	1332.42	1326.98
P-10	1165+50 1162+20		1.7	9.5	10	.7	12	4.2	44.9	1324.36	1323.04	330	.0040	36	45.6	6.4	.0037	1.29	1326.79	1325.50
P-9	1162+50 1160+05		—	9.5	10	.9	13	4.0	43.0	1323.04	1322.18	215	.0040	36	45.6	6.4	.0035	0.76	1325.35	1324.62
P-8	1160+05 1155+65		3.5	13	10	.6	13	4.0	57.0	1322.18	1321.65	440	.0012	42	36	5.9	.0027	1.2	[illegible]	1323.27
P-7	1155+65 1153+63.9		—	13	10	1.2	14	3.8	55.0	1321.65	1321.01	201	.0032	42	62	7.0	.0025	0.51	1323.[illegible]	1322.68
	Skunk CREEK																			

Computed by: _____ Checked by: MRC Date: 11/20/89

F-45

* 5cfs additional from 35th Av Det. (to each run)
** $\left(\frac{P_c+Q}{2}\right)+E$ (from HEC 5 @ Q_{100} for Skunk Creek)

▲ A loss of $.2(V_e^2/2g)$ has been added to each Manhole.

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

STORM SEWER SYSTEM DESIGN: SEWER CALCULATION SHEET

LOCATION DATA
Highway Outer Loop Highway
Location 59th Ave - 35th Ave
Project No. RRM 600-0-305

DESIGN DATA
Frequency 10 years
P_6 = 2.0 in. P_{24} = 2.35 in. P_1 = 1.6 in.
Outlet TW Elev. = 1307.0
Pipe n = .012

SEWER CALCULATIONS

Location		Drainage Area			Time of Flow, Min.			I	Q	Sewer Profile				Sewer Design			Hydraulic Grade Line			
Line No.	From - To	No.	Increm. CA	Σ CA	Inlet	Sewer	Design	in./hr	cfs	Crown Elevation Inlet	Crown Elevation Outlet	Length ft.	Slope ft./ft.	Diam. In.	Q_{full} cfs	V f.p.s.	S_f ft./ft.	h_L ft.	Elevation Inlet	Elevation Outlet
P 41	1132+00 1128+70		4.1	4.1	10	--	10	4.4	18	1313.0	1310.79	330	.0067	24	20	7.0	.0054	1.78	[illegible]	1312.[illegible]
P 40	1128+70 1125+40		—	"	"	.8			"	1310.79	1308.58	330	.0067	24	20	7.0	.0054	1.78	[illegible]	1310.6
P 39	1125+40 1123+00		—	4.1	"	.8			"	1308.58	1306.97	240	.0067	24	20	7.0	.0054	1.30	[illegible]	1309.3
P 38	1123+00 1119+72		3.1	7.2	"	.6	1.2	4.1	30	1306.97	1306.18	330	.0024	30	22	6.1	.0046	1.52	[illegible]	1307.8
P 37	1119+72 1116+00		[illegible]	7.2	"	.9			"	1306.18	1305.36	375	.0022	36	34	5.0	.0017	0.65	[illegible]	1307.1
P 36	1116+00		2.4	9.6	"	1.6	14	3.8	36	1305.36	1305.23	36	.0036	36	43	5.5	.0025	0.09	[illegible]	1307

Computed by: MAL Checked by: MRC Date: 11/21/89

Tab 5

CHECKED BY TIAL DATE

SCALE

SCOUR ANALYSIS SUMMARY -

REACH		TOTAL SCOUR, FT.
SCATTERWASH,	SECT 117.82 - 117.72	0.07'
	SECT 117.71 - 117.65	1.81'
	SECT 117.62 - 117.48	6.41'
	SECT 117.58 - 117.48	5.82'
	SECT 117.36 - 117.14	1.44'
SKUHK CREEK,	SECT 16.908 - 16.870	1.05'
	SECT 16.761 - 6.515	1.20'

SCOUR ANALYSIS -

TOTAL SCOUR = GENERAL SCOUR + CONTRACTION SCOUR

GENERAL SCOUR:

$Y_G = 2\,D_{CRIT}\,(1/P_c - 1)$

$2\,D_{CRIT}$ = THICKNESS OF ARMORING LAYER

P_c = % OF BED MATERIAL COARSER THAN D_{CRIT}

$D_{CRIT} = \tau_{MAX} / 0.047\,(\gamma_s - \gamma_w)$ - SHIELDS EQ.

$\tau_{MAX} = \gamma_w\, Y\, S_b$

CONTRACTION SCOUR:

$Y_2 = Y_1\,(Q_T/Q_c)^{6/7}\,(w_1/w_2)^{K_1}\,(n_2/n_1)^{K_2}$ - LARSEN 1960

$Y_S = Y_2 - Y_1$

- SCATTER WASH - SECT 17.82 TO SECT 117.72

$S_b = \dfrac{43.5 - 43.36}{745} = 0.0002'/FT$

$\tau_{MAX} = (62.4)(6.3')(0.0002) = 0.079$ ✓

$D_{CRIT} = 0.079 / 0.047(165 - 62.4) = 0.016' = 4.9\,mm$ ✓

$\therefore P_c = 0.30$

$Y_G = 2(0.016)(1/0.30 - 1) = 0.07'$ ✓

DEPTH OF SCOUR

- SCATTER WASH - SECT 117.71 TO SECT 117.65

$S_b = \frac{43.0 - 42.56}{410} = 0.0011'/FT$

$\tau_{MAX} = (62.4)(3.20)(0.0011) = 0.220$

$D_{CRIT} = 0.220/0.047(165 - 62.4) = 0.046' = 14\,mm$

$\therefore P_c = 0.43$

$Y_G = 2(0.046)(1/0.43 - 1) = 0.12'$

$Y_2 = 3.20(6100/6100)^{6/7}(776.63/400)^{0.64}(0.03/0.03)^{0.21}$

$= 4.89'$

$Y_c = 4.89 - 3.20 = 1.69$

$Y_T = 1.69 + 0.12 = 1.81'$ ← DEPTH OF SCOUR

- SCATTER WASH - SECT 117.62 TO SECT 117.48

$S_b = \frac{42.56 - 39.50}{749} = 0.0041'/FT$

$\tau_{MAX} = (62.4)(4.76)(0.0041) = 1.218$

$D_{CRIT} = 1.218/0.047(165 - 62.4) = 0.25' = 77\,mm$

$\therefore P_c = 0.26$

$Y_G = 2(0.25)(1/0.26 - 1) = 1.42'$

$Y_2 = (4.76)(6100/6100)^{6/7}(389.07/126.81)^{0.64}(0.03/0.03)^{0.21}$

$= 9.75'$ ✓

$Y_c = 9.75 - 4.76 = 4.99'$ ✓

$Y_T = 4.99 + 1.42 = 6.41'$ ✓ ← DEPTH OF SCOUR

- SCATTER WASH - SECT 117.58 TO SECT 117.48

$S_b = \frac{42.28 - 39.50}{549} = 0.0051$ '/FT ✓

$\tau_{max} = (62.4)(5.27)(0.0051) = 1.677$ ✓

$D_{crit} = 1.677/0.047(165 - 62.4) = 0.35' = 106$ mm ✓

$\therefore P_c =$

$Y_G = 2(0.35)(1/0.23 - 1) = 2.34'$ ✓

$Y_2 = (5.27)(6100/6100)^{6/7}(280.03/126.81)^{0.64}(0.03/0.03)^{0.21}$

$= 8.75'$ ✓

$Y_c = 8.75 - 5.27 = 3.48'$ ✓

$Y_T = 3.48 + 2.34 = 5.82$ ✓ ← DEPTH OF SCOUR

- SCATTER WASH - SECT 117.36 TO SECT 117.14

$S_b = \frac{36.22 - 31.87}{1135} = 0.0038$ '/FT ✓

$\tau_{max} = (62.4)(5.74)(0.0038) = 1.361$ ✓

STANLEY/METTEE-McGILL-MURPHY
1450 EAST INDIAN SCHOOL ROAD
PHOENIX, ARIZONA 85014

$D_{CRIT} = 1.361/0.047(165 - 62.4) = 0.28' = 86\ mm$

$\therefore P_c =$

$Y_G = 2(0.28)(1/0.28 - 1) = 1.44'$

DEPTH OF SCOUR

- SKUNK CREEK - SECT 16.908 TO SECT 16.870

$S_b = \frac{26.30 - 25.51}{200} = 0.0040'/FT$

$\tau_{MAX} = (62.4)(5.3)(0.0040) = 1.323$

$D_{CRIT} = 1.323/0.047(165 - 62.4) = 0.27' = 84\ mm$

$\therefore P_c = 0.52$

$Y_G = 2(0.27)(1/0.52 - 1) = 0.50$

$Y_2 = (5.3)(2600/2600)^{3/7}(99.63/85.33)^{0.64}(0.030/0.030)^{0.21}$

$= 5.85'$

$Y_c = 5.85 - 5.30 = 0.55'$

$Y_T = 0.50 + 0.55 = 1.05'$ DEPTH OF SCOUR

- SKUNK CREEK - SECT 16.761 TO SECT 6.515

$S_b = \frac{21.07 - 17.23}{1321} = 0.0029'/FT$

$\tau_{MAX} = (62.4)(5.57)(0.0029) = 1.008$

$D_{CRIT} = 1.008/0.047(165 - 62.4) = 0.21' = 64\ mm$

STANLEY/METTEE-McGILL-MURPHY
1450 EAST INDIAN SCHOOL ROAD
PHOENIX, ARIZONA 85014

JOB: OUTER LOOP HIGHWAY
SHEET NO. 6 OF 15
CALCULATED BY: DWB DATE: 5/5/89
CHECKED BY: MAL DATE: 5/9/89
SCALE:

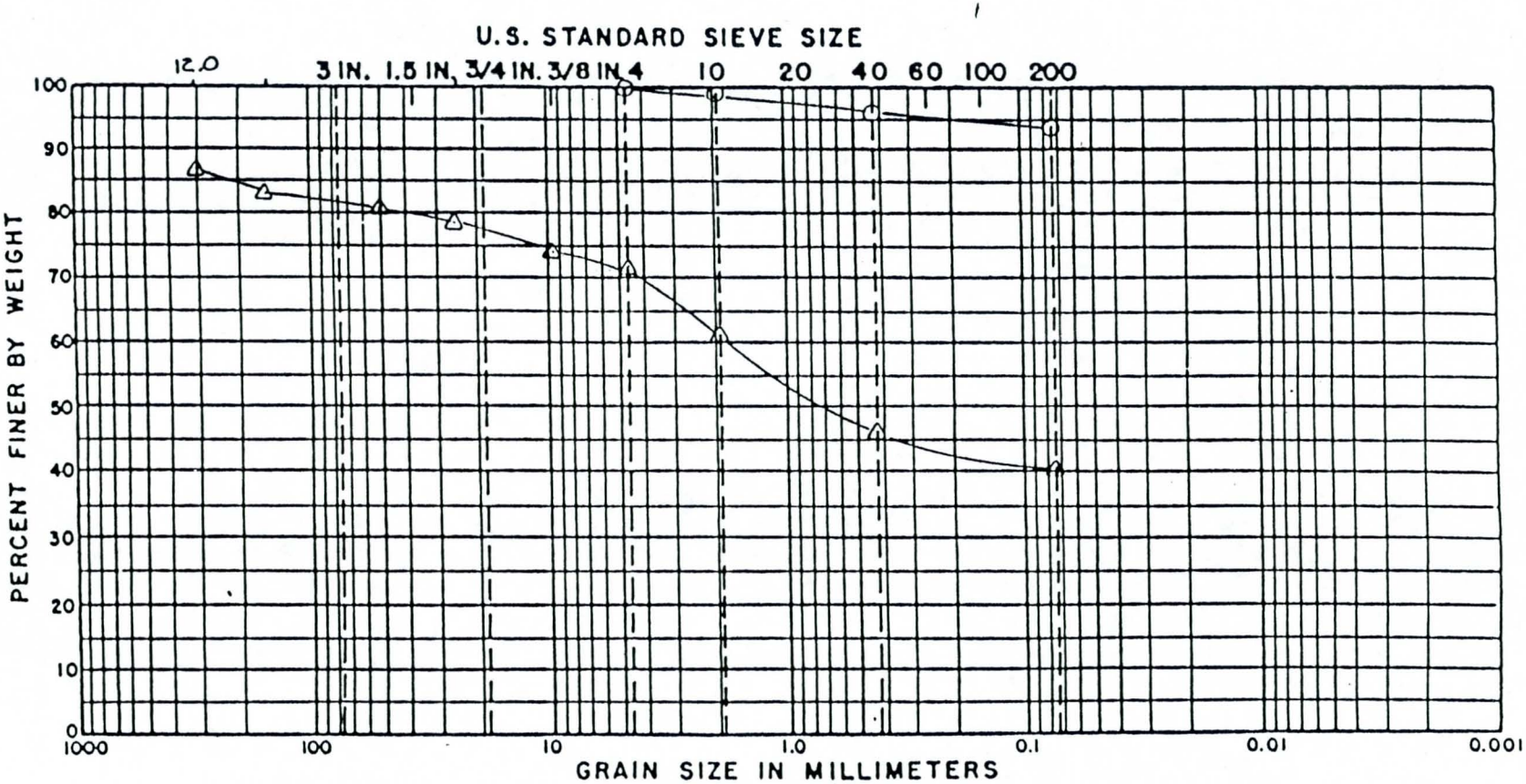
$\therefore P_c = 0.26$

$Y_G = 2(0.21)\left(\frac{1}{0.26} - 1\right) = 1.20'$ ✓ ← DEPTH OF SCOUR

D_c = 0.016' = 4.9 mm

0' - 1'	1' @ 100% FINER	(0.10)(1.0) + (0.43)(.71) + (0.29)(.55) + (0.19)(.69) = 70% FINER
1' - 5.5'	4.5' @ 71%	30% COARSE
5.5' - 8.5'	3' @ 55% "	∴ P_c = 0.30
8.5' - 10.5'	2' @ 69% "	

SCATTER WASH SECT 17.82 TO SECT 117.72



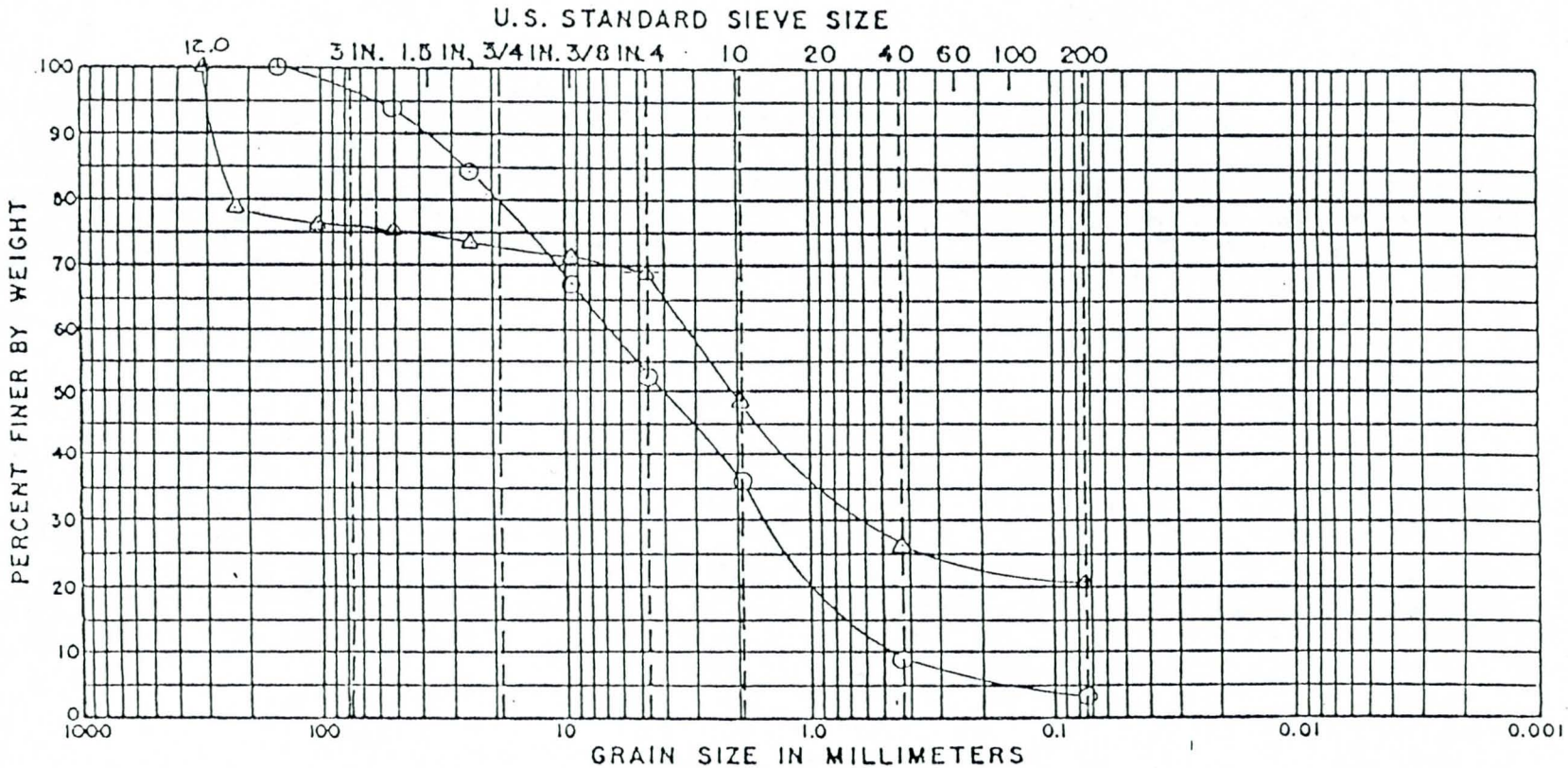
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

	DEPTH	CLASSIFICATION		NAT. WC	LL	PL	PI	
○ T-16 S-1	0 - 1.0'	ML	Silt, Some Sand	-	-	-	-	D_{50} = N/A
△ T-16 S-2	1.0 - 5.5'	SM	Silty Sand, Sm. Grav.	-	-	-	-	D_{50} = N/A

OUTER LOOP HIGHWAY
SCOUR ANALYSIS
SHT 7/15

GRADATION CURVE

SPEDDIE & ASSOCIATES



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

	DEPTH	CLASSIFICATION		NAT. WC	LL	PL	PI	
○ T-16 S-3	5.5 - 8.5'	SW	Gravelly Sand	-	-	-	-	D_{50}= 0.12 in.
△ T-16 S-4	8.5 - 10.5'	SM	Silty Sand Sm. Grav.	-	-	-	-	D_{50}= N/A

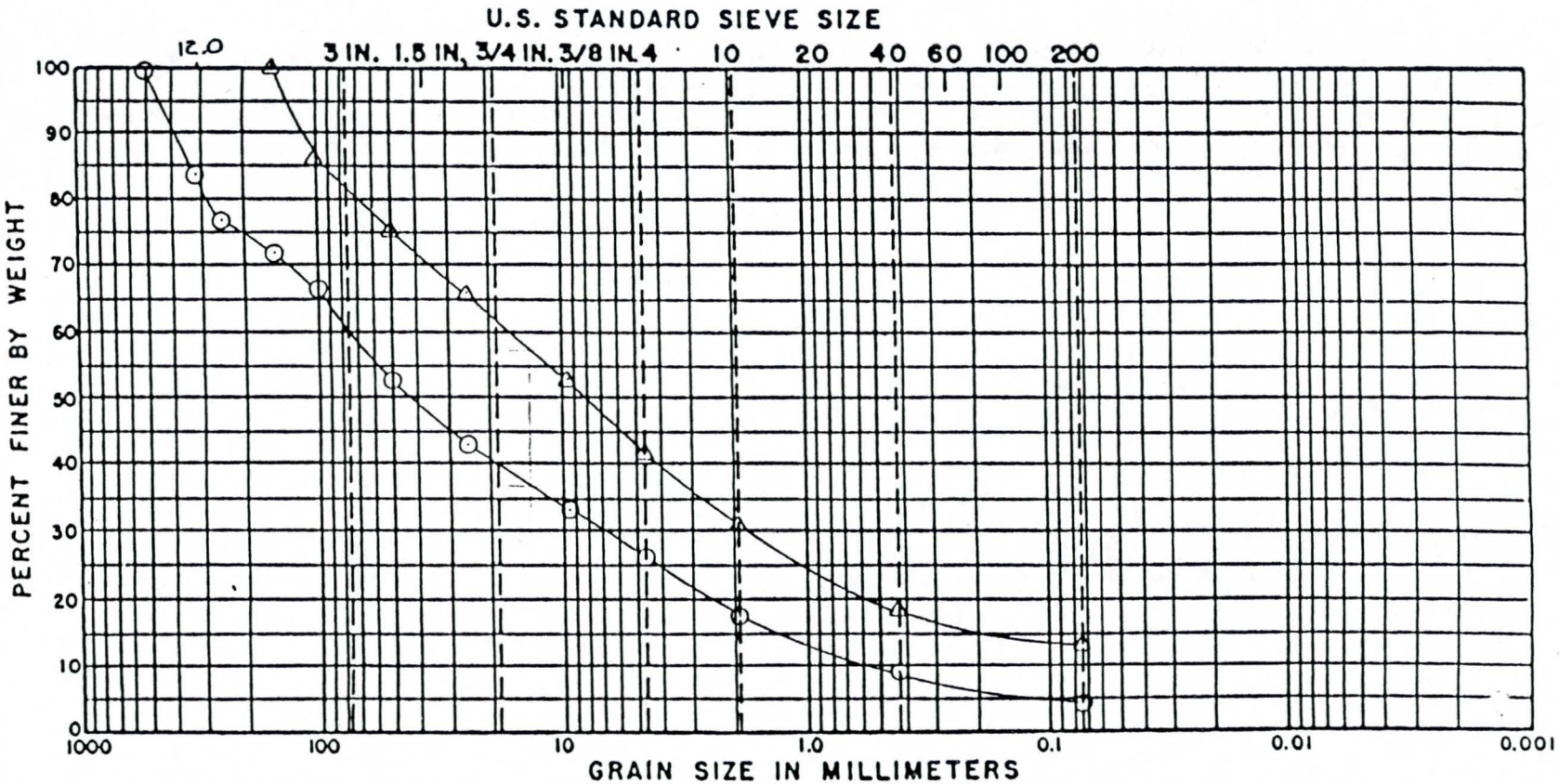
OUTER LOOP HIGHWAY
SCOUR ANALYSIS.
SHT 8/15

GRADATION CURVE

$D_c = 0.046' = 14\ mm$

0'-4.5'	4.5' @ 37% FINER	(.38)(.37) + (.42)(.57) + (.13)(.86) + (0.08)(1.0) = 57% FINER
4.5'-9.5'	5.0' @ 57% "	% COARSER
9.5'-11.0'	1.5' @ 86% "	
11.0'-12.0'	1.0' @ 100% "	∴ P_c = .43

SCATTER WASH SHOT 117.71 TO SHOT 117.65



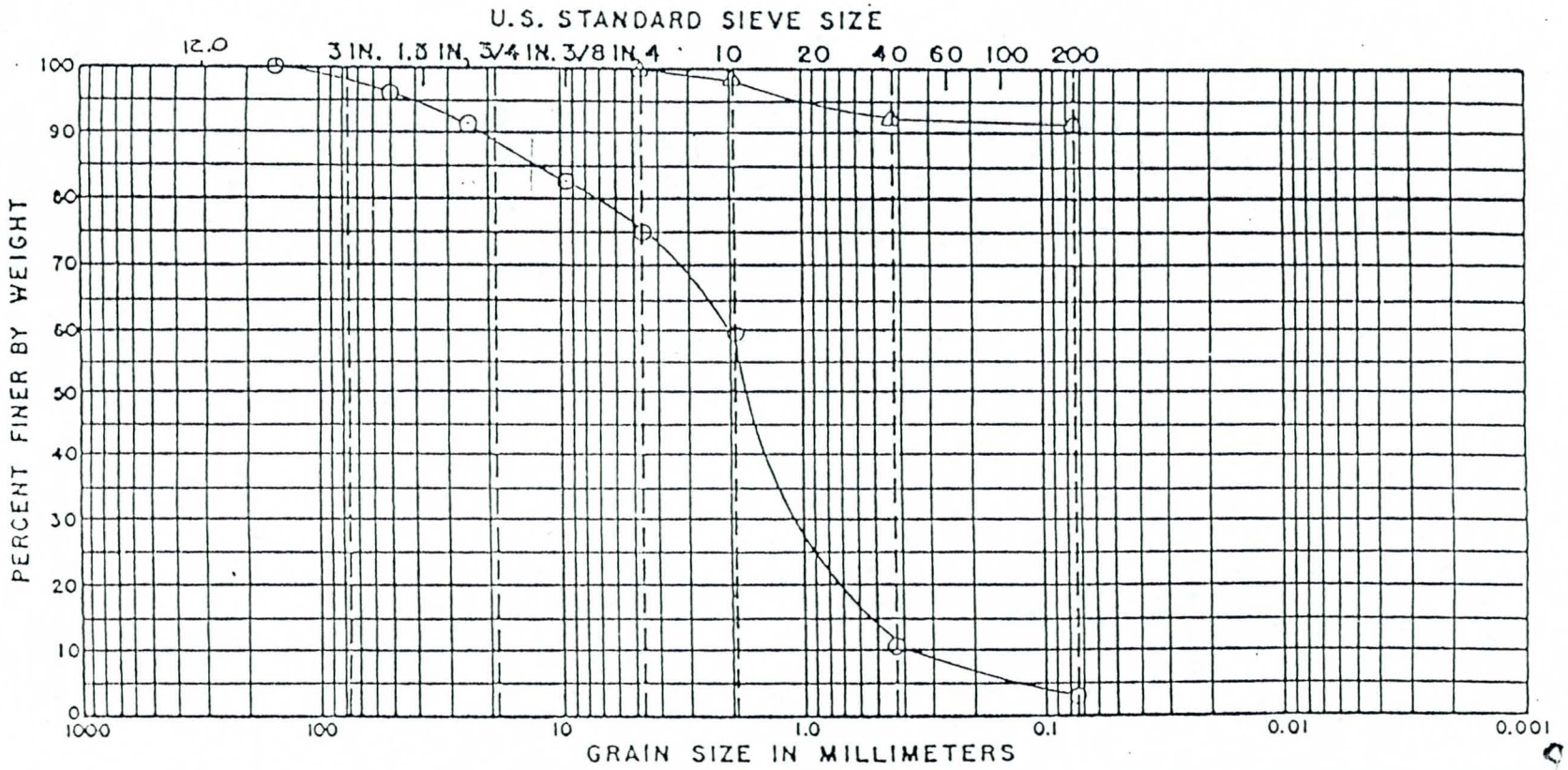
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

	DEPTH	CLASSIFICATION		NAT. WC	LL	PL	PI	
○ T-15 S-1	0 - 4.5'	GW	Sand, Gravel & Cobbles	-	-	-	-	D_{50} = 1.70 in.
△ T-15 S-2	4.5 - 9.5'	GM	Sand, Gravel & Cobbles	-	-	-	-	D_{50} = 0.31 in.

OUTER LOOP HIGHWAY
SCOUR ANALYSIS
SHT 9/15

GRADATION CURVE

SPEEDIE & ASSOCIATES



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

	DEPTH	CLASSIFICATION		NAT. WC	LL	PL	PI	
○ T-15 S-3	9.5 - 11.0'	SW	Gravelly Sand	-	-	-	-	D_{50} = N/A
△ T-15 S-4	11.0 - 12.0'	ML	Silt, Some Sand	-	-	-	-	D_{50} = N/A

OUTER LOOP HIGHWAY
SCOUR ANALYSIS
SHT 10/15

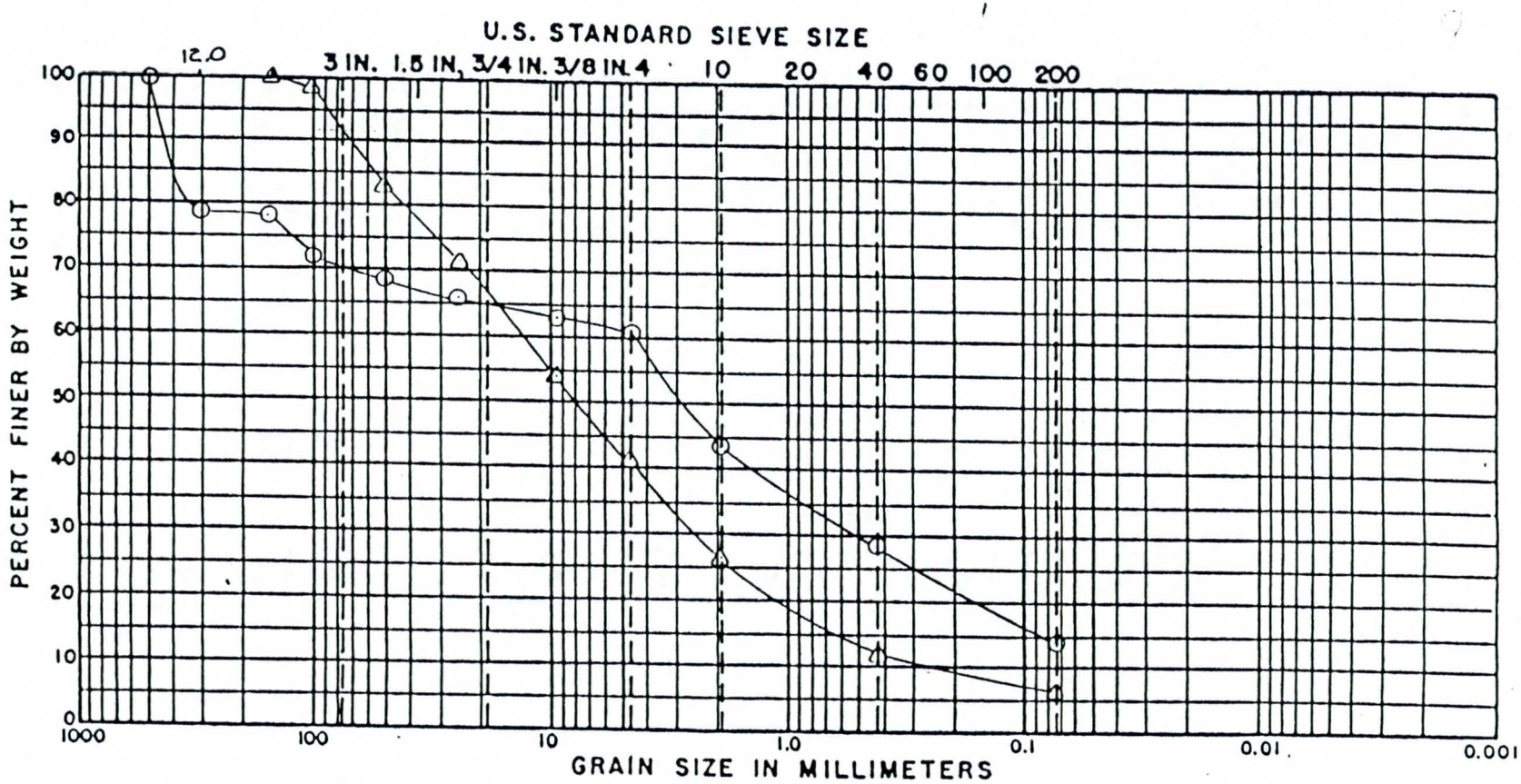
GRADATION CURVE

SHEFFIELD & ASSOCIATES

$D_c = 0.25' = 77mm$ 3'-9.5' 6.5' @ 70% FINER (.81)(.70) + (0.19)(.72) = 74% FINER
9.5'-11' 1.5' @ 72% " 26% COARSER

$\therefore P_c = 0.26$

SCATTER WASH - SECT 117.62 TO SECT 117.48



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

	DEPTH	CLASSIFICATION		NAT. WC	LL	PL	PI	
○ T-13 S-2	3.0 - 9.5'	GM	Sand, Gravel & Cobbles	-	-	-	-	D_{50} = 0.12 in.
△ T-13 S-3	9.5 - 11.0'	GW/GM	Sandy Gravel Tr. Silt	-	-	-	-	D_{50} = 0.31 in.

$D_c = 0.35' = 106mm$ 6.5' @ 72% FINER (.81)(.72) + (.19)(.98) = 77% FINER
1.5' @ 98% FINER 23% COARSER

$\therefore P_c = 0.23$

GRADATION CURVE

OUTER LOOP HIGHWAY
SCOUR ANALYSIS
SHT 11/15

SPEEDIE & ASSOCIATES
CONSULTING ENGINEERS

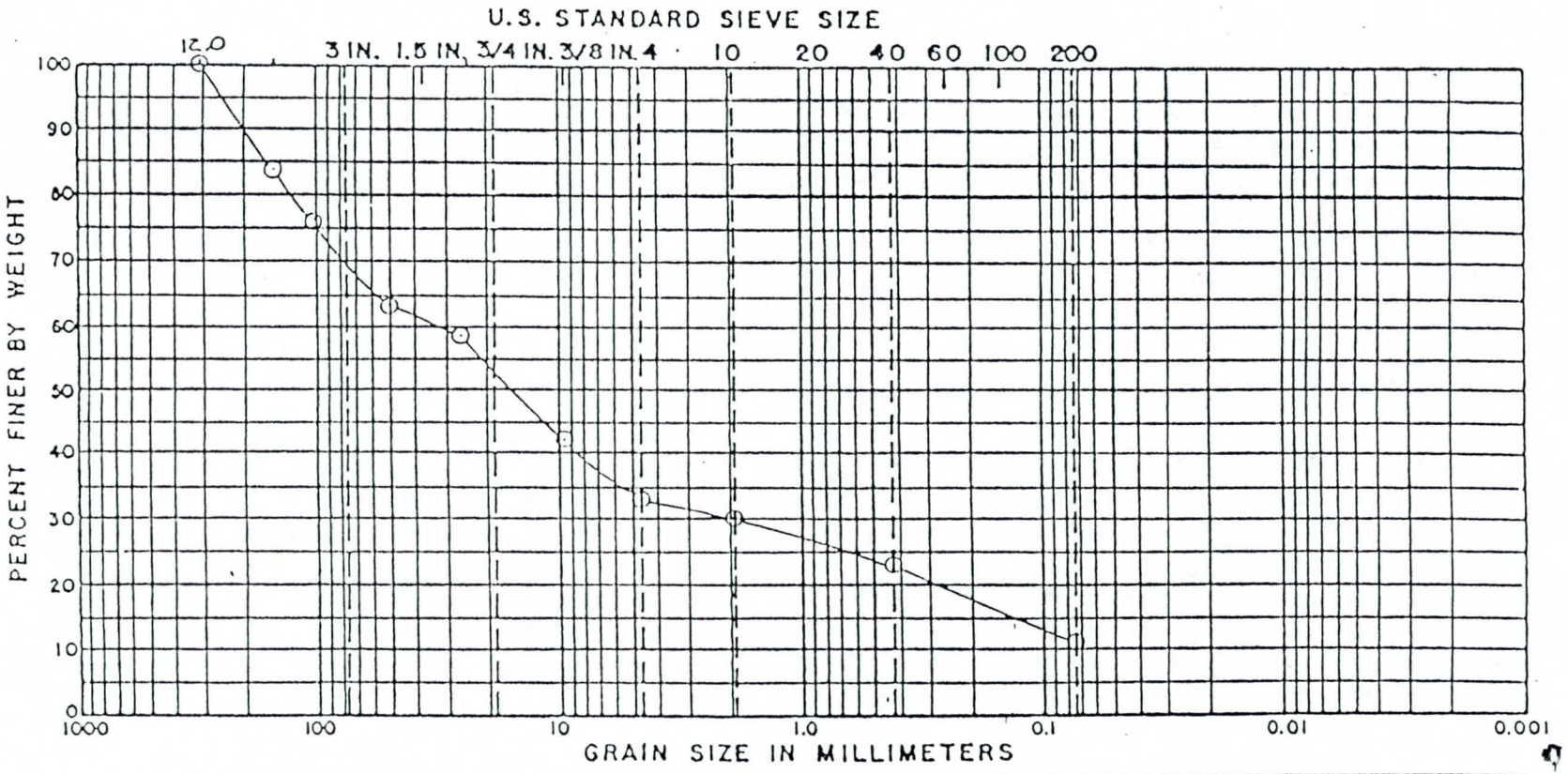
D_c = 0.28 = .36mm

72% FINER

28% COARSER

∴ P_c = 0.28

SCATTER LOCATION SHOT 117.36 TO SHOT 117.14



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

	DEPTH	CLASSIFICATION		NAT. WC	LL	PL	PI	
○ T-9 S-2	1.5 - 10.0'	GM	Sandy Gravel Some Silt	-	-	-	-	D50= 0.67 in.

OUTER LOOP HIGHWAY
SCOUR ANALYSIS
SHT 12/15

GRADATION CURVE

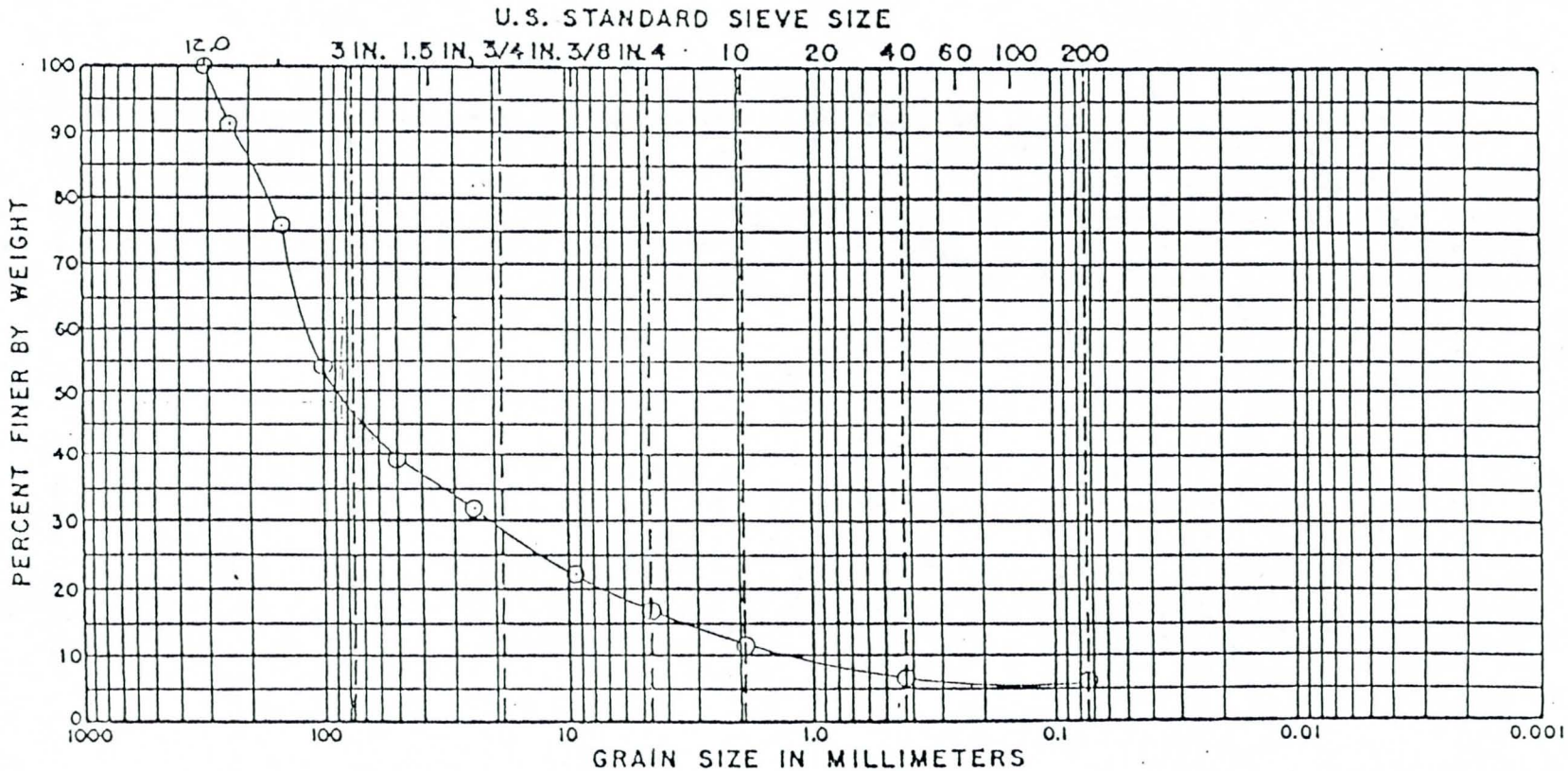
COFFMAN & ASSOCIATES

$D_c = 0.27" = 84$ mm

48% FINER

52% COARSER $\therefore P_c = 0.52$

SKUNK CREEK SECT 16.908 TO SECT 16.870



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

	DEPTH	CLASSIFICATION		NAT. WC	LL	PL	PI	
O T-2 S-1	0 - 8.0	GW/GM	Sand, Gravel &	-	-	-	-	D_{50}=3.50 in.
			Cobbles					

OUTER LOOP HIGHWAY
SCOUR ANALYSIS
SHT 13/15

GRADATION CURVE

SPEEDIE & ASSOCIATES

τ = 0.21' = 64 mm

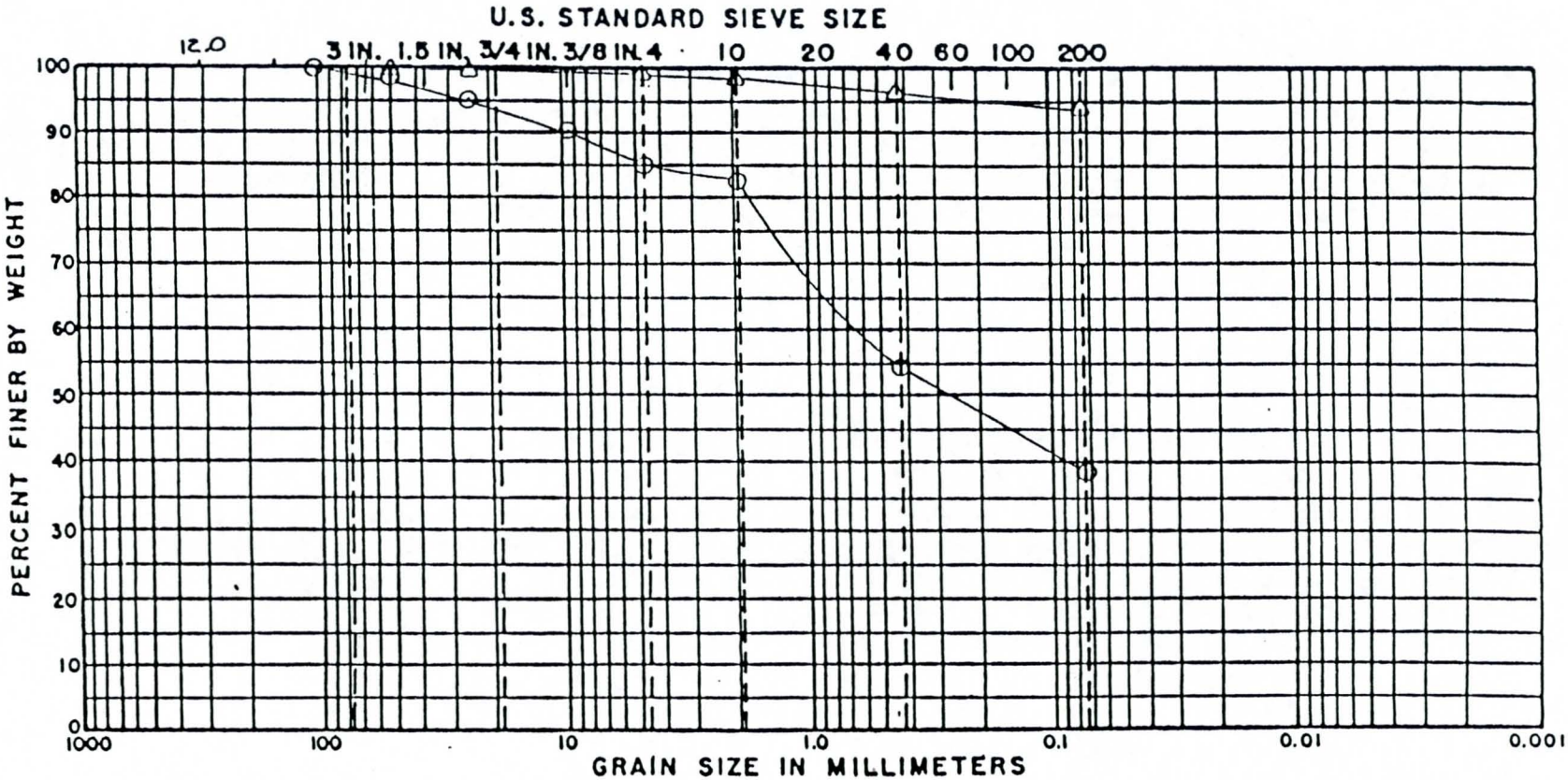
0' - 3' 3' @ 100% FINER
3' - 4' 1' @ 98% "
4' - 6' 2' @ 63% "
6' - 10' 4' @ 53% "

(.3)(1.0) + (.1)(.98) + (.2)(.63) + (.4)(.53) = 74% FINER

∴ 26% COMPSTN

∴ P_c = .26

SKUKIC CREEK STA 16.761 TO STA 6.515



SKUKIC

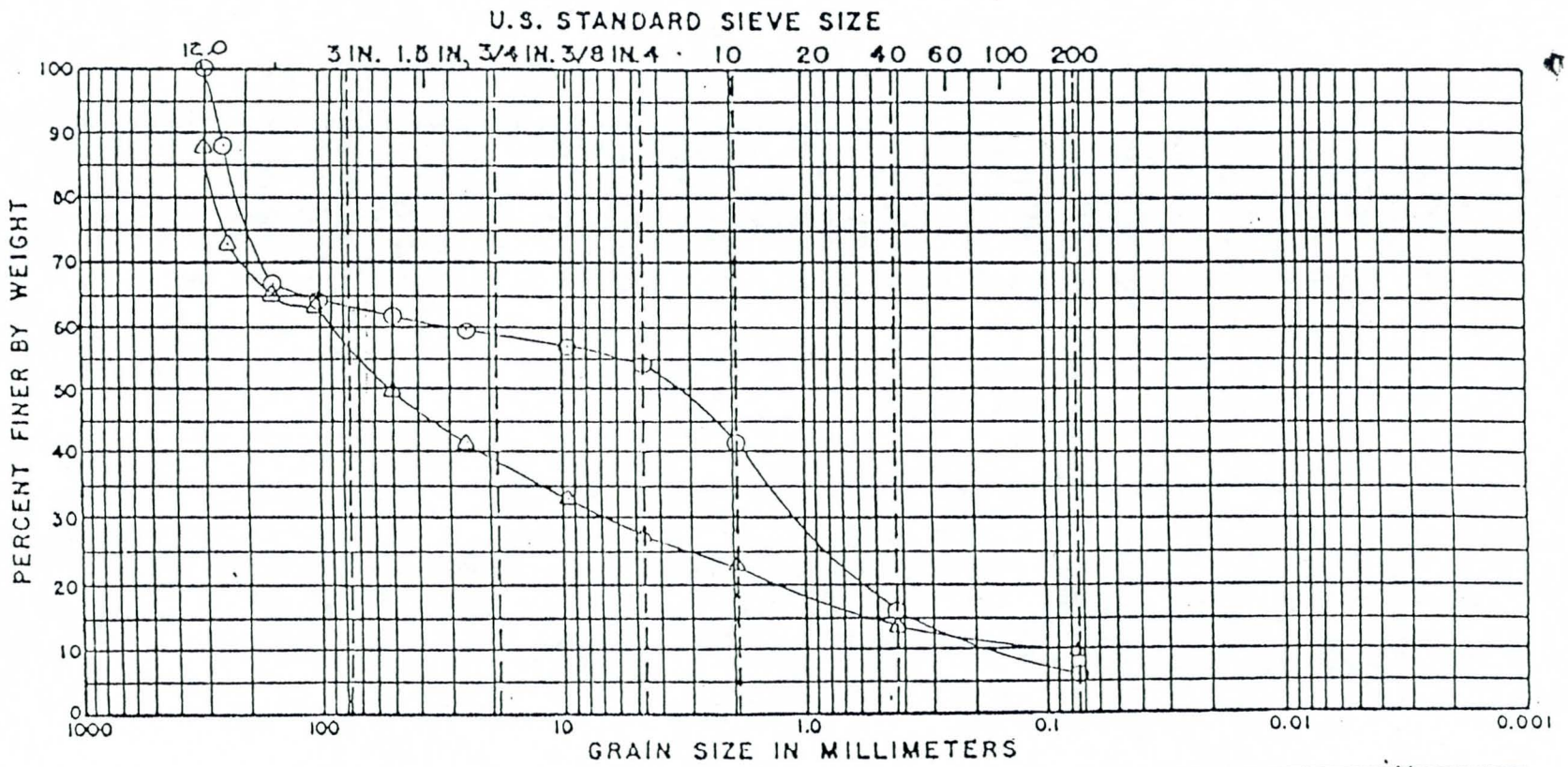
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

	DEPTH	CLASSIFICATION		NAT. WC	LL	PL	PI	
○ T-4 S-1	0 - 3.0'	ML	Silt With Some Sand	-	-	-	-	D_{50} = N/A
△ T-4 S-2	3.0 - 4.0'	SM	Silty Sand Sm. Grav.	-	-	-	-	D_{50} = N/A

OUTER LOOP HIGHWAY
SCOUR ANALYSIS
SHT 14/15

GRADATION CURVE

SPEEDIE & ASSOCIATES



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

	DEPTH	CLASSIFICATION		NAT WC	LL	PL	PI	
○ T-4 S-3	4.0 - 6.0'	SW/SM	Sand, Gravel & Cobbles	-	-	-	-	D_{50}= 0.13 in.
△ T-4 S-5	6.0 - 10.0'	SW/SM	Sand, Gravel & Cobbles	-	-	-	-	D_{50}= 2.0 in.

OUTER LOOP HIGHWAY
SCOUR ANALYSIS
SHT 15/15

GRADATION CURVE

SPEEDIE & ASSOCIATES