JACOBS

Submitted to:

Flood Control District of Maricopa County

City of Peoria

Final Drainage Report **Volume I of I**

83rd Avenue / Pinnacle Peak Road Drainage Improvements FCDMC Contract No. 2003C060 Project Control No. 450.02.33

January, 2006

83rd AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
FCDMC CONTRACT NO. 2006C005
PROJECT CONTROL NO. 450.02.33
THIS FINAL DRAINAGE REPORT
HAS BEEN AMENDED BY A
SUPPLEMENT DATED MARCH, 2006.

A450.307

Submitted by:

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83rd Avenue/Pinnacle Peak Road Drainage Improvements

Prepared for:

Flood Control District of Maricopa County

City of Peoria

Final Drainage Report

FCDMC Contract No. 2003C060
Project Control No. 450.02.33

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Foreword

This Final Drainage Report has been prepared to summarize and document the drainage analyses and computations required for the 90% Plans submittal. As described in the 83rd Avenue/Pinnacle Peak Road Drainage Improvement scope of work, these calculations included hydrology, basins design, closed conduit storm drain design, catch basins design, inlets design and outlet protection design. All analyses were conducted for a 100-year storm event except the storm drains west of 87th Avenue which were designed for the 10-year storm event. The drainage system described in this report was developed from the concepts identified in the Pre-Design Report for 91st Avenue Extension.

After the 90% Plans have been reviewed and approved, completion of final design and construction documents will begin immediately. Public involvement and guidance by the Flood Control District of Maricopa County, City of Peoria, and Maricopa County Department of Transportation will continue to provide the direction needed to complete this project and meet the project goals.

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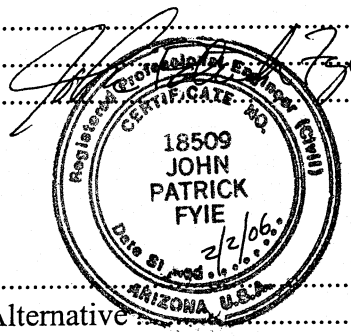

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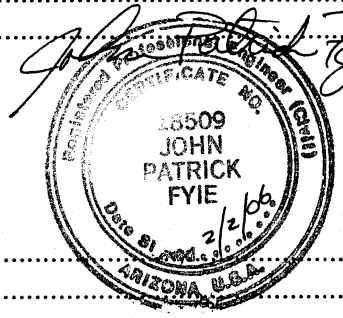

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StormCAD Files

Section 1
Introduction

This project was identified in the Glendale/Peoria Area Drainage Master Plan (ADMP) Update prepared by the consultant firm Entellus. The study was completed in December, 2001 and was sponsored by the Flood Control District of Maricopa County and the City of Peoria. The purpose of the study was to update the original Glendale/Peoria ADMP prepared in 1987 by CDM Inc. and JM Montgomery Inc. The ADMP update was divided into three Levels – Levels 1 through 3. Level 1 included the evaluation of flooding issues, evaluation of the previous ADMP and formulation of very general mitigation alternatives. Level 2 evaluated and refined the base alternatives and Level 3 determined and developed the recommended alternatives.

As identified in Level 3, this project was the recommended alternative for the Northwest Region – 83rd Avenue/Pinnacle Peak Road Region, Preferred Alternative Number 4. This project also ranks first in the City of Peoria's priority of projects as a FY 2002-2003 Capital Improvement Project. This project will be a joint project by the Flood Control District of Maricopa County, Maricopa County Department of Transportation and City of Peoria.

After a Value Engineering Study, Jacobs Civil was directed by the District and City of Peoria to prepare a Pre-Design Study to extend the flood protection facilities west to 91st Avenue. As a result, the Calle Lejos detention basin was replaced with a basin at 87th Avenue and Avenida del Sol. The recommended alternative has additional storm drains in Avenida del Sol, Cielo Grande and Pinnacle Peak Road between 87th Avenue and 91st Avenue. These additional storm drains will be designed to intercept the 10-year peak discharges. The revised project is being funded by the Flood Control District of Maricopa County, City of Peoria and Maricopa County Department of Transportation.

1.1 Project Site

This project is located in the center of Maricopa County in the northwest portion of the Phoenix metropolitan area. The study area is between Deer Valley Road and Hatfield Road and between 81st Avenue and 91st Avenue, as shown in Figure 1-1. In the area between 83rd Avenue and 91st Avenue, storm water runoff drains by sheetflow and small concentrated flows in a southerly direction from the Sunrise Mountains to Deer Valley Road. Most of the streets in this area are unimproved without a storm drain system.

The project site consists of nine principal components:

- Detention basin at 87th Avenue,
- Detention basin at 83rd Avenue and Pinnacle Peak Road,
- Closed conduit storm drain along Calle Lejos,

- Closed conduit storm drain along 87th Avenue,
- Closed conduit storm drain along Avenida del Sol,
- Closed conduit storm drain along 89th Avenue,
- Closed conduit storm drain along Cielo Grande,
- Closed conduit storm drain along Pinnacle Peak Road, and
- Closed conduit storm drain along 83rd Avenue.

See Figure 1-2. The purpose of the project is to provide flood protection for a 100-year storm by collecting runoff in storm drains then routing the flows through offline detention basins. The reduced peak flow would be conveyed to an existing open channel at Deer Valley Estates, south of the 83rd Avenue and Williams Road intersection.

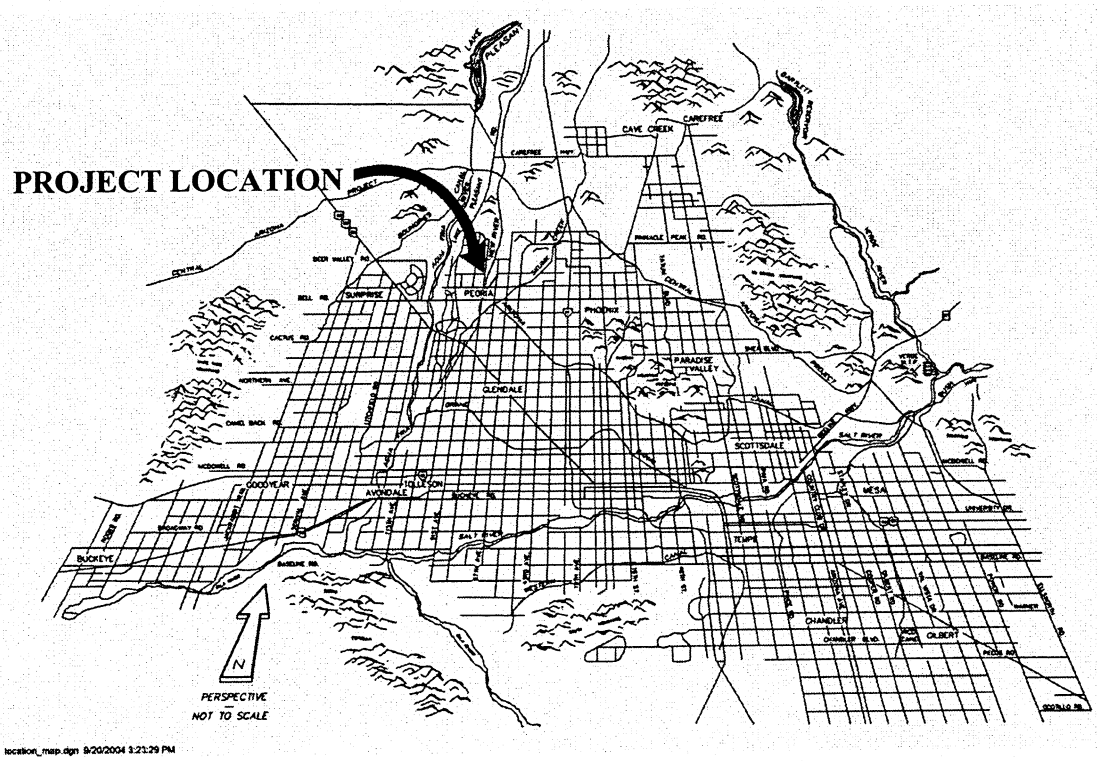


Figure 1-1
Location Map

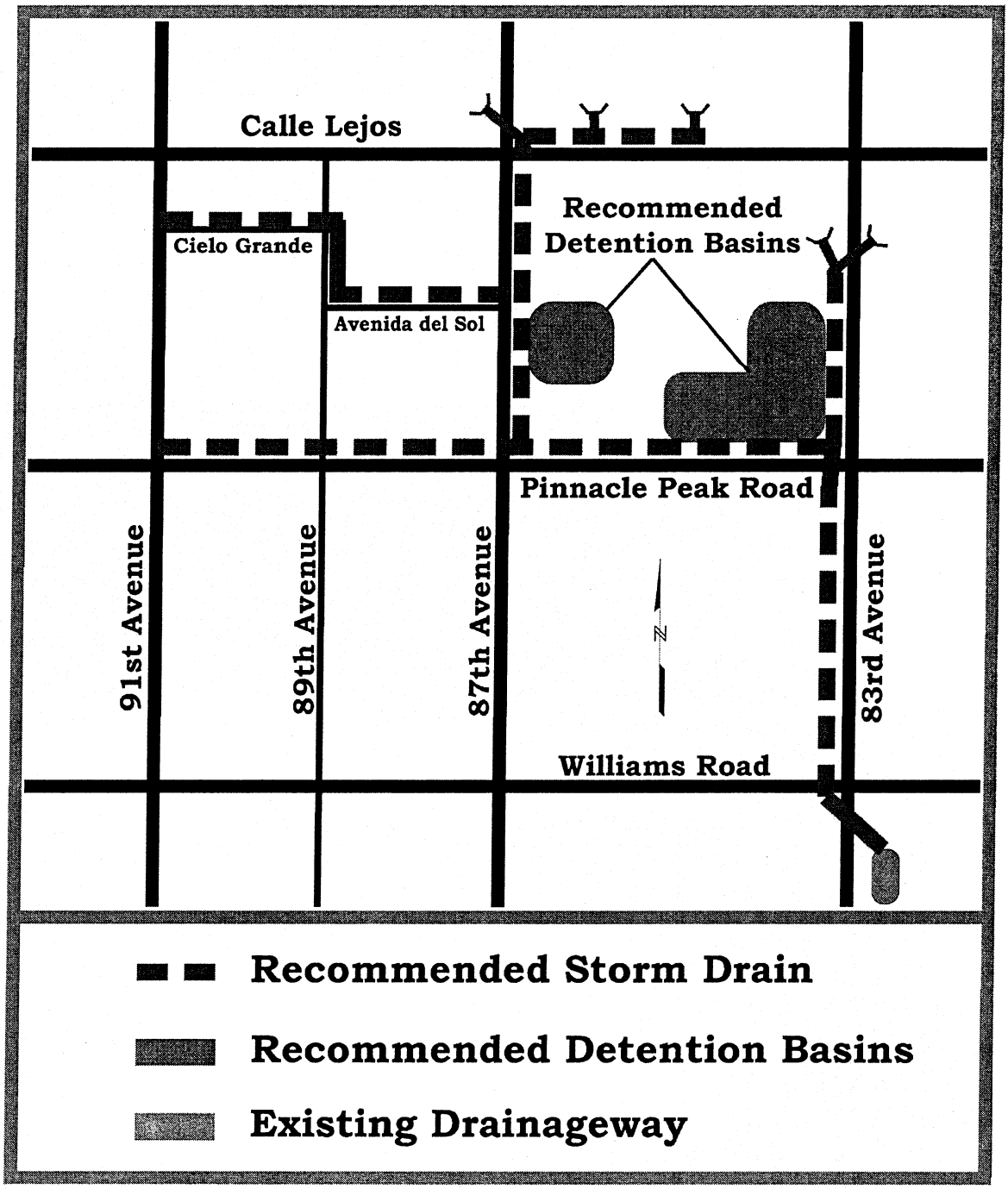
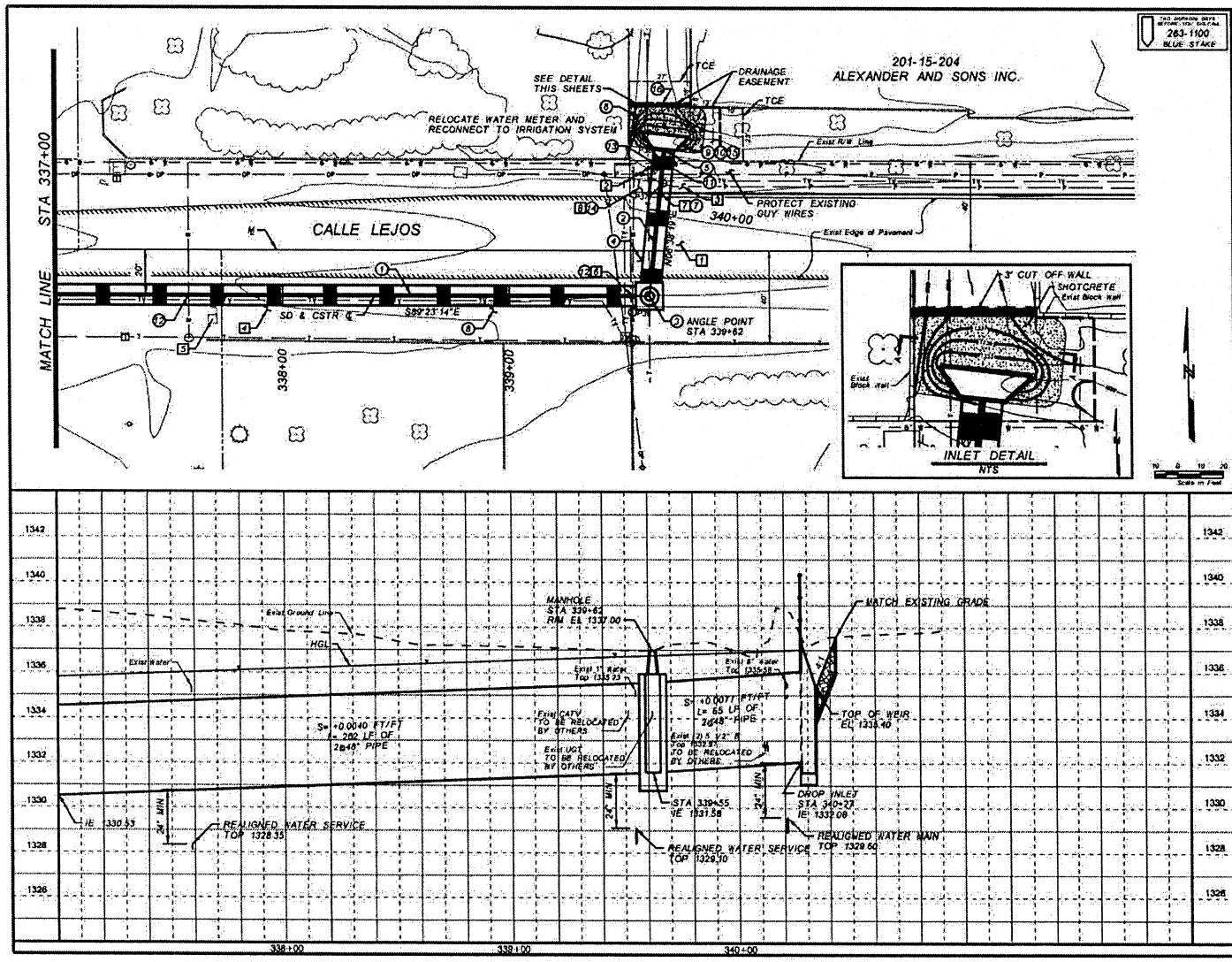


Figure 1-2
ADMP Update – Recommended Alternative

1.2 Description of Improvements

Calle Lejos Storm Drain (Station 340+27 to Station 326+47)

Runoff from the subbasins north of Calle Lejos is concentrated at two locations. The majority of storm water flows southerly in a wash immediately to the west of the Summitt at Sunrise development. At this location a drop inlet will collect the flows and convey the runoff westerly in a storm drain comprised of reinforced concrete pipe (RCP). The runoff from another wash near Station 336+66 will be collected by a lateral pipe to a drop inlet. The Calle Lejos storm drain will be constructed of 2-48" RCP, 1-72" RCP and 1-78" RCP. Due to the adverse grade along Calle Lejos, the storm drain will become deeper as it approaches 87th Avenue. To attain adequate cover for the storm drains, invert elevations are matched at manholes where the pipe changes size. At Station 327+25 a prefabricated fitting will be provided to connect to a 60" lateral that drains a inlet structure at the Ventana Picachos east retention basin. At Station 326+47 the storm drain will be directed south in 87th Avenue. At this location, a 60" lateral will be constructed toward the northwest to intercept excess flows from the west retention basin being constructed for the Ventana Picachos development. See Figures 1-3 to 1-6. Design flows are 352 cubic feet per second (cfs) from Station 326+47 to Station 327+25, 194 cfs between Station 327+25 and Station 336+62 and 175 cfs from Station 336+62 to Station 340+27. Near the manhole to be constructed at the intersection of Calle Lejos and 87th Avenue, 193 cfs will be directed from the Ventana Picachos development into the storm drain system.



REMOVE		
1	ASPHALT PAVEMENT	58 SY
2	WATER MAIN, GATE VALVE AND METER	N.P.I.
3	REMOVE AND REPLACE IN KIND LANDSCAPE STONE	N.P.I.
4	REMOVE AND REPLACE IN KIND LANDSCAPE BLOCK WALL AND LIGHTS	N.P.I.
5	REMOVE AND REINSTALL MAILBOX	1 EA
6	WATER SERVICE	N.P.I.
7	REMOVE CURB AND GUTTER	15 LF
8	REMOVE CONCRETE SIDEWALK	75 SF

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	337+00 TO 339+62	2@48	524
2	339+62 TO 340+27	2@48	130

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
3	339+62	DTL 16	DTL 16

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
4	339+70 TO 340+06	SY	58

NEW CATCH BASIN AND CONNECTOR PIPE

NO.	STATION	TYPE	LENGTH AND SIZE
5	340+27	DTL 22	N/A

6	SHOTCRETE	523 SF
7	CURB AND GUTTER REPLACEMENT, MAG 220 TYPE A	15 LF
8	NATIVE HYDROSEEDING	4780 SF
9	42" STEEL HANDRAIL, DTL 01	23 LF
10	TRASH RACK, MAG 502	N.P.I.
11	VERTICAL REALIGNMENT FOR WATER MAIN, DTL 25	1 EA
12	VERTICAL REALIGNMENT FOR WATER SERVICE, DTL 25	2 EA
13	RELOCATE 6" GATE VALVE AND WATER METER	1 LS
14	SIDEWALK REPLACEMENT, MAG 230	75 SF
15	CONCRETE STAINING	N.P.I.
16	CUT-OFF WALL 3' DEEP MAG 552	25 LF

NO.	REVISION	BY	DATE
3			
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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

90% PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	J. FYIE	03/2006
DRAWN	S. RIVERA	03/2006
CHECKED		

JACOBS CIVIL INC.

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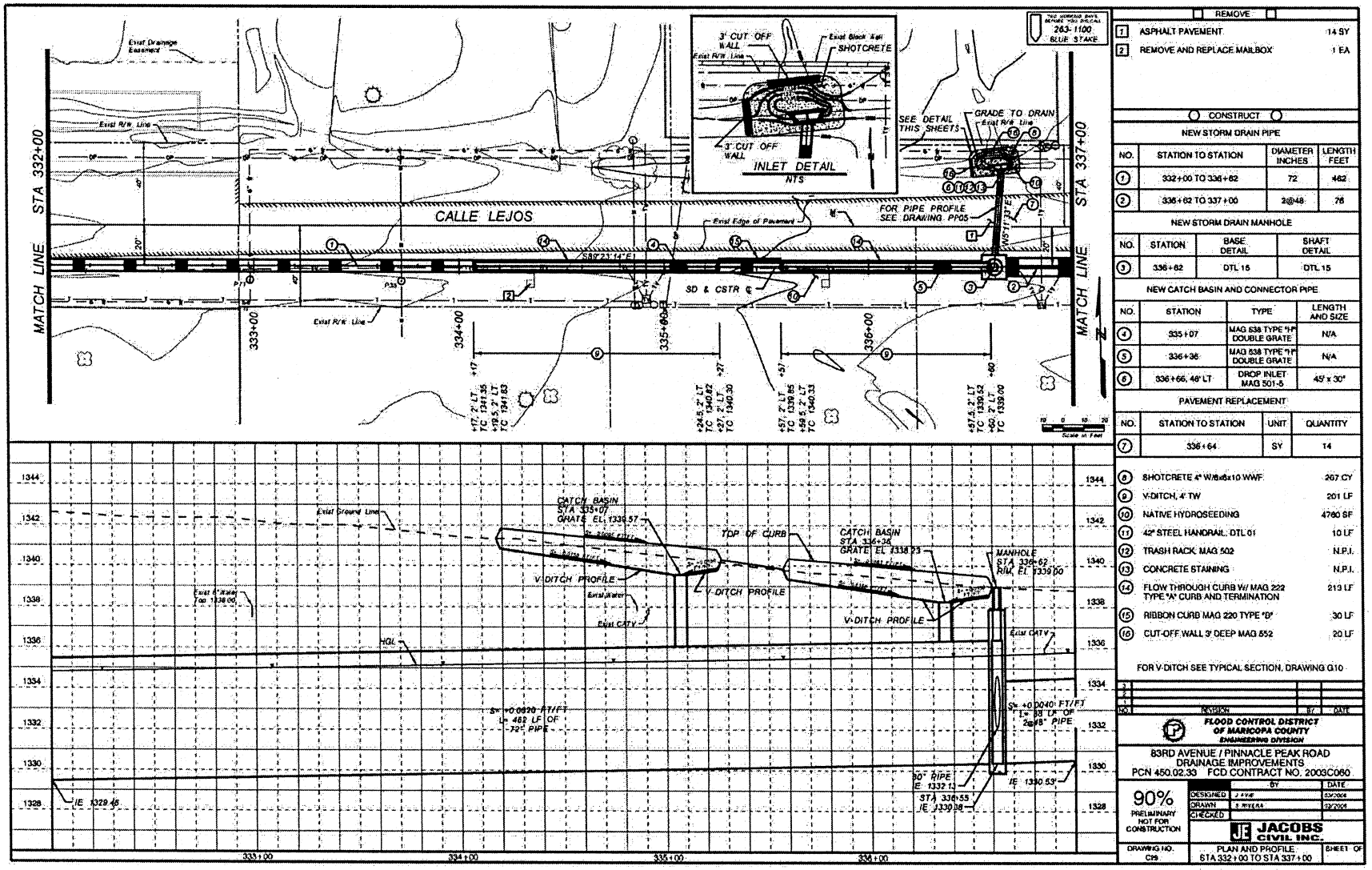
Figure 1-3



REMOVE		
1	ASPHALT PAVEMENT	14 SY
2	REMOVE AND REPLACE MAILBOX	1 EA

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	332+00 TO 336+62	72	462
2	336+62 TO 337+00	2@48	76

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
3	336+62	DTL 15	DTL 15

NEW CATCH BASIN AND CONNECTOR PIPE

NO.	STATION	TYPE	LENGTH AND SIZE
4	335+07	MAG 536 TYPE "H" DOUBLE GRATE	N/A
5	336+36	MAG 536 TYPE "H" DOUBLE GRATE	N/A
6	336+66, 46' LT	DROP INLET MAG 501-5	45° x 30"

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
7	336+64	SY	14

8	SHOTCRETE 4" W/6x6x10 WWF	267 CY
9	V-DITCH, 4' TW	201 LF
10	NATIVE HYDROSEEDING	4760 SF
11	42" STEEL HANDRAIL, DTL 01	10 LF
12	TRASH RACK, MAG 502	N.P.I.
13	CONCRETE STAINING	N.P.I.
14	FLOW THROUGH CURB W/ MAG 222 TYPE "A" CURB AND TERMINATION	213 LF
15	RIBBON CURB MAG 220 TYPE "D"	30 LF
16	CUT-OFF WALL 3' DEEP MAG 552	20 LF

FOR V-DITCH SEE TYPICAL SECTION, DRAWING G10

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
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JE JACOBS CIVIL INC.

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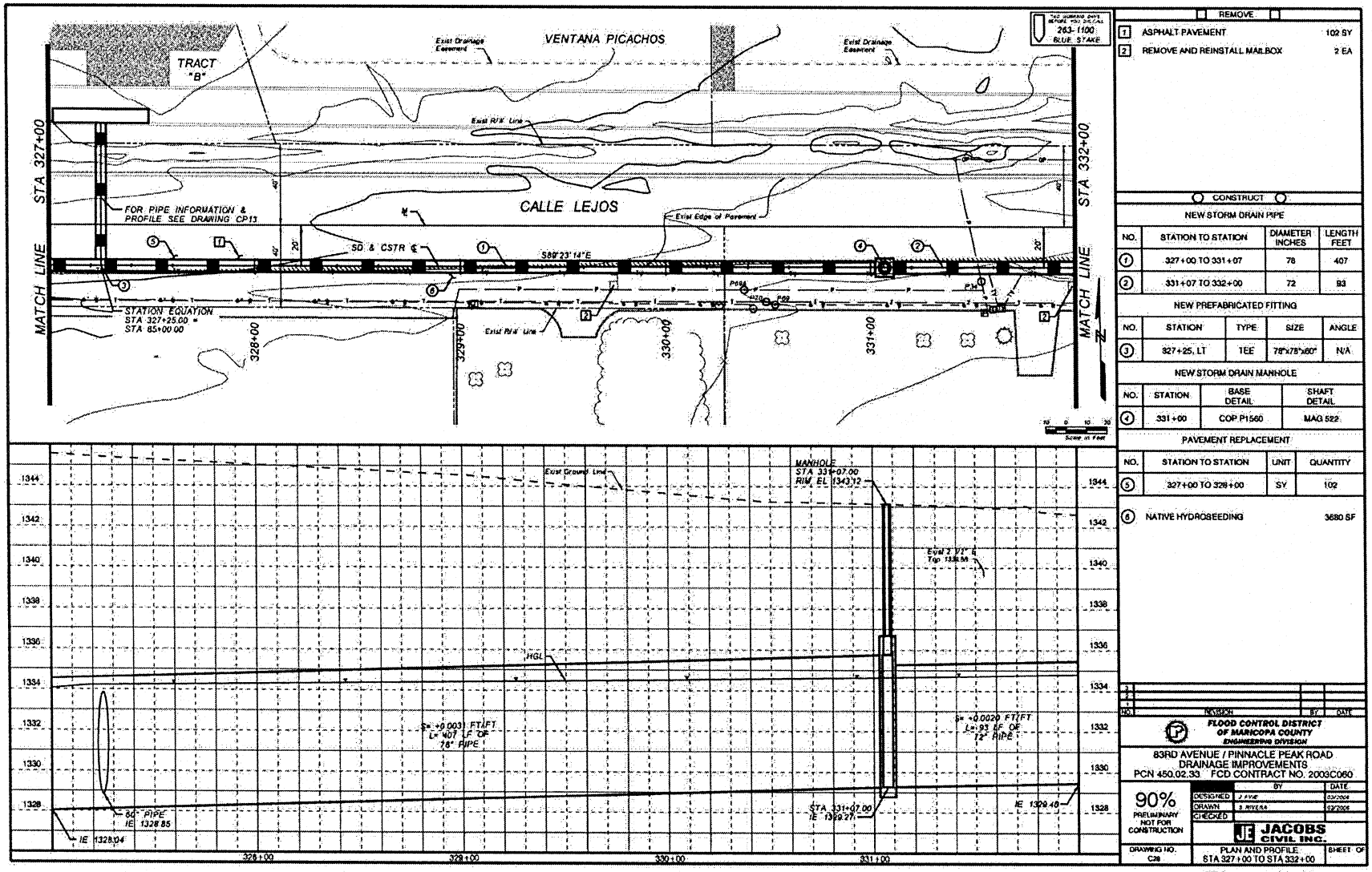
Figure 1-4



REMOVE

1	ASPHALT PAVEMENT	102 SY
2	REMOVE AND REINSTALL MAILBOX	2 EA

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	327+00 TO 331+07	78	407
2	331+07 TO 332+00	72	93

NEW PREFABRICATED FITTING

NO.	STATION	TYPE	SIZE	ANGLE
3	327+25, LT	TEE	78"x78"x60"	N/A

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
4	331+00	COP P1560	MAG 522

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
5	327+00 TO 328+00	SY	102

6	NATIVE HYDROSEEDING	3680 SF

NO.	REVISION	BY	DATE
1			
2			
3			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

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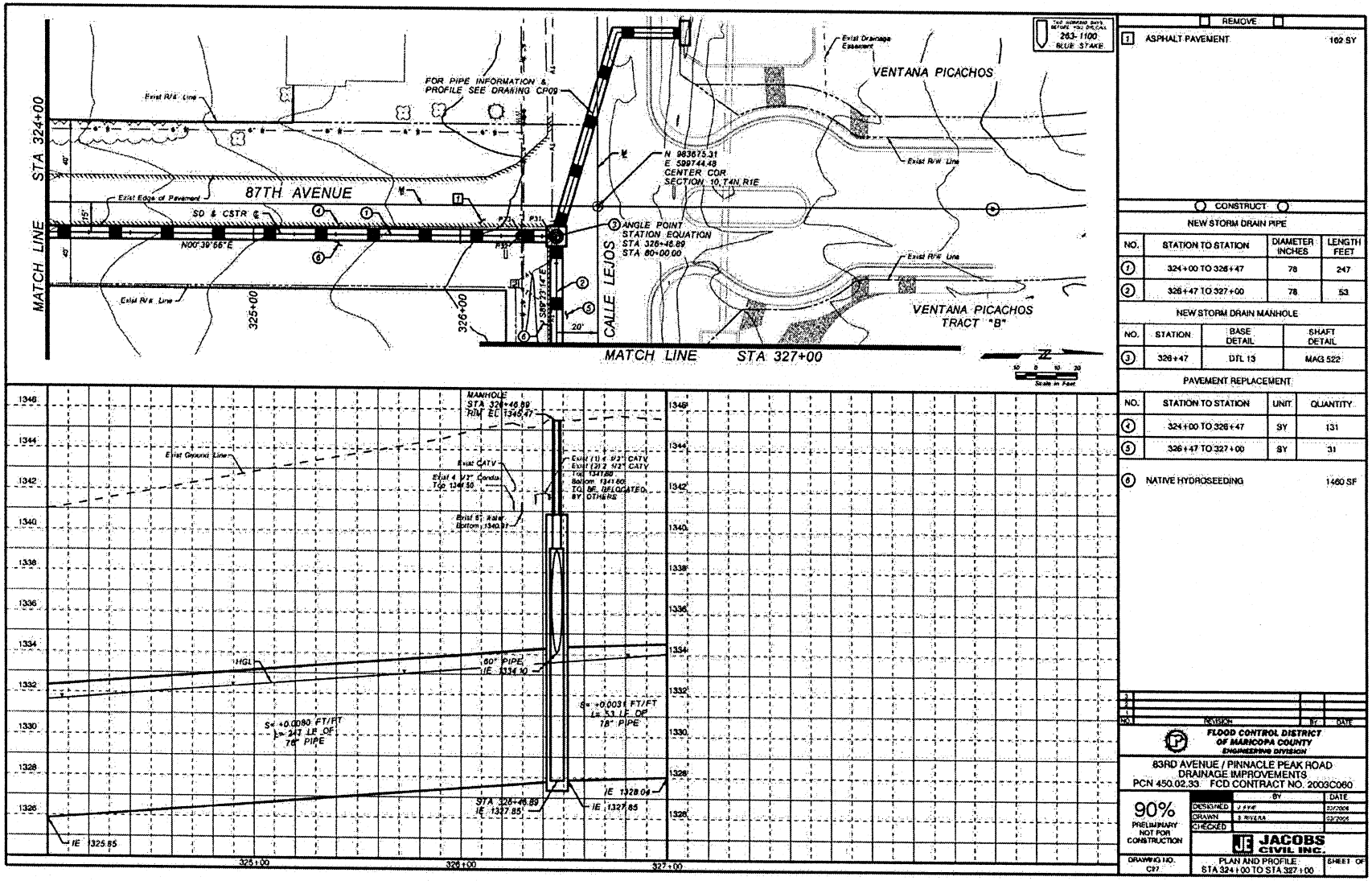
Figure 1-5



REMOVE		
1	ASPHALT PAVEMENT	162 SY

CONSTRUCT			
NEW STORM DRAIN PIPE			
NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	324+00 TO 326+47	78	247
2	326+47 TO 327+00	78	53

NEW STORM DRAIN MANHOLE			
NO.	STATION	BASE DETAIL	SHAFT DETAIL
3	326+47	DTL 13	MAG 522

PAVEMENT REPLACEMENT			
NO.	STATION TO STATION	UNIT	QUANTITY
4	324+00 TO 326+47	SY	131
5	326+47 TO 327+00	SY	31

6	NATIVE HYDROSEEDING	1460 SF

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

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PLAN AND PROFILE STA 324+00 TO STA 327+00

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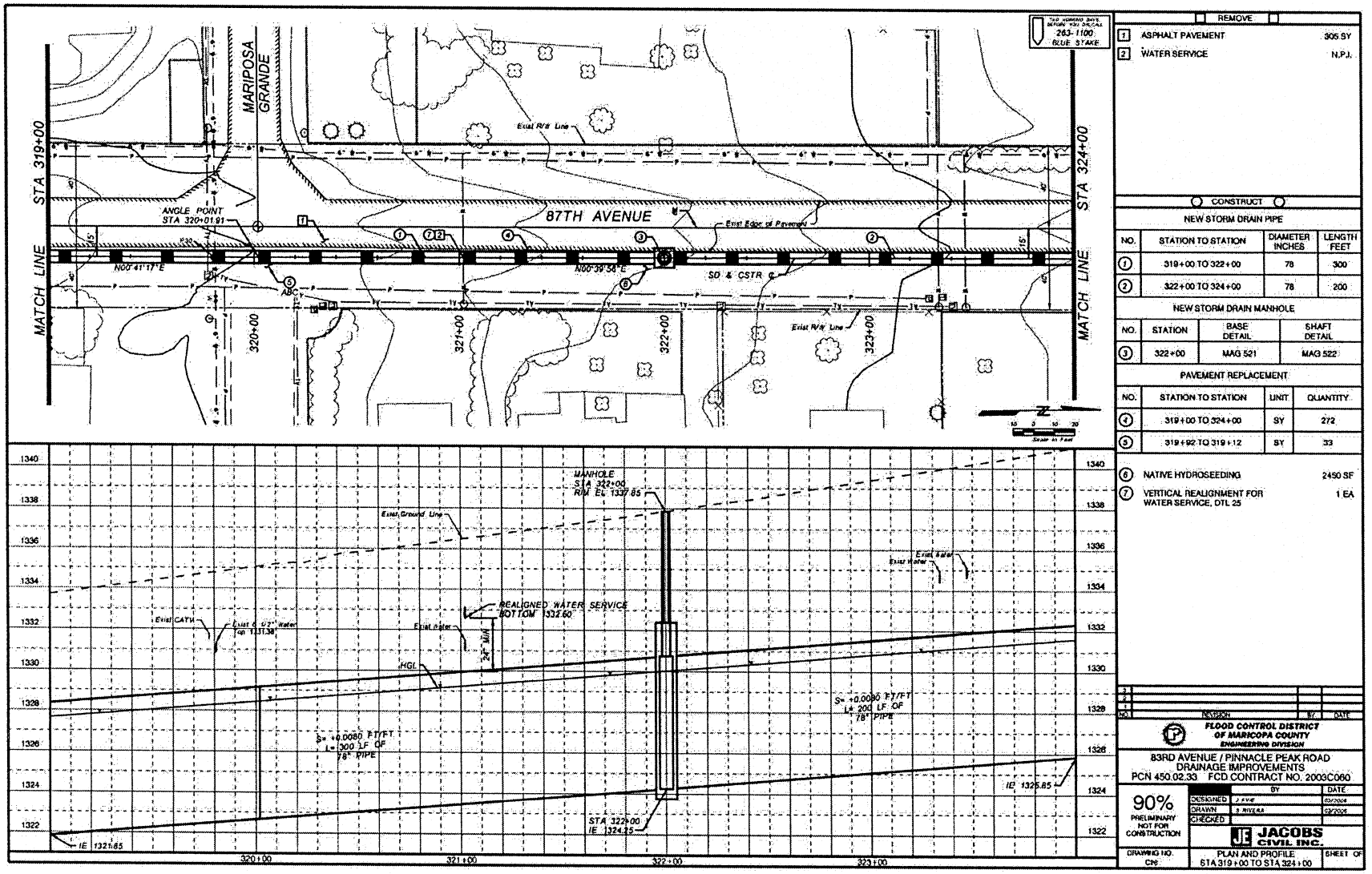
Figure 1-6

87th Avenue Storm Drain (Station 326+47 to Station 313+52 and Station 60+00 to Station 61+81)

A 78" storm drain in 87th Avenue will convey storm water from the Calle Lejos storm drain south to the 87th Avenue basin. Since 100-year storm water will be collected at Calle Lejos, the runoff south of Calle Lejos is expected to be minimal; therefore, no collection system is being proposed for this segment of the project. The storm drain will be constructed of 78" RCP to Avenida del Sol and an 84" RCP to the 87th Avenue basin. Storm water from the Cielo Grande storm drain to the west will discharge at the manhole at 87th Avenue and Avenida del Sol. From this junction structure at Station 60+00 to a manhole at Station 61+54 the storm drain will be an 84" RCP. The manhole will have a connection to the bypass/dewater storm drain consisting of a 42" RCP with a plate to restrict flows through a 30.4" orifice. As shown in Apprendix C-4, the strom drain entrance was partially covered with a steel plate to provide the same opening size as a 30.4" orifice. The 84" RCP will continue to the 87th Avenue basin. At the outlet, a stilling basin will be constructed to dissipate the energy. From the HEC-1 model it was determined the water elevation would be 1318.10 at the time of the peak flow from the 87th Avenue storm drain. This was used as the tailwater elevation for the StormCAD analysis. Peak flow rates are 491 cfs between Station 313+52 and Station 326+47 and 683 cfs from Station 60+00 to the 87th Avenue basin. See Figures 1-7 to 1-10.

Cielo Grande and Avenida del Sol Storm Drain (Station 400+30 to Station 429+91)

A 66" storm drain in Cielo Grande will collect the 10-year storm event between 91st Avenue to 87th Avenue. Field visits and reviews of aerial mapping indicate the majority of the storm water along Cielo Grande is concentrated in 91st Avenue and 89th Avenue. Other flows will be collected in concrete V-ditches along the south side of Cielo Grande and the north side of Avenida del Sol with a series of catch basins to convey the runoff to the Cielo Grande storm drain (see Appendix C-5). At 91st Avenue and 89th Avenue, storm water is primarily in roadside ditches. To intercept these flows, drop inlets will be provided. The storm drain will be 72" RCP along 89th Avenue and 72" and 78" along Avenida del Sol. The inverts of the pipe were matched at the manholes where the pipe changes size. Design flows vary from 85 cfs to 246 cfs. See Figures 1-10 to 1-16.



REMOVE		
1	ASPHALT PAVEMENT	305 SY
2	WATER SERVICE	N.P.I.

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	319+00 TO 322+00	78	300
2	322+00 TO 324+00	78	200

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
3	322+00	MAG 521	MAG 522

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
4	319+00 TO 324+00	SY	272
5	319+92 TO 319+12	SY	33

6	NATIVE HYDROSEEDING	2450 SF
7	VERTICAL REALIGNMENT FOR WATER SERVICE, DTL 25	1 EA

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

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DESIGNED	J. KYLE	03/2004
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DRAWING NO. C06 | PLAN AND PROFILE STA 319+00 TO STA 324+00 | SHEET OF

Figure 1-7

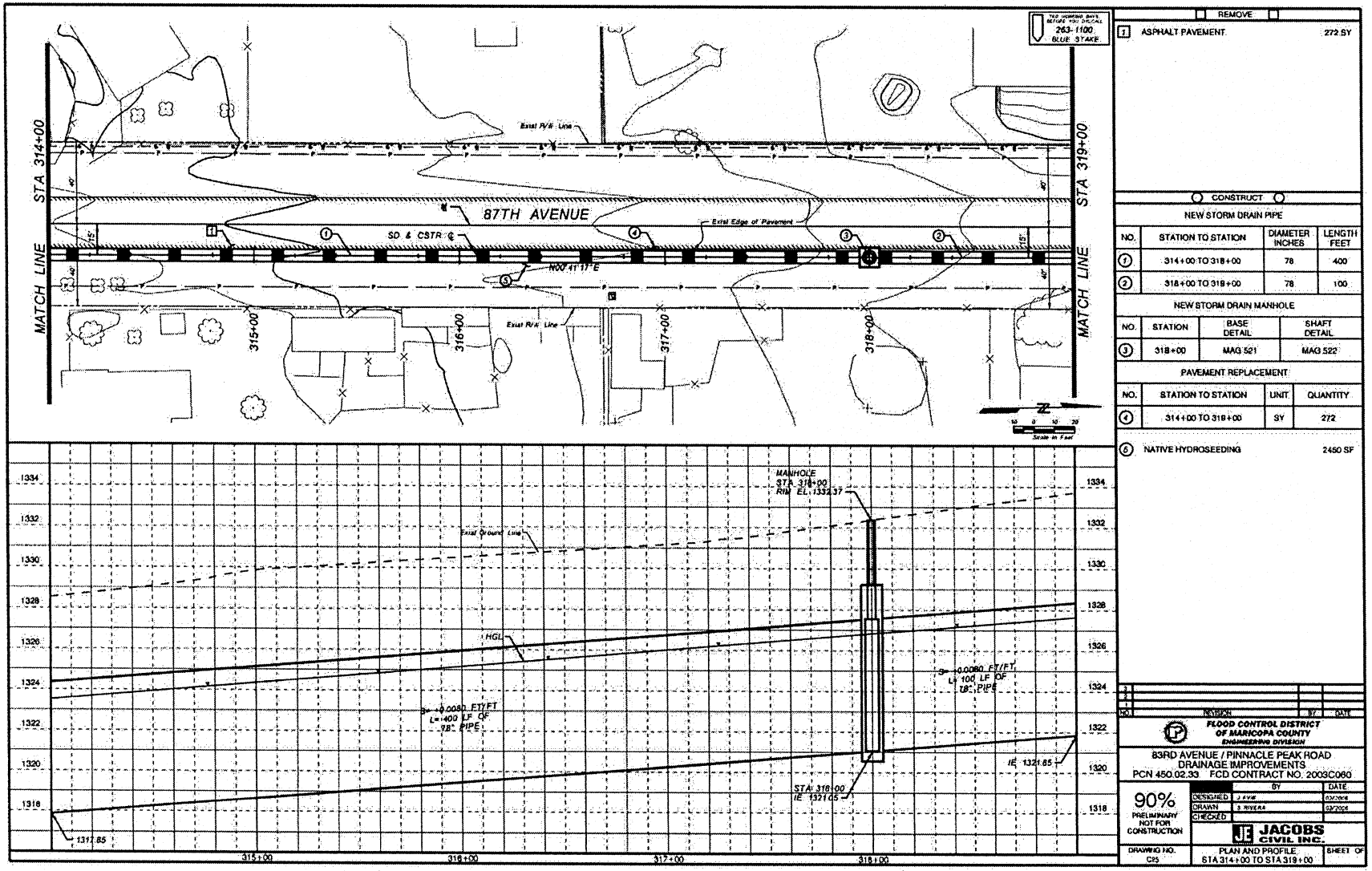

STA 314+00
STA 319+00
MATCH LINE
MATCH LINE
87TH AVENUE
SD. & CSTR. ℄
Exist R/W Line
Exist Edge of Pavement
N00°41'17"E
315+00
316+00
317+00
318+00
263-1100
BLUE STAKE
REMOVE
1 ASPHALT PAVEMENT 272 SY
CONSTRUCT
NEW STORM DRAIN PIPE
NO. | STATION TO STATION | DIAMETER INCHES | LENGTH FEET
1 | 314+00 TO 318+00 | 78 | 400
2 | 318+00 TO 319+00 | 78 | 100
NEW STORM DRAIN MANHOLE
NO. | STATION | BASE DETAIL | SHAFT DETAIL
3 | 318+00 | MAG 521 | MAG 522
PAVEMENT REPLACEMENT
NO. | STATION TO STATION | UNIT | QUANTITY
4 | 314+00 TO 318+00 | SY | 272
5 NATIVE HYDROSEEDING 2450 SF
MANHOLE STA 318+00 RIM EL. 1332.37
Exist Ground Line
HGL
S= 0.0080 FT/FT L= 400 LF OF 78" PIPE
S= 0.0080 FT/FT L= 100 LF OF 78" PIPE
IE 1321.85
STA 318+00 IE 1321.85
1311.85
315+00
316+00
317+00
318+00
NO. REVISION BY DATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION
83RD AVENUE / PINNACLE PEAK ROAD DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060
90% PRELIMINARY NOT FOR CONSTRUCTION
BY DATE
DESIGNED J. KYLE 03/2004
DRAWN S. RIVERA 03/2004
CHECKED
JACOBS CIVIL INC.
DRAWING NO. CP5
PLAN AND PROFILE STA 314+00 TO STA 319+00
SHEET OF

Figure 1-8

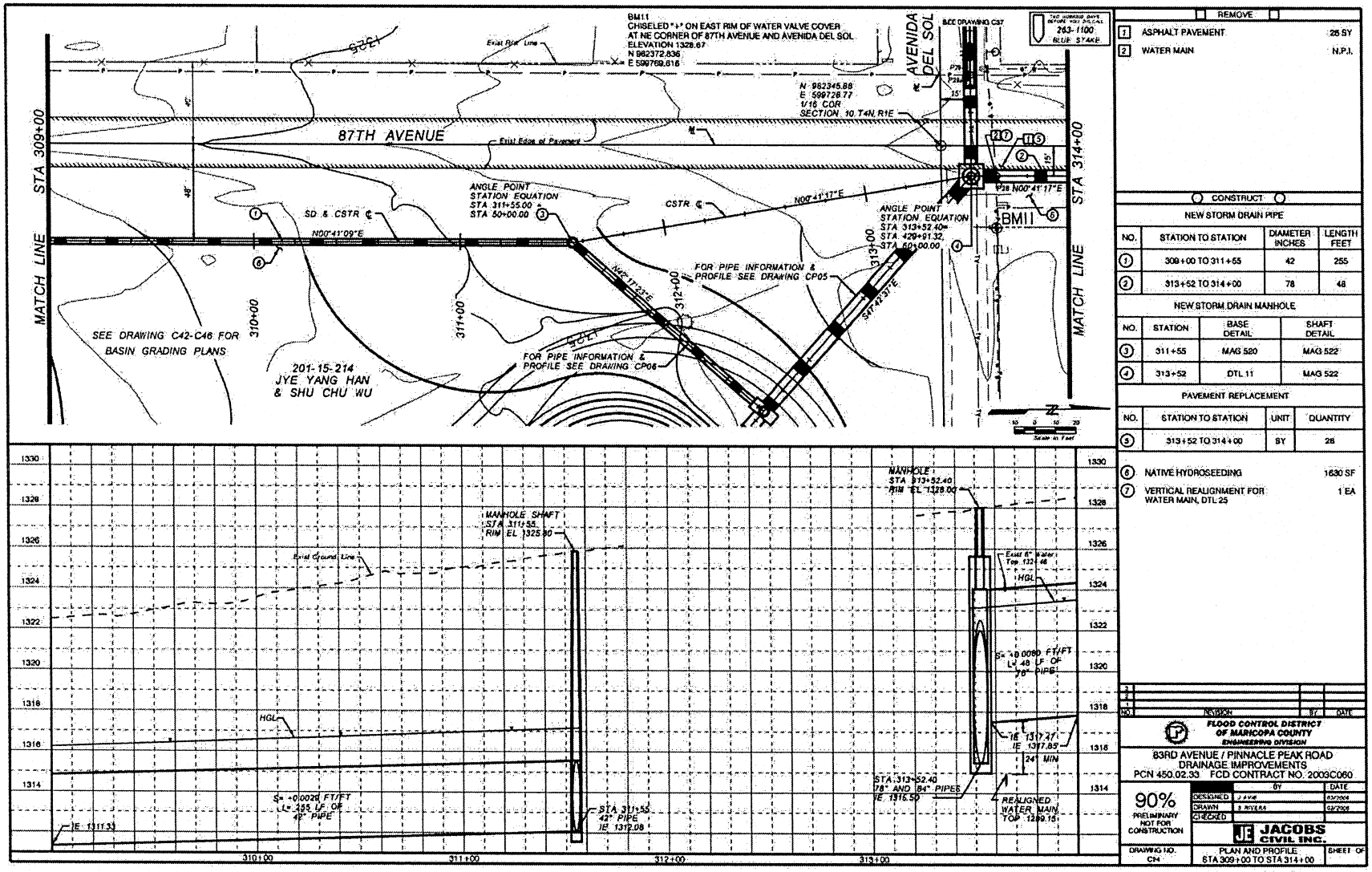
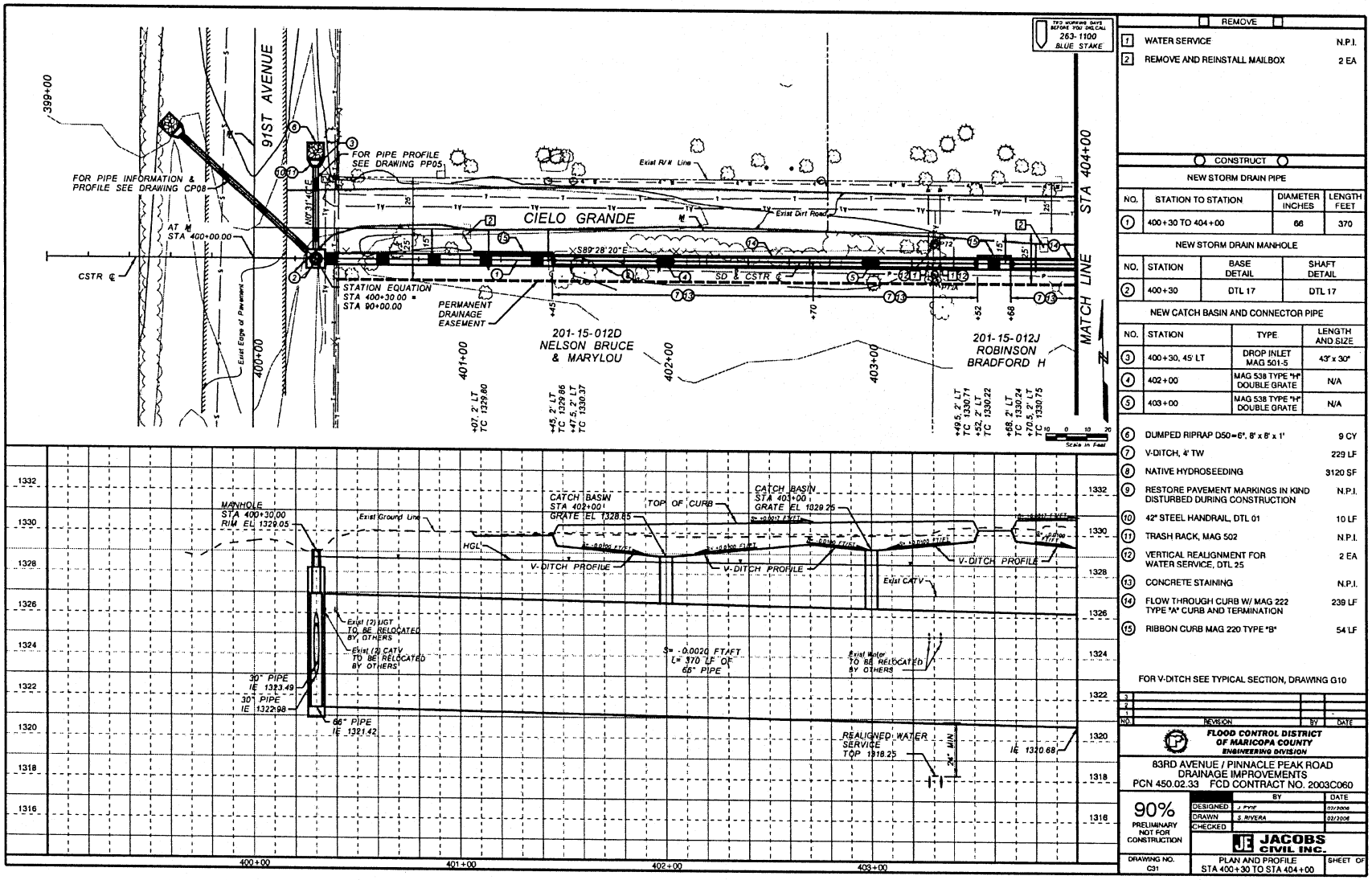

BM11
CHISELED "+" ON EAST RIM OF WATER VALVE COVER
AT NE CORNER OF 87TH AVENUE AND AVENIDA DEL SOL
ELEVATION 1328.67
N 982372.836
E 599769.616
AVENIDA DEL SOL
87TH AVENUE
STA 309+00
STA 314+00
MATCH LINE
ANGLE POINT
STATION EQUATION
STA 311+55.00 =
STA 50+00.00
ANGLE POINT
STATION EQUATION
STA 313+52.40=
STA 429+91.32,
STA 50+00.00
FOR PIPE INFORMATION &
PROFILE SEE DRAWING CP05
FOR PIPE INFORMATION &
PROFILE SEE DRAWING CP06
SEE DRAWING C42-C46 FOR
BASIN GRADING PLANS
201-15-214
JYE YANG HAN
& SHU CHU WU
MANHOLE SHAFT
STA 311+55
RIM EL 1325.80
MANHOLE
STA 313+52.40
RIM EL 1328.00
HGL
S= +0.0029 FT/FT
L= 255 LF OF
42" PIPE
STA 311+55
42" PIPE
IE 1312.08
IE 1311.33
S= +0.0080 FT/FT
L= 48 LF OF
78" PIPE
IE 1317.47
IE 1317.85
24" MIN
STA 313+52.40
78" AND 84" PIPES
IE 1316.50
REALIGNED
WATER MAIN
TOP 1289.15
310+00
311+00
312+00
313+00
REMOVE
1 ASPHALT PAVEMENT 25 SY
2 WATER MAIN N.P.I.
CONSTRUCT
NEW STORM DRAIN PIPE
NO. STATION TO STATION DIAMETER INCHES LENGTH FEET
1 309+00 TO 311+55 42 255
2 313+52 TO 314+00 78 48
NEW STORM DRAIN MANHOLE
NO. STATION BASE DETAIL SHAFT DETAIL
3 311+55 MAG 520 MAG 522
4 313+52 DTL 11 MAG 522
PAVEMENT REPLACEMENT
NO. STATION TO STATION UNIT QUANTITY
5 313+52 TO 314+00 SY 28
6 NATIVE HYDROSEEDING 1630 SF
7 VERTICAL REALIGNMENT FOR WATER MAIN, DTL 25 1 EA
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION
83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060
90%
PRELIMINARY
NOT FOR
CONSTRUCTION
JACOBS
CIVIL INC.
DRAWING NO.
CH1
PLAN AND PROFILE
STA 309+00 TO STA 314+00

Figure 1-9



REMOVE		
1	WATER SERVICE	N.P.I.
2	REMOVE AND REINSTALL MAILBOX	2 EA

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	400+30 TO 404+00	66	370

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
2	400+30	DTL 17	DTL 17

NEW CATCH BASIN AND CONNECTOR PIPE

NO.	STATION	TYPE	LENGTH AND SIZE
3	400+30, 45' LT	DROP INLET MAG 501-5	43' x 30"
4	402+00	MAG 538 TYPE "H" DOUBLE GRATE	N/A
5	403+00	MAG 538 TYPE "H" DOUBLE GRATE	N/A

6	DUMPED RIPRAP D50=6", 8' x 8' x 1'	9 CY
7	V-DITCH, 4' TW	229 LF
8	NATIVE HYDROSEEDING	3120 SF
9	RESTORE PAVEMENT MARKINGS IN KIND DISTURBED DURING CONSTRUCTION	N.P.I.
10	42" STEEL HANDRAIL, DTL 01	10 LF
11	TRASH RACK, MAG 502	N.P.I.
12	VERTICAL REALIGNMENT FOR WATER SERVICE, DTL 25	2 EA
13	CONCRETE STAINING	N.P.I.
14	FLOW THROUGH CURB W/ MAG 222 TYPE "A" CURB AND TERMINATION	239 LF
15	RIBBON CURB MAG 220 TYPE "B"	54 LF

FOR V-DITCH SEE TYPICAL SECTION, DRAWING G10

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

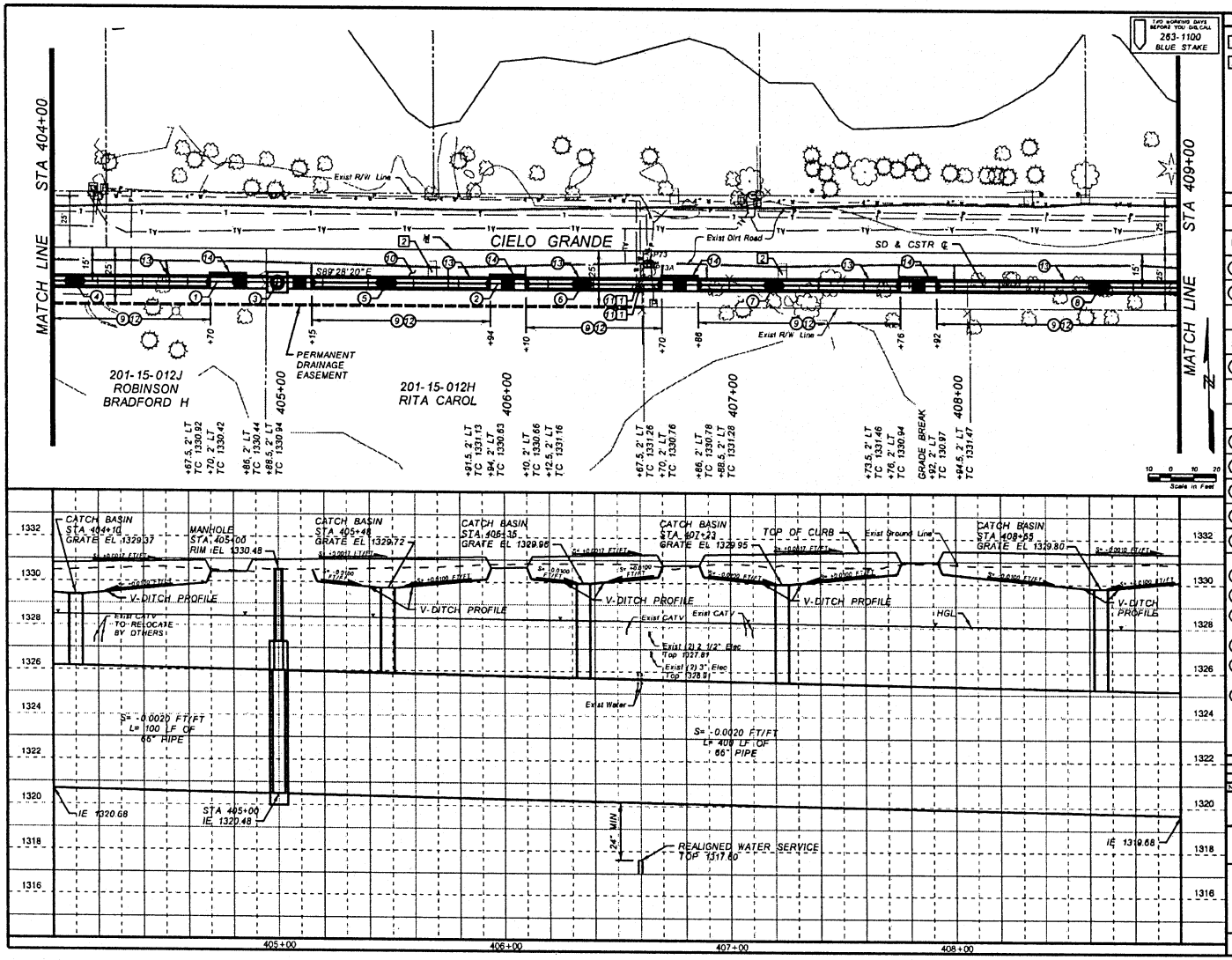
83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

90% PRELIMINARY NOT FOR CONSTRUCTION		BY	DATE
	DESIGNED	J. FYFE	02/2006
	DRAWN	S. RIVERA	02/2006
	CHECKED		

JACOBS CIVIL INC.

DRAWING NO.	PLAN AND PROFILE	SHEET OF
C31	STA 400+30 TO STA 404+00	

Figure 1-10



REMOVE		
1	WATER SERVICE	N.P.I.
2	REMOVE AND REINSTALL MAILBOX	2 EA

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	404+00 TO 405+00	66	100
2	405+00 TO 409+00	66	400

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
3	405+00	MAG 521	MAG 522

NEW CATCH BASIN AND CONNECTOR PIPE

NO.	STATION	TYPE	LENGTH AND SIZE
4	404+10	MAG 538 TYPE "H" DOUBLE GRATE	N/A
5	405+48	MAG 538 TYPE "H" DOUBLE GRATE	N/A
6	406+35	MAG 538 TYPE "H" DOUBLE GRATE	N/A
7	407+23	MAG 538 TYPE "H" DOUBLE GRATE	N/A
8	408+65	MAG 538 TYPE "H" DOUBLE GRATE	N/A

9	V-DITCH, 4' TW	382 LF
10	NATIVE HYDROSEEDING	3940 SF
11	VERTICAL REALIGNMENT FOR WATER SERVICE, DTL 25	2 EA
12	CONCRETE STAINING	N.P.I.
13	FLOW THROUGH CURB W/ MAG 222 TYPE "A" CURB AND TERMINATION	436 LF
14	RIBBON CURB MAG 220 TYPE "B"	84 LF

FOR V-DITCH SEE TYPICAL SECTION, DRAWING G10

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

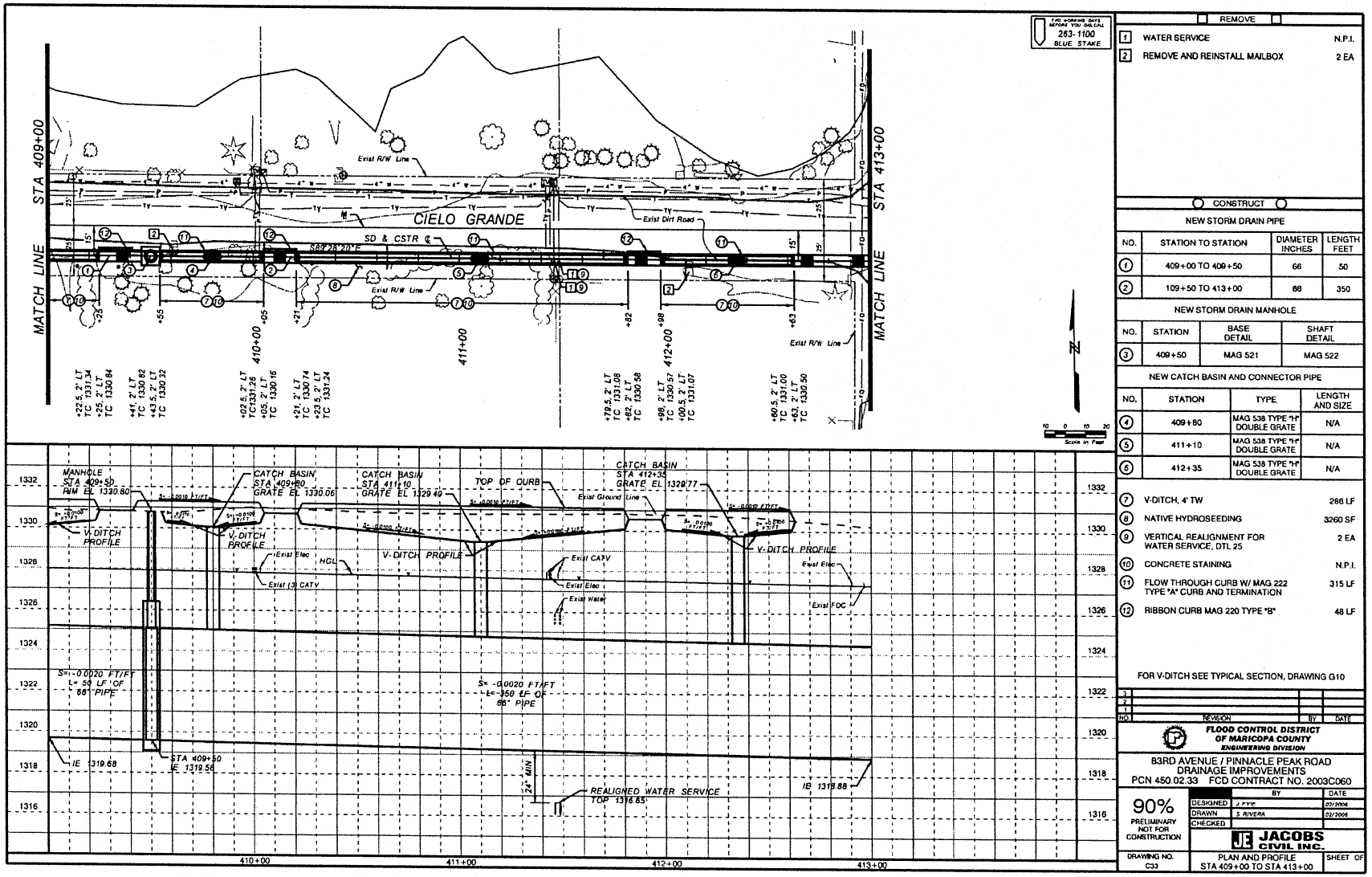
83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

90% PRELIMINARY NOT FOR CONSTRUCTION		BY	DATE
	DESIGNED	J. FYNE	02/2008
	DRAWN	S. RIVERA	02/2008
	CHECKED		

JE JACOBS CIVIL INC.

DRAWING NO.	PLAN AND PROFILE STA 404+00 TO STA 409+00	SHEET OF
C32		

Figure 1-11



REMOVE

1	WATER SERVICE	N.P.I.
2	REMOVE AND REINSTALL MAILBOX	2 EA

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	409+00 TO 409+50	66	50
2	109+50 TO 413+00	66	350

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
3	409+50	MAG 521	MAG 522

NEW CATCH BASIN AND CONNECTOR PIPE

NO.	STATION	TYPE	LENGTH AND SIZE
4	409+80	MAG 538 TYPE "H" DOUBLE GRATE	N/A
5	411+10	MAG 538 TYPE "H" DOUBLE GRATE	N/A
6	412+35	MAG 538 TYPE "H" DOUBLE GRATE	N/A

7	V-DITCH, 4' TW	286 LF
8	NATIVE HYDROSEEDING	3260 SF
9	VERTICAL REALIGNMENT FOR WATER SERVICE, DTL 25	2 EA
10	CONCRETE STAINING	N.P.I.
11	FLOW THROUGH CURB W/ MAG 222 TYPE "A" CURB AND TERMINATION	315 LF
12	RIBBON CURB MAG 220 TYPE "B"	48 LF

FOR V-DITCH SEE TYPICAL SECTION, DRAWING G10

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

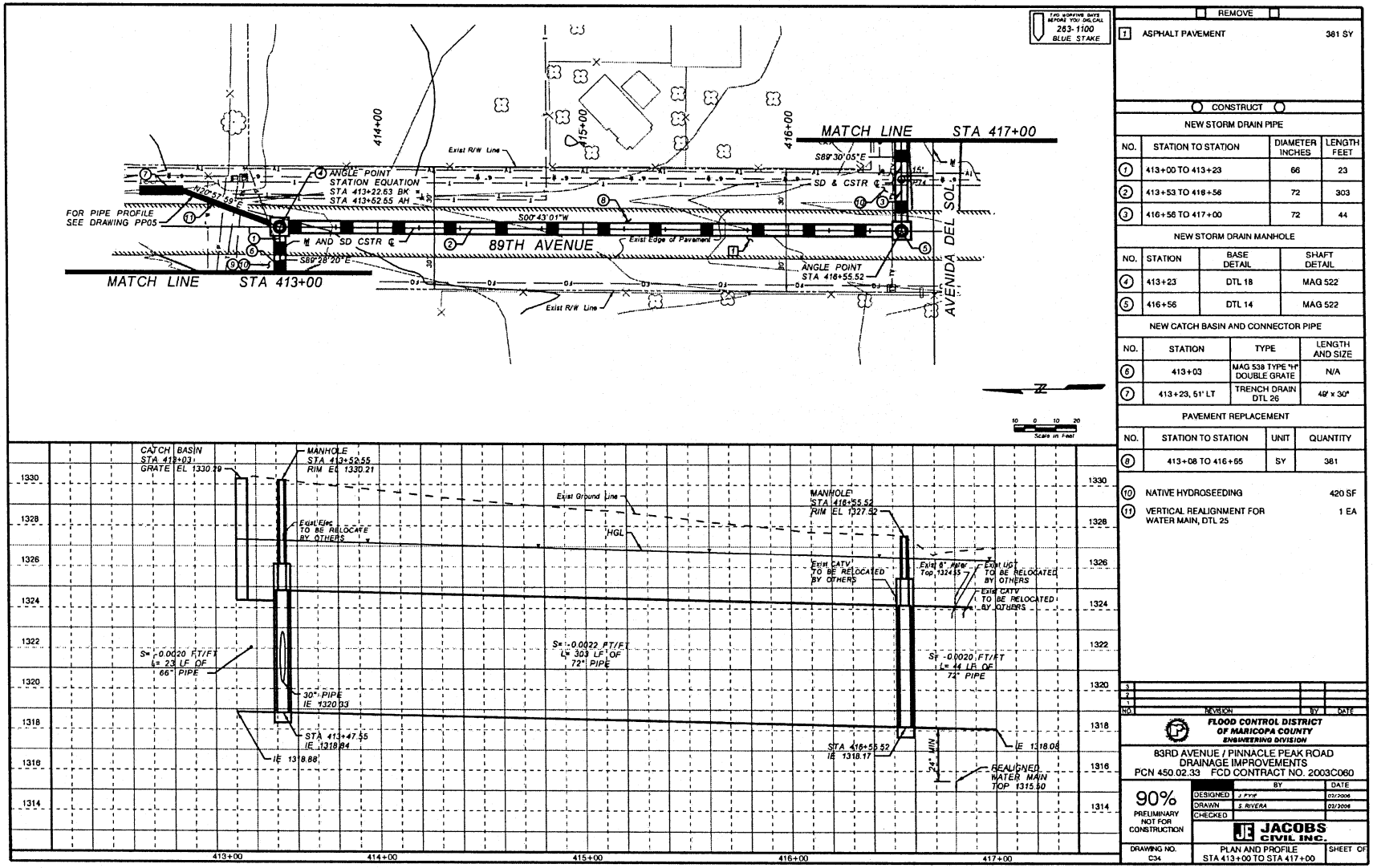
83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

		BY	DATE
90% PRELIMINARY NOT FOR CONSTRUCTION	DESIGNED	J. FYFE	02/2006
	DRAWN	S. RIVERA	02/2006
	CHECKED		

JACOBS CIVIL INC.

DRAWING NO.	PLAN AND PROFILE	SHEET OF
C33	STA 409+00 TO STA 413+00	

Figure 1-12



REMOVE

1	ASPHALT PAVEMENT	381 SY

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	413+00 TO 413+23	66	23
2	413+53 TO 416+56	72	303
3	416+56 TO 417+00	72	44

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
4	413+23	DTL 18	MAG 522
5	416+56	DTL 14	MAG 522

NEW CATCH BASIN AND CONNECTOR PIPE

NO.	STATION	TYPE	LENGTH AND SIZE
6	413+03	MAG 538 TYPE "H" DOUBLE GRATE	N/A
7	413+23, 51' LT	TRENCH DRAIN DTL 26	49' x 30"

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
8	413+08 TO 416+55	SY	381

10	NATIVE HYDROSEEDING	420 SF
11	VERTICAL REALIGNMENT FOR WATER MAIN, DTL 25	1 EA

NO.	REVISION	BY	DATE
1			
2			
3			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

90% PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	J. FYFE	02/2006
DRAWN	S. RIVERA	02/2006
CHECKED		

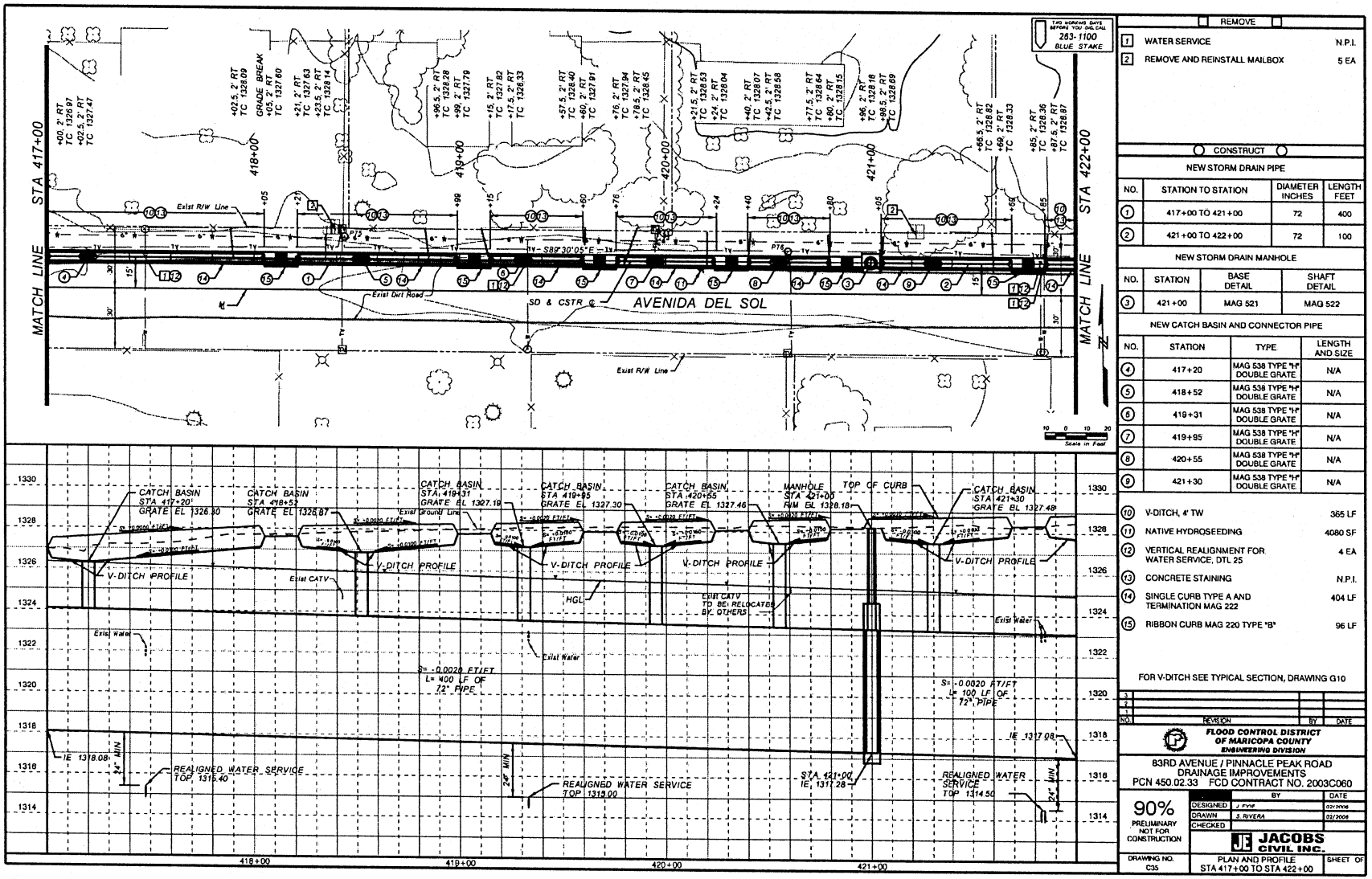
JACOBS CIVIL INC.

DRAWING NO. C34

PLAN AND PROFILE STA 413+00 TO STA 417+00

SHEET OF

Figure 1-13



REMOVE		
1	WATER SERVICE	N.P.I.
2	REMOVE AND REINSTALL MAILBOX	5 EA

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	417+00 TO 421+00	72	400
2	421+00 TO 422+00	72	100

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
3	421+00	MAG 521	MAG 522

NEW CATCH BASIN AND CONNECTOR PIPE

NO.	STATION	TYPE	LENGTH AND SIZE
4	417+20	MAG 538 TYPE "H" DOUBLE GRATE	N/A
5	418+52	MAG 538 TYPE "H" DOUBLE GRATE	N/A
6	419+31	MAG 538 TYPE "H" DOUBLE GRATE	N/A
7	419+95	MAG 538 TYPE "H" DOUBLE GRATE	N/A
8	420+55	MAG 538 TYPE "H" DOUBLE GRATE	N/A
9	421+30	MAG 538 TYPE "H" DOUBLE GRATE	N/A

10	V-DITCH, 4' TW	365 LF
11	NATIVE HYDROSEEDING	4080 SF
12	VERTICAL REALIGNMENT FOR WATER SERVICE, DTL 25	4 EA
13	CONCRETE STAINING	N.P.I.
14	SINGLE CURB TYPE A AND TERMINATION MAG 222	404 LF
15	RIBBON CURB MAG 220 TYPE "B"	96 LF

FOR V-DITCH SEE TYPICAL SECTION, DRAWING G10

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

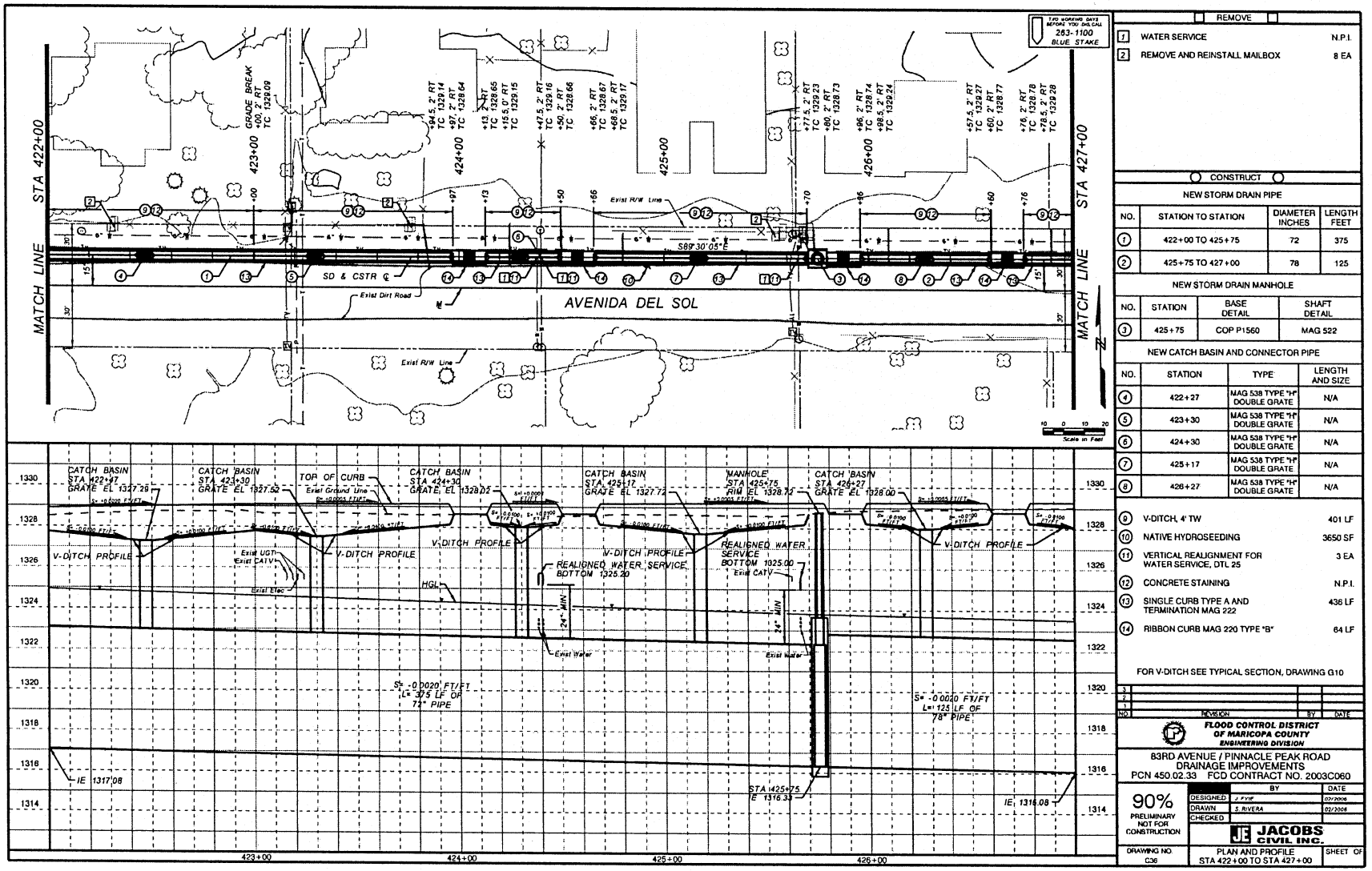
90% PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	J. FYNE	02/2006
DRAWN	S. RIVERA	02/2006
CHECKED		

JACOBS CIVIL INC.

DRAWING NO. C35 | PLAN AND PROFILE STA 417+00 TO STA 422+00 | SHEET OF

Figure 1-14



REMOVE

1	WATER SERVICE	N.P.I.
2	REMOVE AND REINSTALL MAILBOX	8 EA

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	422+00 TO 425+75	72	375
2	425+75 TO 427+00	78	125

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
3	425+75	COP P1560	MAG 522

NEW CATCH BASIN AND CONNECTOR PIPE

NO.	STATION	TYPE	LENGTH AND SIZE
4	422+27	MAG 538 TYPE "H" DOUBLE GRATE	N/A
5	423+30	MAG 538 TYPE "H" DOUBLE GRATE	N/A
6	424+30	MAG 538 TYPE "H" DOUBLE GRATE	N/A
7	425+17	MAG 538 TYPE "H" DOUBLE GRATE	N/A
8	426+27	MAG 538 TYPE "H" DOUBLE GRATE	N/A

9	V-DITCH, 4' TW	401 LF
10	NATIVE HYDROSEEDING	3650 SF
11	VERTICAL REALIGNMENT FOR WATER SERVICE, DTL 25	3 EA
12	CONCRETE STAINING	N.P.I.
13	SINGLE CURB TYPE A AND TERMINATION MAG 222	436 LF
14	RIBBON CURB MAG 220 TYPE "B"	64 LF

FOR V-DITCH SEE TYPICAL SECTION, DRAWING G10

NO	REVISION	BY	DATE
1			
2			
3			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

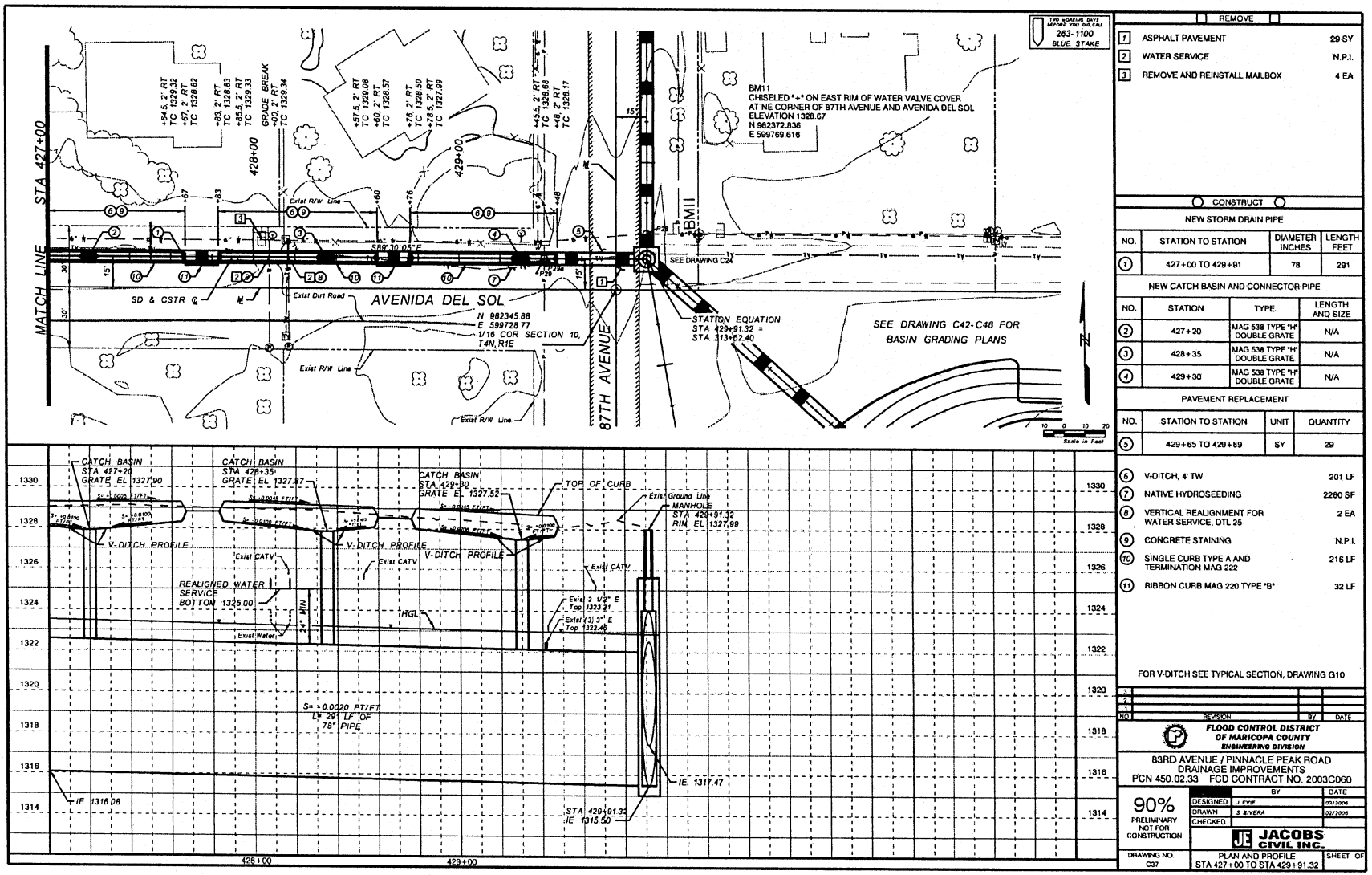
90% PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	J. FYFE	07/2006
DRAWN	S. RIVERA	02/2006
CHECKED		

JACOBS CIVIL INC.

DRAWING NO. C36 | PLAN AND PROFILE STA 422+00 TO STA 427+00 | SHEET OF

Figure 1-15



REMOVE		
1	ASPHALT PAVEMENT	29 SY
2	WATER SERVICE	N.P.I.
3	REMOVE AND REINSTALL MAILBOX	4 EA

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	427+00 TO 429+91	78	291

NEW CATCH BASIN AND CONNECTOR PIPE

NO.	STATION	TYPE	LENGTH AND SIZE
2	427+20	MAG 538 TYPE "H" DOUBLE GRATE	N/A
3	428+35	MAG 538 TYPE "H" DOUBLE GRATE	N/A
4	429+30	MAG 538 TYPE "H" DOUBLE GRATE	N/A

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
5	429+65 TO 429+89	SY	29

6	V-DITCH, 4' TW	201 LF
7	NATIVE HYDROSEEDING	2260 SF
8	VERTICAL REALIGNMENT FOR WATER SERVICE, DTL 25	2 EA
9	CONCRETE STAINING	N.P.I.
10	SINGLE CURB TYPE A AND TERMINATION MAG 222	216 LF
11	RIBBON CURB MAG 220 TYPE "B"	32 LF

FOR V-DITCH SEE TYPICAL SECTION, DRAWING G10

NO	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

90% PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	J. EVIS	02/2006
DRAWN	S. RIVERA	02/2006
CHECKED		

JACOBS CIVIL INC.

DRAWING NO. C37 | PLAN AND PROFILE STA 427+00 TO STA 429+91.32 | SHEET OF

Figure 1-16

87th Avenue Detention Basin

This facility will be located on a 10 acre parcel at the southeast quadrant of 87th Avenue and Avenida del Sol. The property is privately owned so acquisition will be necessary. To accommodate future street improvements, the ultimate right-of-way limits were identified and used as a guide for locating the drainage improvements. These limits are 80' for 87th Avenue, 60' for Avenida del Sol and Camino de Oro and 50' for 86th Avenue. The detention basin property is presently unimproved with grades sloping to the south. Existing washes were delineated in the aerial mapping. Grading was provided to convey runoff from Avenida del Sol and 86th Avenue. At these locations, riprap was provided to protect the basin side slopes. Future multi-use opportunities include equestrian facilities, parking along the west side and recreational facilities within the basin. A 14' wide maintenance access is planned for the perimeter of the basin. The maximum ponding depth is approximately 7 feet. Side slopes vary to meet the criteria of the City of Peoria for unfenced basins. To a depth of 4' the maximum slope is 4:1, from 4' to 6' depth the maximum slope is 6:1 and over 6' depth the slope cannot exceed 10:1. To limit the height above ground of the stilling basin, 3:1 side slopes were used at that location. The basin will initially be graded for future uses but would only have native landscaping. Any future equestrian or neighborhood park improvements would be dependent on funding by the City of Peoria.

The proposed layout provides storage for approximately 29.2 acre-feet of runoff. The basin will be dewatered through two 42" RCP storm drains each being regulated by a steel plate. The maximum water surface elevation is 1319.66. The basin will provide a minimum 12" freeboard and an emergency spillway in the southern end, aligned with the existing wash. Peak discharge through the dewater storm drains is 122 cfs total. See Table 1-1 for the basin design characteristics. See Figures 1-17 and 1-18 for landscaping concepts and the preliminary grading plan.

Table 1-1
87th Avenue Detention Basin Data

83rd Avenue/Pinnacle Peak Road Drainage Improvements												
FCDMC Contract No. 2003C060 Project No. 450.02.33												
87th Avenue Basin												
								Discharge	Discharge	Total	Bypass	Total
			Total	Volume	Volume	H1	H2	1	2	Discharge	Flows	Discharge
Elevation			(sq ft)	(cu ft)	(ac ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
1313			0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1314			70,608	35,304	0.81	0.00	0.23	0.00	12.11	12.11	12.11	0.00
1315			157,478	149,347	3.43	1.23	1.23	27.85	27.85	55.70	21.57	34.13
1316			169,554	312,863	7.18	2.23	2.23	37.48	37.48	74.96	21.57	53.39
1317			180,871	488,076	11.20	3.23	3.23	45.10	45.10	90.19	21.57	68.62
1318			188,761	672,892	15.45	4.23	4.23	51.60	51.60	103.20	21.57	81.63
1319			196,472	865,508	19.87	5.23	5.23	57.37	57.37	114.74	21.57	93.17
1320			204,093	1,065,791	24.47	6.23	6.23	62.61	62.61	125.23	21.57	103.66
1321			211,648	1,273,661	29.24	7.23	7.23	67.45	67.45	134.90	21.57	113.33
Q = Cd x Ao x (2gh)^0.5												
Cd =	0.62	2 Orifices - 1 at Elev 1312.50 and 1 at Elev 1312.50										
Orifice Diameter each @ (			30.4									
Orifice Area each (sq ft) =			5.04									
h = elevation - center of orifice						total bypass flow (cfs) =			21.57			
center of orifices		1313.77	and	1313.77								
bypass to elev =		0.00	and	1314.51		bypass flows (cfs) =		0	and	21.57		
Revised 10/26/05												

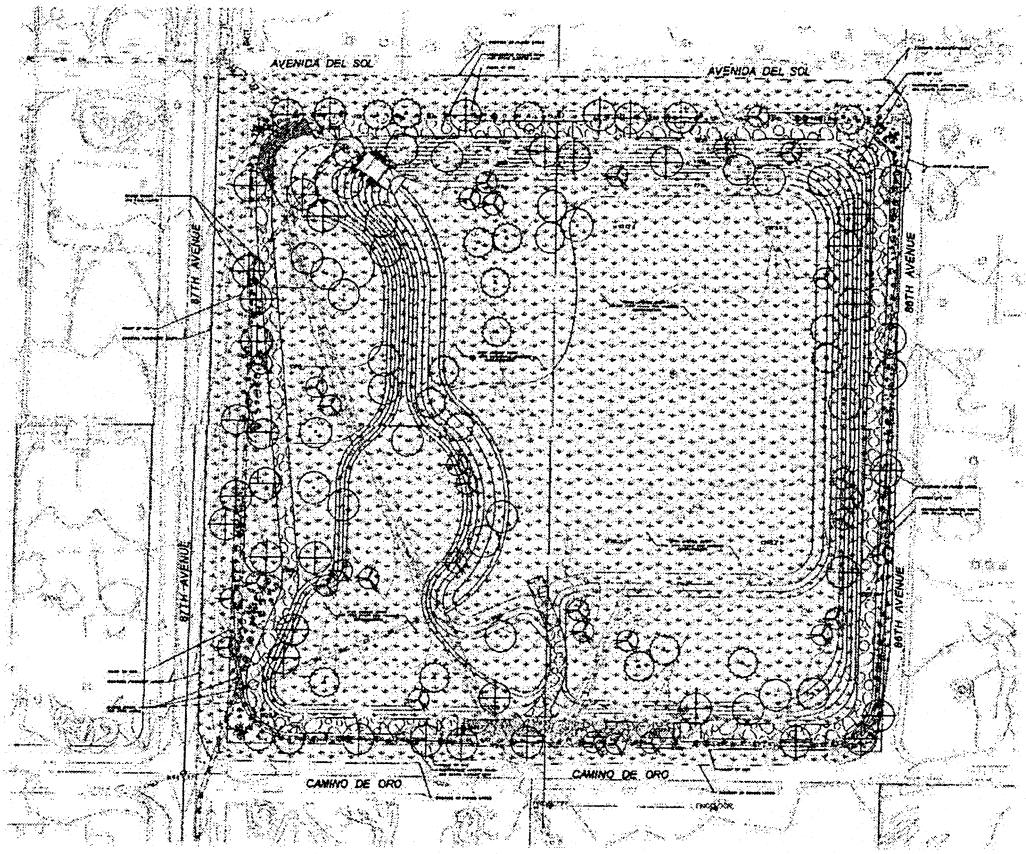


Figure 1-17
87th Avenue Basin

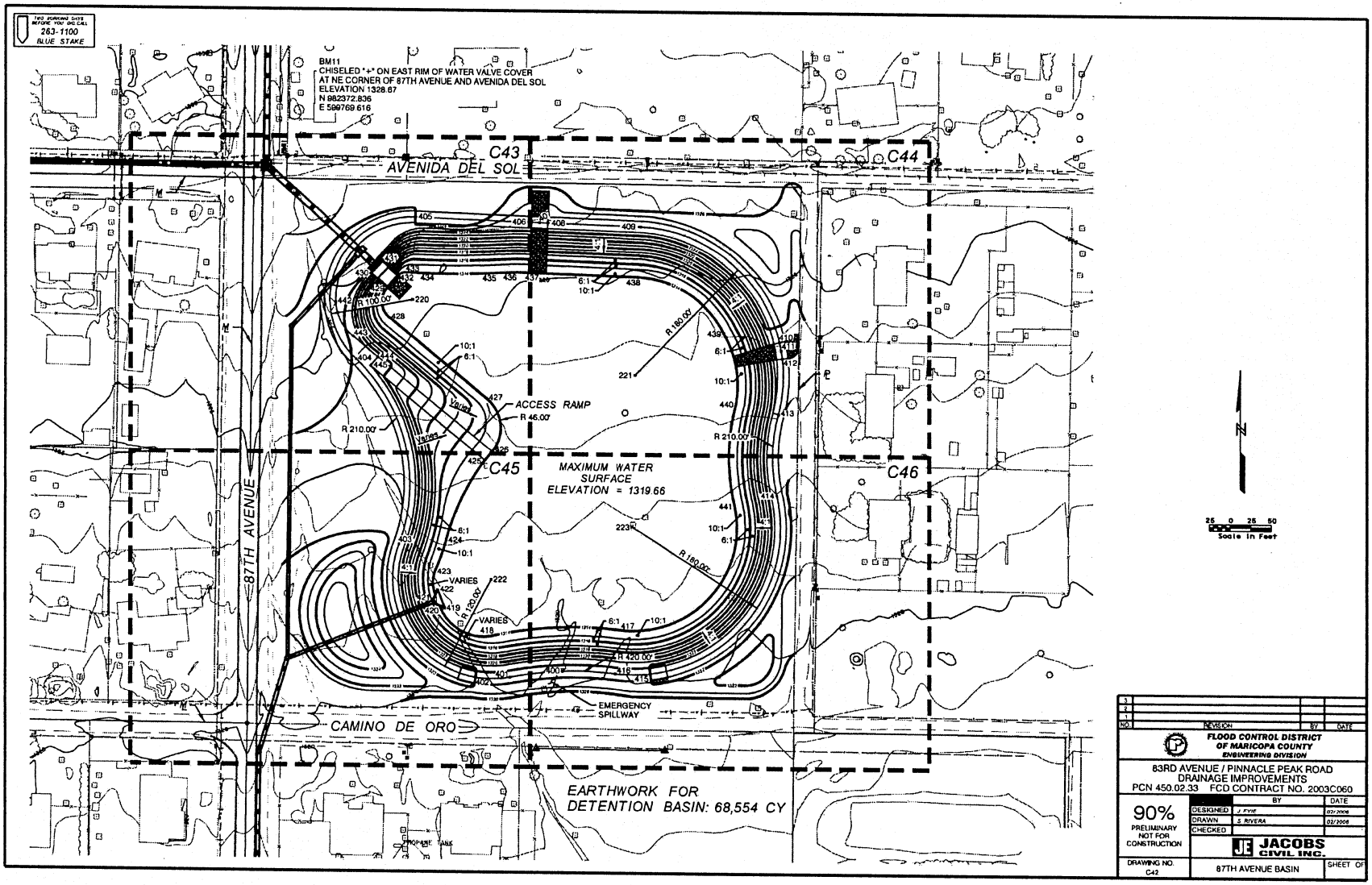
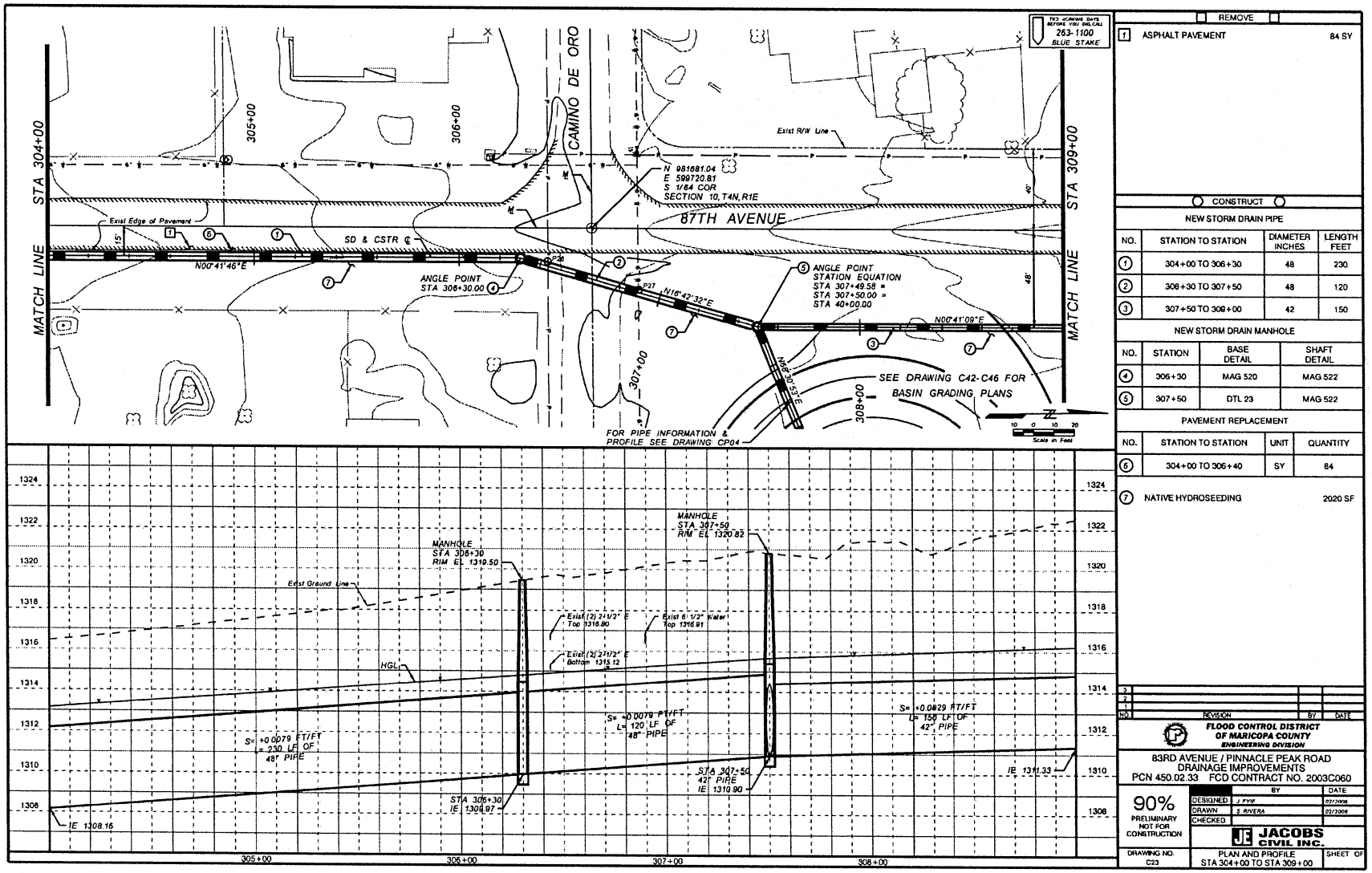

263-1100
BLUE STAKE
BM11
CHISELED "+" ON EAST RIM OF WATER VALVE COVER
AT NE CORNER OF 87TH AVENUE AND AVENIDA DEL SOL
ELEVATION 1328.67
N 982372.836
E 599769.616
AVENIDA DEL SOL
C43
C44
C45
C46
87TH AVENUE
CAMINO DE ORO
ACCESS RAMP
R 46.00'
MAXIMUM WATER
SURFACE
ELEVATION = 1319.66
EMERGENCY
SPILLWAY
EARTHWORK FOR
DETENTION BASIN: 68,554 CY
R 100.00'
R 180.00'
R 210.00'
R 120.00'
R 420.00'
6:1
10:1
VARIES
Scale in Feet
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION
83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060
90%
PRELIMINARY
NOT FOR
CONSTRUCTION
DESIGNED
DRAWN
CHECKED
JACOBS
CIVIL INC.
DRAWING NO.
C42
87TH AVENUE BASIN
SHEET OF

Figure 1-18

87th Avenue Storm Drain (Station 300+00 to Station 311+55)

Along the west side of the 87th Avenue basin, a bypass/dewater 42" RCP storm drain will be constructed. This storm drain will join another 42" RCP dewater storm drain at Station 307+50. From this point to the Pinnacle Peak storm drain, the facility will be a 48" RCP. The design flow for each dewater storm drain is 62 cfs and the design flow for the 48" storm drain is 124 cfs. Tailwater elevation for the 48" storm drain was determined from the StormCAD analysis of the Pinnacle Peak Road storm drain; this elevation was 1311.12. Catch basins will be provided at Stations 300+60 and 300+80. See Figures 1-19 and 1-20.



REMOVE

1	ASPHALT PAVEMENT	84 SY

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	304+00 TO 306+30	48	230
2	306+30 TO 307+50	48	120
3	307+50 TO 309+00	42	150

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
4	306+30	MAG 520	MAG 522
5	307+50	DTL 23	MAG 522

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
6	304+00 TO 306+40	SY	84

7	NATIVE HYDROSEEDING	2020 SF

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

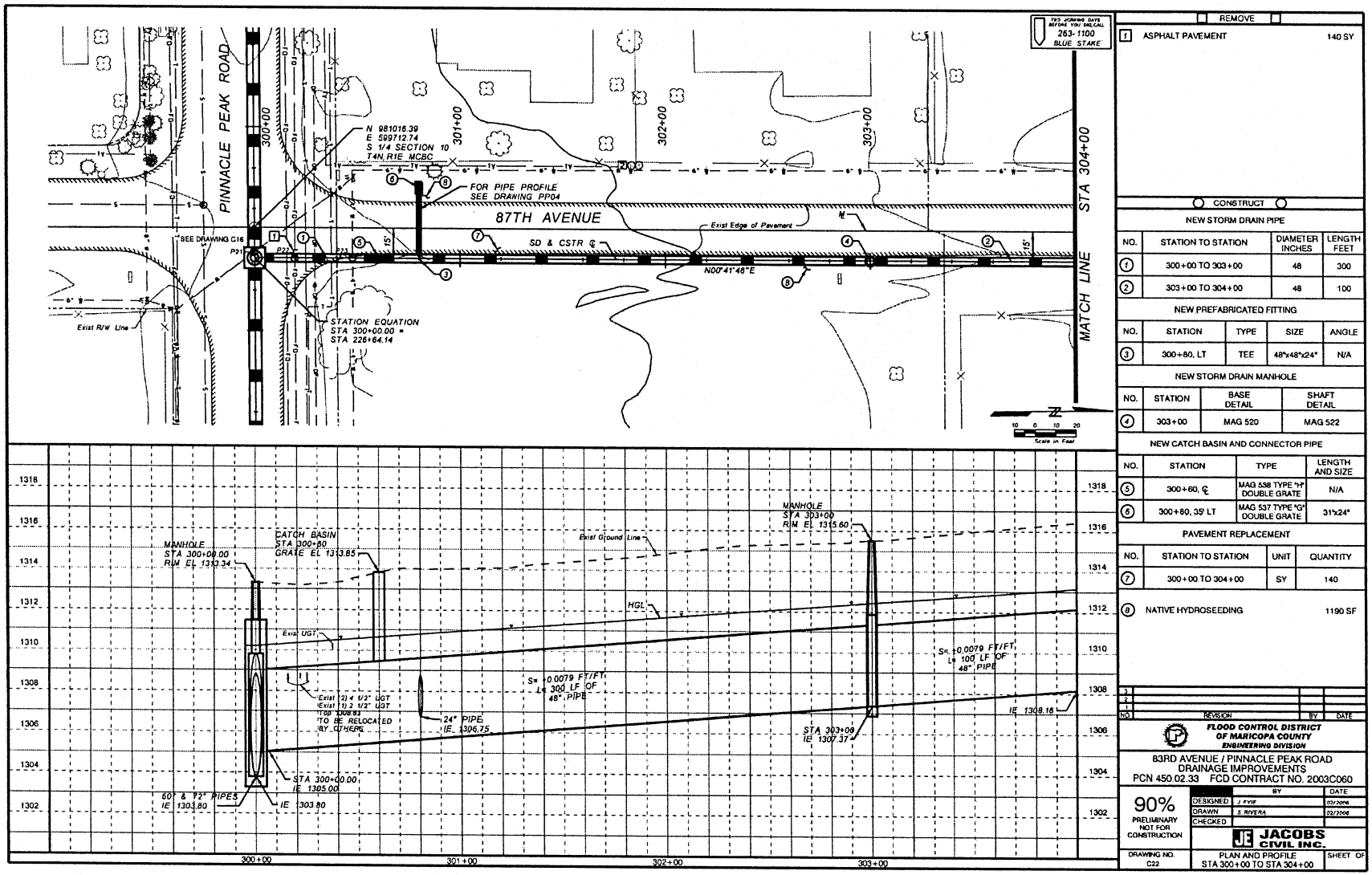
90% PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	J. FYIE	02/2006
DRAWN	S. RIVERA	02/2006
CHECKED		

JACOBS CIVIL INC.

DRAWING NO. C23 | PLAN AND PROFILE STA 304+00 TO STA 309+00 | SHEET OF

Figure 1-19



REMOVE

1	ASPHALT PAVEMENT	140 SY

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	300+00 TO 303+00	48	300
2	303+00 TO 304+00	48	100

NEW PREFABRICATED FITTING

NO.	STATION	TYPE	SIZE	ANGLE
3	300+80, LT	TEE	48"x48"x24"	N/A

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
4	303+00	MAG 520	MAG 522

NEW CATCH BASIN AND CONNECTOR PIPE

NO.	STATION	TYPE	LENGTH AND SIZE
5	300+60, ℄	MAG 538 TYPE "H" DOUBLE GRATE	N/A
6	300+80, 35' LT	MAG 537 TYPE "G" DOUBLE GRATE	31"x24"

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
7	300+00 TO 304+00	SY	140
8	NATIVE HYDROSEEDING		1190 SF

NO	REVISION	BY	DATE
1			
2			
3			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

90% PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	J. RYIE	02/2006
DRAWN	S. RIVERA	02/2006
CHECKED		

JACOBS CIVIL INC.

DRAWING NO. C22

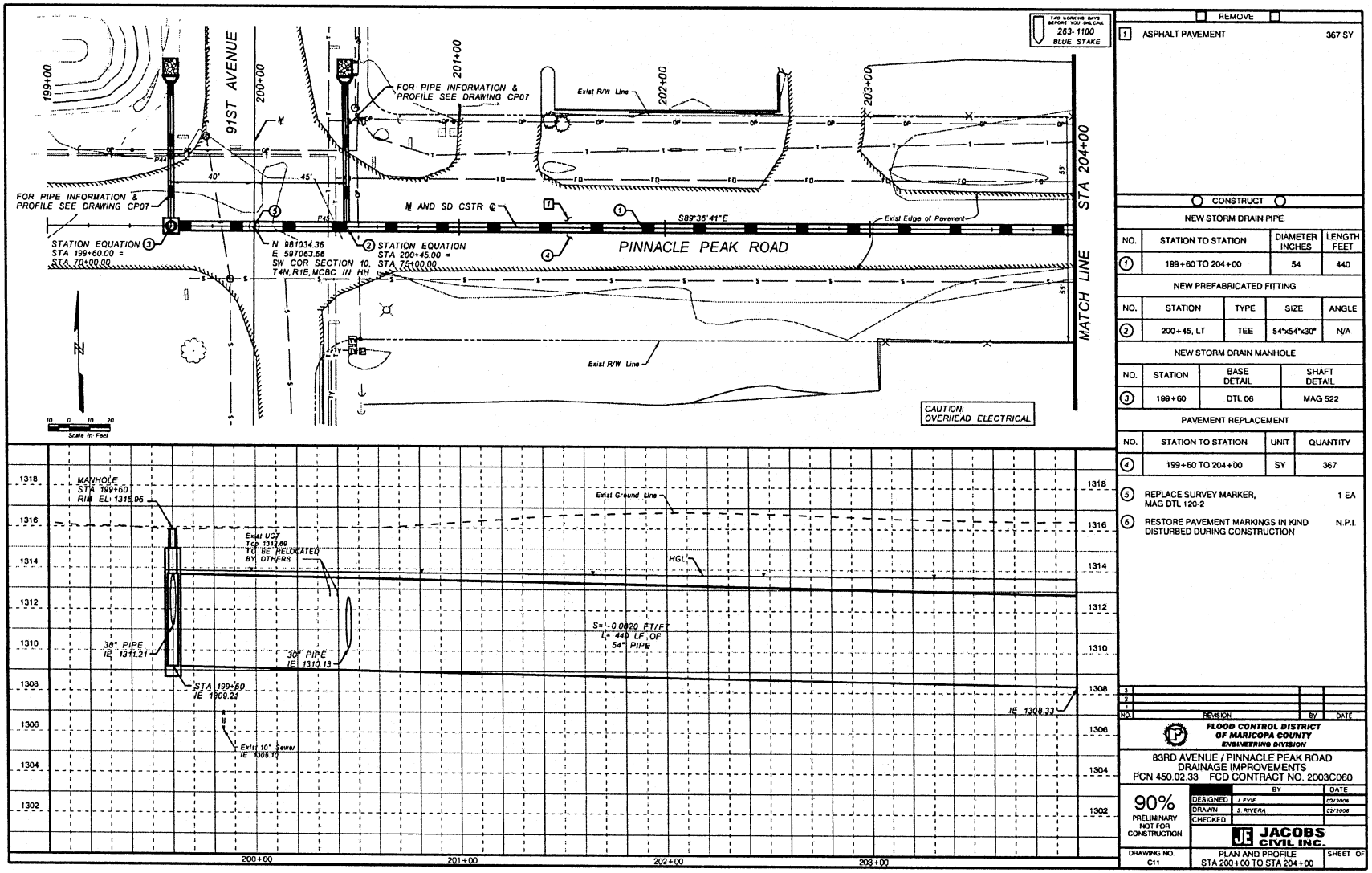
PLAN AND PROFILE
STA 300+00 TO STA 304+00

SHEET OF

Figure 1-20

Pinnacle Peak Storm Drain (Station 199+60 to Station 252+52)

54" to 84" storm drains will collect the 10-year storm event between 91st Avenue to 87th Avenue and the 100-year flows from 87th Avenue to the Pinnacle Peak basin. Field visits and reviews of aerial mapping indicate the majority of the storm water being concentrated in 91st Avenue, 90th Avenue, 89th Avenue and the 85th Avenue alignment. Other nuisance flows will be collected in catch basins at Stations 215+20, 221+60, and 222+90. Sheet flows will be collected by catch basins and concrete 6' V-ditches between Stations 232+60 and 239+90. At the 85th Avenue alignment, concentrated flows will be collected by a trench drain. This system consists of 54" RCP, 60" RCP, 72" RCP, 78" RCP and 84" RCP. Again to maximize the pipe cover, invert elevations were matched at the manhole where the pipe changes size. Design flows are 55 cfs at 91st Avenue, increasing to 97 cfs at 89th Avenue, 200 cfs at 87th Avenue, and 380 cfs at the Pinnacle Peak basin. A 24" RCP bypass/dewater storm drain will continue to the east at the basin ending at a manhole in the 83rd Avenue storm drain. See Figures 1-21 to 1-31.



REMOVE		
1	ASPHALT PAVEMENT	367 SY

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	199+60 TO 204+00	54	440

NEW PREFABRICATED FITTING

NO.	STATION	TYPE	SIZE	ANGLE
2	200+45, LT	TEE	54"x54"x30"	N/A

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
3	199+60	DTL 06	MAG 522

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
4	199+60 TO 204+00	SY	367

5	REPLACE SURVEY MARKER, MAG DTL 120-2	1 EA
6	RESTORE PAVEMENT MARKINGS IN KIND DISTURBED DURING CONSTRUCTION	N.P.I.

NO	REVISION	BY	DATE
1			
2			
3			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

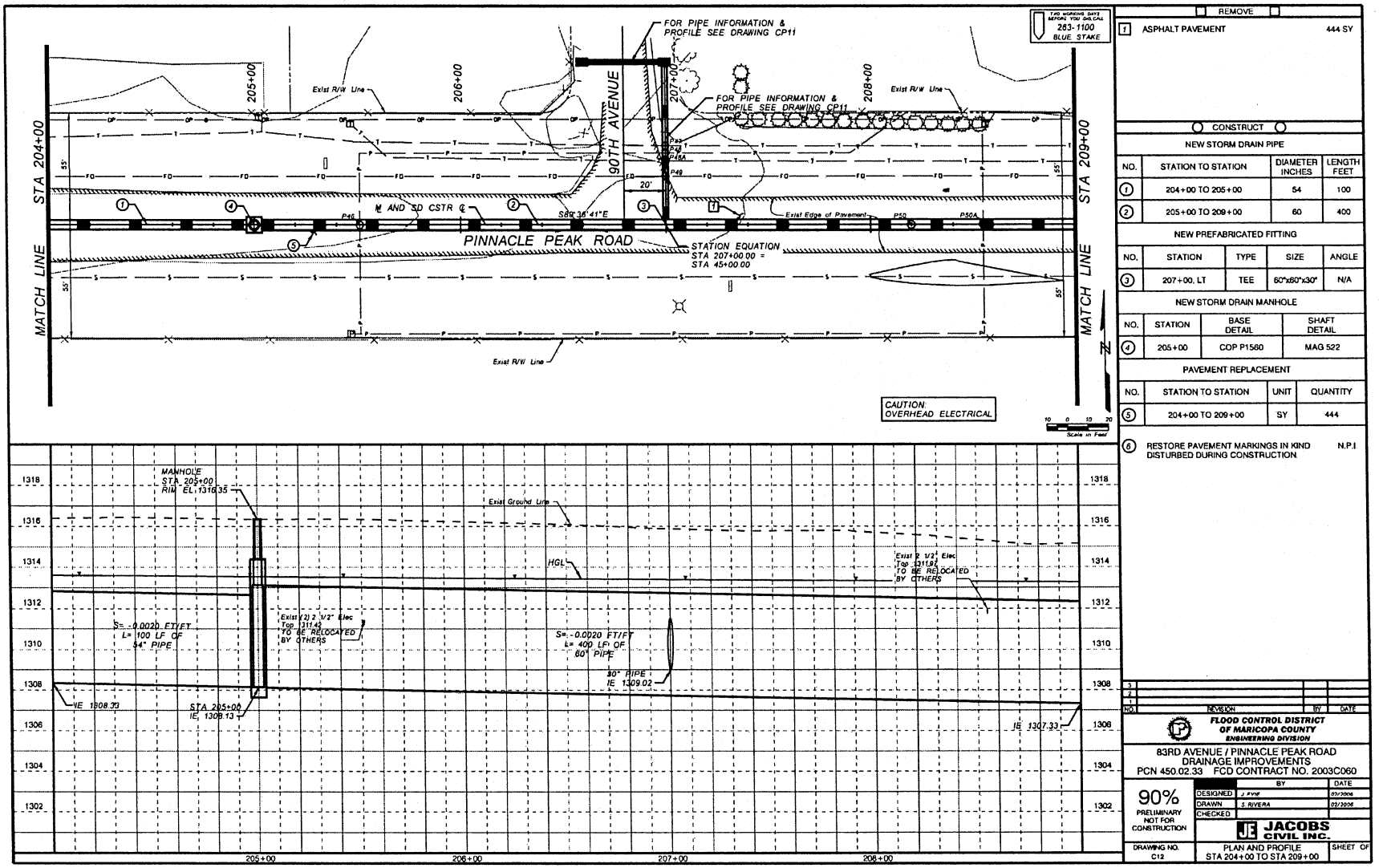
83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

90% PRELIMINARY NOT FOR CONSTRUCTION		BY	DATE
	DESIGNED	J. FYIE	02/2006
	DRAWN	S. RIVERA	02/2006
	CHECKED		

JACOBS CIVIL INC.

DRAWING NO.	PLAN AND PROFILE	SHEET OF
C11	STA 200+00 TO STA 204+00	

Figure 1-21



REMOVE

1	ASPHALT PAVEMENT	444 SY

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	204+00 TO 205+00	54	100
2	205+00 TO 209+00	60	400

NEW PREFABRICATED FITTING

NO.	STATION	TYPE	SIZE	ANGLE
3	207+00, LT	TEE	60"x60"x30"	N/A

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
4	205+00	COP P1560	MAG 522

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
5	204+00 TO 209+00	SY	444

6 RESTORE PAVEMENT MARKINGS IN KIND DISTURBED DURING CONSTRUCTION N.P.I

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

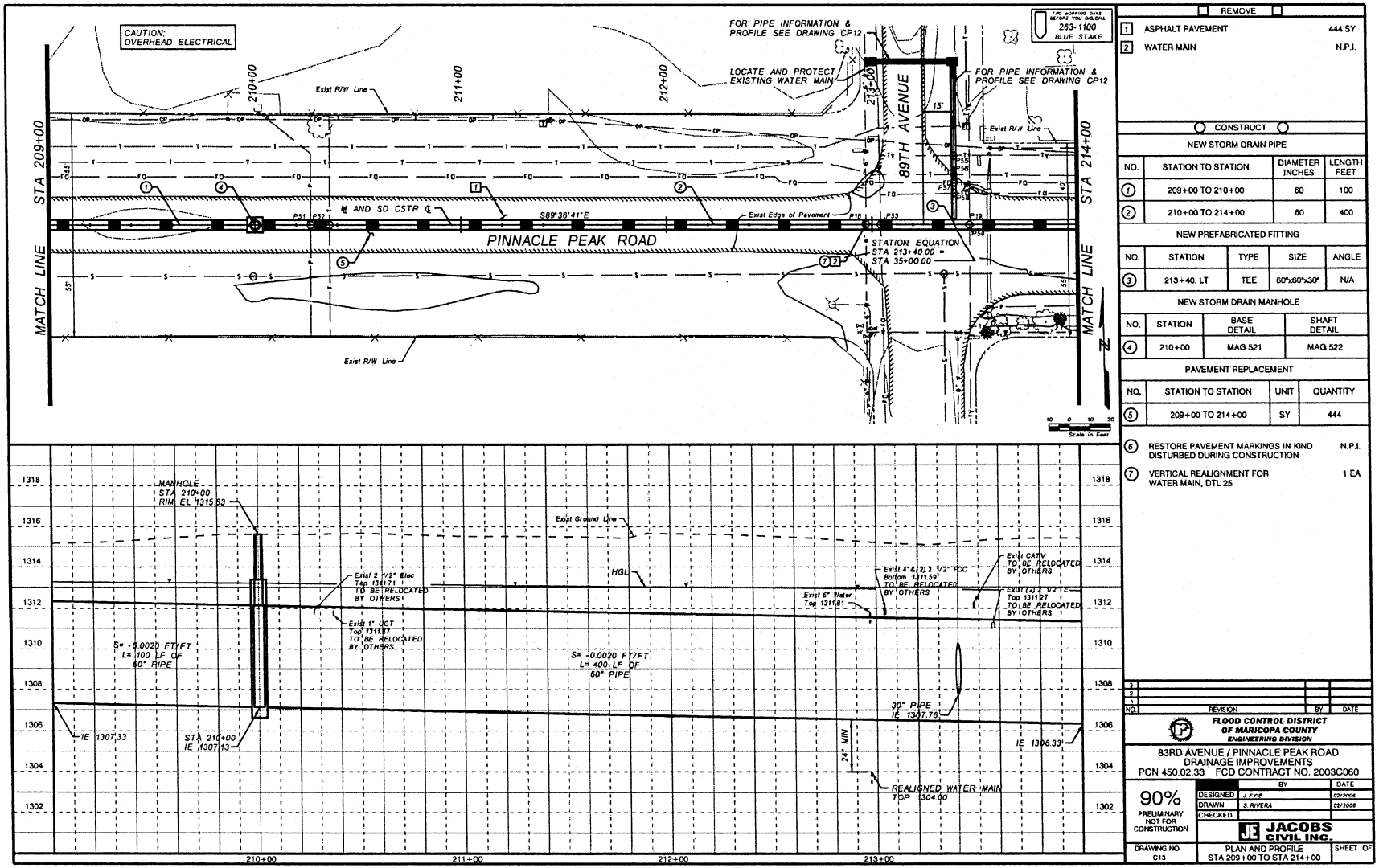
83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

90% PRELIMINARY NOT FOR CONSTRUCTION	BY	DATE
DESIGNED	J. KYNE	03/2006
DRAWN	S. RIVERA	03/2006
CHECKED		

JACOBS CIVIL INC.

DRAWING NO. C12 | PLAN AND PROFILE STA 204+00 TO STA 209+00 | SHEET OF

Figure 1-22



REMOVE		
1	ASPHALT PAVEMENT	444 SY
2	WATER MAIN	N.P.I.

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	209+00 TO 210+00	60	100
2	210+00 TO 214+00	60	400

NEW PREFABRICATED FITTING

NO.	STATION	TYPE	SIZE	ANGLE
3	213+40, LT	TEE	60"x60"x30"	N/A

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
4	210+00	MAG 521	MAG 522

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
5	209+00 TO 214+00	SY	444

6	RESTORE PAVEMENT MARKINGS IN KIND DISTURBED DURING CONSTRUCTION	N.P.I.
7	VERTICAL REALIGNMENT FOR WATER MAIN, DTL 25	1 EA

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

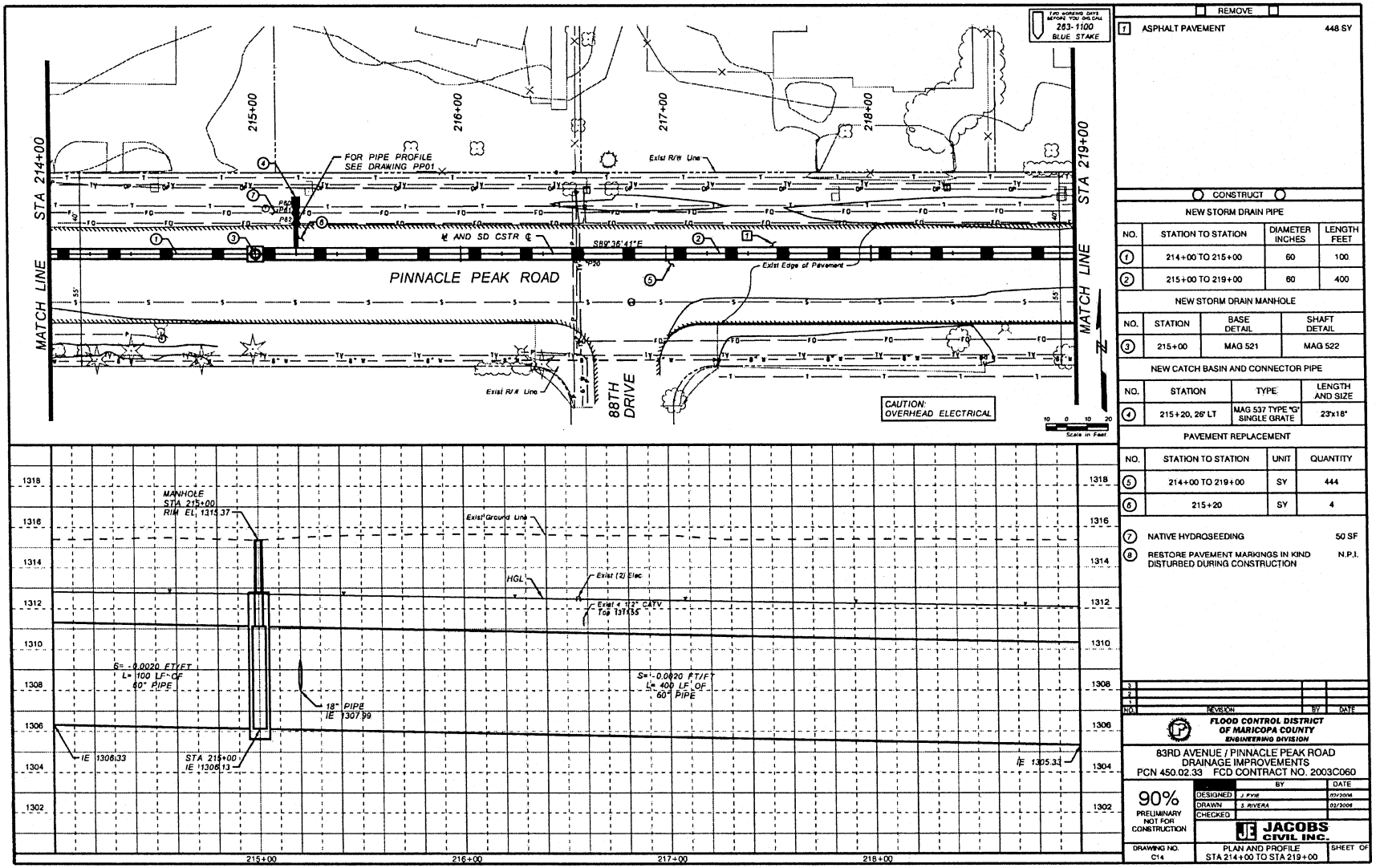
90% PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	J. FYIE	02/2006
DRAWN	S. RIVERA	02/2006
CHECKED		

JACOBS CIVIL INC.

DRAWING NO. C13 | PLAN AND PROFILE STA 209+00 TO STA 214+00 | SHEET OF

Figure 1-23



REMOVE

1	ASPHALT PAVEMENT	448 SY

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	214+00 TO 215+00	60	100
2	215+00 TO 219+00	60	400

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
3	215+00	MAG 521	MAG 522

NEW CATCH BASIN AND CONNECTOR PIPE

NO.	STATION	TYPE	LENGTH AND SIZE
4	215+20, 26' LT	MAG 537 TYPE "G" SINGLE GRATE	23'x18"

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
5	214+00 TO 219+00	SY	444
6	215+20	SY	4

7	NATIVE HYDROSEEDING	50 SF
8	RESTORE PAVEMENT MARKINGS IN KIND DISTURBED DURING CONSTRUCTION	N.P.I.

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

90% PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	J. FYIE	02/2006
DRAWN	S. RIVERA	02/2006
CHECKED		

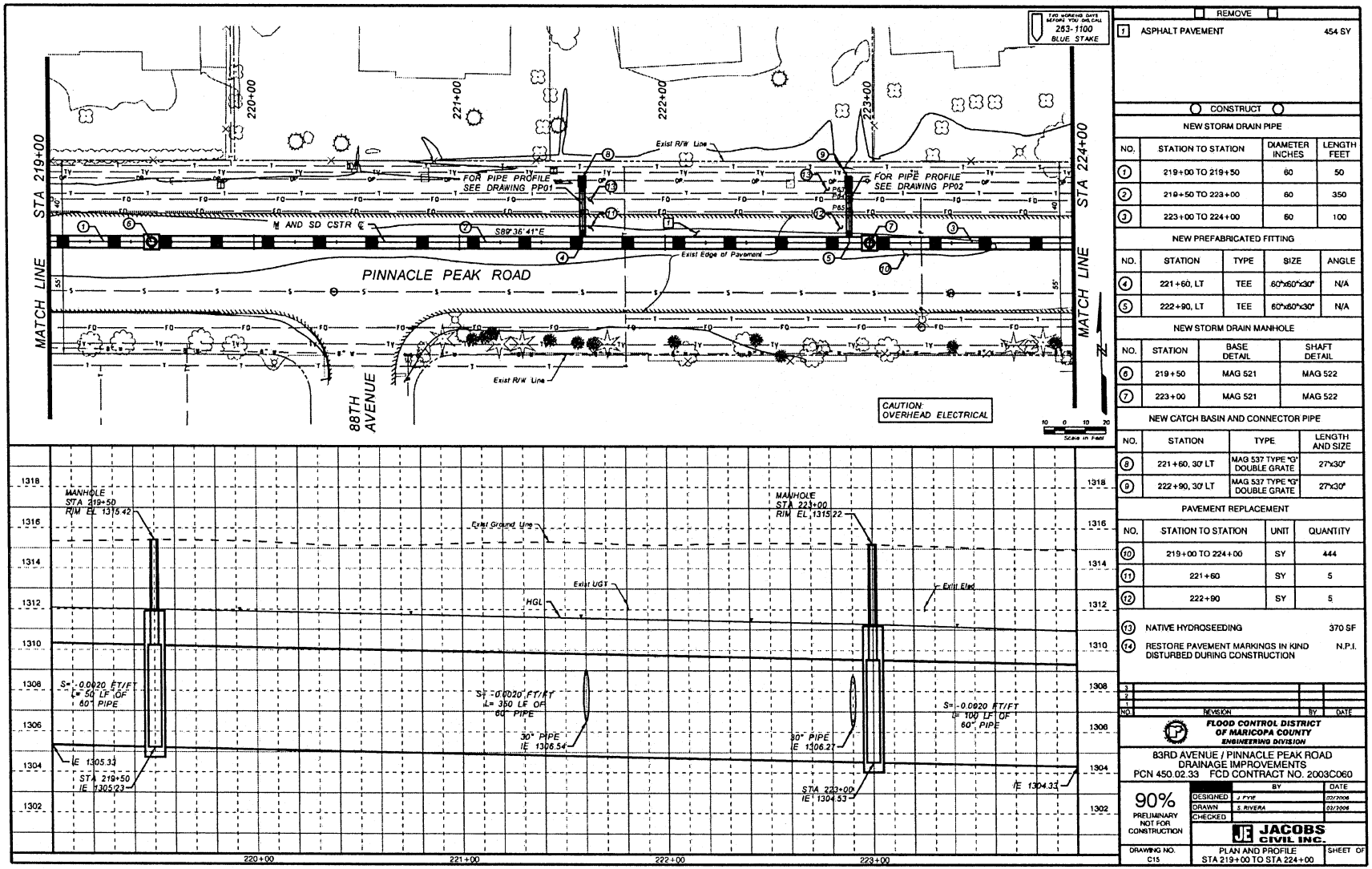
JACOBS CIVIL INC.

DRAWING NO. C14

PLAN AND PROFILE STA 214+00 TO STA 219+00

SHEET OF

Figure 1-24



REMOVE

1	ASPHALT PAVEMENT	454 SY

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	219+00 TO 219+50	60	50
2	219+50 TO 223+00	60	350
3	223+00 TO 224+00	60	100

NEW PREFABRICATED FITTING

NO.	STATION	TYPE	SIZE	ANGLE
4	221+60, LT	TEE	60"x60"x30"	N/A
5	222+90, LT	TEE	60"x60"x30"	N/A

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
6	219+50	MAG 521	MAG 522
7	223+00	MAG 521	MAG 522

NEW CATCH BASIN AND CONNECTOR PIPE

NO.	STATION	TYPE	LENGTH AND SIZE
8	221+60, 30' LT	MAG 537 TYPE "G" DOUBLE GRATE	27"x30"
9	222+90, 30' LT	MAG 537 TYPE "G" DOUBLE GRATE	27"x30"

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
10	219+00 TO 224+00	SY	444
11	221+60	SY	5
12	222+90	SY	5

13	NATIVE HYDROSEEDING	370 SF
14	RESTORE PAVEMENT MARKINGS IN KIND DISTURBED DURING CONSTRUCTION	N.P.I.

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

90% PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	J. FYFE	02/2006
DRAWN	S. RIVERA	02/2006
CHECKED		

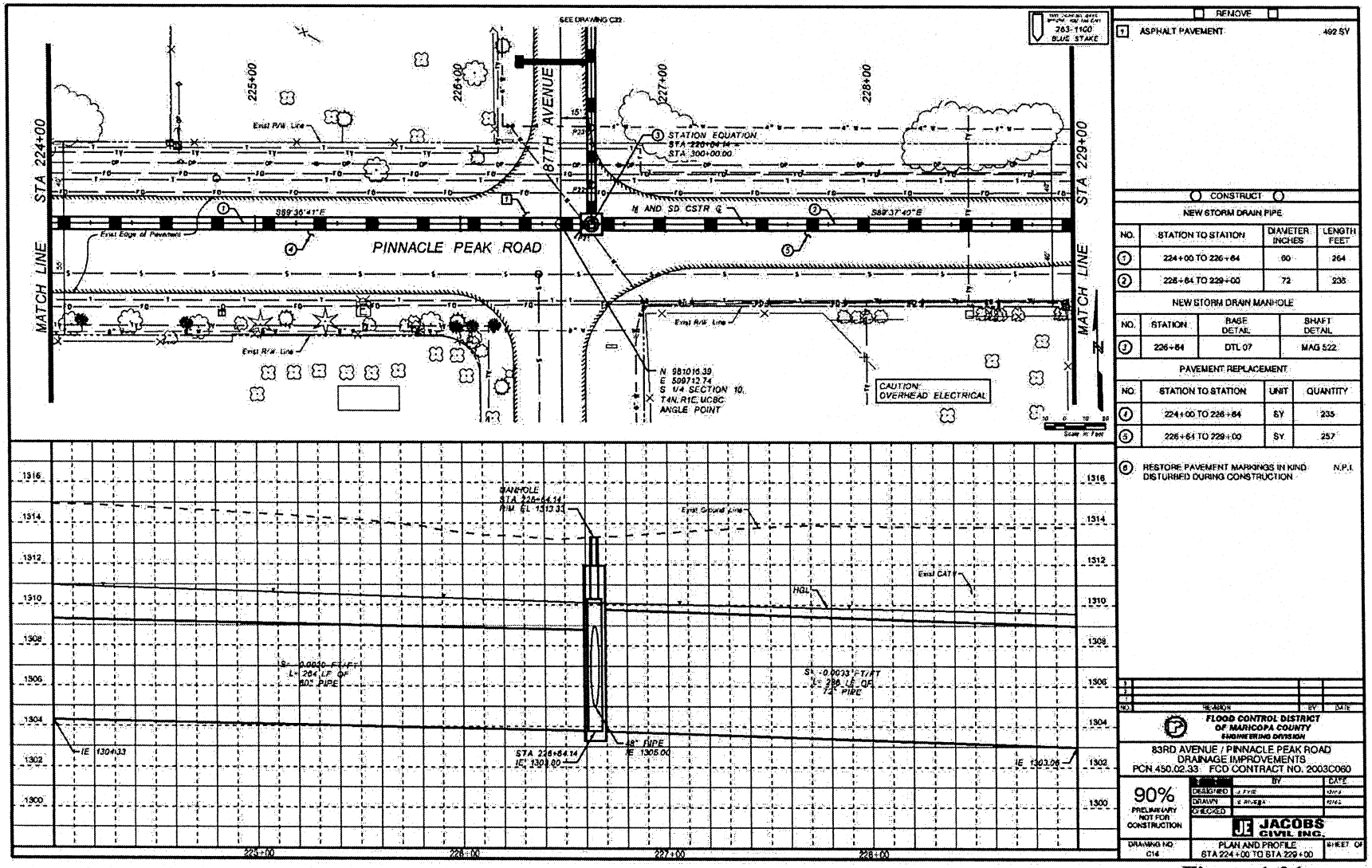
JACOBS CIVIL INC.

DRAWING NO. C15

PLAN AND PROFILE STA 219+00 TO STA 224+00

SHEET OF

Figure 1-25



REMOVE

1	ASPHALT PAVEMENT	492 SY

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	224+00 TO 226+64	60	264
2	226+64 TO 229+00	72	236

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
3	226+64	DTL 07	MAG 522

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
4	224+00 TO 226+64	SY	235
5	226+64 TO 229+00	SY	257

6 RESTORE PAVEMENT MARKINGS IN KIND DISTURBED DURING CONSTRUCTION N.P.I.

NO.	REVISION	BY	DATE
1			
2			
3			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

90% PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	J. FYFE	02/03
DRAWN	E. RIVERA	02/03
CHECKED		

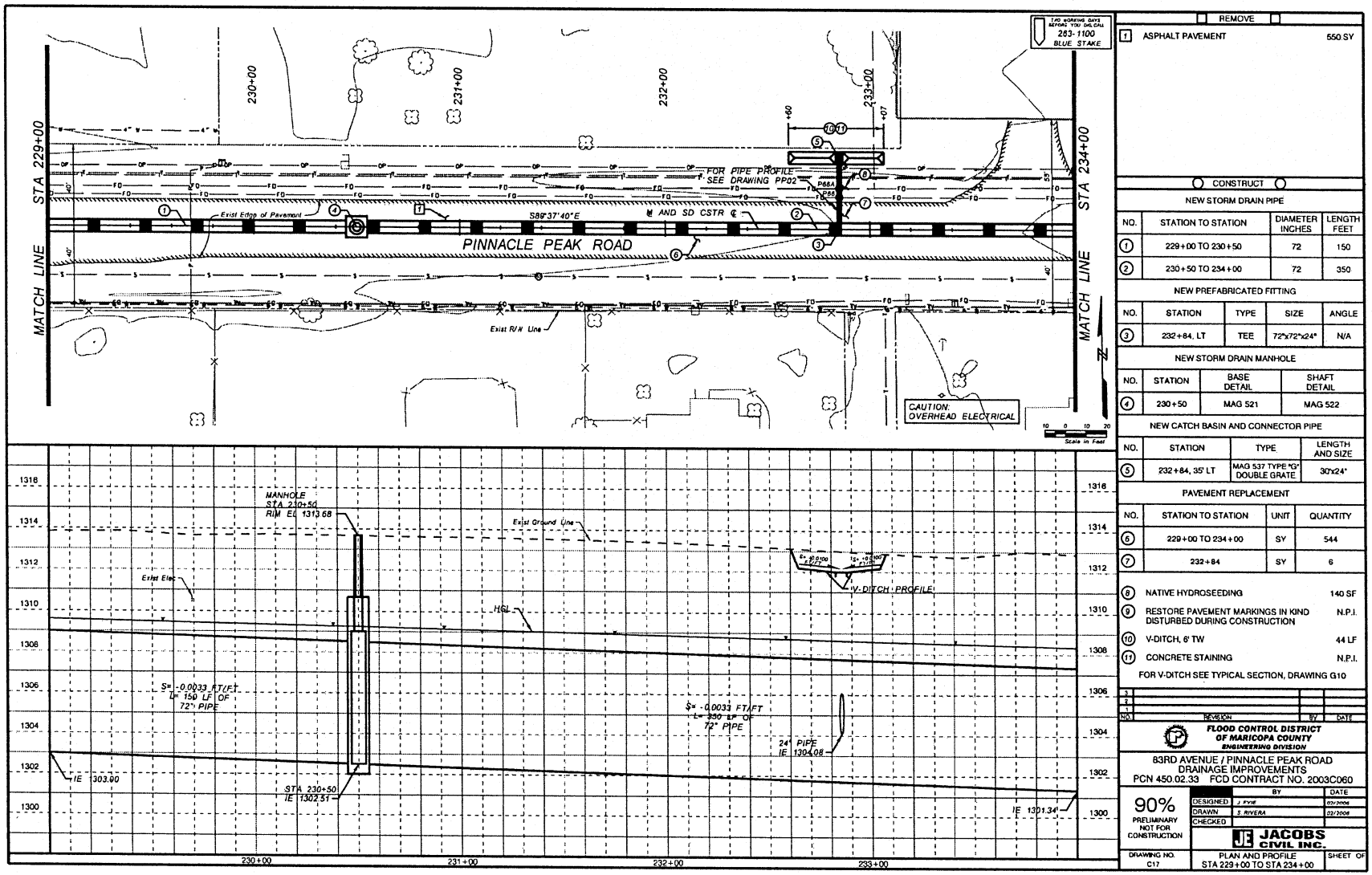
JE JACOBS CIVIL INC.

DRAWING NO. C14

PLAN AND PROFILE
STA 224+00 TO STA 229+00

SHEET OF

Figure 1-26



REMOVE

1	ASPHALT PAVEMENT	550 SY

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	229+00 TO 230+50	72	150
2	230+50 TO 234+00	72	350

NEW PREFABRICATED FITTING

NO.	STATION	TYPE	SIZE	ANGLE
3	232+84, LT	TEE	72"x72"x24"	N/A

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
4	230+50	MAG 521	MAG 522

NEW CATCH BASIN AND CONNECTOR PIPE

NO.	STATION	TYPE	LENGTH AND SIZE
5	232+84, 35' LT	MAG 537 TYPE "G" DOUBLE GRATE	30'x24"

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
6	229+00 TO 234+00	SY	544
7	232+84	SY	6

8	NATIVE HYDROSEEDING	140 SF
9	RESTORE PAVEMENT MARKINGS IN KIND DISTURBED DURING CONSTRUCTION	N.P.I.
10	V-DITCH, 6' TW	44 LF
11	CONCRETE STAINING	N.P.I.

FOR V-DITCH SEE TYPICAL SECTION, DRAWING G10

NO.	REVISION	BY	DATE
1			
2			
3			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

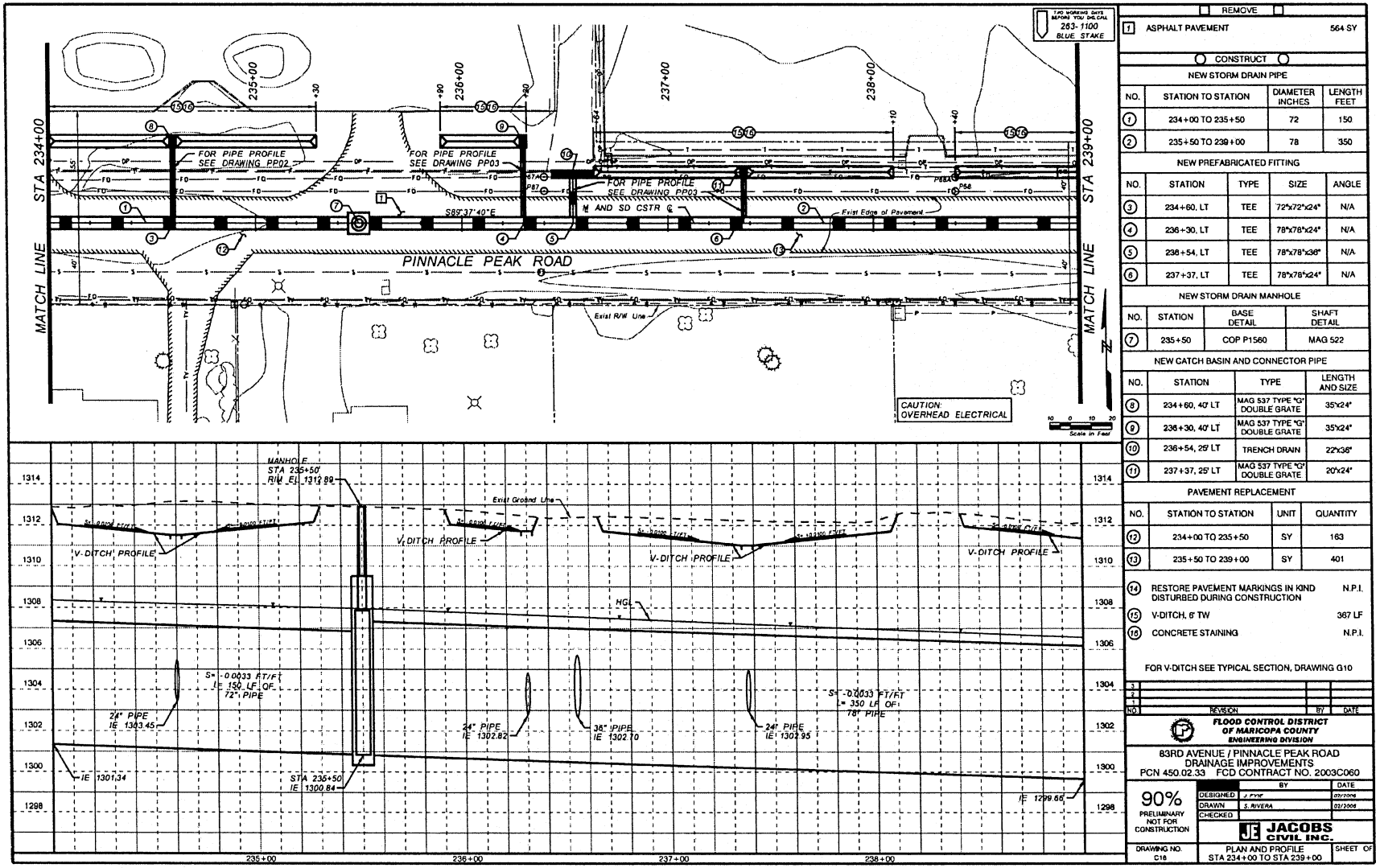
83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

90% PRELIMINARY NOT FOR CONSTRUCTION		BY	DATE
	DESIGNED	J. RYAN	02/2006
	DRAWN	S. RIVERA	02/2006
	CHECKED		

JACOBS CIVIL INC.

DRAWING NO.	PLAN AND PROFILE STA 229+00 TO STA 234+00	SHEET OF
C17		

Figure 1-27



REMOVE

1	ASPHALT PAVEMENT	564 SY

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	234+00 TO 235+50	72	150
2	235+50 TO 239+00	78	350

NEW PREFABRICATED FITTING

NO.	STATION	TYPE	SIZE	ANGLE
3	234+60, LT	TEE	72"x72"x24"	N/A
4	236+30, LT	TEE	78"x78"x24"	N/A
5	236+54, LT	TEE	78"x78"x36"	N/A
6	237+37, LT	TEE	78"x78"x24"	N/A

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
7	235+50	COP P1560	MAG 522

NEW CATCH BASIN AND CONNECTOR PIPE

NO.	STATION	TYPE	LENGTH AND SIZE
8	234+60, 40' LT	MAG 537 TYPE "G" DOUBLE GRATE	35'x24"
9	236+30, 40' LT	MAG 537 TYPE "G" DOUBLE GRATE	35'x24"
10	236+54, 25' LT	TRENCH DRAIN	22'x36"
11	237+37, 25' LT	MAG 537 TYPE "G" DOUBLE GRATE	20'x24"

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
12	234+00 TO 235+50	SY	163
13	235+50 TO 239+00	SY	401

14	RESTORE PAVEMENT MARKINGS IN KIND DISTURBED DURING CONSTRUCTION	N.P.I.
15	V-DITCH, 6' TW	367 LF
16	CONCRETE STAINING	N.P.I.

FOR V-DITCH SEE TYPICAL SECTION, DRAWING G10

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

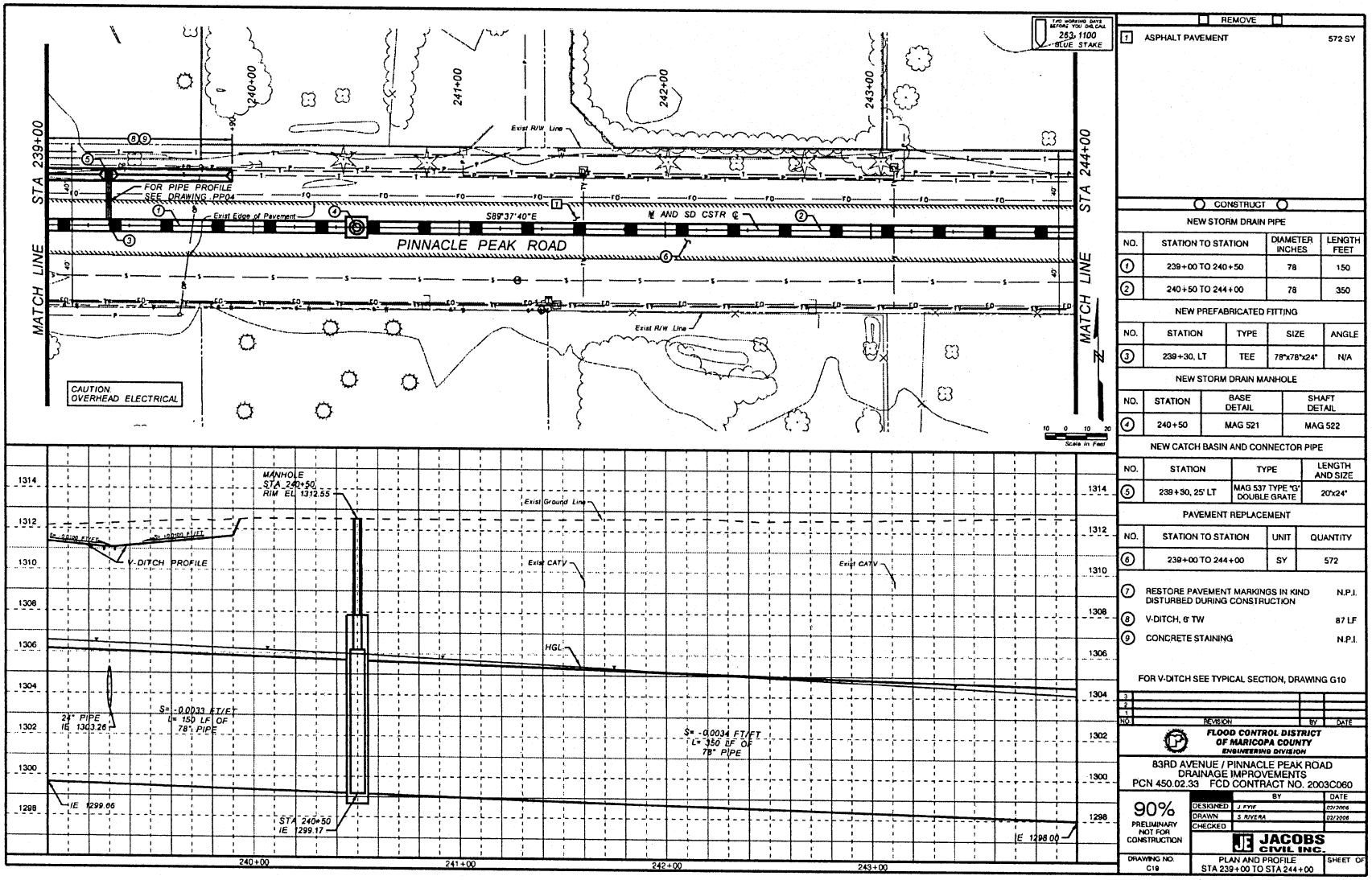
83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

90% PRELIMINARY NOT FOR CONSTRUCTION		BY	DATE
	DESIGNED	J. FYVE	07/2006
	DRAWN	S. RIVERA	02/2006
	CHECKED		

JACOBS CIVIL INC.

DRAWING NO.	PLAN AND PROFILE STA 234+00 TO STA 239+00	SHEET OF
C16		

Figure 1-28



REMOVE

1	ASPHALT PAVEMENT	572 SY

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	239+00 TO 240+50	78	150
2	240+50 TO 244+00	78	350

NEW PREFABRICATED FITTING

NO.	STATION	TYPE	SIZE	ANGLE
3	239+30, LT	TEE	78"x78"x24"	N/A

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
4	240+50	MAG 521	MAG 522

NEW CATCH BASIN AND CONNECTOR PIPE

NO.	STATION	TYPE	LENGTH AND SIZE
5	239+30, 25' LT	MAG 537 TYPE "G" DOUBLE GRATE	20'x24"

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
6	239+00 TO 244+00	SY	572

7	RESTORE PAVEMENT MARKINGS IN KIND DISTURBED DURING CONSTRUCTION	N.P.I.
8	V-DITCH, 6' TW	87 LF
9	CONCRETE STAINING	N.P.I.

FOR V-DITCH SEE TYPICAL SECTION, DRAWING G10

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

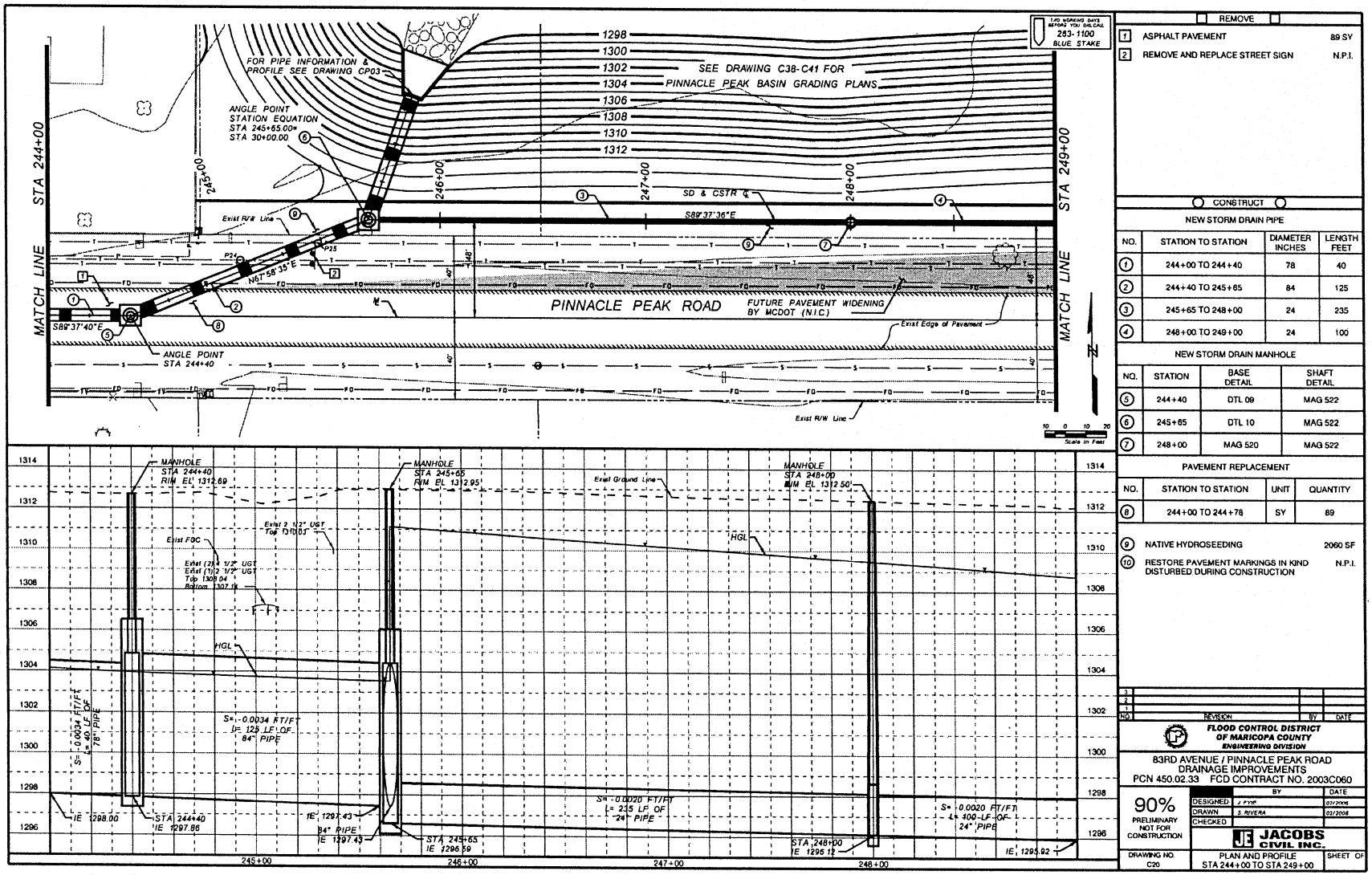
	BY	DATE
DESIGNED	J. FYIE	03/2006
DRAWN	S. RIVERA	03/2006
CHECKED		

90% PRELIMINARY NOT FOR CONSTRUCTION

JACOBS CIVIL INC.

DRAWING NO. C19 | PLAN AND PROFILE STA 239+00 TO STA 244+00 | SHEET OF

Figure 1-29



REMOVE

1	ASPHALT PAVEMENT	89 SY
2	REMOVE AND REPLACE STREET SIGN	N.P.I.

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	244+00 TO 244+40	78	40
2	244+40 TO 245+65	84	125
3	245+65 TO 248+00	24	235
4	248+00 TO 249+00	24	100

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
5	244+40	DTL 09	MAG 522
6	245+65	DTL 10	MAG 522
7	248+00	MAG 520	MAG 522

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
8	244+00 TO 244+78	SY	89

9	NATIVE HYDROSEEDING	2060 SF
10	RESTORE PAVEMENT MARKINGS IN KIND DISTURBED DURING CONSTRUCTION	N.P.I.

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

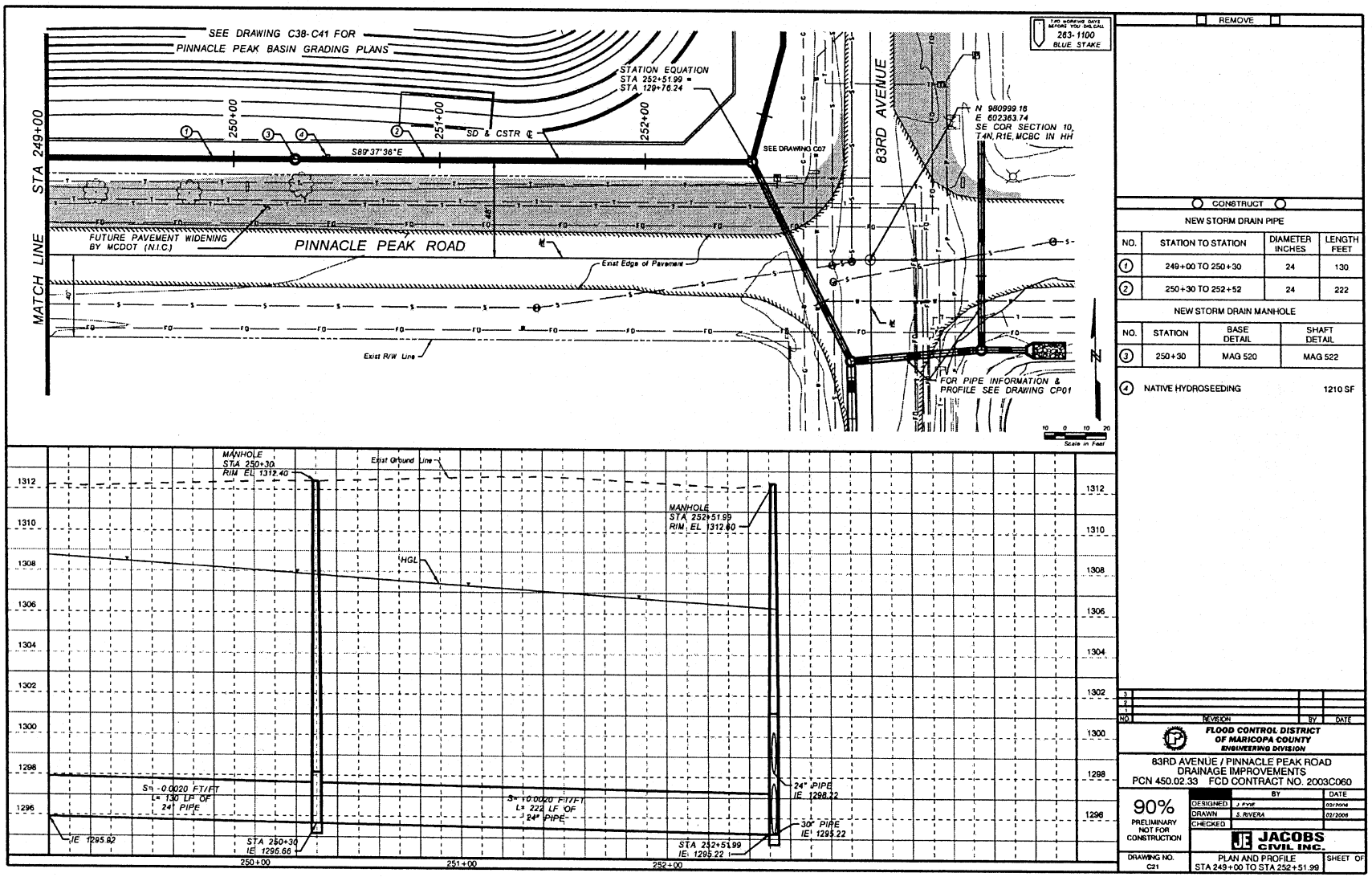
90% PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	J. FINE	02/2006
DRAWN	S. RIVERA	02/2006
CHECKED		

JACOBS CIVIL INC.

DRAWING NO. C20 | PLAN AND PROFILE STA 244+00 TO STA 249+00 | SHEET OF

Figure 1-30



REMOVE

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	249+00 TO 250+30	24	130
2	250+30 TO 252+52	24	222

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
3	250+30	MAG 520	MAG 522

4 NATIVE HYDROSEEDING 1210 SF

NO	REVISION	BY	DATE
1			
2			
3			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

90% PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	J. FYVIE	02/2006
DRAWN	S. RIVERA	02/2006
CHECKED		

JACOBS CIVIL INC.

DRAWING NO. C21

PLAN AND PROFILE
STA 249+00 TO STA 252+51.99

SHEET OF

Figure 1-31

Pinnacle Peak Detention Basin

The Pinnacle Peak detention basin will be located on a 6.2 acre parcel owned by the City of Peoria at the northwest corner of 83rd Avenue and Pinnacle Peak Road. This tract is adjoined by single family residences to the northwest and by Camino De Oro to the north. The layout provides a 14 foot access road on the perimeter and varied slopes to the bottom with a 15 foot depth. Project landscape architects have determined this basin is unsuitable for multi-use opportunities. Since grading will include up to 4:1 slopes, the basin site will have to be fenced. In addition, ground cover will be provided to minimize erosion on the slopes. Native landscaping and view fences will be provided to create more pleasing aesthetics. To accommodate future street improvements, the ultimate right-of-way limits were identified and shown on the plans. These limits are 110' for Pinnacle Peak Road and 130' for 83rd Avenue. The detention basin property is presently unimproved with grades sloping to the southeast.

Storm water from the 83rd Avenue and Pinnacle Peak Road storm drains is conveyed to manholes adjacent to the basin. From these structures, storm drains of the same size will connect to the basin with slopes downward toward the structure. In this way, the connecting storm drains will serve to fill and to drain the basin. At the junction structures, bypass/dewater storm drains will be provided.

The proposed layout provides storage for approximately 52.7 acre-feet of runoff. The basin will be dewatered through two 24" RCP storm drains each being regulated through 13.5" diameter orifices. As shown in Appendix C-4, the storm drain entrances are partially covered with a steel plate to provide the same opening size as a 13.5" orifice. The maximum water surface elevation is 1310.76. The basin will provide a minimum 12" freeboard and an emergency spillway in the southeastern end. Peak discharge through the dewater storm drains is 34 cfs. See Table 1-2 for the basin design characteristics. See Figures 1-32 and 1-33 for landscaping concepts and the preliminary grading plan.

Table 1-2
Pinnacle Peak Detention Basin Data

83rd Avenue/Pinnacle Peak Road Drainage Improvements											
FCDMC Contract No. 2003C060 Project No. 450.02.33											
Pinnacle Peak Detention Basin - 4:1 slopes											
							Discharge	Discharge	Total	Bypass	Total
		Total	Volume	Volume	H1	H2	1	2	Discharge	Flows	Discharge
Elevation		(sq ft)	(cu ft)	(ac ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
1298		35,628	17,814	0.41	0.00	0.85	0.00	4.55	4.55	4.55	0.00
1299		99,078	85,167	1.96	0.00	1.85	0.00	6.72	6.72	6.72	0.00
1300		106,887	188,150	4.32	0.00	2.85	0.00	8.35	8.35	8.35	0.00
1301		114,872	299,029	6.86	0.00	3.85	0.00	9.70	9.70	9.70	0.00
1302		123,002	417,966	9.60	0.00	4.85	0.00	10.89	10.89	9.86	1.03
1303		131,264	545,099	12.51	0.00	5.85	0.00	11.96	11.96	9.86	2.10
1304		139,655	680,559	15.62	2.77	6.85	8.23	12.94	21.17	9.86	11.31
1305		148,170	824,471	18.93	3.77	7.85	9.60	13.85	23.45	9.86	13.59
1306		156,872	976,992	22.43	4.77	8.85	10.80	14.71	25.51	9.86	15.65
1307		165,674	1,138,265	26.13	5.77	9.85	11.88	15.52	27.40	9.86	17.54
1308		174,577	1,308,391	30.04	6.77	10.85	12.87	16.29	29.15	9.86	19.29
1309		183,580	1,487,469	34.15	7.77	11.85	13.78	17.02	30.81	9.86	20.95
1310		192,684	1,675,601	38.47	8.77	12.85	14.64	17.73	32.37	9.86	22.51
1311		201,889	1,872,888	43.00	9.77	13.85	15.46	18.40	33.86	9.86	24.00
1312		211,193	2,079,429	47.74	10.77	14.85	16.23	19.06	35.29	9.86	25.43
1313		220,599	2,295,325	52.69	11.77	15.85	16.97	19.69	36.65	9.86	26.79
Q = Cd x Ao x (2gh)^0.5											
Cd =	0.62	2 Orifices - 1 at Elev 1300.67 and 1 at Elev 1296.59									
Orifice Diameter each @ (i		13.5									
Orifice Area each (sq ft) =		0.99									
h = elevation - center of orifice					total bypass flow (cfs) =			9.86			
center of orifices	1301.23	and	1297.15								
bypass to elev =	1303.00	and	1297.59		bypass flows (cfs) =		6.58	and	3.28		
Revised 12/22/05											

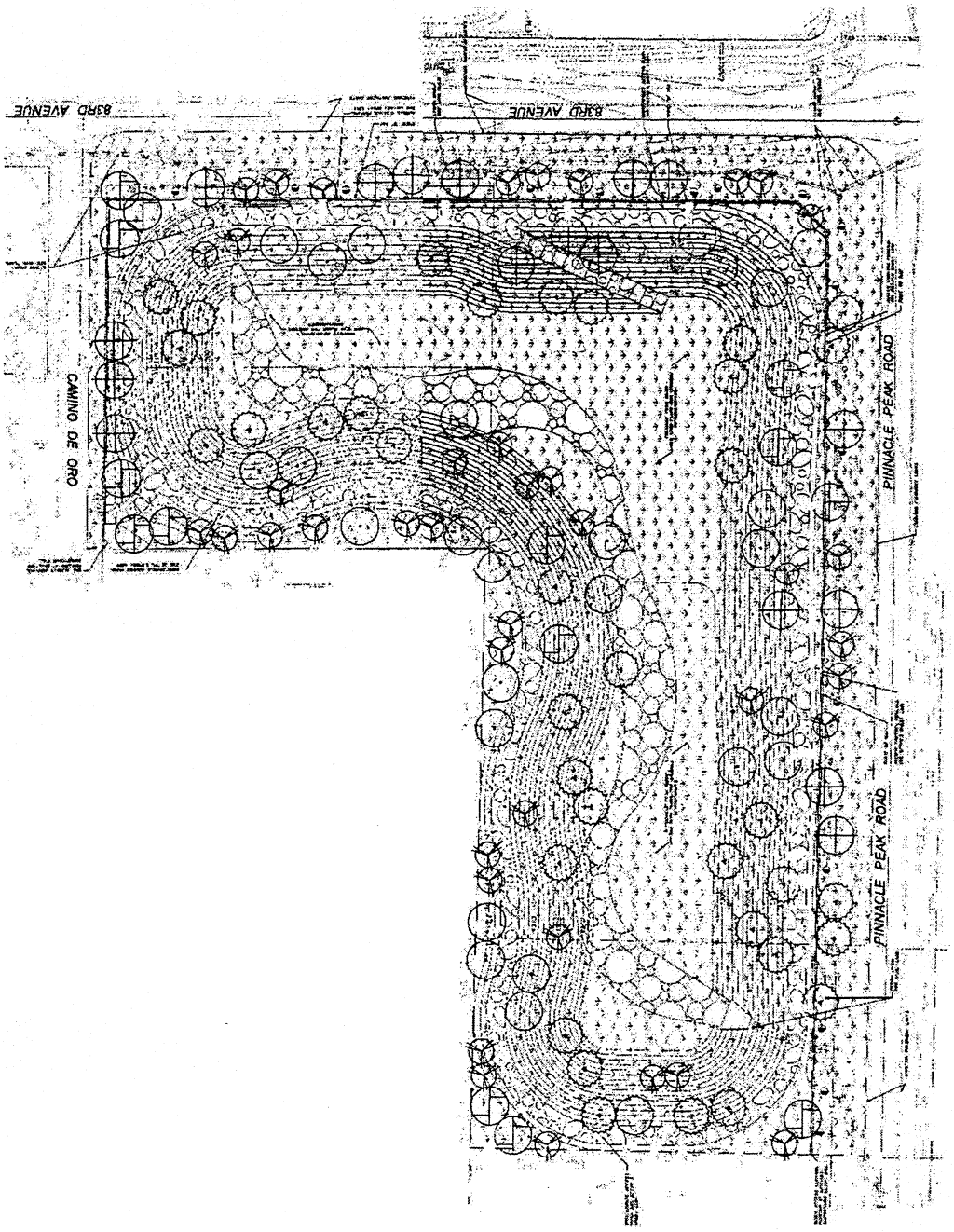


Figure 1-32
Pinnacle Peak Basin

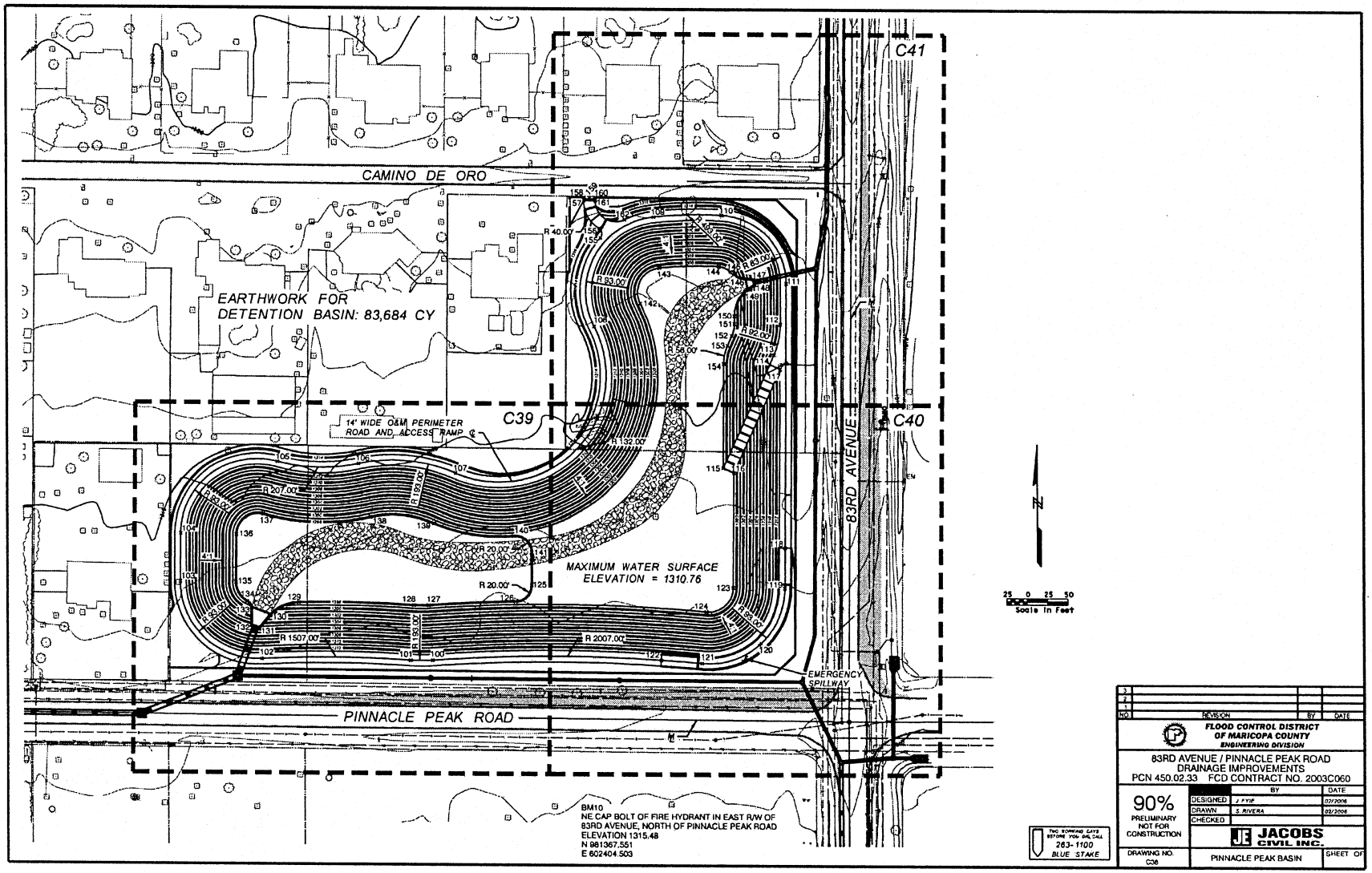
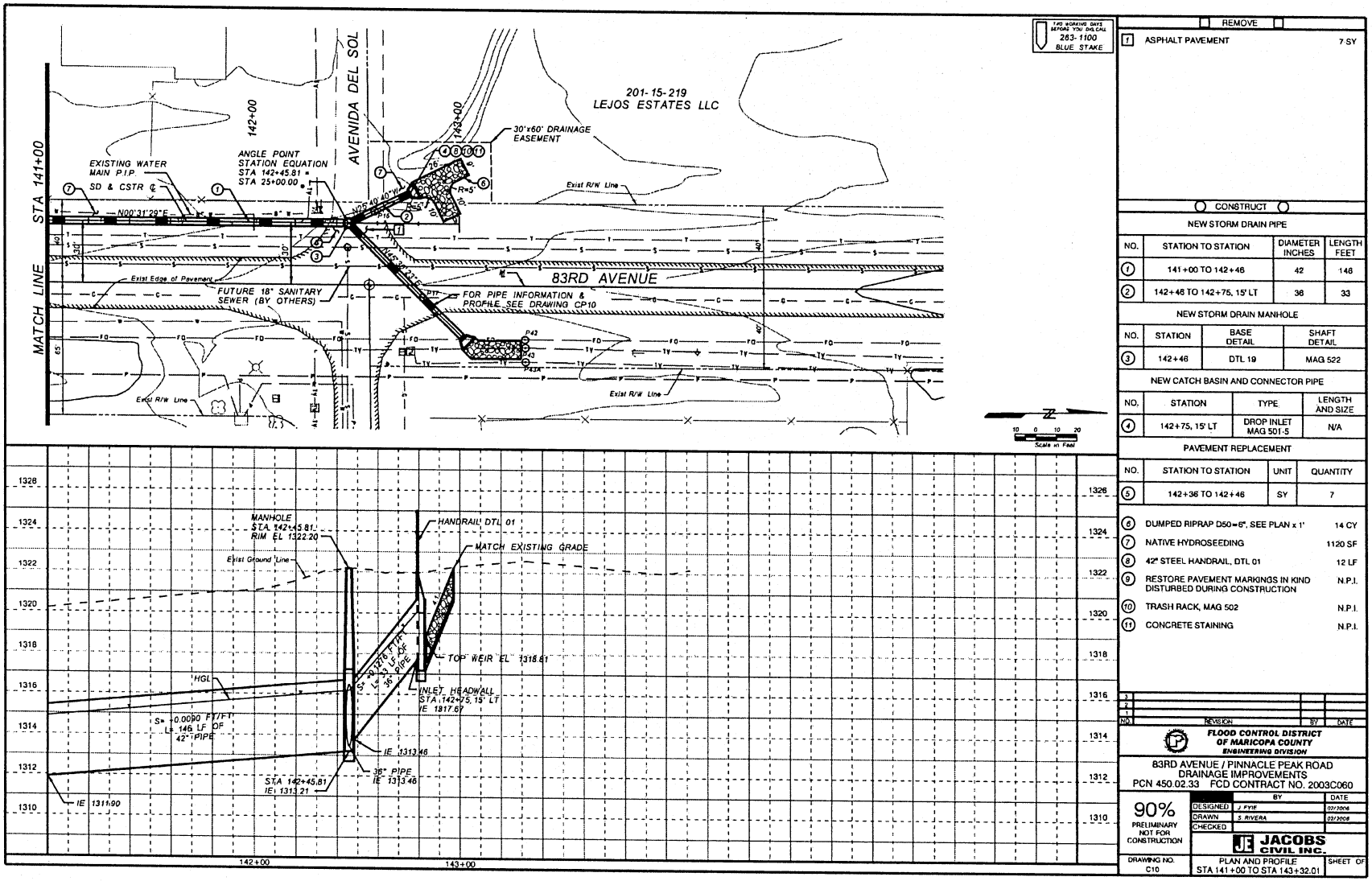

C41
CAMINO DE ORO
EARTHWORK FOR
DETENTION BASIN: 83,684 CY
14' WIDE O&M PERIMETER
ROAD AND ACCESS RAMP
C39
C40
83RD AVENUE
MAXIMUM WATER SURFACE
ELEVATION = 1310.76
EMERGENCY
SPILLWAY
PINNACLE PEAK ROAD
BM10
NE CAP BOLT OF FIRE HYDRANT IN EAST R/W OF
83RD AVENUE, NORTH OF PINNACLE PEAK ROAD
ELEVATION 1315.48
N 981367.551
E 602404.503
Scale In Feet
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION
83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060
90%
PRELIMINARY
NOT FOR
CONSTRUCTION
DESIGNED
DRAWN
CHECKED
JACOBS
CIVIL INC.
DRAWING NO.
C36
PINNACLE PEAK BASIN
SHEET OF

Figure 1-33

83rd Avenue Storm Drain (Station 142+75 to Station 129+76)

This portion of the 83rd Avenue storm drain inlets will collect the 100-year storm event between Avenida del Sol and the Pinnacle Peak basin. Field visits and reviews of aerial mapping indicate the majority of the storm water is being concentrated at the northwest quadrant of 83rd Avenue and Avenida del Sol and along the east right-of-way of 83rd Avenue. Other nuisance flows will flow directly into the Pinnacle Peak basin. This storm drain system consists of 36" RCP and 42" RCP. Design flows vary from 40 cfs to 92 cfs. At the Pinnacle Peak basin, a 24" RCP bypass/dewater storm drain will continue south ending at a manhole that collects the flows from the Pinnacle Peak Road storm drain. See Figures 1-34 to 1-37.



REMOVE		
1	ASPHALT PAVEMENT	7 SY

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	141+00 TO 142+46	42	146
2	142+46 TO 142+75, 15' LT	36	33

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
3	142+46	DTL 19	MAG 522

NEW CATCH BASIN AND CONNECTOR PIPE

NO.	STATION	TYPE	LENGTH AND SIZE
4	142+75, 15' LT	DROP INLET MAG 501-5	N/A

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
5	142+36 TO 142+46	SY	7

6	DUMPED RIPRAP D50=6", SEE PLAN x 1'	14 CY
7	NATIVE HYDROSEEDING	1120 SF
8	42" STEEL HANDRAIL, DTL 01	12 LF
9	RESTORE PAVEMENT MARKINGS IN KIND DISTURBED DURING CONSTRUCTION	N.P.I.
10	TRASH RACK, MAG 502	N.P.I.
11	CONCRETE STAINING	N.P.I.

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

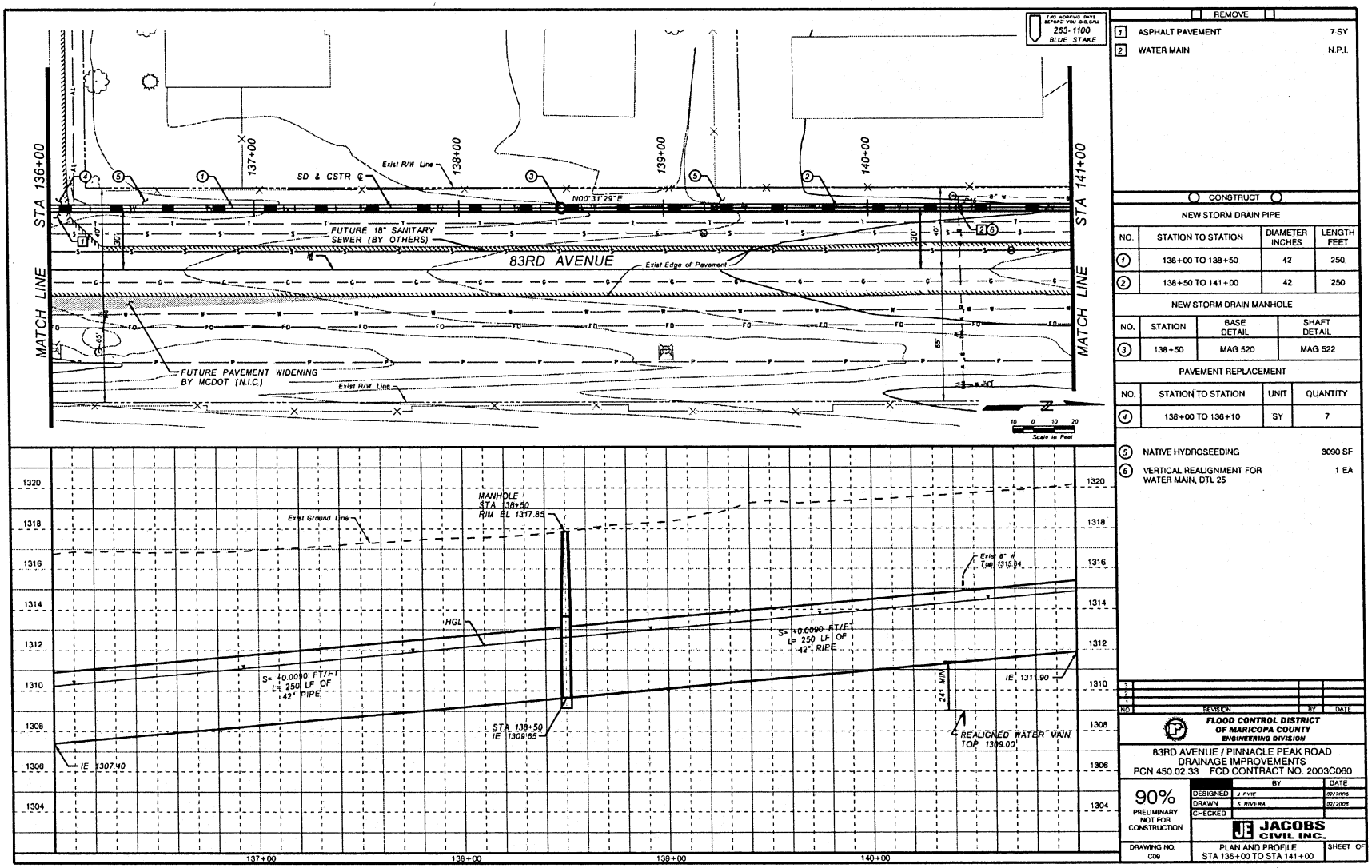
90% PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	J. FYIE	02/2006
DRAWN	S. RIVERA	02/2006
CHECKED		

JE JACOBS CIVIL INC.

DRAWING NO. C10 | PLAN AND PROFILE STA 141+00 TO STA 143+32.01 | SHEET OF

Figure 1-34



REMOVE

1	ASPHALT PAVEMENT	7 SY
2	WATER MAIN	N.P.I.

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	136+00 TO 138+50	42	250
2	138+50 TO 141+00	42	250

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
3	138+50	MAG 520	MAG 522

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
4	136+00 TO 136+10	SY	7

5	NATIVE HYDROSEEDING	3090 SF
6	VERTICAL REALIGNMENT FOR WATER MAIN, DTL 25	1 EA

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

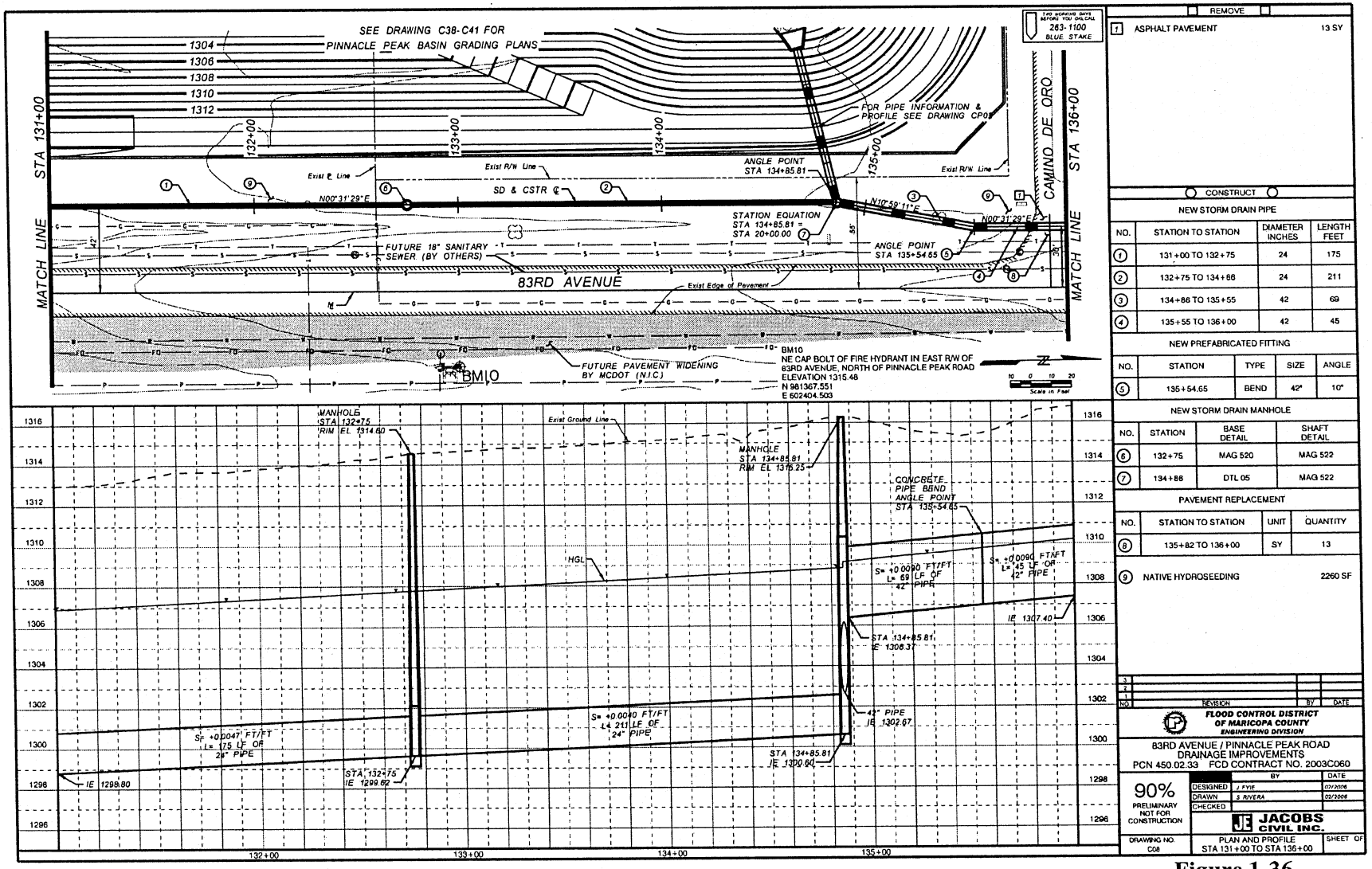
83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

90% PRELIMINARY NOT FOR CONSTRUCTION		BY	DATE
	DESIGNED	J. FYIE	02/2006
	DRAWN	S. RIVERA	02/2006
	CHECKED		

JACOBS CIVIL INC.

DRAWING NO.		SHEET OF
C09	PLAN AND PROFILE STA 136+00 TO STA 141+00	

Figure 1-35



REMOVE

1	ASPHALT PAVEMENT	13 SY

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	131+00 TO 132+75	24	175
2	132+75 TO 134+86	24	211
3	134+86 TO 135+55	42	69
4	135+55 TO 136+00	42	45

NEW PREFABRICATED FITTING

NO.	STATION	TYPE	SIZE	ANGLE
5	135+54.65	BEND	42"	10°

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
6	132+75	MAG 520	MAG 522
7	134+86	DTL 05	MAG 522

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
8	135+82 TO 136+00	SY	13

9	NATIVE HYDROSEEDING	2260 SF

NO	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

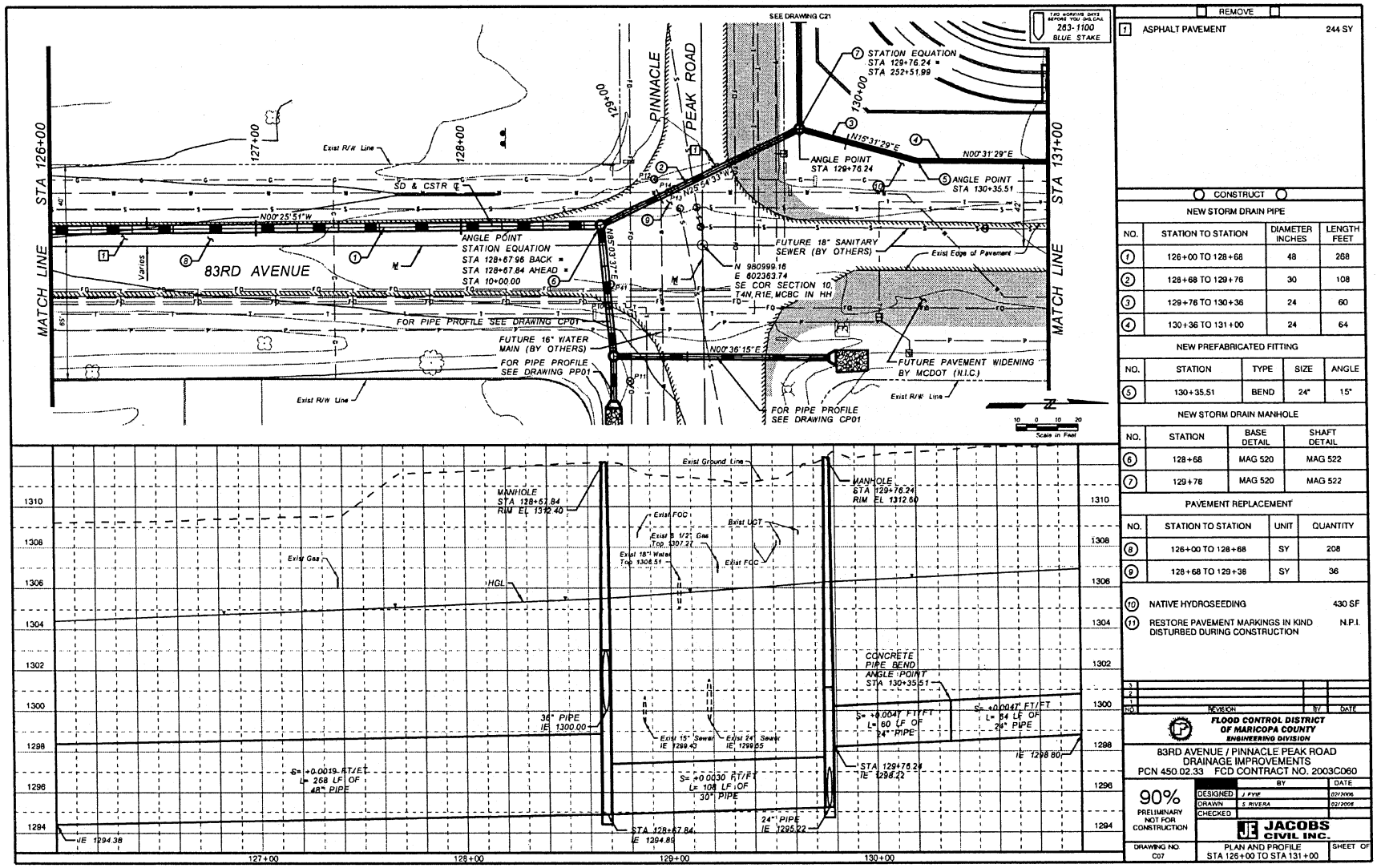
	BY	DATE
DESIGNED	J. FYIE	02/2006
DRAWN	S. RIVERA	02/2006
CHECKED		

90% PRELIMINARY NOT FOR CONSTRUCTION

JACOBS CIVIL INC.

DRAWING NO. C08 | PLAN AND PROFILE STA 131+00 TO STA 136+00 | SHEET OF

Figure 1-36



REMOVE

1	ASPHALT PAVEMENT	244 SY

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	126+00 TO 128+68	48	268
2	128+68 TO 129+76	30	108
3	129+76 TO 130+36	24	60
4	130+36 TO 131+00	24	64

NEW PREFABRICATED FITTING

NO.	STATION	TYPE	SIZE	ANGLE
5	130+35.51	BEND	24"	15°

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
6	128+68	MAG 520	MAG 522
7	129+76	MAG 520	MAG 522

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
8	126+00 TO 128+68	SY	208
9	128+68 TO 129+36	SY	36

10	NATIVE HYDROSEEDING	430 SF
11	RESTORE PAVEMENT MARKINGS IN KIND DISTURBED DURING CONSTRUCTION	N.P.I.

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450 02.33 FCD CONTRACT NO. 2003C060

	BY	DATE
DESIGNED	J. FYFE	02/2006
DRAWN	S. RIVERA	02/2006
CHECKED		

90% PRELIMINARY NOT FOR CONSTRUCTION

JACOBS CIVIL INC.

DRAWING NO. C07

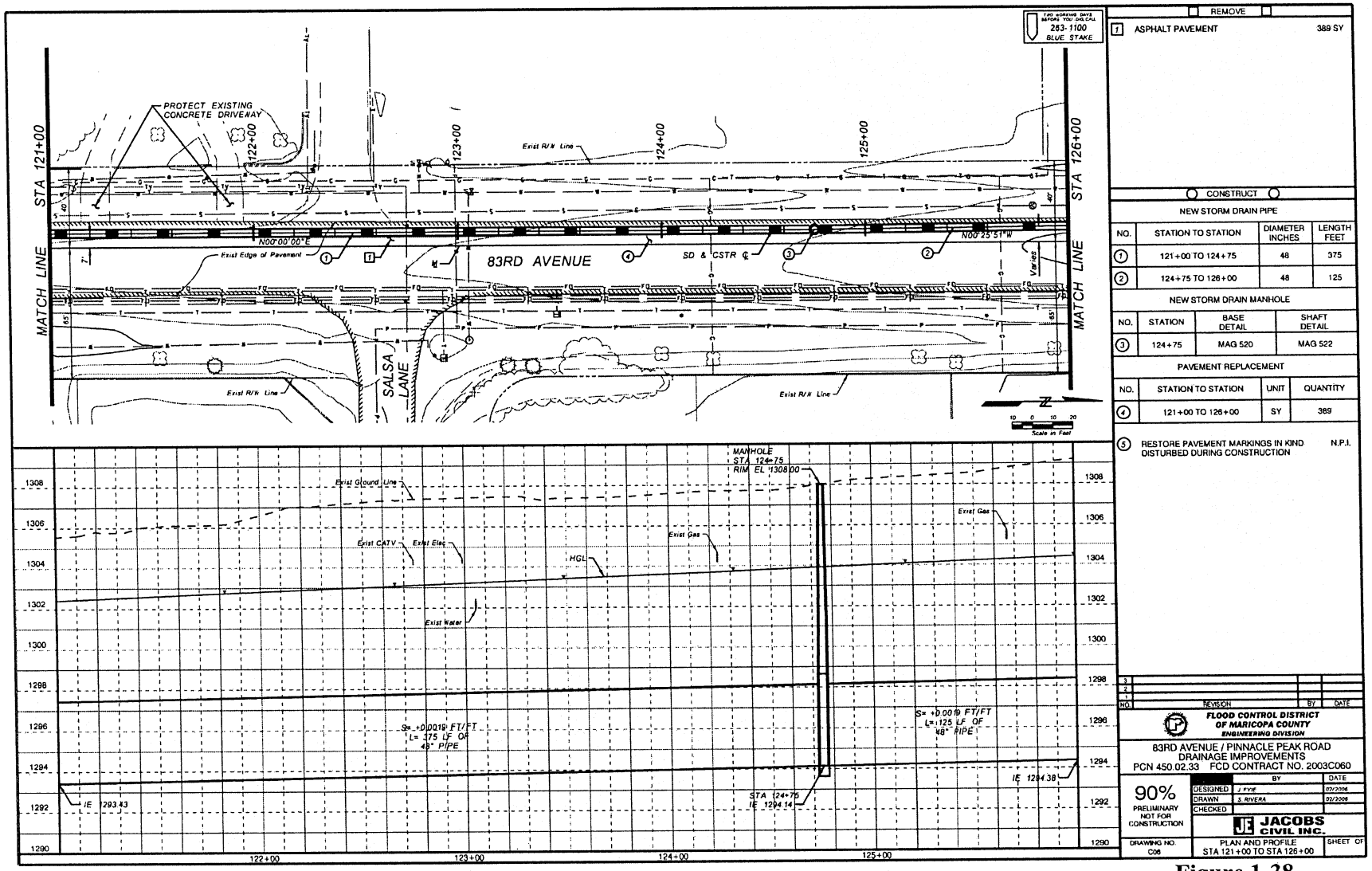
PLAN AND PROFILE
STA 126+00 TO STA 131+00

SHEET OF

Figure 1-37

83rd Avenue Storm Drain (Station 129+76 to Station 99+36)

48" and 2-36" storm drains along 83rd Avenue will collect the 100-year storm event from the Pinnacle Peak basin bypass/dewater storm drains and the runoff entering the 83rd Avenue and Pinnacle Peak Road intersection from the east. The existing 24" sanitary sewer in Pinnacle Peak Road must be crossed under with the 83rd Avenue storm drain. The storm drain passing under the sanitary sewer will be 30". Design flows are 34 cfs for the 30" storm drain and 90 cfs for the 48" storm drain south of Pinnacle Peak Road. The storm drain system discharges into an existing landscaped channel at Deer Valley Estates, south of Williams Road. For design computations, the tailwater at the outlet structure, Station 99+36, was set at 1293.70. This is the water surface elevation of the landscaped channel flowing full. See Figures 1-38 to 1-43.



REMOVE

1	ASPHALT PAVEMENT	389 SY

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	121+00 TO 124+75	48	375
2	124+75 TO 126+00	48	125

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
3	124+75	MAG 520	MAG 522

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
4	121+00 TO 126+00	SY	389

5 RESTORE PAVEMENT MARKINGS IN KIND DISTURBED DURING CONSTRUCTION N.P.I.

NO.	REVISION	BY	DATE
1			
2			
3			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

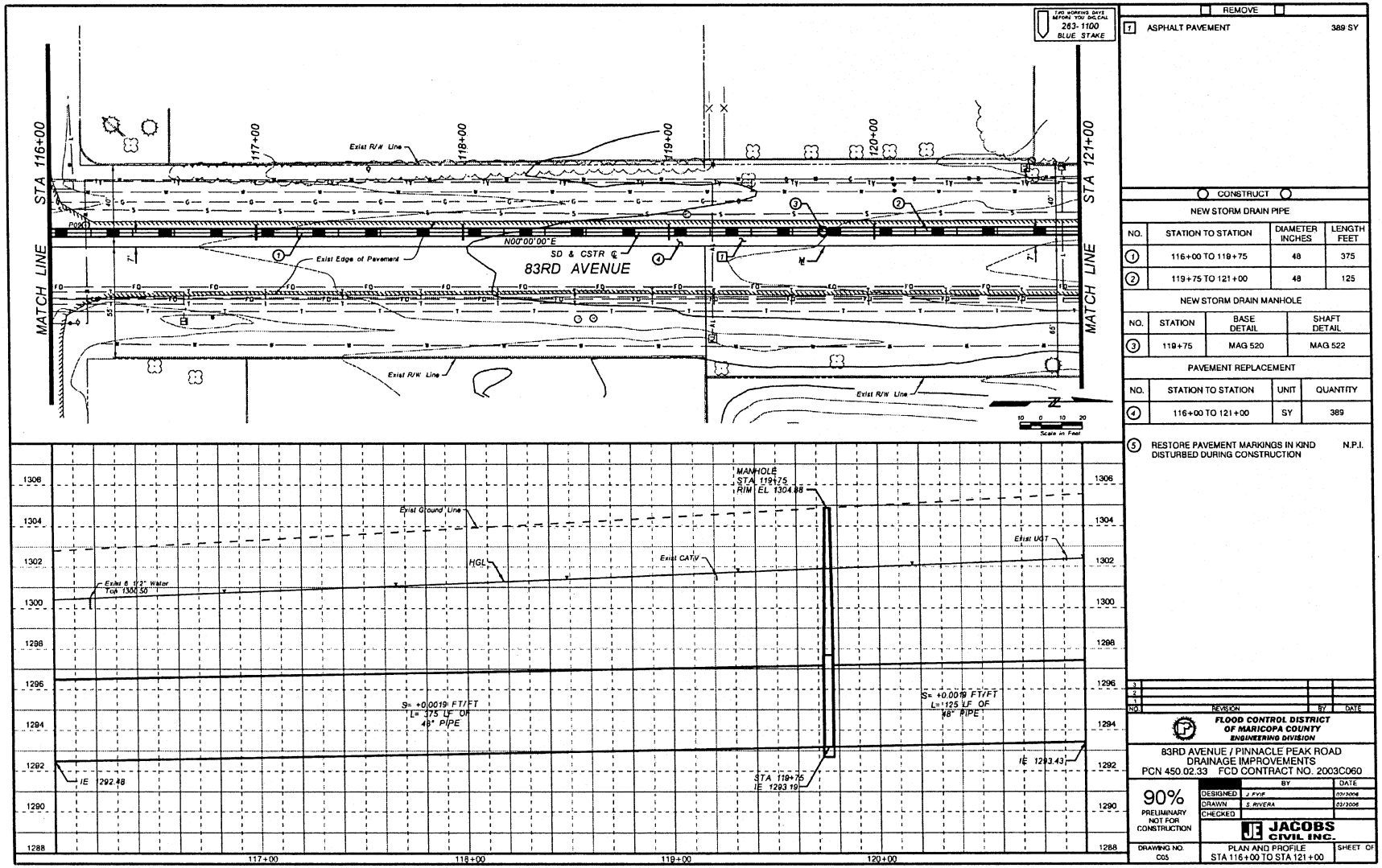
90% PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	J. FYHE	02/2006
DRAWN	S. RIVERA	02/2006
CHECKED		

JACOBS CIVIL INC.

DRAWING NO. C06 | PLAN AND PROFILE STA 121+00 TO STA 126+00 | SHEET OF

Figure 1-38



REMOVE

1	ASPHALT PAVEMENT	389 SY

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	116+00 TO 119+75	48	375
2	119+75 TO 121+00	48	125

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
3	119+75	MAG 520	MAG 522

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
4	116+00 TO 121+00	SY	389

5 RESTORE PAVEMENT MARKINGS IN KIND DISTURBED DURING CONSTRUCTION N.P.I.

NO.	REVISION	BY	DATE
1			
2			
3			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

90% PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	J. RIVIE	03/2006
DRAWN	S. RIVERA	03/2006
CHECKED		

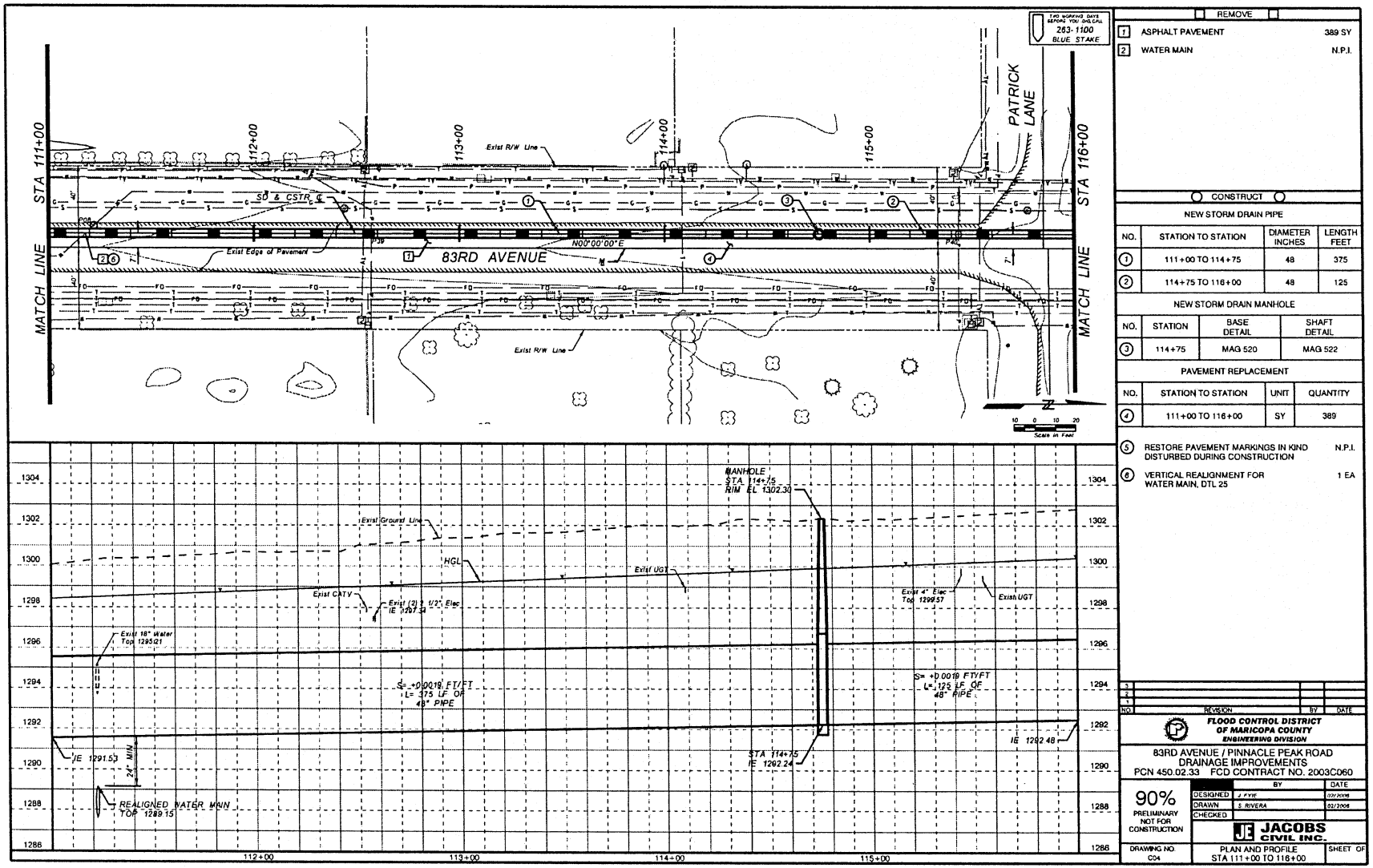
JACOBS CIVIL INC.

DRAWING NO. C05

PLAN AND PROFILE STA 116+00 TO STA 121+00

SHEET OF

Figure 1-39



REMOVE

1	ASPHALT PAVEMENT	389 SY
2	WATER MAIN	N.P.I.

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	111+00 TO 114+75	48	375
2	114+75 TO 116+00	48	125

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
3	114+75	MAG 520	MAG 522

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
4	111+00 TO 116+00	SY	389

5	RESTORE PAVEMENT MARKINGS IN KIND DISTURBED DURING CONSTRUCTION	N.P.I.
6	VERTICAL REALIGNMENT FOR WATER MAIN, DTL 25	1 EA

NO	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

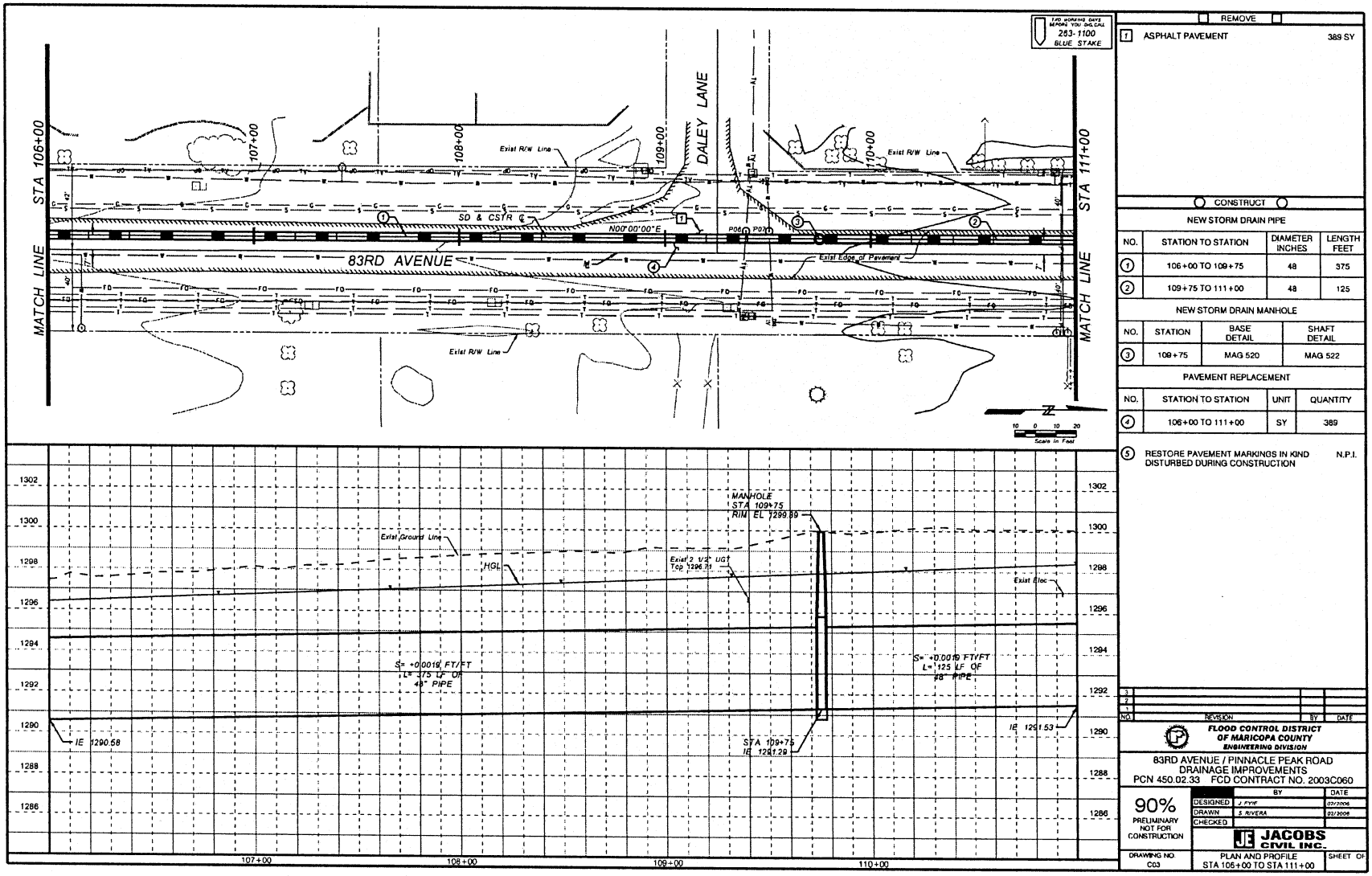
83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

90% PRELIMINARY NOT FOR CONSTRUCTION		BY	DATE
	DESIGNED	J. FYFE	02/2006
	DRAWN	S. RIVERA	02/2006
	CHECKED		

JE JACOBS CIVIL INC.

DRAWING NO.	PLAN AND PROFILE STA 111+00 TO 116+00	SHEET OF
C04		

Figure 1-40



REMOVE

1	ASPHALT PAVEMENT	389 SY

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	106+00 TO 109+75	48	375
2	109+75 TO 111+00	48	125

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
3	109+75	MAG 520	MAG 522

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
4	106+00 TO 111+00	SY	389

5 RESTORE PAVEMENT MARKINGS IN KIND DISTURBED DURING CONSTRUCTION N.P.I.

NO	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

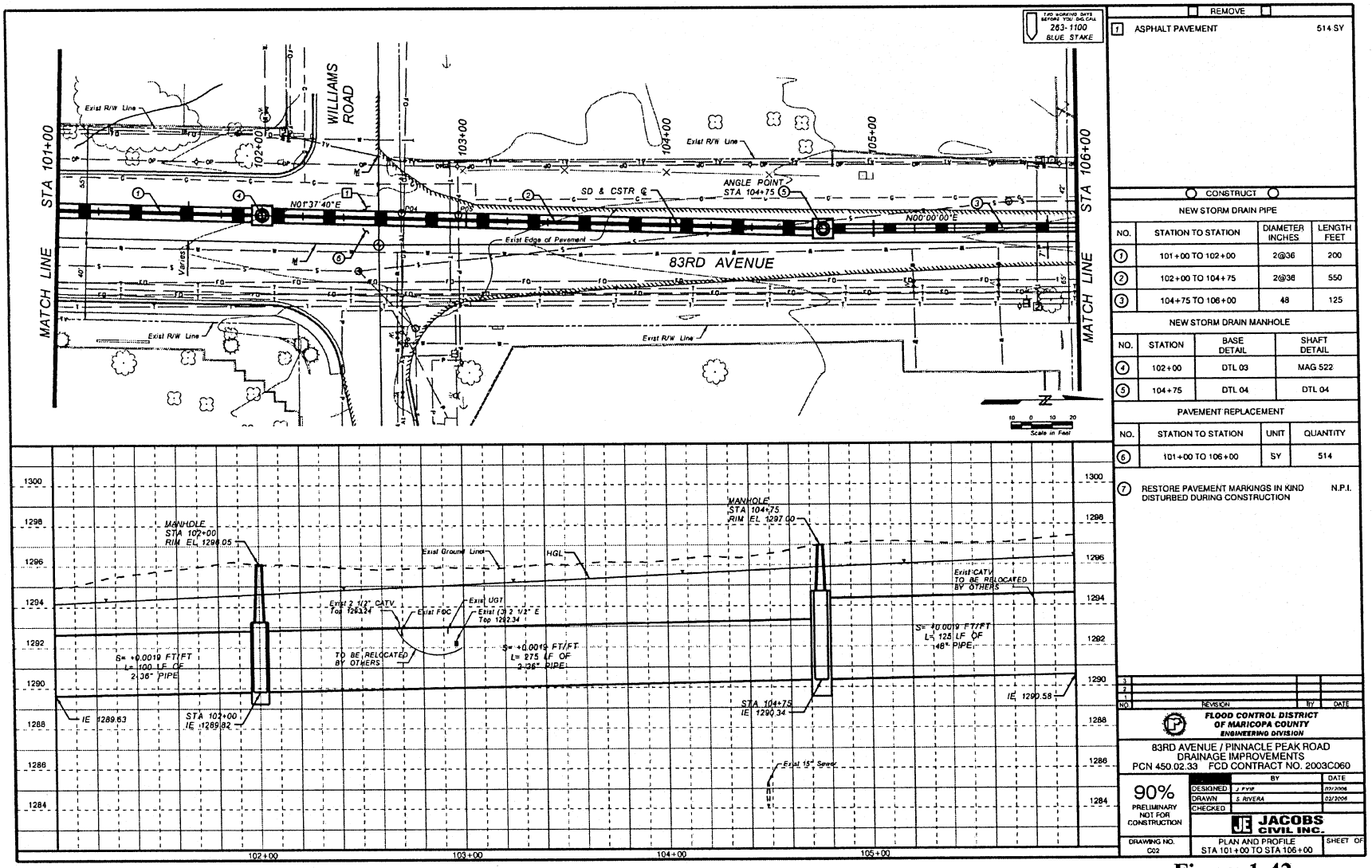
	BY	DATE
DESIGNED	J. FYFE	07/2006
DRAWN	S. RIVERA	07/2006
CHECKED		

90% PRELIMINARY NOT FOR CONSTRUCTION

JACOBS CIVIL INC.

DRAWING NO. C03 | PLAN AND PROFILE STA 106+00 TO STA 111+00 | SHEET OF

Figure 1-41



REMOVE

1	ASPHALT PAVEMENT	514 SY

CONSTRUCT

NEW STORM DRAIN PIPE

NO.	STATION TO STATION	DIAMETER INCHES	LENGTH FEET
1	101+00 TO 102+00	2@36	200
2	102+00 TO 104+75	2@36	550
3	104+75 TO 106+00	48	125

NEW STORM DRAIN MANHOLE

NO.	STATION	BASE DETAIL	SHAFT DETAIL
4	102+00	DTL 03	MAG 522
5	104+75	DTL 04	DTL 04

PAVEMENT REPLACEMENT

NO.	STATION TO STATION	UNIT	QUANTITY
6	101+00 TO 106+00	SY	514

7 RESTORE PAVEMENT MARKINGS IN KIND DISTURBED DURING CONSTRUCTION N.P.I.

NO	REVISION	BY	DATE
1			
2			
3			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060

90% PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	J. PYLE	02/2006
DRAWN	S. RIVERA	02/2006
CHECKED		

JACOBS CIVIL INC.

DRAWING NO. C02

PLAN AND PROFILE STA 101+00 TO STA 106+00

SHEET OF

Figure 1-42

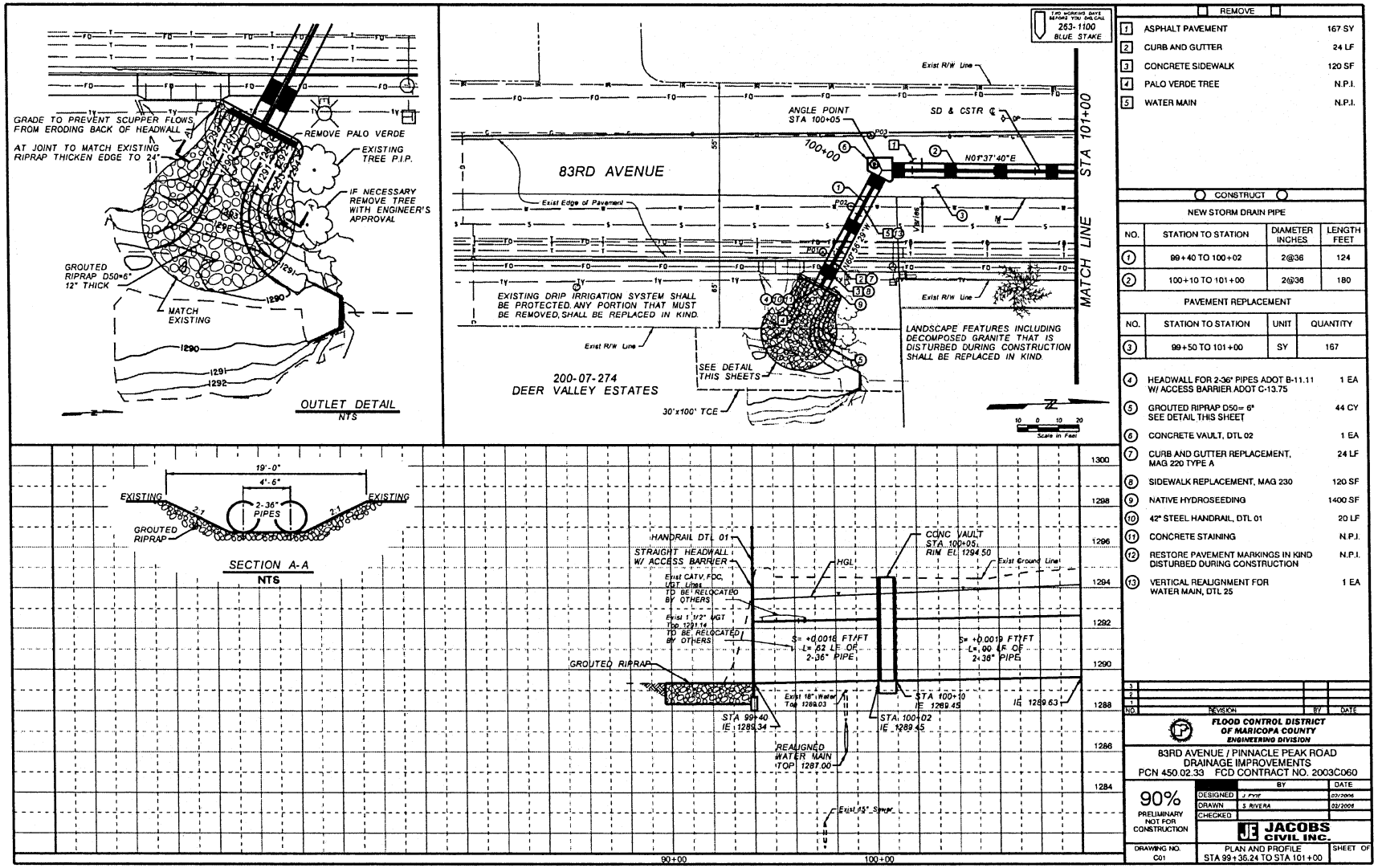

GRADE TO PREVENT SCUPPER FLOWS FROM ERODING BACK OF HEADWALL
AT JOINT TO MATCH EXISTING RIPRAP THICKEN EDGE TO 24"
REMOVE PALO VERDE
EXISTING TREE P.I.P.
IF NECESSARY REMOVE TREE WITH ENGINEER'S APPROVAL
GROUTED RIPRAP D50=6" 12" THICK
MATCH EXISTING
OUTLET DETAIL
NTS
83RD AVENUE
ANGLE POINT STA 100+05
SD & CSTR
STA 101+00
MATCH LINE
Exist R/W Line
Exist Edge of Pavement
EXISTING DRIP IRRIGATION SYSTEM SHALL BE PROTECTED. ANY PORTION THAT MUST BE REMOVED, SHALL BE REPLACED IN KIND.
LANDSCAPE FEATURES INCLUDING DECOMPOSED GRANITE THAT IS DISTURBED DURING CONSTRUCTION SHALL BE REPLACED IN KIND.
SEE DETAIL THIS SHEETS
200-07-274
DEER VALLEY ESTATES
30'x100' TCE
263-1100 BLUE STAKE
REMOVE
1 ASPHALT PAVEMENT 167 SY
2 CURB AND GUTTER 24 LF
3 CONCRETE SIDEWALK 120 SF
4 PALO VERDE TREE N.P.I.
5 WATER MAIN N.P.I.
CONSTRUCT
NEW STORM DRAIN PIPE
NO. | STATION TO STATION | DIAMETER INCHES | LENGTH FEET
1 | 99+40 TO 100+02 | 2@36 | 124
2 | 100+10 TO 101+00 | 2@36 | 180
PAVEMENT REPLACEMENT
NO. | STATION TO STATION | UNIT | QUANTITY
3 | 99+50 TO 101+00 | SY | 167
4 HEADWALL FOR 2-36" PIPES ADOT B-11.11 W/ ACCESS BARRIER ADOT C-13.75 1 EA
5 GROUTED RIPRAP D50= 6" SEE DETAIL THIS SHEET 44 CY
6 CONCRETE VAULT, DTL 02 1 EA
7 CURB AND GUTTER REPLACEMENT, MAG 220 TYPE A 24 LF
8 SIDEWALK REPLACEMENT, MAG 230 120 SF
9 NATIVE HYDROSEEDING 1400 SF
10 42" STEEL HANDRAIL, DTL 01 20 LF
11 CONCRETE STAINING N.P.I.
12 RESTORE PAVEMENT MARKINGS IN KIND DISTURBED DURING CONSTRUCTION N.P.I.
13 VERTICAL REALIGNMENT FOR WATER MAIN, DTL 25 1 EA
19'-0"
4'-6"
2-36" PIPES
EXISTING
GROUTED RIPRAP
SECTION A-A
NTS
HANDRAIL DTL 01
STRAIGHT HEADWALL W/ ACCESS BARRIER
CONC VAULT STA 100+05, RIM EL 1294.50
HGL
Exist Ground Line
Exist CATV, FOC, UGT Lines TO BE RELOCATED BY OTHERS
Exist 1 1/2" UGT Top 1291.14 TO BE RELOCATED BY OTHERS
S= +0.0016 FT/FT L= 82 LF OF 2-36" PIPE
S= +0.0019 FT/FT L=100 LF OF 2-36" PIPE
GROUTED RIPRAP
Exist 16" Water Top 1288.03
STA 99+40 IE 1289.34
STA 100+10 IE 1289.45
STA 100+02 IE 1289.45
IE 1289.63
REALIGNED WATER MAIN TOP 1287.00
Exist 15" Sewer
1300
1298
1296
1294
1292
1290
1288
1286
1284
90+00
100+00
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION
83RD AVENUE / PINNACLE PEAK ROAD DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060
90% PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED J. FYFE 02/2006
DRAWN S. RIVERA 02/2006
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C01
PLAN AND PROFILE STA 99+36.24 TO STA 101+00
SHEET OF

Figure 1-43

1.3 Topographic Survey Data

Wilson and Company provided field surveys, aerial mapping and digital terrain modeling. Panels were set on June 16, 2004 and the project was flown later that month. On July 23, 2004 a Project Survey Report was issued along with the electronic mapping and survey files. The surveying and mapping services were conducted in accordance with the policies and requirements of the Flood Control District of Maricopa County. After the project was expanded to include drainage to 91st Avenue, Wilson and Company performed additional topographic surveys for the Cielo Grande and Pinnacle Peak Road storm drains.

1.4 Geotechnical Investigations

Speedie and Associates performed a geotechnical investigation for the project site. A draft Report on Geotechnical Evaluation was submitted on August 16, 2004. As a result of the Pre-Design Study for the 91st Avenue extension, additional geotechnical investigations were performed for the new basin at 87th Avenue and additional storm drains. This section provides a summary of the results from those investigations.

The proposed detention basins are located in undeveloped areas with moderate to thick native desert vegetation. The 87th Avenue basin is located within several undeveloped lots, surrounded by residential neighborhoods and streets. The area appears to be relatively flat with a slight slope to the south. Several minor washes were noted at this site.

Subsoil conditions generally consist of clayey sand and sandy clay with occasional zones of silty sand, poorly graded sand, and clayey gravel. These soils generally become harder with depth and are comprised of moderate to strong calcareously cemented silty sand and clayey sand. Occasional layers with varying amounts of gravel were encountered.

No groundwater was encountered during this investigation. Depending on the time of year, groundwater and floodwaters may be an issue near the washes. Based on visual and tactile observation, the soils were in a dry or dry to moist state at the time of the investigation.

A total of 20 borings were drilled from July 15, 2004 to July 23, 2004. This included 12 borings in the channel and storm drain areas and 8 borings in the proposed detention basin areas. The additional borings consisted of 3 borings at the 87th Avenue basin and 4 borings along Pinnacle Peak Road, Cielo Grande and Avenida del Sol. Laboratory testing consisted of moisture content, dry density, moisture-density relationships, consolidation tests, grain size distribution, and plasticity tests for classification purposes. Laboratory minimum resistivity, soluble sulfate and pH tests were conducted for corrosivity analysis and several agronomic analyses were performed to ascertain the suitability of the areas for landscaping vegetation.

Laboratory testing indicates in-situ dry densities of the upper soils on the order of 90 to 123 pounds per cubic foot with a range of 3.6 to 6.5 percent moisture at the time of investigation. Liquid limits ranged from "non-plastic" to 42 percent. Plasticity indices range from "non-plastic" to 25 percent. The fraction finer than the No. 200 sieve ranges from 12 to 69 percent. Laboratory resistivity tests indicated results ranging from 1074 to 8,723 ohm-cm in the saturated state and pH values of 7.2 to 8.6. Sulfate contents ranged from 0.0009% to 0.0026%. Chloride contents ranged from 0.0007% to 0.0219%. All field and laboratory data were presented in the draft report.

Recommendations were made with respect to pipe bedding, backfill and fill in non-building areas. Soil corrosion potentials were also addressed. The minimum resistivity tests produced results ranging from 1074 ohms-cm to 8,723 ohm-cm. These saturated values reflect a potential mild to moderate degree of corrosiveness. Suitable pipe wall thickness and corrosion protection will be selected per the trench/traffic load, moisture condition and lifetime requirements of the project. At the Calle Lejos storm drain area, more aggressive excavation would be required for depths more than 10 feet. Due to the presence of rock, it was recommended not to allow the use of cast-in-place concrete pipe.

Section 2
Hydrology

This section documents the hydrologic modeling used to design the 83rd Avenue and Pinnacle Peak Road area drainage improvements. The watershed draining to 83rd Avenue and Pinnacle Peak Road is 1.7 square miles in size and is bounded by the Sunrise Mountains to the north, Pinnacle Peak Road to the south, 91st Avenue to the west and New River to the east.

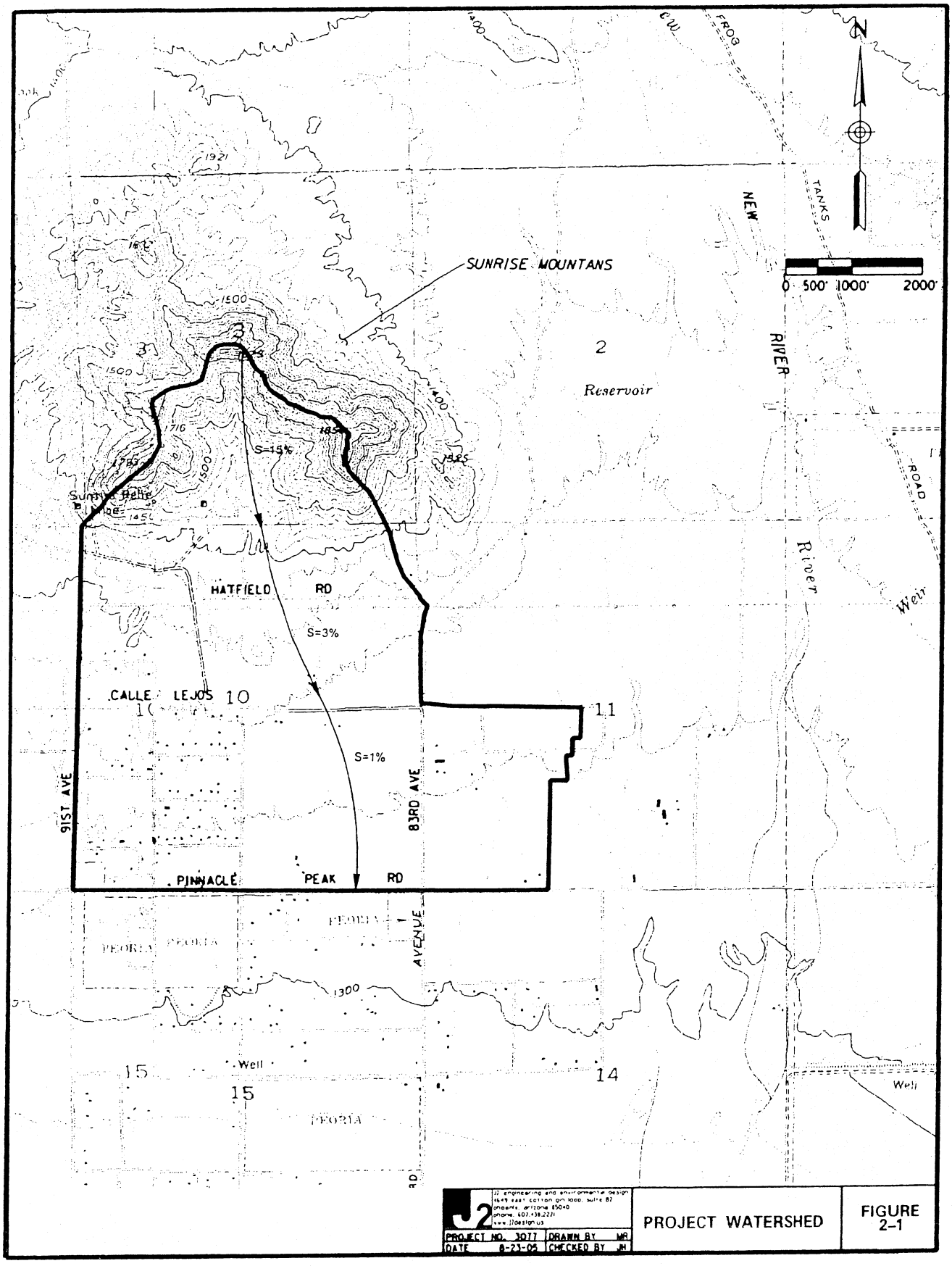
The area has been previously studied as part of the *Glendale-Peoria Area Drainage Master Plan,* the *Glendale-Peoria Area Drainage Master Plan Update,* and most recently, the *Final Pre-Design Report* (November 2004) for the current project.

The current hydrologic model is based on the above studies and includes recent refinements and changes necessary to add the drainage area between 89th Avenue and 91st Avenue north of Pinnacle Peak Road, the current design of the proposed 87th Avenue and Pinnacle Peak basins, and the proposed storm drain systems.

2.1 Topography and Land Use

The Sunrise Mountains (also known as West Wing Mountains) comprise the northern and highest limit of the watershed. The general topographic gradient is from the northwest towards the southeast. Elevations range from 1825 MSL at the peak of the Sunrise Mountains to 1360 MSL at Pinnacle Peak Road and 1290 MSL just south of Williams Road. Slopes range from 15% in the upper watershed to 1% in the vicinity of Pinnacle Peak Road. The watershed drains to New River located to the east-southeast of the project site. Figure 2-1 shows the watershed location.

From the summit of the Sunrise Mountains to Hatfield Road, the land use is undeveloped desert. From Hatfield Road to Calle Lejos the land use is low density single family residential with some open desert areas with interspersed rock outcrops. South of Calle Lejos, significant development has taken place consisting of single family residential developments and light industry (e.g. planting nursery and equipment staging areas). Many of the older 1 acre lots do not have onsite retention. Offsite flows entering the properties are generally routed through these lots. The newer planned residential communities generally utilize onsite retention for the 100-year 2-hour event and have dedicated tracts to storage route offsite and onsite storm water.



PROJECT WATERSHED

FIGURE 2-1

2.2 Vegetation and Soils

Vegetative cover is typical of the Sonoran Desert. Saguaros, Ocotillo, Palo Verde and Mesquite comprise the larger sized vegetation, whereas various desert grasses, Creosote, Ironwood and multiple small cacti such as Cholla and Prickly Pear comprise the predominant smaller vegetation. Vegetative cover is approximately 10 percent. Figure 2-2 shows typical site vegetation.

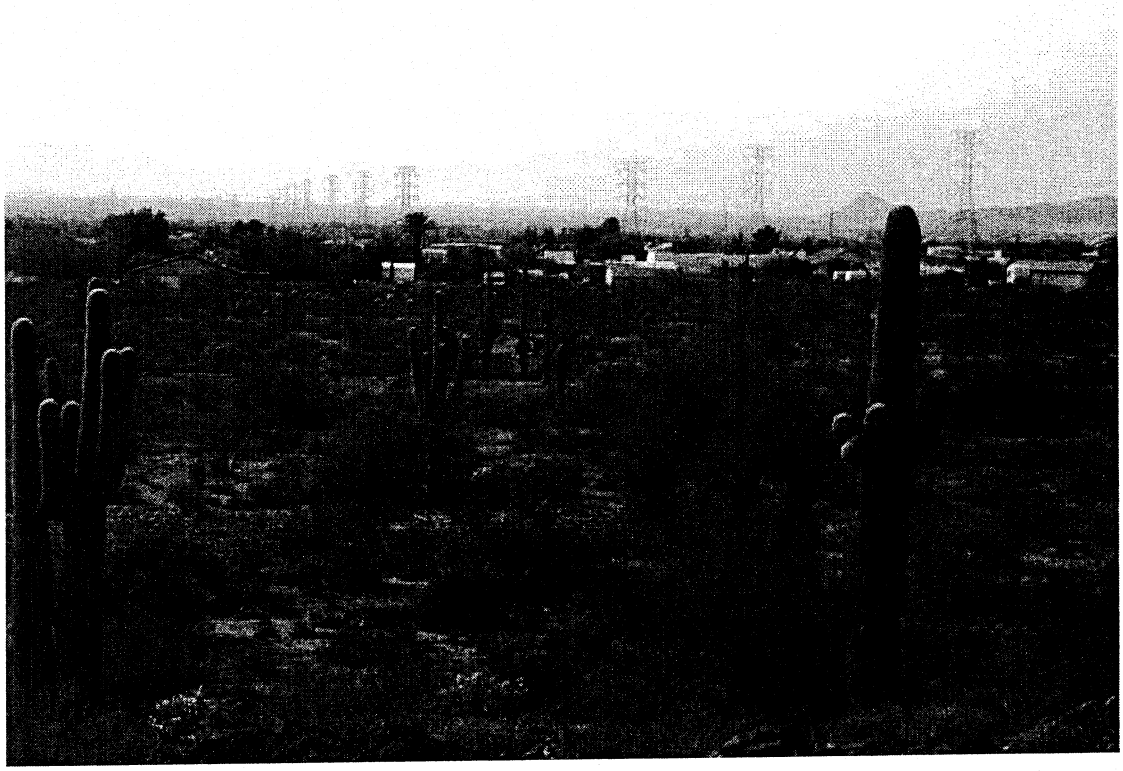


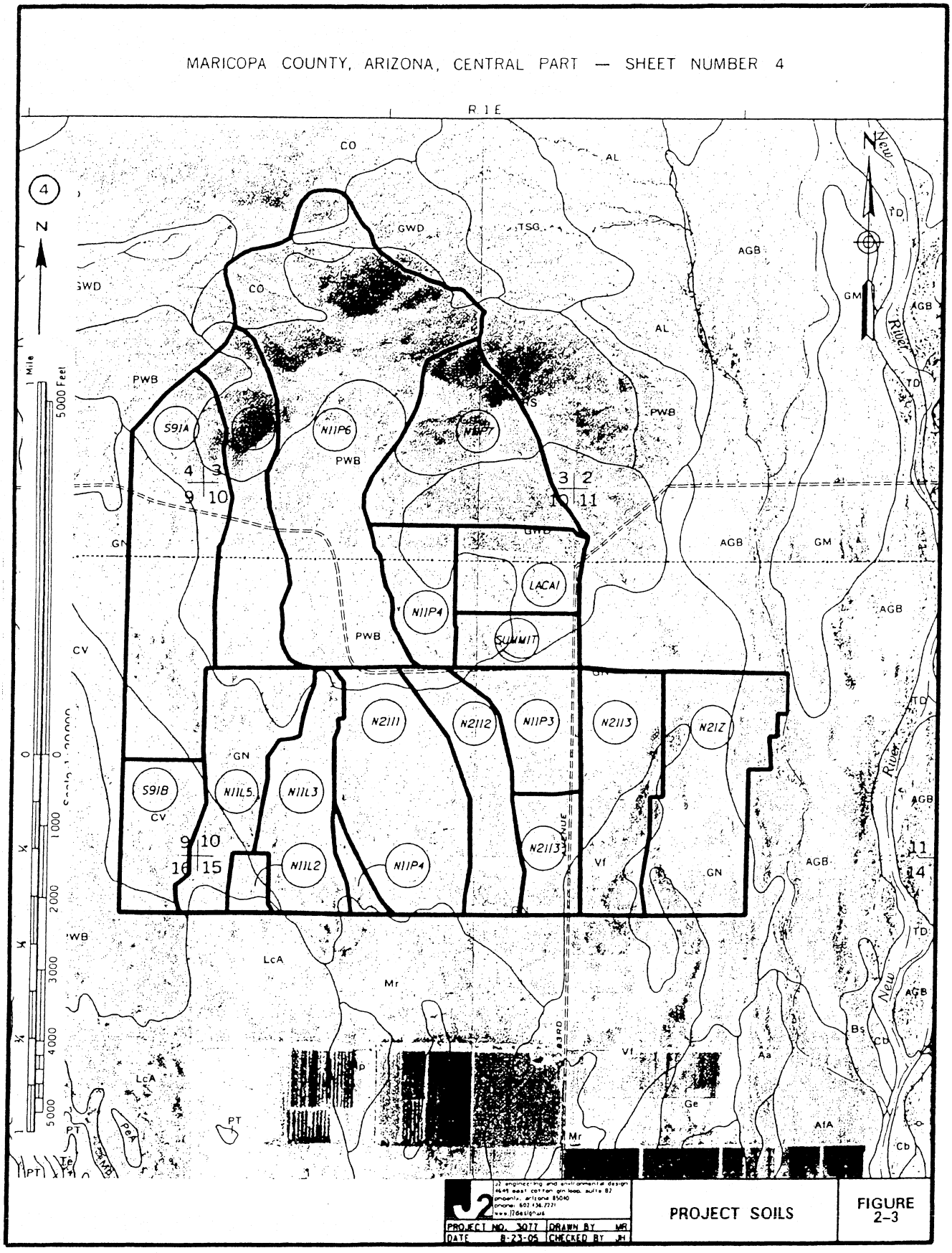
Figure 2-2
Site Vegetation

The specific soil associations found in the project limits are documented in the *Soil Survey of Maricopa County, Arizona- Central Part.*

- CO – Cherioni Rock Outcrop complex
- RS – Rock Outcrop Cherioni complex
- PWB – Pinal-Suncity complex 0-3 % slopes
- GWD – Gunsight-Pinal complex, 1-10% slopes
- GN – Gilman Laveen association
- CV – Coolidge Laveen association

- LcA – Laveem Loam, 0 to 1% slopes
- MR – Mohall Clay Loam
- Vf – Vecont Clay

Green-Ampt HEC-1 parameters are based on soil associations and complexes. The hydrologic analysis matched the loss parameters used in the ADMP Update study. Therefore, for this hydrologic analysis, the soil loss parameters were essentially the same as those used in the ADMP update. The soils located on the project site are shown in Figure 2-3.


MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 4
R 1 E
4
N
1 Mile
5000 Feet
S91A
N11P6
N11P7
LACA1
N11P4
SUMMIT
N2111
N2112
N11P3
N2113
N21Z
S91B
N11L5
N11L3
N11L2
N11P4
N2113
CO
AL
GWD
TSG
AGB
GM
TD
PWB
GN
CV
Vf
LcA
Mr
Aa
Ge
AfA
Bs
Cb
PT
PeA
New River
83RD AVENUE
J2 engineering and environmental design
4649 east cotton gin loop, suite 82
phoenix, arizona 85040
phone: 602 436.7221
www.j2design.us
PROJECT NO. 3077
DRAWN BY MR
DATE 8-23-05
CHECKED BY JH
PROJECT SOILS
FIGURE 2-3

2.3 FEMA Floodplains

The project area is located on Federal Emergency Management Agency (FEMA) Flood Insurance Rate (FIRM) Map panel 1180 of 4350. The FIRM map number is 04013C1180 F, revised July 19, 2001. The project site is located in flood Zone X. Zone X is defined as "Areas of 500-year flood; areas of 100-year floods with average depths of less than one foot or with drainage areas less than one square mile; and areas protected by levees from 100-year flood". Figure 2-4 includes the FIRM map.

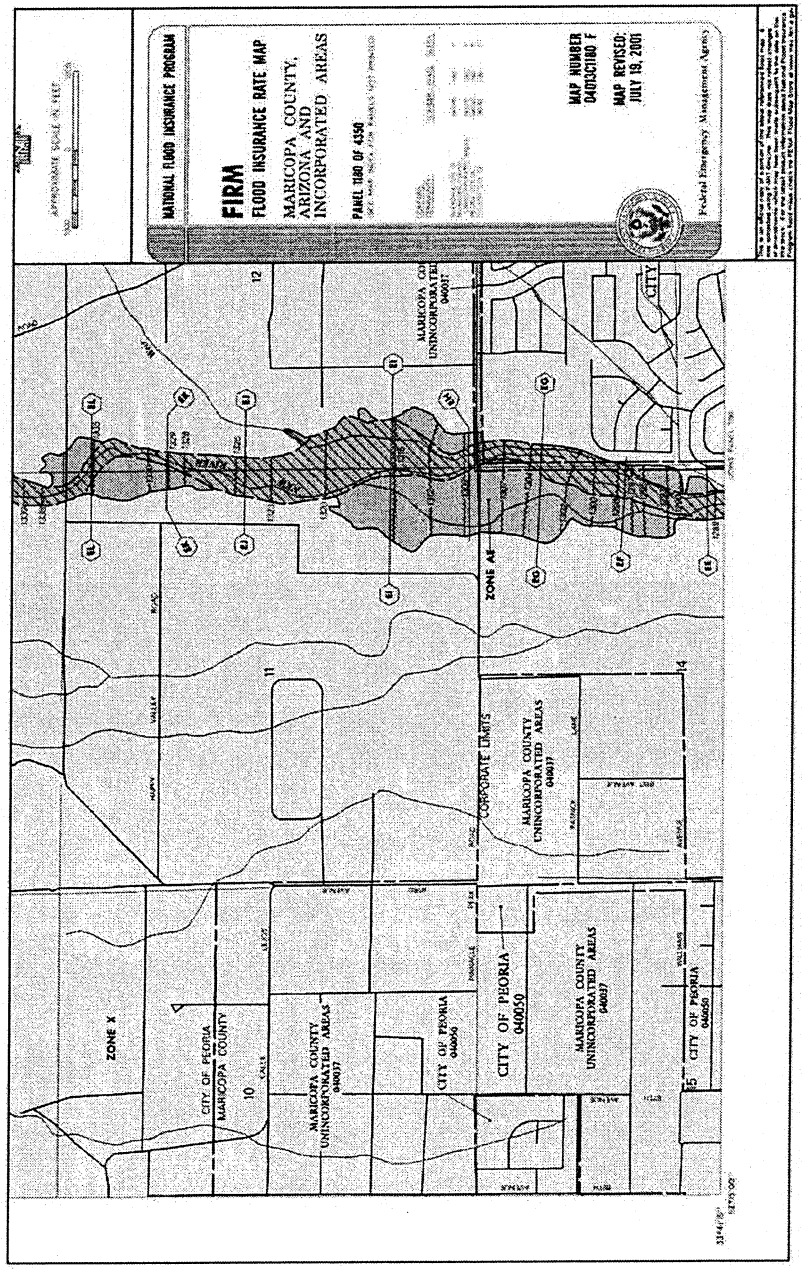


Figure 2-4
FIRM Panel 04013C1180F

2.4 Existing Conditions

Undeveloped Areas

The less developed upper portion of the watershed routes storm water runoff through natural washes and roadside ditches. Erosion is evident with head cutting and rilling. There is evidence of sediment deposits at locations where the washes and ditches crossed Hatfield Road and Calle Lejos. Generally storm water overtops the roads where the washes intersect the roadway.

Residential Developments

Residential development within the watershed generally falls into two categories: 1) individually built, single family residences with lot sizes of ½ to 1 acre and 2) planned community developments. Individually built and owned lots were established prior to the planned community developments and drainage planning was not coordinated in an organized fashion. Generally, these parcels did not have dedicated onsite retention facilities and passed offsite flows through or around the parcels.

Planned community developments built within the last 10 years, typically have onsite retention storage basins and dedicated offsite storm water facilities. Notable exceptions are the two developments located north of Calle Lejos and west of 83rd Avenue, La Caille and Summit at Sunrise Mountain. These developments pass offsite flows through wall openings and dedicated drainage tracts within the subdivision. Lot sizes are large enough to allow retention of the runoff generated by the individual lots. Pipe culverts are used to pass flows under roadways between drainage tracts. Riprap lined channels are provided to route both offsite and onsite flows.

Where retention and detention basins were provided, curb and gutter sections routed onsite flows to catch basin inlets. These flows are then routed by storm drains or spillways to the basins.

Calle Lejos

Storm water generated upstream at the Sunrise Mountains drains south to Calle Lejos. The street section does not have storm drain improvements, although it has recently been paved in a PM 10 project. This storm water sheet flows across the roadway except the portion along Summit at Sunrise. This runoff is conveyed by the roadway section and existing open channels located along the north side of Calle Lejos.

83rd Avenue

Storm water generated upstream drains to 83rd Avenue and is routed south. This storm water is conveyed by the roadway section and existing open channels located along either side of 83rd Avenue. There is no storm drain trunkline along 83rd Avenue. Pavement

flows in curb and gutter sections are collected by curb open inlets and conveyed to adjacent roadside ditches or channels or retention/detention basins.

Pinnacle Peak Road

Storm water generated north of Pinnacle Peak Road is routed south by north-south arterials and roadside ditches. Pinnacle Peak Road to the east acts as a collector for these flows and routes the water to 83rd Avenue. There is no storm drain trunkline along Pinnacle Peak Road. Pavement flows in curb and gutter sections are collected by curb open inlets and conveyed to adjacent roadside ditches or channels or retention/detention basins.

2.5 Hydrologic Analysis of the Proposed Improvements

The HEC-1 file corresponding to Alternative 3A2 from the Value Engineering Study was used as the basis for hydrologic modeling. The design team updated this model utilizing the current detention basin and storm drain design information. New aerial photos and observations from field visits were also used to update the hydrologic model. The revised model was limited to modeling subbasins pertinent to this project and not to the *ADMP Update* watershed, which is considerably larger. The HEC-1 model simulates the 100-year 6-hour storm event. HEC-1 output files are contained in Appendix A. See Table 2-1 for a summary of flows and Table 2-2 for a summary of proposed detention basin data from the HEC-1 analysis.

HEC-1 Modeling Methodology

HEC-1 uses numerical parameters to describe the amount and temporal distribution of rainfall, the runoff characteristics of the watershed, and the hydraulic properties of overland flow planes and channels that collect and convey the direct runoff to concentration points. Appendix A contains the HEC-1 input and output data as well as a HEC-1 schematic diagram. Each of the HEC-1 components is discussed below.

HEC-1 Precipitation, PC Record

The HEC-1 model computes a hypothetical storm using the Corps of Engineers hypothetical rainfall distribution. The input consists of point rainfall depths for various storm events which were determined from the NOAA Atlas and FCDMC methodologies, as previously described. The precipitation values were input into the HEC-1 model using the PC record. The 6-hour storm duration is typically used for basins with a total area less than 20 square miles and the 24-hour storm duration is used for basins area greater than 20 square miles. Therefore, the 6-hour duration was used on this project. The rainfall distribution matched the ADMP Update model. The rainfall depths are shown in Appendix A as a function of return period and storm duration.

HEC-1 Rainfall Losses, LG Record

Rainfall losses are primarily due to surface retention and soil infiltration. The ADMP Update estimated rainfall losses in accordance with procedures outlined in the FCDMC *Drainage Design Manual for Maricopa County Volume 1 – Hydrology.* Rainfall infiltration losses were estimated by the Green and Ampt method. The rate of soil infiltration is primarily a function of the soil texture. This method calculates losses based on soil texture, vegetation cover and soil moisture. Losses due to surface retention were obtained from Table 4.2 in the FCDMC Manual. This hydrology utilized the Green and Ampt values used in the ADMP Update HEC-1 model.

HEC-1 Unit Hydrograph, UC Record

The basin outflow hydrograph was calculated using the Clark Unit Hydrograph method. This method requires the estimation of three parameters: time of concentration (T_c), storage coefficient (R), and time-area relation. The Maricopa County Unit Hydrograph Program1 (MCUHP1) was used to estimate Tc (Papadakis-Kazan equation 5.5) and R (storage coefficient). MCUHP1 estimates R with equation 5.6 in the drainage manual.

HEC-1 Time Area Relation, UA Record

The MCUHP1 implementation of the Clark Unit hydrograph utilizes synthetic dimensionless time area values as defined on Table 5.2 in the drainage manual. The subbasin UA category is defined as urban, natural or HEC-1 default (all others). Natural and urban categories were used for this HEC-1 modeling.

HEC-1 Normal Depth Routing, RS, RC, RX, RY Records

The Normal depth method was performed to simulate routing by natural washes, arterial streets or roadways and other irregular cross sections drainageways.

HEC-1 Kinematic Wave Routing, RK Record

The Kinematic Wave routing function was used to simulate routing by prismatic routing shapes such as trapezoidal channels and pipe conduits.

HEC-1 Subdivision Retention, DQ and DI Records

Where a portion of a subbasin is drained to a retention basin, a flow diversion operation was used to divert the volume of water corresponding to the capacity of the retention storage volume. This method is used to model the proposed retention in the Ventana Picachos development north of Calle Lejos (HEC-1 operation VPDIV).

HEC-1 Street Intersection Diversions, DQ and DI Records

Where a flow split occurs at an intersection, diversion cards were used to define the amount of flow being passed to multiple downstream directions. In general, the ADMP Update diversions were utilized.

Table 2-1
HEC-1 Summary of Flows

HEC-1 OPERATION	DESCRIPTION	100 YEAR PEAK DISCHARGE, cfs
SUMP7S	CALLE LEJOS STORM DRAIN	194
SDLEJ2	87TH AVENUE STORM DRAIN AT CALLE LEJOS	491
C87BA	INFLOW INTO 87TH AVENUE BASIN	683
87BA	OUTFLOW FROM 87TH AVENUE BASIN	100
DS91A	CIELO GRANDE STORM DRAIN AT 91ST AVENUE	149 *
RS91A	CIELO GRANDE STORM DRAIN AT 89TH AVENUE	149 *
D91	PINNACLE PEAK ROAD AT 91ST AVENUE	55 *
CN11L5	PINNACLE PEAK ROAD AT 89TH AVENUE	201 *
PPSD	PINNACLE PEAK ROAD STORM DRAIN AT 85TH AV	377
RPPSD	PINNACLE PEAK ROAD STORM DRAIN AT PP BASIN	377
US_BSN	TOTAL INFLOW INTO PINNACLE PEAK BASIN	564
R83BSN	OUTFLOW FROM PINNACLE PEAK BASIN	34
JCT	83RD AVENUE STORM DRAIN AT PINNACLE PK RD	90
OUTLET	83RD AVENUE STORM DRAIN AT WILLIAMS RD	90

* denotes 10 Year Peak Discharge

Table 2-2
Detention Basin Summary

BASIN HEC-1 ID	DESCRIPTION	100-YEAR PEAK STAGE	100-YEAR PEAK OUTFLOW, CFS
87BA	87TH AVENUE BASIN	1319.66	123
R83BSN	PINNACLE PEAK BASIN	1310.76	34

This project involves the hydrologic modeling for a 1.3 square mile watershed. The area of analysis is bounded by the Sunrise Mountains to the north, Pinnacle Peak Road to the south, 91st Avenue to the west and New River to the east.

Section 3
Hydraulic Design and Calculations

HEC-1 was used to model the detention basins while storm drains were modeled using StormCAD. All calculations were performed with 100-year flows except for the storm drains between 87th Avenue and 91st Avenue where the 10-year flows were intercepted by the proposed storm drain system. General design criteria for the detention basins have been listed below.

- Side slopes were limited to 4:1 up to 4 feet deep, 6:1 for 4 feet to 6 feet deep, 10:1 for 6 feet to 9 feet deep and 14:1 for more than 9 feet deep. Side slopes to 4:1 were used at the Pinnacle Peak basin to provide the required storage volume.
- A maintenance road with a minimum width of 14' was provided and set at an elevation above the 100-year water surface.
- Basin layouts were coordinated with the landscape architect for aesthetics and multi-use opportunities.
- Stage-storage curves and earthwork volumes were developed with InRoads digital terrain modeling software.
- Basin discharge rates were developed using orifice flow through various sized openings.
- HEC-1 modeling was used to determine the total time to drain each basin.
- Outfall facilities were designed to drain the basins within 36 hours of the end of the storm event.

General design criteria for storm drains are listed below.

- Minimum depth of cover is two feet and total trench depth was limited to 10 feet where possible.
- Pipe flow velocity was maintained between 3 and 11 feet per second for design flow.
- Pipe invert elevations were matched in manholes or concrete vaults when pipe sizes changed.
- Roughness factor of n = 0.013 was used for all pipe calculations. If HDPE pipe is used, the actual roughness factor will be less.
- HEC-22 was used to model losses at junctions, bends and diameter changes.
- Manholes were spaced in accordance with *Drainage Design Manual, Volume 2 – Hydraulics*.

Open channel design criteria will include the following.

- Concrete lined V-ditches will be used to collect sheet flows.
- All sloping and flat concrete, shotcrete, and soil cement finished surfaces shall have roughened surfaces to discourage inappropriate recreational use.
- Use of grouted riprap for channel lining is not permitted in any application. Rock embedded into structural concrete linings is acceptable.

- The minimum thickness of riprap linings shall be the greater of d100 or 1.5 times d50. In a well graded stone riprap lining, the recommended maximum stone size is two times the d50 and the recommended minimum size is one-third of the d50.
- All stones composing riprap shall be angular, with a minimum specific gravity of 2.4, following the standard test ASTM C127.

3.1 Detention Basins

The 87th Avenue and Pinnacle Peak detention basins are off-line facilities. Discharge of storm water from these basins is through storm drains with the ultimate outlet at the existing open channel at Deer Valley Estates.

The Pinnacle Peak basin was designed for maximum storage volume since multi-use opportunities were determined not to be feasible; therefore, the side slopes were set at 4:1 on the east and south sides and variable on the other sides. The basin will be provided a view fence on the sides where fences do not presently exist. This will enable the landscape designers an opportunity to provide pleasing landscapes visible to the public.

Emergency spillways will be provided at each basin to allow excess storm water to discharge in the direction of the natural flow pattern. Table 3-1 lists the physical dimensions, maximum water surface elevation, spillway conditions, storage volume, maximum discharge rate and time to drain. Table 3-2 summarizes the stage-storage and stage-discharge for each basin. See Appendix A for HEC-1 analysis.

Storage volumes for each basin were computed by measuring the area of each contour. These volumes were summarized and the discharge rates computed. It was assumed that the discharge would be through an orifice of the size indicated. Each basin has an emergency spillway designed to pass the peak flow rate into the basin over a broad-crested weir. These computations have been included in Appendix C-4.

Table 3-1
Detention Basin Data

DESCRIPTION	87TH AVENUE BASIN	PINNACLE PEAK BASIN
Basin Bottom Elevation	1312.50	1297.59
100 Year Maximum Water Surface Elevation	1319.66	1310.76
100 Year Maximum Storage Volume (ac-ft)	29.24	52.69
Spillway Elevation	1321.70	1311.84
Spillway Length (ft)	200.00	100.00
Maximum Discharge Rate (cfs)	123.00	34.00
Time to Drain (hr)	5.80	29.90

Table 3-2 Detention Basin Stage-Storage/Discharge

83rd Avenue/Pinnacle Peak Road Drainage Improvements
FCDMC Contract No. 2003C060 Project No. 450.02.33
87th Avenue Basin

Elevation	Total (sq ft)	Volume (cu ft)	Volume (ac ft)	H1 (ft)	H2 (ft)	Discharge 1 (cfs)	Discharge 2 (cfs)	Total Discharge (cfs)	Bypass Flows (cfs)	Total Discharge (cfs)
1313	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1314	70,608	35,304	0.81	0.00	0.23	0.00	12.11	12.11	12.11	0.00
1315	157,478	149,347	3.43	1.23	1.23	27.85	27.85	55.70	21.57	34.13
1316	169,554	312,863	7.18	2.23	2.23	37.48	37.48	74.96	21.57	53.39
1317	180,871	488,076	11.20	3.23	3.23	45.10	45.10	90.19	21.57	68.62
1318	188,761	672,892	15.45	4.23	4.23	51.60	51.60	103.20	21.57	81.63
1319	196,472	865,508	19.87	5.23	5.23	57.37	57.37	114.74	21.57	93.17
1320	204,093	1,065,791	24.47	6.23	6.23	62.61	62.61	125.23	21.57	103.66
1321	211,648	1,273,661	29.24	7.23	7.23	67.45	67.45	134.90	21.57	113.33

Q = Cd x Ao x (2gh)^0.5
Cd = 0.62 | 2 Orifices - 1 at Elev 1312.50 and 1 at Elev 1312.50
Orifice Diameter each @ (30.4
Orifice Area each (sq ft) = 5.04
h = elevation - center of orifice | total bypass flow (cfs) = 21.57
center of orifices 1313.77 and 1313.77
bypass to elev = 0.00 and 1314.51 | bypass flows (cfs) = 0 and 21.57
Revised 10/26/05

83rd Avenue/Pinnacle Peak Road Drainage Improvements
FCDMC Contract No. 2003C060 Project No. 450.02.33
Pinnacle Peak Detention Basin - 4:1 slopes

Elevation	Total (sq ft)	Volume (cu ft)	Volume (ac ft)	H1 (ft)	H2 (ft)	Discharge 1 (cfs)	Discharge 2 (cfs)	Total Discharge (cfs)	Bypass Flows (cfs)	Total Discharge (cfs)
1298	35,628	17,814	0.41	0.00	0.85	0.00	4.55	4.55	4.55	0.00
1299	99,078	85,167	1.96	0.00	1.85	0.00	6.72	6.72	6.72	0.00
1300	106,887	188,150	4.32	0.00	2.85	0.00	8.35	8.35	8.35	0.00
1301	114,872	299,029	6.86	0.00	3.85	0.00	9.70	9.70	9.70	0.00
1302	123,002	417,966	9.60	0.00	4.85	0.00	10.89	10.89	9.86	1.03
1303	131,264	545,099	12.51	0.00	5.85	0.00	11.96	11.96	9.86	2.10
1304	139,655	680,559	15.62	2.77	6.85	8.23	12.94	21.17	9.86	11.31
1305	148,170	824,471	18.93	3.77	7.85	9.60	13.85	23.45	9.86	13.59
1306	156,872	976,992	22.43	4.77	8.85	10.80	14.71	25.51	9.86	15.65
1307	165,674	1,138,265	26.13	5.77	9.85	11.88	15.52	27.40	9.86	17.54
1308	174,577	1,308,391	30.04	6.77	10.85	12.87	16.29	29.15	9.86	19.29
1309	183,580	1,487,469	34.15	7.77	11.85	13.78	17.02	30.81	9.86	20.95
1310	192,684	1,675,601	38.47	8.77	12.85	14.64	17.73	32.37	9.86	22.51
1311	201,889	1,872,888	43.00	9.77	13.85	15.46	18.40	33.86	9.86	24.00
1312	211,193	2,079,429	47.74	10.77	14.85	16.23	19.06	35.29	9.86	25.43
1313	220,599	2,295,325	52.69	11.77	15.85	16.97	19.69	36.65	9.86	26.79

Q = Cd x Ao x (2gh)^0.5

3.2 Storm Drains

All storm drain calculations were performed with StormCAD. It was assumed the storm drains would be either reinforced concrete pipe or concrete box culverts. Mannings' n value was set at 0.013. Minimum slope was approximately 0.2%. Where pipe sizes are changed, the crowns of the pipes were matched if possible. As noted previously, several storm drains have minimal cover so at those locations the inverts were matched.

The Calle Lejos storm drain collects runoff flowing south to Calle Lejos in the area between 87th Avenue and 83rd Avenue. Lateral pipes will be included at two locations to collect runoff concentrated on the north side of Calle Lejos. Due to the limited cover, the headwall at Station 340+27 is drained by 2@48" pipes.

The 87th Avenue storm drain begins at Calle Lejos where lateral 60" RCP storm drains convey runoff from the future Ventana Picachos retention basins. These flows and the Calle Lejos storm drain flows will be conveyed south within the right-of-way limits of 87th Avenue. At Avenida Del Sol, the runoff from the Cielo Grande storm drain will be discharged into the 87th Avenue storm drain. These flows will be conveyed to the 87th Avenue detention basin. Prior to entering the basin, low flows will be discharged to a bypass/dewater storm drain located on the west side of the 87th Avenue detention basin. The water surface elevation in the basin at the time of peak discharge was used for setting the tailwater for the 87th Avenue storm drain. From the southern end of the basin, another dewater storm drain will convey storm water to the 87th Avenue storm drain. This facility will then convey the runoff in a southerly direction to the Pinnacle Peak Road storm drain. The HGL in the Pinnacle Peak storm drain at 87th Avenue was used for the tailwater elevation for the 87th Avenue storm drain, south of the 87th Avenue basin. For storm drain computations, see Appendix B-3.

The storm drain in Cielo Grande, 89th Avenue and Avenida del Sol was designed to collect and convey the 10-year storm event. These flows will be discharged into the 87th Avenue storm drain. The HGL for the 87th Avenue storm drain at Avenida del Sol was used for the tailwater elevation of the Cielo Grande storm drain. See Appendix B-4 for design computations.

Between 87th Avenue and 91st Avenue, the Pinnacle Peak Road storm drain will collect the 10-year storm event. This runoff will be conveyed east to 87th Avenue where the runoff from the 87th Avenue storm drain is discharged. The Pinnacle Peak Road storm drain will then convey the 100-year storm event easterly to the Pinnacle Peak detention basin. The last segment of storm drain will be constructed on a negative gradient to the basin. In this manner, low flows will be directed to the bypass/dewater storm drain. After the storm event, the basin will be drained back through the last segment of storm drain to the bypass/dewater storm drain. This facility will discharge to the 83rd Avenue storm drain at a manhole located at the northwest quadrant of the Pinnacle Peak Road and 83rd Avenue intersection. The water surface elevation in the Pinnacle Peak basin at the time of peak discharge was used for the tailwater elevation for the Pinnacle Peak storm drain. Appendix B-2 contains calculations for the Pinnacle Peak Road storm drain.

The 83rd Avenue storm drain begins at Avenida del Sol with drop inlets to collect runoff from the northwest and from open channels on either side of 83rd Avenue. This runoff will be conveyed in a pipe to the Pinnacle Peak detention basin. It will also have a bypass/dewater storm drain so that low flows to not enter the basin. The water surface elevation in the basin at the time of peak discharge was used for the tailwater elevation for the 83rd Avenue storm drain. These flows will be conveyed south to the Pinnacle Peak Road and 83rd Avenue intersection where the runoff from the Pinnacle Peak Road storm drain is collected. Also in this intersection, catch basins will be provided to intercept runoff from the east in Pinnacle Peak Road. From this point all flows will be directed south in a pipe within 83rd Avenue. All runoff from this system of improvements will be discharged to an open channel at Deer Valley Estates, south of Williams Road. It was assumed the existing channel would be flowing full at the time of peak discharge for the 83rd Avenue storm drain and the tailwater was set at that elevation. See Appendix B-1 for 83rd Avenue storm drain calculations.

3.3 Catch Basins

All catch basins were located in sag conditions and analyzed using HEC-22 methods. MAG standard 537 Single Grate, 537 Double Grate and 538 Double Grate were used. A clogging factor of 50% was included in the analysis. As shown in the analyses, the flow rates for weir flow and orifice flow were calculated for the various depths. The more restrictive flow was used at the design depth. See Appendix C-1 for the computations. At the 85th Avenue alignment north of Pinnacle Peak Road, a trench drain is provided to collect flows from the existing unpaved street. The width of the trench drain was set at the distance between fences along this street.

3.4 Drop Inlets

At locations where the quantity of flow did not allow use of a catch basin, drop inlets were utilized. MAG standard 501-5 and special design drop inlets were used. For each drop inlet the depth of flow over the weir was computed. Maintaining a minimum water surface elevation of 6" below the ground, the weir elevation was established. To ensure the flow could enter the storm drain, the headwater elevation was computed using the nomograph "Headwater Depth For Concrete Pipe Culverts With Inlet Control". Again the headwater depth had to be at least 6" below the ground. See Appendix C-2 for the computations.

3.5 Outlet Protections

At each storm drain outlet, protection would be provided using riprap. Size of riprap and volume required was determined by methods detailed in the *Drainage Design Manual for Maricopa County, Volume 2, January 28, 1996*. At the 87th Avenue storm drain outlet

into the 87th Avenue basin, it was determined the riprap required would be excessive. At this location, a stilling basin was designed in accordance with *Design of Small Canal Structures.* See Appendix C-3 for these design computations.

References

A and B Investments, *Final Drainage Report for Eagle Canyon*. Prepared by American Engineering Company, January 7, 1998 Revised May 11, 1998.

A and B Investments, *Preliminary Drainage Report for Summit at Sunrise Mountain* Prepared by RBF and Associates, January 25, 1999 Revised October 30, 1999.

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Federal Emergency Management Agency, *FIRM Flood Insurance Rate Map, Maricopa County, Arizona and Incorporated Areas*, Map No.04013C1180 F.

Flood Control District of Maricopa County, *Glendale Peoria Area Drainage Master Plan Update*. Prepared by Entellus, December 2001 Revised May 16, 2002.

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Fulton Homes and Fletcher Farms, *Fletcher Heights, Phase 1 Final Drainage Plan*, June 1996 Revised March 1997.

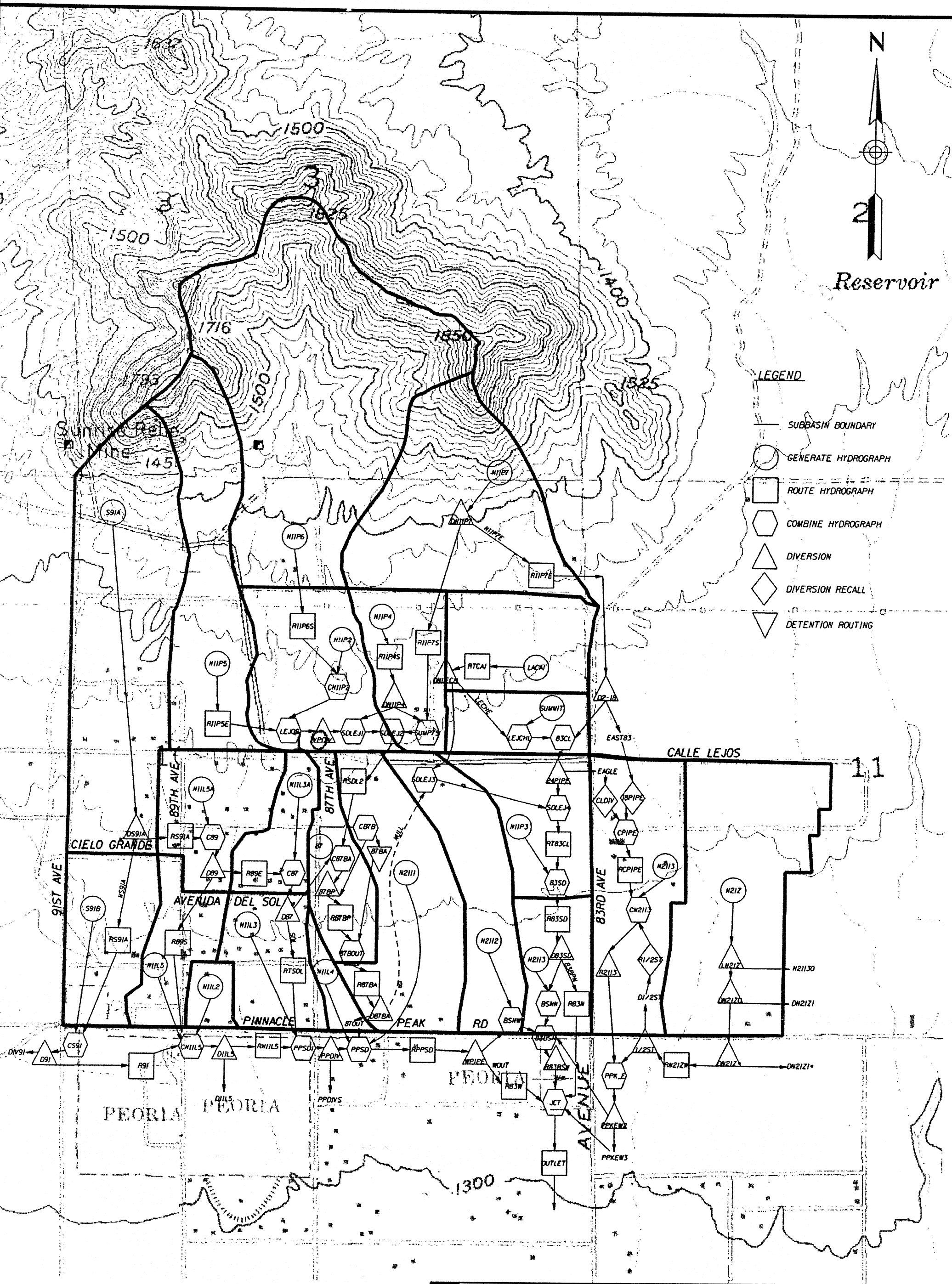
Hancock Communities, *Final Drainage Report for Clearview Estates*. Prepared by Sage Engineering Corporation, April 7, 1999.

Knight, Knight, Jones LLC, *Drainage Report for La Caille*, Prepared by CMX Group Inc. December 22, 1994

Ventana Picachos, LLC. Drainage Report for Peoria 60 (Ventana Picachos). Prepared by SKG Enterprises, Inc. May 9, 2003. Last revision May, 2004.

Appendix A

HEC-1 Analyses



J2 engineering and environmental design 4649 east cotton gin loop, suite B2 phoenix, arizona 85040 phone: 602.438.2221 www.j2design.us	
PROJECT NO. 3077	DRAWN BY MR
DATE 8-23-05	CHECKED BY JH

HEC-1 SCHEMATIC DIAGRAM

```
1*****************************************
*                                       *
*    FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*                JUN  1998              *
*             VERSION 4.1               *
*                                       *
*  RUN DATE   22DEC05  TIME  13:56:33   *
*                                       *
*****************************************
```

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

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

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

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

1 HEC-1 INPUT PAGE 1

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

   1          ID
   2          ID   BYPASS2.DAT
   3          ID   REVISED 9/19/05 BY AJR (J2):  MODIFIED SUBBASINS AND ROUTING OPERATIONS
   4          ID           WITHIN SUBBASINS S91A, S91B, N11L5A, N11L5, N11L3A, N11L3, 87,
   5          ID           AND N21I1
   6          ID   REVISED 8/23/05 BY AJR (J2):  MODIFIED 87TH AVE BASIN AND PINNACLE PEAK
   7          ID           BASIN STAGE-STORAGE-DISCHARGE INFORMATION PER CURRENT DESIGN;
   8          ID           MODIFIED STORM DRAIN ROUTING DATA PER CURRENT DESIGN
   9          ID   REVISED 8/4/05 BY AJR (J2):  MODIFIED DIVERT OPERATION AT D11L5 TO DIVERT
  10          ID           FLOW IN EXCESS OF THE 10-YEAR FLOW OUT OF MODEL; ADDED DIVERT
  11          ID           OPERATION AFTER R91 TO DIVERT FLOW IN EXCESS OF 10 YEAR FLOW OUT OF
  12          ID           MODEL
  13          ID   REVISED 7/29/05 BY AJR (J2):  CHANGED 87TH AVENUE BASIN AND PINNACLE PEAK
  14          ID           BASIN STAGE-STORAGE-DISCHARGE PER JACOBS 7/28/05 REVISIONS
  15          ID   REVISED 4/19/05 BY AJR (J2):  ADDED DIVERT OPERATIONS TO MODEL 10-YEAR
  16          ID           STORM DRAIN IN AVENIDA DEL SOL TO 91ST AVENUE; EMAIL PER EMILI
  17          ID   REVISED 4/5/05 BY AJR (J2): DELETED CALLE LEJOS BASIN; ADDED NEW 87TH
  18          ID           AVENUE BASIN; MODIFIED MODEL STRUCTURE NEAR CALLE LEJOS BASIN;
  19          ID           SUBDIVIDED SUBBASIN S91, DIVERTED UPPER PART OF S91 TO NEW 87TH
  20          ID           AVENUE BASIN.
  21          ID   REVISED 3/3/05 BY AJR (J2): PINNACLE PEAK BASIN STAGE-STORAGE-DISCHARGE
  22          ID           RELATIONSHIP BASED ON DATA FROM JACOBS (ALTERNATIVE 2)
  23          ID   REVISED 3/3/05 BY AJR (J2) TO CHANGE TC AND R FOR BASIN S91 TO 100-YEAR
  24          ID           VALUES
  25          ID   REVISED 2/21/05 BY AJR (J2) TO ADD JP AND JR RECORDS TO MODEL 10, 25, 50,
  26          ID           AND 100-YEAR STORM EVENTS
  27          ID   REVISED 2/15/05 BY AJR (J2) TO ADD SUBBASIN S91 AND ROUTING OPERATIONS
  28          ID           ALONG PINNACLE PEAK ROAD BETWEEN 91ST AVENUE AND CP PPSD;
  29          ID   REVISED 12/27/04 BY DES TO REFLECT CHANGES IN LINEWORK TO REMOVE
  30          ID           ANY BASIN EXCAVATION FROM THE TRACT B AREA.
  31          ID           THE RBSN STAGE STORAGE RECORD WAS ADJUSTED FOR THE NEW VOLUMES.
  32          ID   REVISED 12/08/04 BY DES TO REMOVE OVRLND DIVERSION STEP AND
  33          ID           SPLIT UP ROUTING STEPS R11P4S, R11P7S, RTCAI, & SUMMIT
```

```
ID          TO ADD IN WITH CLPIPE (ROUTED OUTFLOW FROM RBSN).
ID   REVISED 12/07/04 BY DES TO CHANGE LEJOS DETEN BASIN
ID          STAGE STORAGE INPUT RECORD, BOTTOM AT 1337.
ID          INCLUDES A 10-FOOT O&M ROAD WITH 4:1 BACKSLOPES
ID          INCLUDES CHANGES BY J2 SUBMITTED 12-07-04.
ID   REVISED 11/16/04 BY JPF TO REMOVE DIVERSIONS NPIPE, WPIPE AND PPKES
ID   REVISED 11/15/04 BY JPF FOR PINNACLE PEAK BASIN MODIFICATIONS
ID   REVISED 11/4/04 BY JPF FOR CHANGES IN FAX TO JEFF H 11/2/04
ID   83RD AVENUE AND PINNACLE PEAK DRAINAGE IMPROVEMENTS
ID   THIS FILE MODELS THE HYDRYOLOGY FOR THE PROPOSED
ID   DRAINAGE IMPROVEMENTS FROM THE SUNRISE MOUNTAINS SOUTH TO
ID   TO PINNACLE PEAK ROAD AND FROM 89TH AVE WEST TO 81ST AVE
ID
ID   J2 MODIFIED THE ENTELLUS GLENDALE/PEORIA ADMP UPDATE
ID   LEVEL3.DAT
ID   J2 UPDATED THE HYDROLOGY MODEL AND REDUCED THE LIMITS TO AREAS PERTINENT
ID   TO THIS PROJECT.
ID
ID   PREPARED BY: KBD
ID   DATE: SEPTEMBER 2004
ID   REVISED OCTOBER 2004
ID   UPDATED FOR FCD PREDESIGN COMMENTS FROM STEVE TUCKER
```



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

ID
ID   STEVE TUCKER COMMENTS:
ID
ID   1) In the schematic, all triangles should have 2 arrows going outward.
ID      All other symbols should have 1 arrow pointing outward.
ID      Specifically, QINCL - CLBRK, RN21ZW - 1/2ST,
ID      and PPK_E - 83_S are drawn incorrectly.
ID
ID      J2 RESPONSE: AGREE WILL UPDATE THE HEC-1 DIAGRAM
ID
ID   2) The diamond RI1/2ST should be moved to the southside of R21I3 for clarity.
ID
ID      J2 RESPONSE: AGREE WILL UPDATE THE HEC-1 DIAGRAM
ID
ID   3) The model should include the total areas that contribute to the channel
ID      at the downstream exit of the storm drain (at Deer Valley Estates).
ID      I think this should involve no more than cut and paste of the original
ID      Model.
ID
ID      J2 RESPONSE: THE ADDITIONAL AREAS WERE ADDED. THE SUBBASINS ADDED FROM
ID                   THE LEVEL3.DAT FILE WERE N22B AND N21F.
ID
ID   4) The alternative of taking flows from east of 83rd Avenue and
ID      Pinnacle Peak should be addressed, advantages and disadvantages.
ID
ID      J2 RESPONSE: THE FLOWS ARRIVEING ALONG PINNACLE PEAK FORM THE EAST AT
ID                   83RD AVENUE AND PINNACLE PEAK WERE ROUTED INTO PINNACLE
ID                   PEAK BASIN.
ID
ID   5) The diversions east and south for N212 do not appear to conform to what
ID      I saw in the field. It says that at 300 cfs, the entire flow would turn to
ID      the west, and at 400 cfs, almost all the flow would travel west. It
ID      appeared to me that there would be significant flows east and south.
ID
ID      J2 RESPONSE: THROUGH DISCUSIONS WITH THE FCD AND BY CONDUCTING A SITE
ID                   VISIT 10-26-2004, THE DESIGN TEAM DETERMINED THAT THE
ID                   FLOW SPLIT OCCURRING AT 81ST AVE AND PINNACLE PEAK HAD
ID                   A RATIO OF 50% TRAVELING SOUTH AND 50% WEST. SEE "DN21Z*"
ID
ID
ID
ID   MODEL ID: 83REV.DAT
ID
ID   ==========================================================================
ID   ==========================================================================
```

```
101          ID
102          ID   Project ID: GP - Major Basin: 01 - Return Period: 100 Years 6-HR
103          ID
104          ID   ********************************************************************************
105          ID   **                                                                            **
106          ID   **                      Glendale/Peoria ADMP Update                           **
107          ID   **                                                                            **
108          ID   ********************************************************************************
109          ID   ********************************************************************************
110          ID   PROJECT:                 Glendale Peoria ADMP Update
1                                           HEC-1 INPUT                                    PAGE  3

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

111          ID   CLIENT:                  Flood Control District of Maricopa County
112          ID   PREPARED BY:             Entellus, Inc.
113          ID   PROJECT No:              FCD 99-44              Entellus 310.017
114          ID   FILE NAME: LEVEL3.DAT              CREATED DATE: JUNE 6, 2001
115          ID   MODIFIED:
116          ID   STORM:                   100-year 6-hour Storm
117          ID   DEVELOPMENT CONDITIONS: LEVEL 3 HYDROLOGY
118          ID
119          ID   ================================================================================
120          ID   ================================================================================
121          ID
122          ID   DDM MCUHP1
             *
             * ********************************************************************************
123          IT       2                    1000
124          IO       5
             *
             *DIAGRAM
125          IN      15
126          JP       1
127          JR    PREC    0.63    0.78    0.89    1.00
             *
             * ********************************************************************************
             * ********************************************************************************
             * **********************       83RD AVENUE     **********************************
             * ********************************************************************************
             *

128          KK   N11P5   BASIN
129          KM   THE ADMP UPDATE SHOWED N11P5 BASIN ENDING AT HATFIELD ROAD.
130          KM   J2 MODIFIED THE DRAINAGE AREA DELINEATION AND EXTENDED TO
131          KM   CALLE LEJOS ROAD
132          BA    .088
133          KM   ORIG. PRECIP JD AND CARDS AND JC DISTRIBUTIONS WERE REPLACED BY SINGLE
134          KM   PB AND SINGLE PC DISTRIBUTION
135          KM   RAINFALL DEPTH OF 3.20 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
136          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF 1.000
137          PB   3.200
138          KM   THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN No. OF 1.00
139          PC    .000    .008    .016    .025    .033    .041    .050    .058    .066    .074
140          PC    .087    .099    .118    .138    .216    .377    .834    .911    .931    .950
141          PC    .962    .972    .983    .991   1.000
142          LG    .350    .350   2.650   1.200    .000
143          UC    .371    .399
144          UA       0       3       5       8      12      20      43      75      90      96
145          UA     100
             *

146          KK  R11P5E
147          KM   ROUTE N11P5 FLOWS EAST IN CALLE LEJOS PROPOSED CHANNEL
148          KM   THEN THRU BOX AT 88TH AVE
149          RK    1430    .002    .018            TRAP      10       4
             *
1                                           HEC-1 INPUT                                    PAGE  4

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

```
150          KK   N11P6   BASIN
151          BA    .203
152          LG    0.35    0.35    2.65    1.20       0
153          UC   0.213   0.128
154          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
155          UA     100
             *

156          KK  R11P6S
157          KM   ROUTE THRU N11P2 TO JUST NORTH OF THE PROPOSED CALLE LEJOS BASIN
158          KM   ROUTE R11P6S IS 1620 FT WITH A SLOPE OF 0.0222
159          KM   CROSS SECTION IS A MEDIUM WASH
160          RS       3    FLOW       0
161          RC     .05     .05     .05    1620  0.0222
162          RX       0     100     300     360     380     420     620     720
163          RY      10       8       6       2       0       6       8      10
             *

164          KK   N11P2   BASIN
165          BA    .063
166          LG    0.35    0.35    2.65    1.20       0
167          UC   0.338   0.327
168          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
169          UA     100
             *

170          KK  CN11P2
171          KM   COMBINE N11P6 AND BASIN N11P2
172          KM   BASICALLY THESE BASIN FLOWS OUTFALL TO THE NORTH SIDE OF THE PROPOSED CALLE
173          KM   LEJOS BASIN
174          HC       2
             *

175          KK   LEJOS
176          KM   COMBINE INFLOWS FROM N11P5 AND COMBINED FLOWS FROM N11P6 AND N11P2
177          KO       0                                  22
178          HC       2
             *

179          KK   VPDIV
180          KM   DIVERT 8.34 ACRE-FEET OUT OF MODEL FOR VENTANA PICACHOS RETENTION
181          DT   VPRET    8.34
182          DI       0    1000
183          DQ       0    1000
             *
             * KK  RBSN
             * KM CALLE LEJOS DETENTION BASIN ROUTING, PER BASIN_ADMP20 CONFIGURATION
             * KM THE ADMP ALLOWS FOR 45 CFS METERED OUT
             * KM IN OUTFLOW PIPE
             * KO      0                                  22
             * RS      1    STOR       0
             * SV      0    0.42    1.97    3.68    5.54    7.57    9.78   12.20   15.13   18.
             * SE   1336    1337    1338    1339    1340    1341    1342    1343    1344    13
             * SQ      0    6.85    20.1    27.6    33.5    38.4    42.8    46.8    50.5    53
             *
             * KKCLPIPE
             * KM CALLE LEJOS DETENTION BASIN OUTLET PIPE
             * KM DRAIN BASIN VIA PROPOSED CONC. OUTLET PIPE
             * KM IS 72" PIPE AT 0.2% GRADE AS A MINIMUM.
             * KM OUTFALL IS CHANNEL ALONG 83RD AVE.
             * RK   2000    .002    .013            CIRC       6
             *
```



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

184          KK   N11P4   BASIN
185          KM   SUBDIVIDE BASIN N11P4 INTO 3 SUBBASINS. EAST BASIN - CALL N11P4,
186          KM   LACAI- THE LA CAILLE DEVELOPMENT
```

```
187          KM   SUMMIT - SUMMIT AT SUNRISE MOUTAIN DEVELOPMENT
188          KM   ORIGINAL BASIN SIZE WAS 0.124
189          KM   ADMP UPDATE GREEN-AMPT PARAMETERS MATCHED
190          KM     L =  .33  Kb = .061  Adj. Slope =  112.0
191          BA    .039
192          LG    .320    .350   2.650   1.200   3.000
193          UC    .213    .174
194          UA       0       3       5       8      12      20      43      75      90      96
195          UA     100
             *

196          KK  R11P4S
197          KM   ROUTE R11P4 IS 1570 WITH A SLOPE OF 0.002 FT/FT
198          RS       5    FLOW       0
199          RC    .016   0.020   0.035    1570   0.002  100.33
200          RX     0.0      24      26    26.1      29      33      38      40
201          RY     100     100     100  100.33  100.33   99.13  100.33  100.33
             *

202          KK  DN11P4
203          KM   ADDED BY DES
204          KM   N11P4E IS APPROXIMATELY HALF THE RUNOFF THAT IS ROUTED TO
205          KM   BE RECALLED AT RDP4E.
206          KM   REMAINDER GOES INTO HEADWALL AND LATERAL AT 13+80.
207          DT  N11P4E
208          DI       0      10      50      80     120     200     300     400
209          DQ       0       5      25      40      60     100     150     200
             *

210          KK  SDLEJ1
             * KM Q IN CALLE LEJOS STORM DRAIN AT STA 13+80
             * KM INTERCEPT WITH DROP INLET HEADWALL & LATERAL
211          HC       2
             *

212          KK   N11P7   BASIN
213          KM   SUBBASIN NORTH OF LA CAILLE DEV.
214          BA    .103
215          LG   0.35    0.35    2.83    1.06       9
216          UC  0.162   0.091
217          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
218          UA     100
             *

219          KK  DN11P7
220          KM   DES SWITCHED REMAINDER FLOW FROM N11P7S TO CONTINUE SOUTH
221          KM   DIVERSION N11P7E SPLITS FLOWS EAST ALONG HATFIELD THEN SOUTH ALONG
222          KM   83RD AVE TO 83RD AND CALLE LEJOS INTERSECTION
223          KM   (RECALL N11P7E JUST AFTER SUMMIT).
224          DT  N11P7E
225          DI       0      10      50      80     125     200     300     400
```



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

226          DQ       0       2      10      16      25      40      60      80
             *

227          KK  R11P7S
228          KM   ROUTE R11P7S
229          KM   ROUTE R11P7S IS 2707 FT WITH A SLOPE OF 0.0111
230          KM   ROUTE IS LENGTH IS TO
231          KM   CROSS SECTION IS SHALLOW CONCENTRATED FLOW
232          RS       4   FLOW       0
233          RC    0.05    0.05    0.05    1465   0.016       8
234          RX       0     200     250     260     270     280     330     530
235          RY       3       2       1       0       0       1       2       8
             *

236          KK  RDP4E
237          KM   DIVERSION RECOVER N11P4E
```

```
238           KM   RECOVER FLOWS FROM DN11P4 (EASTERN DIVERT)
239           DR  N11P4E
              *
240           KK  SUMP7S
241           KM   TOTAL INFLOW AT INLET HEADWALL FOR R11P7S AT STA 17+00
242           HC       2
              *
243           KK  SDLEJ2
              * KM Q IN CALLE LEJOS STORM DRAIN AT STA 17+00
              * KM INTERCEPT WITH DROP INLET HEADWALL & LARGE LATERAL
244           HC       2
              *
245           KK   RSDL2
246           KM   ROUTE SCLEJ2 TO NEW BASIN AT 87TH AVENUE IN 78 IN DIA STORM DRAIN
247           RD    1320   .0080    .013            CIRC       6
              *
248           KK    S91A   BASIN
249           KM   UPPER PART OF SUBBASIN S91 (NORTH OF AVENIDA DEL SOL)
250           BA   .1353
251           LG     .30     .35     4.5     .37       5
252           UC     .20     .17
253           UA       0       5      16      30      65      77      84      90      94      97
254           UA     100
              *
255           KK   DS91A
256           KM   DIVERT FLOW IN EXCESS OF THE 10-YEAR RUNOFF SOUTH TO S91 (9/19/05)
257           DT   NS91A
258           DI       0     149   10000
259           DQ       0       0    9851
              *
1                                        HEC-1 INPUT                                        PAGE  7

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

260           KK   RS91A
261           KM   ROUTE S91A FROM EAST OF 91ST AVENUE TO NEW 87TH AVENUE DETENTION BASIN
262           RK    1730    .009    .035            DEEP     200
              *
263           KK  N11L5A
264           KM   UPPER PART OF SUBBASIN N11L5
265           BA   .0433
266           LG      .3     .22    10.3     .04       5
267           UC     .15     .10
268           UA       0       5      16      30      65      77      84      90      94      97
269           UA     100
              *
270           KK     C89
271           KM   COMBINE RS91A AND N11L5A AT AVENIDA DEL SOL AND 89TH AVENUE
272           HC       2
              *
273           KK     D89
274           KM   DIVERT FLOW IN EXCESS OF THE 10-YEAR RUNOFF SOUTH THROUGH N11L5
275           DT    ED89
276           DI       0     218   10000
277           DQ       0       0    9782
              *
278           KK    R89E
279           KM   ROUTE D89 TO EAST TO CP C87
280           RD     996    .002    .013            CIRC       6
              *
```

```
KK  N11L3A
KM   RUNOFF FROM UPPER PART OF SUBBASIN N11L3
BA   .0247
LG      .3      .22     10.3      .04       15
UC     .13      .11
UA       0        5       16       30       65       77       84       90       94       97
UA     100
*

KK     C87
KM   COMBINE R89E AND N11L3A AT 87TH AVENUE AND AVENIDA DEL SOL
HC       2
*

KK     D87
KM   DIVERT FLOW IN EXCESS OF 10-YEAR FLOW SOUTH TO PPSD
DT     SOL
DI       0      246    10000
DQ       0        0     9754
*
```



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

KK   C87BA
KM   COMBINE RSDL2 AND C87 AT 87TH AVENUE AND AVENIDA DEL SOL
HC       2
*

KK    87BP
KM   DIVERT FLOW IN EXCESS OF BYPASS PIPE CAPACITY INTO 87TH AVE BASIN
DT   87BAS
DI       0       22      683    10000
DQ       0        0      661     9978
*

KK   R87BP
KM   ROUTE 87BP THROUGH 87TH AVE DET BASIN BYPASS PIPE
RD    1320    .0093     .013            CIRC      3.5
*

KK      87
KM   RUNOFF DIRECTLY ENTERING 87TH AVENUE BASIN
BA   .0326
LG     .30      .22     10.3      .04        5
UC     .15      .16
UA       0        5       16       30       65       77       84       90       94       97
UA     100
*

KK    R87B
KM   RETRIEVE DIVERTED FLOW 87BAS
DR   87BAS
*

KK    C87B
KM   COMBINE 87 AND R87B (TOTAL INFLOW INTO 87TH AVE BASIN)
HC       2
*

KK    87BA
KM   ROUTE C87B THROUGH NEW BASIN AT 87TH AVENUE (LAST UPDATED 12/22/05)
RS       1     STOR        0
SV       0     0.81     3.43     7.18    11.20    15.45    19.87    24.47    29.24
SE    1313     1314     1315     1316     1317     1318     1319     1320     1321
SQ       0        0    34.13    53.39    68.62    81.63    93.17   103.66   113.33
*
* KK  87BA
* KM ROUTE C87B THROUGH NEW BASIN AT 87TH AVENUE
* RS      1     STOR        0
```

```
*  SV     0    2.19    4.69    7.56   10.84   14.51   18.73   23.42   28.39
*  SE  1314    1315    1316    1317    1318    1319    1320    1321    1322
*  SQ     0       0   31.26   44.21   54.15   62.52    69.9   76.58   82.71
*
```



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

  326     KK  87BOUT
  327     KM   COMBINE 87BA AND BYPASS PIPE FLOW
  328     HC       2
          *

  329     KK   R87BA
  330     KM   ROUTE TOTAL OUTFLOW FROM 87TH AVE BAS & BYPASS TO PINNACLE PEAK ROAD
  331     RD    1155   .0093    .013            CIRC     3.5
          *

  332     KK   D87BA
  333     KM   DIVERT ALL OF R87BA OUT OF MODEL FOR LATER RETRIEVAL
  334     DT   87OUT
  335     DI       0    5000
  336     DQ       0    5000
          *

  337     KK   LACAI
  338     KM   SUB-BASIN CAILLE
  339     KM   LA CAILLE DEVELOPMENT
  340     KM   OFFSITE CONVEYANCE SYSTEM IS A PASS THRU SYSTEM
  341     KM   REFER TO "DRAINAGE REPORT FOR LA CAILLE" DEC. 22, 1994
  342     KM   BY CMX - MICHAEL M. LLOYD, PE
  343     KM   IMPERVIOUS AREA BASED ON 1 ACRE LOTS OF SIMILAR AND TYPICAL SUBDIVISION TYPE
  344     KM   3,000 SQUARE FOOT HOUSE, DRIVEWAY AND 1/2 STREETS USED AS IMPERVIOUS
  345     KM   AREA OUT OF TOTAL 43,560 SQUARE FT
  346     KM   ADMP UPDATE GREEN-AMPT PARAMETERS MATCHED
  347     KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF 1.000
  348     KM     L =  .36  Kb = .060  Adj. Slope =  177.0
  349     BA    .044
  350     LG    .320    .350   2.650   1.200   3.000      12
  351     UC    .192    .155
  352     UA       0       5      16      30      65      77      84      90      94      97
  353     UA     100
          *

  354     KK   RTCAI
  355     KM   ROUTE LA CAILLE FLOWS SOUTH THROUGH SUMMIT AT SUNRISE
  356     KM   CALLE LEJOS ROAD
  357     RS       1    FLOW       0
  358     RC    .035   0.020   0.016     572   0.009   100.17
  359     RX     0.0     8.8    17.5    32.4    32.9      33      49      65
  360     RY     100   97.08   98.54  100.03  100.03   99.53   99.85  100.17
          *

  361     KK  DNLECH
  362     KM   REMAINDER FLOW DRAINS ACROSS CALLE LEJOS INTO NEW CATCH BASINS
  363     KM   DIVERSION LECHE CARRIES CHANNEL FLOW EAST.
  364     KM   LECHE IS RECALLED PRIOR TO STEP 83CL
  365     DT   LECHE
  366     DI       0      10      20      40     120     200     300     400
  367     DQ       0      10      20      20      20      20      20      20
          *
```



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

  368     KK  SDLEJ3
  369     KM   TOTAL Q IN CALLE LEJOS STORM DRAIN AT STA 22+00
  370     KM   INTERCEPT STREET OVERFLOW WITH DOUBLE MEDIAN DIKE CATCH BASINS
  371     HC       2
```

```
*
KK  SUMMIT
KM   SUMMIT AT SUNRISE MOUNTAIN DEVELOPMENT
KM   REFER TO "PRELIMINARY DRAINAGE REPORT FOR SUMMIT AT SUNRISE MOUNTAIN"
KM   JAN 25, 1999, REV. OCTOBER 30, 1999
KM   SCOTT M. LARSON, P.E. & ROY B. MCDANIEL
KM   IMPERVIOUS AREA BASED ON 1 ACRE LOTS OF SIMILAR AND TYPICAL SUBDIVISION TYPE
KM   3,000 SQUARE FOOT HOUSE, DRIVEWAY AND 1/2 STREETS USED AS IMPERVIOUS
KM   AREA OUT OF TOTAL 43,560 SQUARE FT
KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF 1.000
KM     L =  .35  Kb = .063  Adj. Slope =   23.0
BA    .027
LG    .320    .350   2.650   1.200   3.000      12
UC    .458    .527
UA       0       5      16      30      65      77      84      90      94      97
UA     100
*

KK  RDLECH
KM   DIVERSION RECOVER LECHE
KM   FLOWS ALONG NORTH SIDE OF CALLE LEJOS
DR   LECHE
*

KK  LEJCHL
KM   TOTAL FLOW INTO EXIST CHL ON N. SIDE OF CALLE LEJOS
HC       2
*

KK  RDP7E
KM   DIVERSION RECOVER N11P7E
KM   RECOVER FLOWS FROM DN11P7 (EASTERN DIVERT)
DR  N11P7E
*

KK  R11P7E
KM   ROUTE R11P7E IS 2356 FT WITH A SLOPE OF 0.0144
KM   ROUTE EAST TO NORTHWEST CORNER OF 83RD AVE AND CALLE LEJOS RD - VIA
KM   HATFIELD ROAD AND RIPRAP SWALE ON WEST SIDE OF 83RD AVE
RS       4    FLOW       0
RC    0.05    0.05    0.05    2356  0.0144
RX       0     200     250     260     270     280     330     530
RY       3       2       1       0       0       1       2       8
*
```



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

KK   D2-18
KM   DIVERT FLOWS VIA 2-18" PIPE AT SE CORNER OF LA CAILLE DEV.
KM   SUMMIT AT SUNRISE MOUTAIN REPORT INDICATED 34 CFS BEING
KM   PASSED DURING THE 100-YEAR STORM. J2 ESTIMATED 20 CFS.
DT  EAST83
DI       0       6      12      18    1000    2000
DQ       0       6      12      18      20      20
*

KK    83CL
KM   COMBINE RDLECH FROM WEST AND D2-18 FROM NORTH
KM   LOCATION IS NW CORNER OF 83RD AVE AND CALLE LEJOS
KM   CONC POINT IS LOCATED JUST BEFORE THE ENTRANCE TO THE 3-24 INCH CROSS PIPES
KM   USED TO BE CALLED CNP11P4 IN ADMP UPDATE MODEL
HC       2
*

KK  24PIPE
KM   DIVERT FLOWS THAT PASS THRU EXISTING 3-24" CMPS (PASSED TO EAGLE CANYON
KM   RETENTION BASIN)
```

```
423          KM   CULVERT CAPACITY FOR 3-24 INCH PIPES WAS CALCUALTED TO BE ABOUT 60 CFS.
424          KM   OUTFALL IS AT THE EAGLE CANYON DEVLOPMENT DETENTION BASIN ON THE SE CORNER
425          KM   OF 83RD AND CALLE LEJOS
426          KM   FLOWS UP TO 60 CFS DIVERTED TO EAGLE CANYON ESTATES - OVERFLOWS TO SOUTH
427          KM
428          DT   EAGLE
429          DI       0      30      60     100    1000    2000
430          DQ       0      30      60      60      60      60
             *

431          KK  SDLEJ4
432          KM   TOTAL Q IN CALLE LEJOS STORM DRAIN AT STA 27+00
433          KM   OVERFLOW FROM 24PIPE INTERCEPTED WITH DOUBLE MEDIAN DIKE CATCH BASINS
434          HC       2
             *

435          KK  RT83CL
436          KM   ROUTE LEJOS STORM DRAIN FLOWS SOUTH ALONG WEST SIDE OF 83RD AVE
437          KM   8-FT BOT WIDTH UNLINED ROADSIDE CHANNEL, 4:1 SS
438          RS       1    FLOW       0
439          RC    .035   0.025   0.016    1177   0.002
440          RX     0.0      50      70      94     102     126     146     200
441          RY     100      99      98      92      92      98      99     100
             *

442          KK   N11P3   BASIN
443          BA    .041
444          LG    0.27    0.35    2.65    1.17       2
445          UC   0.308   0.274
446          UA       0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
447          UA     100
             *

1                                        HEC-1 INPUT                                        PAGE 12

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

448          KK    83SD
449          KM   FLOWS AT BEGINNING OF PROPOSED 83RD AVE RCBC
450          KM   INCLUDES FLOWS FROM N11P3, FLOWS FROM RT83CL
451          HC       2
             *

452          KK   R83SD
453          KM   ROUTE THRU PROPOSED 10x4 RCBC
454          RK     771   .0089    .013            DEEP      10    0.01
             *

455          KK  RNS91A
456          KM   RETRIEVE DIVERTED FLOW NS91A
457          DR   NS91A
             *

458          KK   RS91A
459          KM   ROUTE NS91A THROUGH SUBBASIN S91B
460          RK     771   .0089    .013            DEEP     100    .001
             *

461          KK    S91B   BASIN
462          KM   LOWER PART OF SUBBASIN S91 (SOUTH OF AVENIDA DEL SOL)
463          BA   .0453
464          LG     .25     .35     4.1     .56      30
465          UC     .20     .16
466          UA       0       5      16      30      65      77      84      90      94      97
467          UA     100
             *

468          KK    CS91
469          KM   COMBINE S91B AND RS91A AT 91ST AVENUE AND PINNACLE PEAK
470          HC       2
             *
```

```
                                                                                                                    
  471          KK     D91
  472          KM   DIVERT FLOW IN EXCESS OF 10-YEAR FLOW OUT OF MODEL
  473          DT   DIV91
  474          DI       0      55   10000
  475          DQ       0       0    9945
               *

  476          KK     R91
  477          KM   ROUTE D91 TO PPSD ALONG PINNACLE PEAK ROAD
  478          RD    1700    .002    .013            CIRC       5
               *

  479          KK   N11L5   BASIN
  480          KM   SUBBASIN CONTRIBUTING TO 89TH AND PINNACLE PEAK ROAD
  481          KM   FLOWS TO BE COLLECTED BY INLETS ALONG 89TH AVE.
  482          KM   AND ENTER PROPOSED STORMDRAIN (RCBC) ALONG PINNACLE PEAK DIRECTLY.
  483          BA   .0303
  484          LG    0.25    0.35     4.4     .46       5
  485          UC    0.17    0.15
1                                        HEC-1 INPUT                                                 PAGE 13

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

  486          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  487          UA     100
               *

  488          KK   RED89
  489          KM   RETRIEVE DIVERTED FLOW ED89
  490          DR    ED89
               *

  491          KK    R89S
  492          KM   ROUTE ED89 THROUGH SUBBASIN N11L5 TO PINNACLE PEAK RD
  493          RD    1310    .011    .035            DEEP     200
               *

  494          KK   N11L2   BASIN
  495          KM   ASSUMED THAT FLOWS GENERATED ARE COLLECTED BY INLETS
  496          KM   AND ENTER PROPOSED STORMDRAIN ALONG PINNACLE PEAK DIRECTLY.
  497          BA    .010
  498          LG    .300    .350   2.650   1.400  15.000
  499          UC    .425    .479
  500          UA       0       5      16      30      65      77      84      90      94      97
  501          UA     100
               *

  502          KK  CN11L5
  503          KM   COMBINE 91R, N11L5, N11L2, AND R89S
  504          HC       4
               *

  505          KK   D11L5
  506          KM   DIVERT FLOW IN EXCESS OF 10-YEAR FLOW FROM RN11L5 OUT OF MODEL (8/4/05)
               * KM DIVERT RN11L5 OUT OF MODEL (4/19/05, MODIFIED ALT 3A)
  507          DT    NULL
  508          DI       0      90   10000
  509          DQ       0       0    9910
               *

  510          KK  RN11L5
  511          KM   ROUTE D11L5 TO PPSD ALONG PINNACLE PEAK ROAD
  512          RD    1335    .002    .013            CIRC       5
               *

  513          KK   N11L3   BASIN
  514          KM   SUBBASIN RUNOFF
  515          BA   .0382
  516          LG    0.25    0.35     5.0     .35      15
  517          UC    0.17    0.14
```

```
518          UA      0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
519          UA    100
             *
```



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

520          KK    RSOL
521          KM   RETRIEVE DIVERTED FLOW FROM AVENIDA DEL SOL WEST OF 87TH AVENUE
522          DR     SOL
             *

523          KK   RTSOL
524          KM   ROUTE SOL THROUGH N11L3 TO PPSD
525          RD    1470     .01    .035            DEEP     200
             *
             * KK  87SD
             * KM 87TH AVE STORMDRAIN
             * KM COLLECT FLOWS IN PROPOSED STORMDRAIN AND ROUTE TO PINN PK STORAGE BASIN
             * RK   855    .002    .013            CIRC     3.5    0.01
             *

526          KK   PPSD1
527          KM   COMBINE RN11L5, N11L3, AND RTSOL AT PINNACLE PEAK ROAD
528          HC       3
             *

529          KK   PPDIV
530          KM   DIVERT FLOW IN EXCESS OF 10-YEAR FLOW OUT OF MODEL
531          DT  PPDIVS
532          DI       0     122   10000
533          DQ       0       0    9878
             *

534          KK   N11L4   BASIN
535          KM   FLOWS COLLECTED BY INLETS AND
536          KM   ENTER PROPOSED STORMDRAIN ALONG PINNACLE PEAK DIRECTLY.
537          BA    .010
538          LG    .300    .350   2.650   1.390  14.000
539          UC    .396    .544
540          UA       0       3       5       8      12      20      43      75      90      96
541          UA     100
             *

542          KK   N21I1   BASIN
543          KM   CONTRIBUTES TO PROPOSED STORMDRAIN AT 85TH AVE.
544          BA   .0777
545          LG    0.30    0.35     4.9     .36       5
546          UC    0.19    0.16
547          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
548          UA     100
             *
             * KK  85SD
             * KM COLLECT FLOWS IN SECOND PROPOSED STORMDRAIN AND ROUTE
             * KM 85TH AVE STORMDRAIN
             * RK   855    .002    .013            CIRC     3.5    0.01
             *
```



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

549          KK   87OUT
550          KM   RETRIEVE DIVERTED FLOW FROM 87TH AVE BASIN
551          DR   87OUT
             *

552          KK    PPSD
553          KM   COMBINE 87OUT,PPDIV, N11L4, AND N21I1 AT PINNACLE PEAK ROAD
554          HC       4
```

```
*
KK   RPPSD
KM   ROUTE IN PROPOSED 84 INCH PIPE TO PINNACLE PEAK BASIN
RK    1870    .002    .013            CIRC       7
*

KK   N21I2   BASIN
KM   ASSUME THE FLOWS FROM N21I2 ENTER THE PINNACLE PEAK DETENTION BASIN DIRECTLY
BA    .057
LG    0.32    0.29    4.65    0.32       3
UC   0.392   0.436
UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
UA     100
*

KK   N21I3
KM   ADMP UPDATE BASIN N21I3 RE-DELINEATED
KM   ORIGINAL BASIN SIZE WAS 0.115 SQ MILES
KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF 1.000
KM     L =   .17  Kb = .063  Adj. Slope =   38.0
BA    .027
LG    .330    .350   2.650   1.300   8.000
UC    .221    .131
UA       0       5      16      30      65      77      84      90      94      97
UA     100
*
* ============================================================================
* ADMP FLOWS FROM EAST FACE OF SUNRISE MOUNTAINS AND DEVLOPMENTS EAST OF
* 83RD AVE
* RUNOFF GENERATED ON EAST FACE OF SUNRISE MOUNTAINS FLOWS SOUTHEAST TO
* 83RD AVE.  FLOWS ARE ROUTED EAST UNDER 83RD VIA 48" CMPS.
* FLOWS IS ROUTED AROUND CALLE LEJOS ESTATES TO 81ST AVE WHERE FLOWS ROUTE
* SOUTH AND EAST.
* ============================================================================
*
* ADMP UPDATE SUBBASIN N21J NOT INCLUDED AS PART OF THE CONTRIBUTING AREA
* TO THE PROJECT SITE
* PORTION OF SUBBASIN ABOVE HATFIELD ROAD IS CUT OFF BY A CONCRETE
* TRAPEZOIDAL CHANNEL THAT RUNS WEST TO EAST FROM 83RD AVENUE TO THE OUTFALL
* AT NEW RIVER (APPROXIMATELY 79TH AVE)
* THE CHANNEL WAS BUILT AS PART OF THE CALLE LEJOS ESTATES AND SILVER CREST AT
* TREASURE CANYON DEVLOPMENTS
* CALLE LEJOS ROAD FROM 83RD AVENUE TO END OF STREET (79TH AVE - NEW RIVER) ACTS
* AS A COLLECTOR OF FLOWS GNERATED BETWEEN HATFIELD ROADS AND CALLE LEJOS BETWEE
* 83RD AVENUE AND 79TH AVE.
*
```



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

KK    N21Z   BASIN
KM   APPEARS THAT FLOWS FROM N21J ARE DIVERTED BY WALL AROUND
KM   CALLE LEJOS ESTATES TO WASH ON WEST
KM   CALLE LEJOS PICKS UP REST OF FLOWS GENERATED NORTH AND DIVERTS EAST
KM   THEREFORE N21J HAS BEEN ELIMINATED FROM THE PROJECT WATERSHED
KM   THIS SUB-BASIN INCLUDES EAGLE DEV
KM     L =   .52  Kb = .038  Adj. Slope =   33.0
BA    .109
LG    0.18    0.35    6.40    0.14       6
UC   0.300   0.203
UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
UA     100
*

KK   LN21Z
KM   EAST SIDE OF EAGLE STORAGE ACCOUNTED FOR
KM   EAGLE WEST OF 81ST AVE AVAILABLE RETENTION = 3.42 ACRE-FT
DT  N21I30    3.42
```

```
592          DI       0     100    1000   10000
593          DQ       0     100    1000   10000
             *

594          KK  DN21ZO
595          KM   DIVERSION DN21Z
596          KM   SPLIT EAST TO NEW RIVER ALONG PINNACLE PEAK
597          KM   ORIGINAL ADMP COMMENT INDICATED FLOWS WENT WEST
598          KM   THIS WAS VERIFIED AS A TYPOGRAPHICAL ERROR AND HAS BEEN CORRECTED HERE
599          KM   KBD PER PAW 9-2004
600          DT  DN21ZI
601          DI       0       1     100     200     300     400     450     500
602          DQ       0     .05      .1      .2      .3       5      27      35
             *

603          KK  DN21Z*
604          KM   FLOW SPLIT AT 81ST AVENUE AND PINNACLE PEAK ROAD
605          KM   FLOW SPLIT ESTIMATED IN THE FIELD WITH FCD (ST) 10-26-2004
606          KM   MAIN FLOWS WEST ALONG PINNACLE PEAK TO 83RD, SPLIT CONTINUES SOUTH
607          DT  N21ZI*
608          DI       0       1     300     500
609          DQ       0      .5     150     250
             *

610          KK  RN21ZW
611          KM   ROUTE RN21ZW
612          KM   ROUTE RN21ZW IS 871 FT WITH A SLOPE OF 0.0011
613          KM   CROSS SECTION IS MEDIUM ROAD WITH FENCE ON WEST SIDE
614          KM   ALONG PINNACLE PEAK RD
615          KM   ROUTE FLOW FROM 81ST AVE (CN21Z) TO 83RD AVE, (CN21I)
616          RS       1    FLOW       0
617          RC    .035    .035    .035     871   .0011
618          RX       0       1      15      16      56      57      82     582
619          RY    9.25    1.25    0.25       0       0    0.25    1.25    4.25
             *
```

1

HEC-1 INPUT PAGE 17

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

620          KK  1/2ST
621          KM   DIVERT 1/2 STREET FLOW (NORTH SIDE PINNACLE PEAK)
622          KM   TO CLEARVIEW BASIN
623          DT  D1/2ST
624          DI       0       1      12      50     100     500    1000
625          DQ       0       1      12      12      12      12      12
             *

626          KK  R1/2ST
627          KM   RECALL DIVERT 1/2 STREET INTERCEPT
628          DR  D1/2ST
             *

629          KK  18PIPE
630          KM   RECALL DIVERT FROM 2-18" PIPES PASSING FLOW FROM LA CAILLE
631          KM   WEST SIDE 83RD AVE SWALE TO EAST SIDE SWALE
632          DR  EAST83
             *

633          KK   CLDIV
634          KM   RECALL DIVERT FROM 3-24" PIPES PASSING FLOW FROM NW CORNER OF
635          KM   CALLE LEJOS ROAD AND 83RD AVE
636          DR   EAGLE
             *

637          KK   CPIPE
638          KM   COMBINE EAST83 AND EAGLE FLOWS
639          HC       2
             *

640          KK  RCPIPE
```

```
KM   ROUTE CPIPE TO CN21I3
RK    2640    .003    .035            DEEP     200
*

KK   N21I3
KM   BASIN INCLUDES THE WEST HALF OF EAGLE AND CLEARVIEW DEV
BA    .115
LG    0.33    0.35    2.65     1.3       8
UC   0.433    .287
UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
UA     100
*

KK  CN21I3
KM   COMBINE N21I3, RCPIPE AND R1/2ST
HC       3
*
```



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

KK  R21I3
KM   WEST SIDE OF EAGLE AND CLEARVIEW RETENTION ACCOUNTED FOR
KM   EAGLE WEST SIDE TRACTS ARE F AND L COMBINED IS 2.2 AND E = 9.8
KM   CLEARVIEW WEST OF 81ST AVE AVAILABLE RETETNION = 5.19
DT  N21I3O    17.2
DI       0     100    1000   10000
DQ       0     100    1000   10000
*
* ==========================================================================
*

KK   PPK_E
KM   COMBINE FLOWS TRAVELING ALONG PINNACLE PEAK FROM THE EAST
KM   INTERCEPT ENTIRETY VIA CULVERT AND CONVEY PART TO 48" STORM DRAIN
HC       2
*

KK  PPKEW2
KM   DIVERSION PPKEW2 AT PINNACLE PEAK RD AND 83RD AVE
DT  PPKEW3
DI       0      10      20      30      40      50      70     100
DQ       0      10      20      30      40      50      70     100
*

KK  US_BSN
KO       0                              22
KM   COMBINE INLFOWS JUST AS THEY ENTER PROPOSED 83RD
KM   SEE OUTPUT FOR VOLUME AND PEAK FLOW ENTERING BASIN
HC       5
*

KK    PPBP
KM   DIVERT BYPASS FLOWS
DT   PPBAS
DI       0      10     100    1000
DQ       0      10      10      10
*

KK  R83BSN
KM   STORAGE ROUTING REGIONAL BASIN ON 83RD AVENUE AND PINNACLE PEAK (LAST UPDATED
KO       0                              22
RS       1    STOR       0
SV    0.41    1.96    4.32    6.86    9.60   12.51   15.62   18.93   22.43   26.13
SV   30.04   34.15   38.47   43.00   47.74   52.69
SE    1298    1299    1300    1301    1302    1303    1304    1305    1306    1307
SE    1308    1309    1310    1311    1312    1313
SQ       0       0       0       0    1.03    2.10   11.31   13.59   15.65   17.54
SQ   19.29   20.95   22.51   24.00   25.43   26.79
SE    1298    1299    1300    1301    1302    1303    1304    1305    1306    1307
```

```
690          SE    1308    1309    1310    1311    1312    1313
             *
1                                    HEC-1 INPUT                                                    PAGE 19
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

691          KK    RPPB
692          KM   RETREIVE DIVERTED BYPASS FLOWS
693          DR   PPBAS
             *

694          KK    JCT1
695          KM   COMBINE DIVERTED BYPASS FLOWS WITH BASIN DISCHARGE
696          HC       2
             *

697          KK    RESD
698          KM   RETRIEVE FLOWS DIVERTED IN EAST PIPE
699          DR  PPKEW3
             *

700          KK     JCT
701          KM   COMBINE DIVERTED PIPE FLOWS FROM THE NORTH, EAST AND WEST WITH BASIN ROUTE FL
702          HC       2
             *

703          KK  OUTLET
704          KM   ROUTE FLOWS IN PROPOSED PIPE
705          KM   ROUTE RN21I IS 3117 FT WITH A SLOPE OF 0.004
706          KM   ALONG 83RD AVE. ROADWAY TO JUST SOUTH OF WILLIAMS DRIVE
707          KO       3                                  22
708          RK    3117   .0019    .013              CIRC       4
             *
             * ******************************************************************************
             * FROM THE LEVEL.DAT HEC-1 MODEL
             * ******************************************************************************
             *

709          KK    N22B   BASIN
710          KM   SUB-BASIN N22B
711          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
712          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .998
713          KM     L =  .53  Kb = .052  Adj. Slope =   34.0
714          BA    .185
715          LG    0.30    0.17    7.00    0.12       5
716          UC   0.342   0.177
717          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
718          UA     100
             *
             * MAIN TO 83RD AVE & SPLIT SOUTH TO DEER VALLEY RD

719          KK   DN22B
720          DT   N22BI
721          DI       0       1      10     100     200     300     400
722          DQ       0      .9       9      90     180     270     360
             *
             * ROUTE RN22BE IS 1403 FT WITH A SLOPE OF 0.0007
             * CROSS SECTION IS A SMALL ROAD WITH A FENCE ON THE EAST SIDE
             * FLOW ALONG WILLIAMS RD.
             * ROUTE FLOW FROM 85TH AVE. (CN21F) TO 83RD AVE. (CN22B)
             *
1                                    HEC-1 INPUT                                                    PAGE 20
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

723          KK  RN22BE
724          RS       1    FLOW       0
725          RC    0.05    0.04    0.05    1403   .0007
726          RX       0     500     525     526     556     557     567     568
```

```
727           RY    4.25    1.25    0.25       0       0    0.25    1.25    9.25
              *
              * BASIN N21F
              *
728           KK     N21F    BASIN
729           KM    SUB-BASIN N21F
730           KM    6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
731           KM    THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .999
732           KM      L =  .34  Kb = .055  Adj. Slope =   15.0
733           BA     .104
734           LG    0.30     0.10   11.20     0.03       15
735           UC   0.554    0.507
736           UA       0       5.0     16.0     30.0     65.0     77.0     84.0     90.0     94.0     97.0
737           UA     100
              *
738           KK    CN21F
739           KM    COMBINE N22B, CN21I, N21F, RPPKES
740           KM    INTERSECTION OF 83RD AVE. AND WILLIAMS RD.
741           HC        3
              *
742           ZZ
```

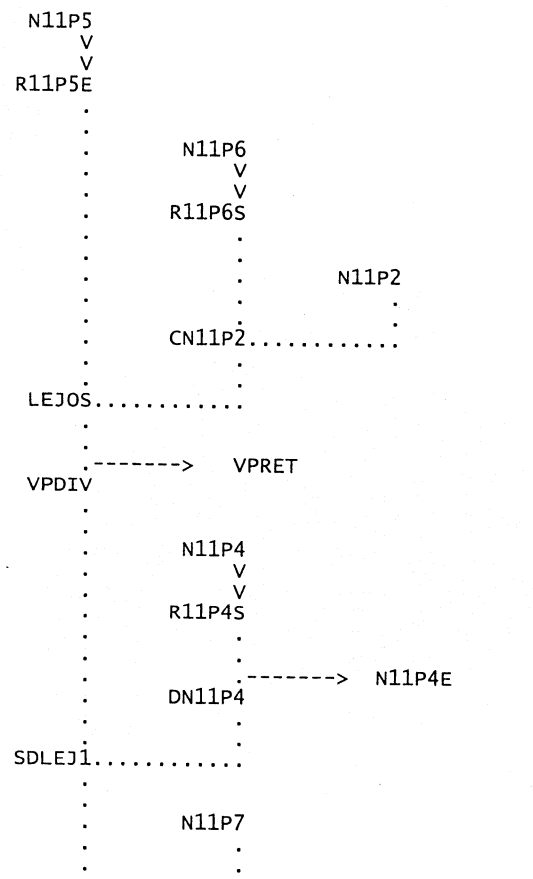
1

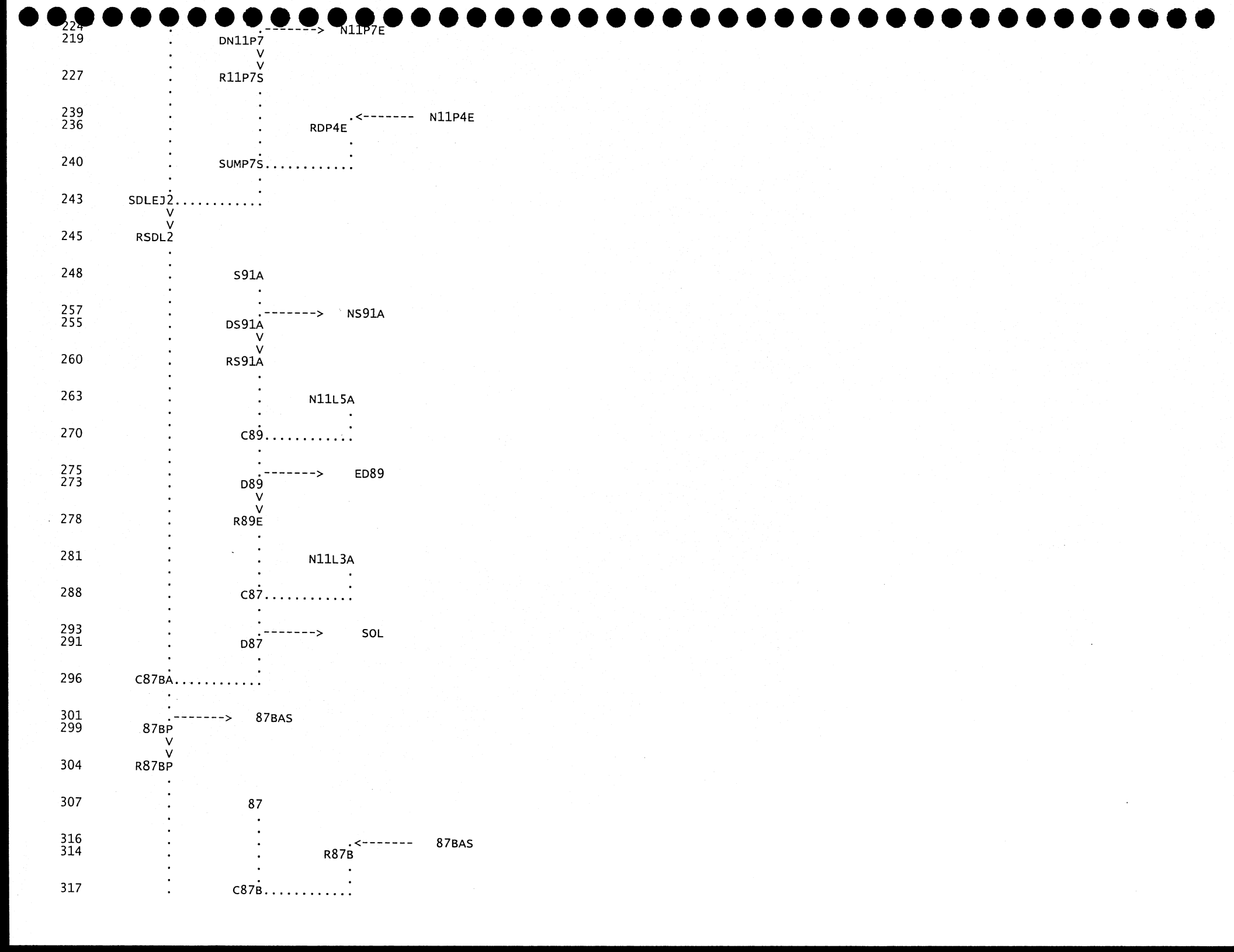
SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE NO.

(V) ROUTING (---->) DIVERSION OR PUMP FLOW

(.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW

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255
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275
273
278
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291
296
301
299
304
307
316
314
317
N11P7E
DN11P7
R11P7S
N11P4E
RDP4E
SUMP7S
SDLEJ2
RSDL2
S91A
NS91A
DS91A
RS91A
N11L5A
C89
ED89
D89
R89E
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C87
SOL
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87BAS
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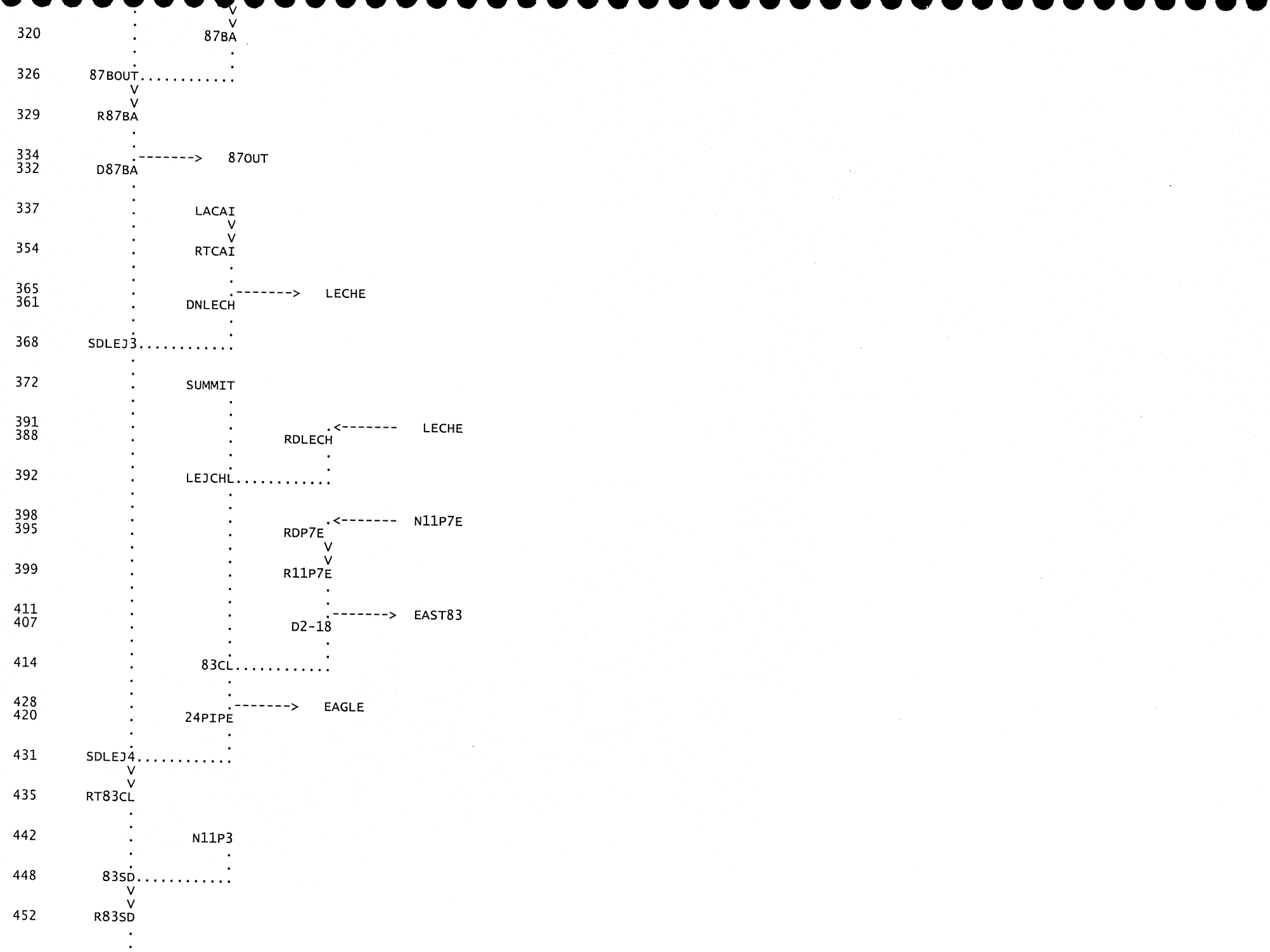
R87BP
87
87BAS
R87B
C87B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87BOUT
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R87BA
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87OUT
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D87BA
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LACAI
354
RTCAI
365
LECHE
361
DNLECH
368
SDLEJ3
372
SUMMIT
391
LECHE
388
RDLECH
392
LEJCHL
398
N11P7E
395
RDP7E
399
R11P7E
411
EAST83
407
D2-18
414
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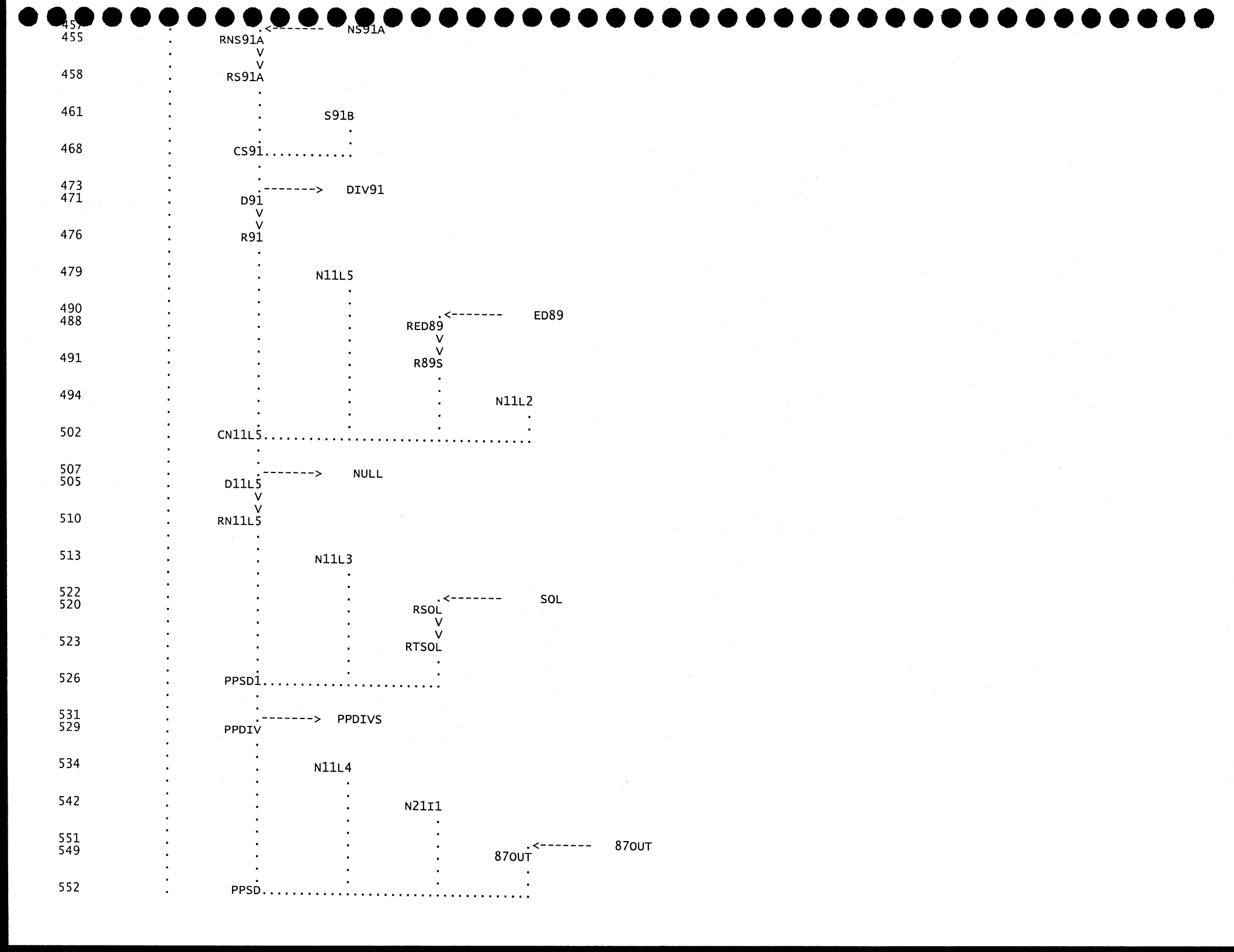
83SD
452
R83SD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534
542
551
549
552
NS91A
RNS91A
RS91A
S91B
CS91
DIV91
D91
R91
N11L5
ED89
RED89
R89S
N11L2
CN11L5
NULL
D11L5
RN11L5
N11L3
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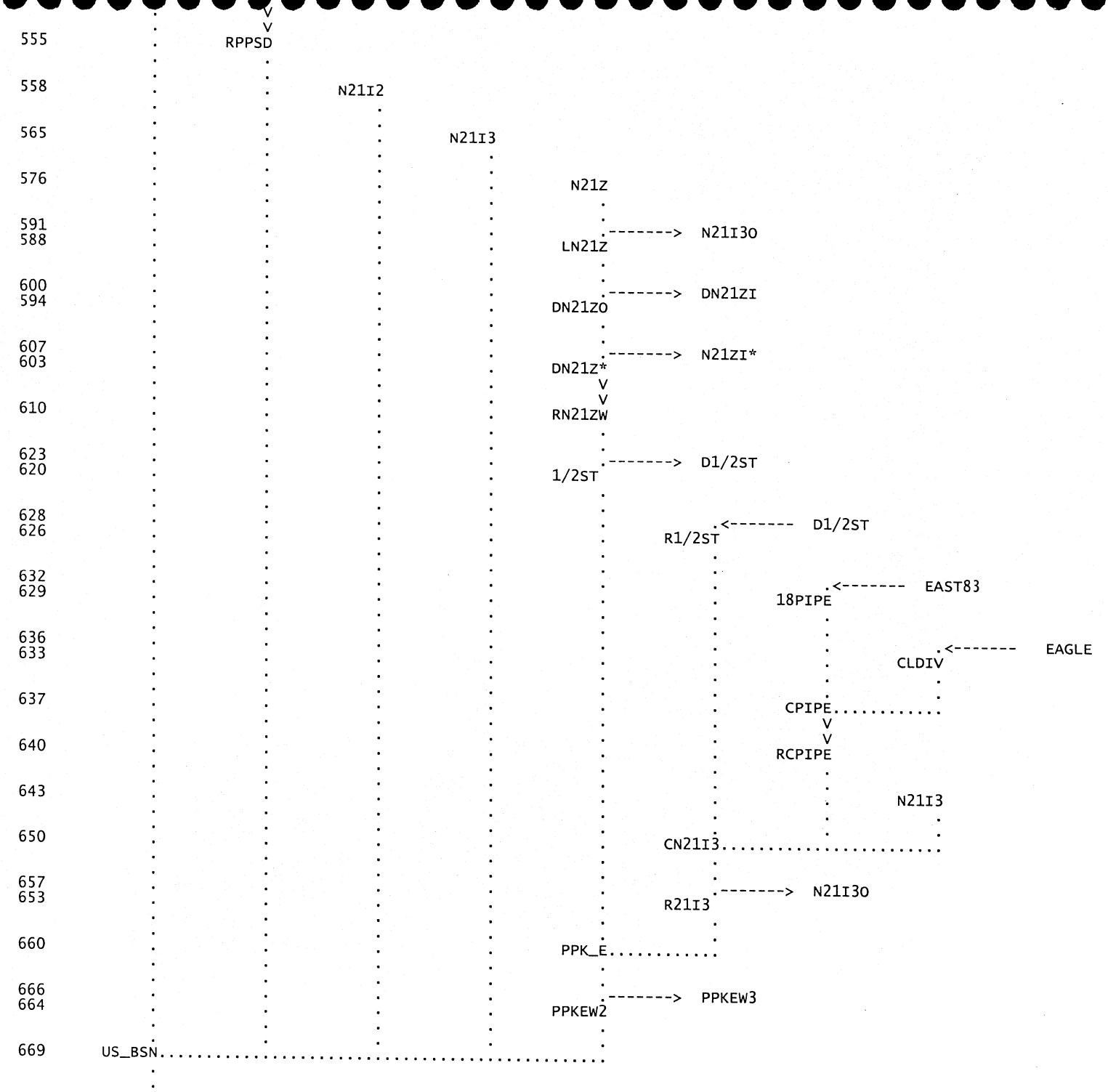
RSOL
RTSOL
PPSD1
PPDIVS
PPDIV
N11L4
N21I1
87OUT
87OUT
PPSD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RPPSD
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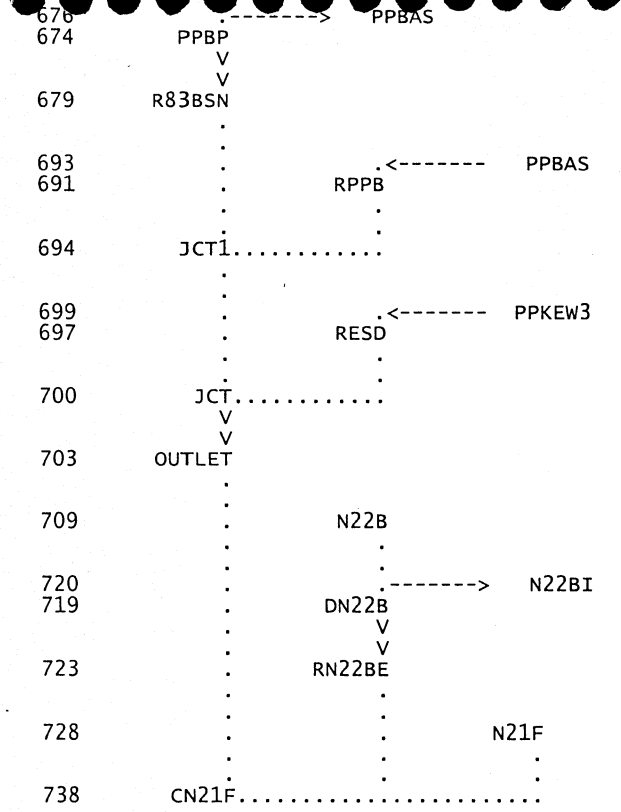
N21I2
565
N21I3
576
N21Z
591
588
LN21Z
N21I3O
600
594
DN21ZO
DN21ZI
607
603
DN21Z*
N21ZI*
610
RN21ZW
623
620
1/2ST
D1/2ST
628
626
R1/2ST
D1/2ST
632
629
18PIPE
EAST83
636
633
CLDIV
EAGLE
637
CPIPE
640
RCPIPE
643
N21I3
650
CN21I3
657
653
R21I3
N21I3O
660
PPK_E
666
664
PPKEW2
PPKEW3
669
US_BSN



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN  1998               *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   22DEC05  TIME  13:56:33   *
*                                       *
*****************************************
```

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

```
BYPASS2.DAT
REVISED 9/19/05 BY AJR (J2):  MODIFIED SUBBASINS AND ROUTING OPERATIONS
        WITHIN SUBBASINS S91A, S91B, N11L5A, N11L5, N11L3A, N11L3, 87,
        AND N21I1
REVISED 8/23/05 BY AJR (J2):  MODIFIED 87TH AVE BASIN AND PINNACLE PEAK
        BASIN STAGE-STORAGE-DISCHARGE INFORMATION PER CURRENT DESIGN;
        MODIFIED STORM DRAIN ROUTING DATA PER CURRENT DESIGN
REVISED 8/4/05 BY AJR (J2):  MODIFIED DIVERT OPERATION AT D11L5 TO DIVERT
        FLOW IN EXCESS OF THE 10-YEAR FLOW OUT OF MODEL; ADDED DIVERT
        OPERATION AFTER R91 TO DIVERT FLOW IN EXCESS OF 10 YEAR FLOW OUT OF
        MODEL
REVISED 7/29/05 BY AJR (J2):  CHANGED 87TH AVENUE BASIN AND PINNACLE PEAK
        BASIN STAGE-STORAGE-DISCHARGE PER JACOBS 7/28/05 REVISIONS
REVISED 4/19/05 BY AJR (J2):  ADDED DIVERT OPERATIONS TO MODEL 10-YEAR
        STORM DRAIN IN AVENIDA DEL SOL TO 91ST AVENUE; EMAIL PER EMILI
REVISED 4/5/05 BY AJR (J2): DELETED CALLE LEJOS BASIN; ADDED NEW 87TH
```

AVENUE BASIN; MODIFIED MODEL STRUCTURE NEAR CALLE LEJOS BASIN;
SUBDIVIDED SUBBASIN S91, DIVERTED UPPER PART OF S91 TO NEW 87TH
AVENUE BASIN.
REVISED 3/3/05 BY AJR (J2): PINNACLE PEAK BASIN STAGE-STORAGE-DISCHARGE
RELATIONSHIP BASED ON DATA FROM JACOBS (ALTERNATIVE 2)
REVISED 3/3/05 BY AJR (J2) TO CHANGE TC AND R FOR BASIN S91 TO 100-YEAR
VALUES
REVISED 2/21/05 BY AJR (J2) TO ADD JP AND JR RECORDS TO MODEL 10, 25, 50,
AND 100-YEAR STORM EVENTS
REVISED 2/15/05 BY AJR (J2) TO ADD SUBBASIN S91 AND ROUTING OPERATIONS
ALONG PINNACLE PEAK ROAD BETWEEN 91ST AVENUE AND CP PPSD;
REVISED 12/27/04 BY DES TO REFLECT CHANGES IN LINEWORK TO REMOVE
ANY BASIN EXCAVATION FROM THE TRACT B AREA.
THE RBSN STAGE STORAGE RECORD WAS ADJUSTED FOR THE NEW VOLUMES.
REVISED 12/08/04 BY DES TO REMOVE OVRLND DIVERSION STEP AND
SPLIT UP ROUTING STEPS R11P4S, R11P7S, RTCAI, & SUMMIT
TO ADD IN WITH CLPIPE (ROUTED OUTFLOW FROM RBSN).
REVISED 12/07/04 BY DES TO CHANGE LEJOS DETEN BASIN
STAGE STORAGE INPUT RECORD, BOTTOM AT 1337.
INCLUDES A 10-FOOT O&M ROAD WITH 4:1 BACKSLOPES
INCLUDES CHANGES BY J2 SUBMITTED 12-07-04.
REVISED 11/16/04 BY JPF TO REMOVE DIVERSIONS NPIPE, WPIPE AND PPKES
REVISED 11/15/04 BY JPF FOR PINNACLE PEAK BASIN MODIFICATIONS
REVISED 11/4/04 BY JPF FOR CHANGES IN FAX TO JEFF H 11/2/04
83RD AVENUE AND PINNACLE PEAK DRAINAGE IMPROVEMENTS
THIS FILE MODELS THE HYDRYOLOGY FOR THE PROPOSED
DRAINAGE IMPROVEMENTS FROM THE SUNRISE MOUNTAINS SOUTH TO
TO PINNACLE PEAK ROAD AND FROM 89TH AVE WEST TO 81ST AVE

J2 MODIFIED THE ENTELLUS GLENDALE/PEORIA ADMP UPDATE
LEVEL3.DAT
J2 UPDATED THE HYDROLOGY MODEL AND REDUCED THE LIMITS TO AREAS PERTINENT
TO THIS PROJECT.

PREPARED BY: KBD
DATE: SEPTEMBER 2004
REVISED OCTOBER 2004
UPDATED FOR FCD PREDESIGN COMMENTS FROM STEVE TUCKER

STEVE TUCKER COMMENTS:

1) In the schematic, all triangles should have 2 arrows going outward.
   All other symbols should have 1 arrow pointing outward.
   Specifically, QINCL - CLBRK, RN21ZW - 1/2ST,
   and PPK_E - 83_S are drawn incorrectly.

   J2 RESPONSE: AGREE WILL UPDATE THE HEC-1 DIAGRAM

2) The diamond RI1/2ST should be moved to the southside of R21I3 for clarity.

   J2 RESPONSE: AGREE WILL UPDATE THE HEC-1 DIAGRAM

3) The model should include the total areas that contribute to the channel
   at the downstream exit of the storm drain (at Deer Valley Estates).
   I think this should involve no more than cut and paste of the original
   Model.

   J2 RESPONSE: THE ADDITIONAL AREAS WERE ADDED. THE SUBBASINS ADDED FROM
   THE LEVEL3.DAT FILE WERE N22B AND N21F.

4) The alternative of taking flows from east of 83rd Avenue and
   Pinnacle Peak should be addressed, advantages and disadvantages.

   J2 RESPONSE: THE FLOWS ARRIVEING ALONG PINNACLE PEAK FORM THE EAST AT
   83RD AVENUE AND PINNACLE PEAK WERE ROUTED INTO PINNACLE
   PEAK BASIN.

5) The diversions east and south for N212 do not appear to conform to what
   I saw in the field. It says that at 300 cfs, the entire flow would turn to
   the west, and at 400 cfs, almost all the flow would travel west. It
   appeared to me that there would be significant flows east and south.

```
J2 RESPONSE: THROUGH DISCUSIONS WITH THE FCD AND BY CONDUCTING A SITE
             VISIT 10-26-2004, THE DESIGN TEAM DETERMINED THAT THE
             FLOW SPLIT OCCURRING AT 81ST AVE AND PINNACLE PEAK HAD
             A RATIO OF 50% TRAVELING SOUTH AND 50% WEST. SEE "DN21Z*"


                    MODEL ID: 83REV.DAT

                    ============================================================================
                    ============================================================================

                    Project ID: GP - Major Basin: 01 - Return Period: 100 Years 6-HR

                    ****************************************************************************
                    **                                                                        **
                    **                     Glendale/Peoria ADMP Update                        **
                    **                                                                        **
                    ****************************************************************************
                    ****************************************************************************
                    PROJECT:                Glendale Peoria ADMP Update
                    CLIENT:                 Flood Control District of Maricopa County
                    PREPARED BY:            Entellus, Inc.
                    PROJECT No:             FCD 99-44              Entellus 310.017
                    FILE NAME: LEVEL3.DAT            CREATED DATE: JUNE 6, 2001
                    MODIFIED:
                    STORM:                  100-year 6-hour Storm
                    DEVELOPMENT CONDITIONS: LEVEL 3 HYDROLOGY

                    ==========================================================================
                    ==========================================================================

                    DDM MCUHP1

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

    IT         HYDROGRAPH TIME DATA
                      NMIN           2  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1    0  STARTING DATE
                     ITIME        0000  STARTING TIME
                        NQ        1000  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      2    0  ENDING DATE
                    NDTIME        0918  ENDING TIME
                     ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL     .03 HOURS
                     TOTAL TIME BASE   33.30 HOURS

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

    JP         MULTI-PLAN OPTION
                     NPLAN           1  NUMBER OF PLANS

    JR         MULTI-RATIO OPTION
                   RATIOS OF PRECIPITATION
                    .63      .78      .89     1.00


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

```
            **************
            *            *
175 KK      *     LEJOS  *
            *            *
            **************

177 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2        1000  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .033  TIME INTERVAL IN HOURS

WARNING --- ROUTED OUTFLOW (     30.) IS GREATER THAN MAXIMUM OUTFLOW (     26.) IN STORAGE-OUTFLOW TABLE


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


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



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

            **************
            *            *
669 KK      *    US_BSN  *
            *            *
            **************

670 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2        1000  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .033  TIME INTERVAL IN HOURS



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

            **************
            *            *
679 KK      *    R83BSN  *
            *            *
            **************

681 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
```

```
                    ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2       1000  LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .033  TIME INTERVAL IN HOURS


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


            **************
            *            *
 703 KK     *    OUTLET  *
            *            *
            **************

 707 KO          OUTPUT CONTROL VARIABLES
                    IPRNT          3  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                     IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2       1000  LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .033  TIME INTERVAL IN HOURS

              HYDROGRAPH ROUTING DATA

 708 RK          KINEMATIC WAVE STREAM ROUTING
                        L      3117.  CHANNEL LENGTH
                        S      .0019  SLOPE
                        N       .013  CHANNEL ROUGHNESS COEFFICIENT
                       CA        .00  CONTRIBUTING AREA
                    SHAPE       CIRC  CHANNEL SHAPE
                       WD       4.00  BOTTOM WIDTH OR DIAMETER
                        Z        .00  SIDE SLOPE
                   NDXMIN          2  MINIMUM NUMBER OF DX INTERVALS

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

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

                 MAIN          3.40      1.25       2.13    779.25     22.74    389.96       .19      6.21

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1408E+02  EXCESS= .0000E+00 OUTFLOW= .1406E+02 BASIN STORAGE= .2147E-01 PERCENT ERROR=    .0

                                     INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

                 MAIN          3.40      1.25       2.00              22.74    390.00       .19
     ***            ***            ***            ***            ***

                      HYDROGRAPH AT STATION   OUTLET
                        FOR PLAN 1, RATIO =  .63

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR     33.30-HR
+   (CFS)       (HR)
                          (CFS)
+      23.      6.50                  17.         7.          5.          5.
                       (INCHES)      .116        .179        .193        .193
                        (AC-FT)        8.         13.         14.         14.
```

CUMULATIVE AREA = 1.36 SQ MI

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

ELEMENT	ALPHA	M	DT (MIN)	DX (FT)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	MAXIMUM CELERITY (FPS)
MAIN	3.40	1.25	1.84	779.25	47.14	269.41	.35	7.19

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2531E+02 EXCESS= .0000E+00 OUTFLOW= .2529E+02 BASIN STORAGE= .2565E-01 PERCENT ERROR= .0

INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

MAIN	3.40	1.25	2.00		47.04	270.00	.35
***	***	***	***		***		

HYDROGRAPH AT STATION OUTLET
FOR PLAN 1, RATIO = .78

PEAK FLOW + (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	33.30-HR
		(CFS)				
+ 47.	4.50		25.	12.	9.	9.
		(INCHES)	.173	.330	.348	.348
		(AC-FT)	13.	24.	25.	25.

CUMULATIVE AREA = 1.36 SQ MI

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

ELEMENT	ALPHA	M	DT (MIN)	DX (FT)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	MAXIMUM CELERITY (FPS)
MAIN	3.40	1.25	2.26	1039.00	69.35	265.28	.50	7.77

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3622E+02 EXCESS= .0000E+00 OUTFLOW= .3620E+02 BASIN STORAGE= .2480E-01 PERCENT ERROR= .0

INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

MAIN	3.40	1.25	2.00		69.02	264.00	.50
***	***	***	***		***		

HYDROGRAPH AT STATION OUTLET
FOR PLAN 1, RATIO = .89

PEAK FLOW + (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	33.30-HR
		(CFS)				
+ 69.	4.40		31.	17.	13.	13.
		(INCHES)	.214	.473	.498	.498
		(AC-FT)	16.	34.	36.	36.

CUMULATIVE AREA = 1.36 SQ MI

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

ELEMENT	ALPHA	M	DT (MIN)	DX (FT)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	MAXIMUM CELERITY (FPS)
MAIN	3.40	1.25	2.14	1039.00	89.71	260.64	.65	8.17

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4719E+02 EXCESS= .0000E+00 OUTFLOW= .4716E+02 BASIN STORAGE= .3167E-01 PERCENT ERROR= .0

INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

MAIN	3.40	1.25	2.00	89.43	262.00	.65
***	***	***	***	***		

HYDROGRAPH AT STATION OUTLET
FOR PLAN 1, RATIO = 1.00

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	33.30-HR
		(CFS)				
89.	4.37		36.	22.	17.	17.
		(INCHES)	.247	.598	.649	.649
		(AC-FT)	18.	44.	47.	47.

CUMULATIVE AREA = 1.36 SQ MI

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 .63	RATIO 2 .78	RATIO 3 .89	RATIO 4 1.00
HYDROGRAPH AT								
+	N11P5	.09	1	FLOW	23.	47.	66.	83.
				TIME	4.27	4.23	4.23	4.23
ROUTED TO								
+	R11P5E	.09	1	FLOW	23.	47.	65.	83.
				TIME	4.33	4.30	4.30	4.30
HYDROGRAPH AT								
+	N11P6	.20	1	FLOW	109.	215.	294.	370.
				TIME	4.13	4.10	4.10	4.10
ROUTED TO								
+	R11P6S	.20	1	FLOW	97.	200.	276.	354.
				TIME	4.20	4.17	4.17	4.17
			** PEAK STAGES IN FEET **					
			1	STAGE	1.69	2.23	2.54	2.77
				TIME	4.20	4.17	4.17	4.17
HYDROGRAPH AT								
+	N11P2	.06	1	FLOW	19.	39.	54.	69.
				TIME	4.23	4.23	4.23	4.20
2 COMBINED AT								
+	CN11P2	.27	1	FLOW	115.	238.	327.	418.

				TIME	4.20	4.20	4.17	4.17
2 COMBINED AT								
+	LEJOS	.35	1	FLOW	127.	270.	374.	472.
				TIME	4.23	4.20	4.20	4.20
DIVERSION TO								
+	VPRET	.35	1	FLOW	127.	270.	374.	472.
				TIME	4.23	4.20	4.20	4.20
HYDROGRAPH AT								
+	VPDIV	.35	1	FLOW	0.	41.	209.	351.
				TIME	.00	4.70	4.37	4.30
HYDROGRAPH AT								
+	N11P4	.04	1	FLOW	20.	38.	52.	64.
				TIME	4.13	4.13	4.13	4.13
ROUTED TO								
+	R11P4S	.04	1	FLOW	15.	33.	45.	57.
				TIME	4.33	4.27	4.27	4.27
			**	PEAK STAGES IN FEET **				
			1	STAGE	100.21	100.40	100.52	100.64
				TIME	4.33	4.27	4.27	4.27
DIVERSION TO								
+	N11P4E	.04	1	FLOW	8.	16.	23.	28.
				TIME	4.33	4.27	4.27	4.27
HYDROGRAPH AT								
+	DN11P4	.04	1	FLOW	8.	16.	23.	28.
				TIME	4.33	4.27	4.27	4.27
2 COMBINED AT								
+	SDLEJ1	.39	1	FLOW	8.	45.	227.	379.
				TIME	4.33	4.70	4.37	4.30
HYDROGRAPH AT								
+	N11P7	.10	1	FLOW	88.	149.	193.	236.
				TIME	4.07	4.07	4.07	4.07
DIVERSION TO								
+	N11P7E	.10	1	FLOW	18.	30.	39.	47.
				TIME	4.07	4.07	4.07	4.07
HYDROGRAPH AT								
+	DN11P7	.10	1	FLOW	70.	119.	154.	189.
				TIME	4.07	4.07	4.07	4.07
ROUTED TO								
+	R11P7S	.10	1	FLOW	63.	108.	141.	172.
				TIME	4.17	4.17	4.17	4.17
			**	PEAK STAGES IN FEET **				
			1	STAGE	.99	1.28	1.39	1.49
				TIME	4.17	4.17	4.17	4.17
HYDROGRAPH AT								
+	RDP4E	.00	1	FLOW	8.	16.	23.	28.
				TIME	4.33	4.27	4.27	4.27
2 COMBINED AT								
+	SUMP7S	.10	1	FLOW	65.	117.	157.	194.
				TIME	4.17	4.17	4.17	4.17
2 COMBINED AT								
+	SDLEJ2	.50	1	FLOW	67.	128.	284.	491.
				TIME	4.17	4.20	4.37	4.27
ROUTED TO								

+	RSDL2	.50	1	FLOW	67.	126.	263.	488.
				TIME	4.20	4.20	4.40	4.30
HYDROGRAPH AT								
+	S91A	.14	1	FLOW	149.	213.	260.	307.
				TIME	4.07	4.07	4.07	4.07
DIVERSION TO								
+	NS91A	.14	1	FLOW	0.	64.	111.	158.
				TIME	4.07	4.07	4.07	4.07
HYDROGRAPH AT								
+	DS91A	.14	1	FLOW	149.	149.	149.	149.
				TIME	4.07	3.97	3.93	3.90
ROUTED TO								
+	RS91A	.14	1	FLOW	148.	149.	149.	149.
				TIME	4.10	4.03	4.00	3.97
HYDROGRAPH AT								
+	N11L5A	.04	1	FLOW	84.	107.	124.	140.
				TIME	4.03	4.03	4.03	4.03
2 COMBINED AT								
+	C89	.18	1	FLOW	217.	256.	273.	289.
				TIME	4.07	4.03	4.03	4.03
DIVERSION TO								
+	ED89	.18	1	FLOW	0.	38.	55.	71.
				TIME	.00	4.03	4.03	4.03
HYDROGRAPH AT								
+	D89	.18	1	FLOW	217.	218.	218.	218.
				TIME	4.07	3.97	3.93	3.90
ROUTED TO								
+	R89E	.18	1	FLOW	207.	217.	218.	218.
				TIME	4.10	4.10	4.10	4.10
HYDROGRAPH AT								
+	N11L3A	.02	1	FLOW	48.	61.	70.	79.
				TIME	4.03	4.03	4.03	4.03
2 COMBINED AT								
+	C87	.20	1	FLOW	246.	273.	286.	296.
				TIME	4.07	4.03	4.03	4.03
DIVERSION TO								
+	SOL	.20	1	FLOW	0.	27.	40.	50.
				TIME	.00	4.03	4.03	4.03
HYDROGRAPH AT								
+	D87	.20	1	FLOW	246.	246.	246.	246.
				TIME	4.07	4.00	3.97	3.93
2 COMBINED AT								
+	C87BA	.70	1	FLOW	282.	353.	411.	683.
				TIME	4.10	4.17	4.17	4.30
DIVERSION TO								
+	87BAS	.70	1	FLOW	260.	331.	389.	661.
				TIME	4.10	4.17	4.17	4.30
HYDROGRAPH AT								
+	87BP	.70	1	FLOW	22.	22.	22.	22.
				TIME	3.67	3.63	3.57	3.53
ROUTED TO								
+	R87BP	.70	1	FLOW	23.	23.	23.	22.
				TIME	3.73	3.67	3.63	3.57

HYDROGRAPH AT								
+	87	.03	1	FLOW	55.	71.	83.	94.
				TIME	4.03	4.03	4.03	4.03
HYDROGRAPH AT								
+	R87B	.00	1	FLOW	260.	331.	389.	661.
				TIME	4.10	4.17	4.17	4.30
2 COMBINED AT								
+	C87B	.03	1	FLOW	307.	382.	441.	694.
				TIME	4.10	4.13	4.17	4.30
ROUTED TO								
+	87BA	.03	1	FLOW	58.	71.	86.	100.
				TIME	4.47	4.50	4.67	4.70
			**	PEAK STAGES IN FEET **				
			1	STAGE	1316.29	1317.19	1318.40	1319.66
				TIME	4.47	4.50	4.67	4.70
2 COMBINED AT								
+	87BOUT	.73	1	FLOW	80.	93.	108.	122.
				TIME	4.47	4.50	4.67	4.70
ROUTED TO								
+	R87BA	.73	1	FLOW	80.	93.	108.	122.
				TIME	4.47	4.50	4.70	4.73
DIVERSION TO								
+	87OUT	.73	1	FLOW	80.	93.	108.	122.
				TIME	4.47	4.50	4.70	4.73
HYDROGRAPH AT								
+	D87BA	.73	1	FLOW	0.	0.	0.	0.
				TIME	.00	.00	.00	.00
HYDROGRAPH AT								
+	LACAI	.04	1	FLOW	24.	46.	61.	77.
				TIME	4.07	4.07	4.07	4.07
ROUTED TO								
+	RTCAI	.04	1	FLOW	22.	44.	59.	75.
				TIME	4.10	4.10	4.07	4.07
			**	PEAK STAGES IN FEET **				
			1	STAGE	98.38	98.72	98.90	99.04
				TIME	4.10	4.10	4.07	4.07
DIVERSION TO								
+	LECHE	.04	1	FLOW	20.	20.	20.	20.
				TIME	4.07	3.97	3.93	3.90
HYDROGRAPH AT								
+	DNLECH	.04	1	FLOW	2.	24.	39.	55.
				TIME	4.10	4.10	4.07	4.07
2 COMBINED AT								
+	SDLEJ3	.78	1	FLOW	2.	24.	39.	55.
				TIME	4.10	4.10	4.07	4.07
HYDROGRAPH AT								
+	SUMMIT	.03	1	FLOW	6.	12.	16.	20.
				TIME	4.20	4.20	4.20	4.20
HYDROGRAPH AT								
+	RDLECH	.00	1	FLOW	20.	20.	20.	20.
				TIME	4.07	3.97	3.93	3.90
2 COMBINED AT								
+	LEJCHL	.03	1	FLOW	25.	32.	36.	40.
				TIME	4.17	4.20	4.20	4.20

HYDROGRAPH AT								
+	RDP7E	.00	1	FLOW	18.	30.	39.	47.
				TIME	4.07	4.07	4.07	4.07
ROUTED TO								
+	R11P7E	.00	1	FLOW	9.	20.	27.	34.
				TIME	4.37	4.27	4.27	4.27
			** PEAK STAGES IN FEET **					
			1	STAGE	.39	.57	.68	.78
				TIME	4.37	4.27	4.27	4.27
DIVERSION TO								
+	EAST83	.00	1	FLOW	9.	18.	18.	18.
				TIME	4.37	4.27	4.27	4.23
HYDROGRAPH AT								
+	D2-18	.00	1	FLOW	0.	2.	9.	16.
				TIME	.00	4.27	4.27	4.27
2 COMBINED AT								
+	83CL	.03	1	FLOW	25.	34.	45.	56.
				TIME	4.17	4.27	4.27	4.23
DIVERSION TO								
+	EAGLE	.03	1	FLOW	25.	34.	45.	56.
				TIME	4.17	4.27	4.27	4.23
HYDROGRAPH AT								
+	24PIPE	.03	1	FLOW	0.	0.	0.	0.
				TIME	.00	.00	.00	.00
2 COMBINED AT								
+	SDLEJ4	.80	1	FLOW	2.	24.	39.	55.
				TIME	4.10	4.10	4.07	4.07
ROUTED TO								
+	RT83CL	.80	1	FLOW	1.	14.	27.	40.
				TIME	4.17	4.17	4.17	4.17
			** PEAK STAGES IN FEET **					
			1	STAGE	92.04	92.68	93.00	93.25
				TIME	4.17	4.17	4.17	4.17
HYDROGRAPH AT								
+	N11P3	.04	1	FLOW	17.	32.	42.	53.
				TIME	4.20	4.20	4.20	4.20
2 COMBINED AT								
+	83SD	.84	1	FLOW	18.	45.	69.	92.
				TIME	4.20	4.20	4.17	4.17
ROUTED TO								
+	R83SD	.84	1	FLOW	17.	45.	68.	91.
				TIME	4.23	4.20	4.20	4.20
HYDROGRAPH AT								
+	RNS91A	.00	1	FLOW	0.	64.	111.	158.
				TIME	4.07	4.07	4.07	4.07
ROUTED TO								
+	RS91A	.00	1	FLOW	0.	62.	110.	156.
				TIME	4.50	4.07	4.07	4.07
HYDROGRAPH AT								
+	S91B	.05	1	FLOW	55.	76.	92.	107.
				TIME	4.07	4.07	4.07	4.07
2 COMBINED AT								
+	CS91	.05	1	FLOW	55.	138.	201.	264.

				TIME	4.07	4.07	4.07	4.07
DIVERSION TO								
+	DIV91	.05	1	FLOW	0.	83.	146.	209.
				TIME	.00	4.07	4.07	4.07
HYDROGRAPH AT								
+	D91	.05	1	FLOW	55.	55.	55.	55.
				TIME	4.07	3.97	3.93	3.90
ROUTED TO								
+	R91	.05	1	FLOW	52.	55.	55.	55.
				TIME	4.10	4.20	4.23	4.17
HYDROGRAPH AT								
+	N11L5	.03	1	FLOW	33.	49.	60.	71.
				TIME	4.03	4.03	4.03	4.03
HYDROGRAPH AT								
+	RED89	.00	1	FLOW	0.	38.	55.	71.
				TIME	.00	4.03	4.03	4.03
ROUTED TO								
+	R89S	.00	1	FLOW	0.	39.	53.	71.
				TIME	.00	4.10	4.07	4.07
HYDROGRAPH AT								
+	N11L2	.01	1	FLOW	3.	5.	7.	9.
				TIME	4.20	4.20	4.17	4.17
4 COMBINED AT								
+	CN11L5	.09	1	FLOW	84.	140.	171.	201.
				TIME	4.07	4.10	4.07	4.07
DIVERSION TO								
+	NULL	.09	1	FLOW	0.	50.	81.	111.
				TIME	.00	4.10	4.07	4.07
HYDROGRAPH AT								
+	D11L5	.09	1	FLOW	84.	90.	90.	90.
				TIME	4.07	4.00	3.97	3.93
ROUTED TO								
+	RN11L5	.09	1	FLOW	81.	90.	90.	90.
				TIME	4.13	4.20	4.20	4.23
HYDROGRAPH AT								
+	N11L3	.04	1	FLOW	50.	70.	84.	98.
				TIME	4.03	4.03	4.03	4.03
HYDROGRAPH AT								
+	RSOL	.00	1	FLOW	0.	27.	40.	50.
				TIME	.00	4.03	4.03	4.03
ROUTED TO								
+	RTSOL	.00	1	FLOW	0.	28.	37.	51.
				TIME	.00	4.10	4.10	4.10
3 COMBINED AT								
+	PPSD1	.12	1	FLOW	122.	176.	198.	235.
				TIME	4.07	4.10	4.07	4.07
DIVERSION TO								
+	PPDIVS	.12	1	FLOW	0.	54.	76.	113.
				TIME	4.07	4.10	4.07	4.07
HYDROGRAPH AT								
+	PPDIV	.12	1	FLOW	122.	122.	122.	122.
				TIME	4.07	4.00	3.97	3.93
HYDROGRAPH AT								

+	N11L4	.01	1	FLOW	3.	5.	7.	8.
				TIME	4.27	4.27	4.27	4.27
HYDROGRAPH AT								
+	N21I1	.08	1	FLOW	87.	124.	152.	180.
				TIME	4.07	4.03	4.03	4.03
HYDROGRAPH AT								
+	87OUT	.00	1	FLOW	80.	93.	108.	122.
				TIME	4.47	4.50	4.70	4.73
4 COMBINED AT								
+	PPSD	.21	1	FLOW	263.	311.	344.	377.
				TIME	4.07	4.07	4.07	4.07
ROUTED TO								
+	RPPSD	.21	1	FLOW	260.	309.	343.	375.
				TIME	4.10	4.10	4.10	4.10
HYDROGRAPH AT								
+	N21I2	.06	1	FLOW	36.	51.	63.	76.
				TIME	4.17	4.17	4.17	4.17
HYDROGRAPH AT								
+	N21I3	.03	1	FLOW	15.	29.	40.	50.
				TIME	4.07	4.07	4.07	4.07
HYDROGRAPH AT								
+	N21Z	.11	1	FLOW	136.	183.	217.	251.
				TIME	4.10	4.10	4.10	4.10
DIVERSION TO								
+	N21I3O	.11	1	FLOW	136.	180.	200.	210.
				TIME	4.10	4.07	4.03	4.00
HYDROGRAPH AT								
+	LN21Z	.11	1	FLOW	95.	175.	217.	251.
				TIME	4.23	4.13	4.10	4.10
DIVERSION TO								
+	DN21ZI	.11	1	FLOW	0.	0.	0.	0.
				TIME	4.23	4.13	4.10	4.10
HYDROGRAPH AT								
+	DN21ZO	.11	1	FLOW	94.	175.	217.	250.
				TIME	4.23	4.13	4.10	4.10
DIVERSION TO								
+	N21ZI*	.11	1	FLOW	47.	88.	108.	125.
				TIME	4.23	4.13	4.10	4.10
HYDROGRAPH AT								
+	DN21Z*	.11	1	FLOW	47.	88.	108.	125.
				TIME	4.23	4.13	4.10	4.10
ROUTED TO								
+	RN21ZW	.11	1	FLOW	17.	44.	61.	80.
				TIME	4.47	4.33	4.30	4.27
			** PEAK STAGES IN FEET **					
			1	STAGE	.45	.76	.95	1.08
				TIME	4.47	4.33	4.30	4.27
DIVERSION TO								
+	D1/2ST	.11	1	FLOW	12.	12.	12.	12.
				TIME	4.33	4.17	4.10	4.07
HYDROGRAPH AT								
+	1/2ST	.11	1	FLOW	5.	32.	49.	68.
				TIME	4.47	4.33	4.30	4.27

HYDROGRAPH AT								
+	R1/2ST	.00	1	FLOW	12.	12.	12.	12.
				TIME	4.33	4.17	4.10	4.07
HYDROGRAPH AT								
+	18PIPE	.00	1	FLOW	9.	18.	18.	18.
				TIME	4.37	4.27	4.27	4.23
HYDROGRAPH AT								
+	CLDIV	.00	1	FLOW	25.	34.	45.	56.
				TIME	4.17	4.27	4.27	4.23
2 COMBINED AT								
+	CPIPE	.00	1	FLOW	30.	52.	63.	74.
				TIME	4.17	4.27	4.27	4.23
ROUTED TO								
+	RCPIPE	.00	1	FLOW	30.	51.	62.	73.
				TIME	4.33	4.40	4.40	4.40
HYDROGRAPH AT								
+	N21I3	.12	1	FLOW	39.	75.	102.	129.
				TIME	4.17	4.17	4.17	4.17
3 COMBINED AT								
+	CN21I3	.12	1	FLOW	72.	114.	149.	181.
				TIME	4.33	4.33	4.30	4.30
DIVERSION TO								
+	N21I3O	.12	1	FLOW	72.	114.	149.	181.
				TIME	4.33	4.33	4.30	4.30
HYDROGRAPH AT								
+	R21I3	.12	1	FLOW	0.	0.	0.	0.
				TIME	.00	.00	.00	.00
2 COMBINED AT								
+	PPK_E	.22	1	FLOW	5.	32.	49.	68.
				TIME	4.47	4.33	4.30	4.27
DIVERSION TO								
+	PPKEW3	.22	1	FLOW	5.	32.	49.	68.
				TIME	4.47	4.33	4.30	4.27
HYDROGRAPH AT								
+	PPKEW2	.22	1	FLOW	0.	0.	0.	0.
				TIME	.00	.00	.00	.00
5 COMBINED AT								
+	US_BSN	1.36	1	FLOW	321.	416.	490.	564.
				TIME	4.13	4.13	4.10	4.10
DIVERSION TO								
+	PPBAS	1.36	1	FLOW	10.	10.	10.	10.
				TIME	3.60	3.53	3.47	3.43
HYDROGRAPH AT								
+	PPBP	1.36	1	FLOW	311.	406.	480.	554.
				TIME	4.13	4.13	4.10	4.10
ROUTED TO								
+	R83BSN	1.36	1	FLOW	13.	17.	21.	24.
				TIME	6.40	6.97	7.77	8.43
			** PEAK STAGES IN FEET **					
			1	STAGE	1304.63	1306.97	1308.93	1310.76
				TIME	6.40	7.00	7.80	8.50
HYDROGRAPH AT								
+	RPPB	.00	1	FLOW	10.	10.	10.	10.
				TIME	3.60	3.53	3.47	3.43

```
  2 COMBINED AT
+                  JCT1      1.36     1   FLOW          23.      27.      31.      34.
                                           TIME         6.40     6.97     7.77     8.43

 HYDROGRAPH AT
+                  RESD       .00     1   FLOW           5.      32.      49.      68.
                                           TIME         4.47     4.33     4.30     4.27

  2 COMBINED AT
+                   JCT      1.36     1   FLOW          23.      47.      70.      90.
                                           TIME         6.40     4.40     4.33     4.30

 ROUTED TO
+                OUTLET      1.36     1   FLOW          23.      47.      69.      89.
                                           TIME         6.50     4.50     4.40     4.37

 HYDROGRAPH AT
+                  N22B       .19     1   FLOW         258.     341.     400.     458.
                                           TIME         4.10     4.10     4.10     4.10

 DIVERSION TO
+                 N22BI       .19     1   FLOW         233.     307.     360.     412.
                                           TIME         4.10     4.10     4.10     4.10

 HYDROGRAPH AT
+                 DN22B       .19     1   FLOW          26.      34.      40.      46.
                                           TIME         4.10     4.10     4.10     4.10

 ROUTED TO
+                RN22BE       .19     1   FLOW          11.      16.      20.      24.
                                           TIME         4.37     4.33     4.33     4.33

                                     ** PEAK STAGES IN FEET **
                                     1   STAGE          .51      .62      .70      .78
                                           TIME         4.37     4.33     4.33     4.33

 HYDROGRAPH AT
+                  N21F       .10     1   FLOW          93.     120.     139.     159.
                                           TIME         4.23     4.23     4.23     4.23

  3 COMBINED AT
+                 CN21F      1.65     1   FLOW         112.     169.     218.     266.
                                           TIME         4.27     4.37     4.37     4.33
1
                                           SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                               (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                  INTERPOLATED TO
                                                                                COMPUTATION INTERVAL
          ISTAQ    ELEMENT      DT       PEAK    TIME TO     VOLUME      DT       PEAK    TIME TO     VOLUME
                                                   PEAK                                     PEAK

                               (MIN)     (CFS)     (MIN)      (IN)     (MIN)     (CFS)     (MIN)       (IN)

         FOR PLAN = 1  RATIO=  .63
           R11P5E  MANE         2.00     22.62    259.28       .24      2.00     22.57    260.00        .24

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .1118E+01 EXCESS= .0000E+00 OUTFLOW= .1119E+01 BASIN STORAGE= .3664E-06 PERCENT ERROR=   -.1

         FOR PLAN = 1  RATIO=  .78
           R11P5E  MANE         1.95     47.24    257.89       .51      2.00     47.23    258.00        .51


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

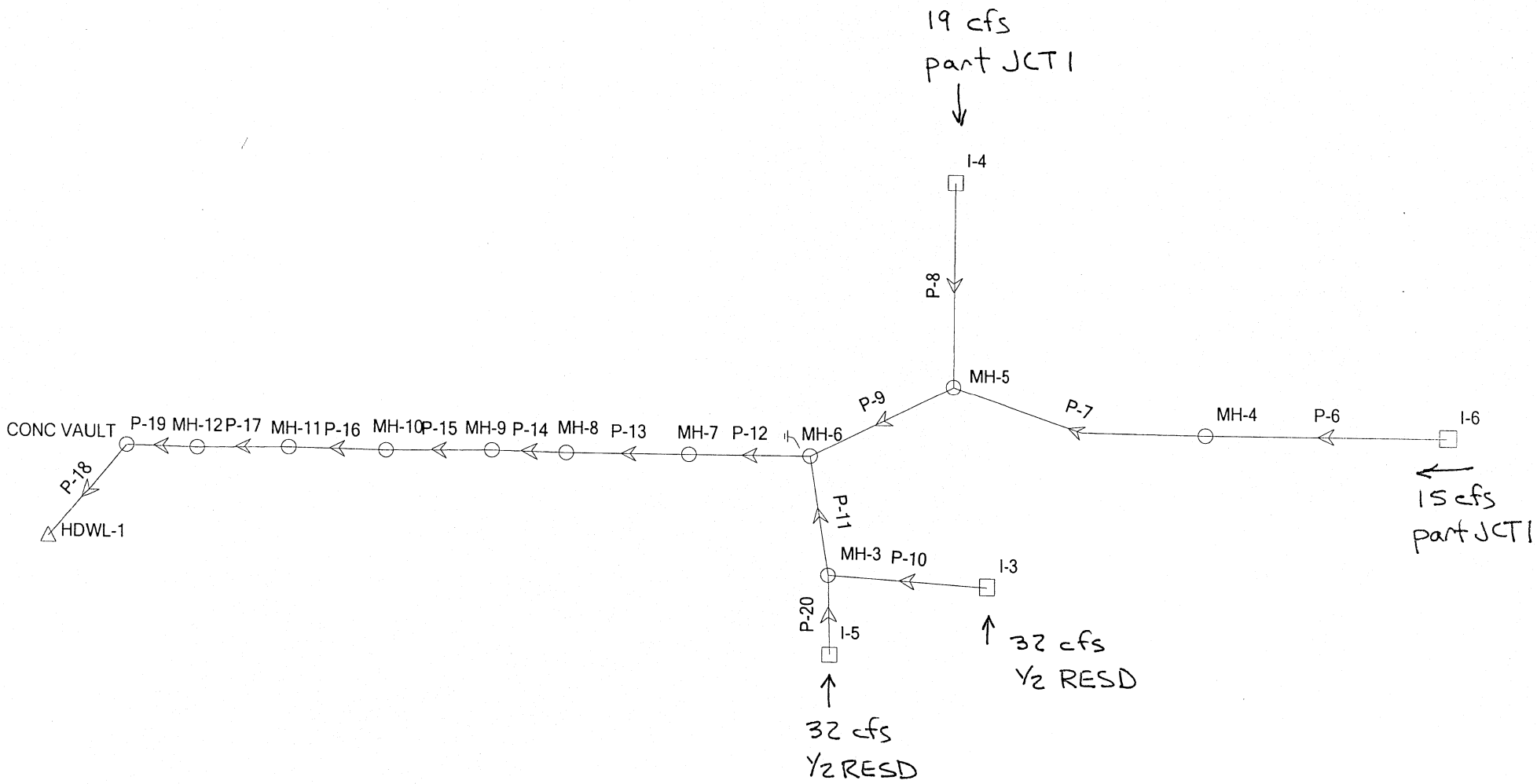
Appendix B

StormCAD Analyses

Appendix B-1

83rd Avenue Storm Drain

Scenario: Base



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Scenario: Base

Pipe Report

Label	Upstm Node	Dnstm Node	Length (ft)	Constructed Slope (ft/ft)	Number of Sections	Section Size	Mannings n	Total Flow (cfs)	Full Capacity (cfs)	Upstm Invert Elev (ft)	Dnstm Invert Elev (ft)	Upstm Ground Elev (ft)	Dnstm Ground Elev (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Velocity Out (ft/s)
P-6	I-6	MH-4	211.00	0.004645	1	24 inch	0.013	16.00	15.42	1,300.60	1,299.62	1,316.25	1,314.60	1,308.82	1,307.76	5.09
P-7	MH-4	MH-5	299.00	0.004682	1	24 inch	0.013	16.00	15.48	1,299.62	1,298.22	1,314.60	1,312.60	1,307.76	1,306.26	5.09
P-8	I-4	MH-5	687.00	0.001994	1	24 inch	0.013	19.00	10.10	1,296.59	1,295.22	1,312.95	1,312.60	1,311.11	1,306.26	6.05
P-20	I-5	MH-3	20.00	0.213000	1	30 inch	0.013	34.00	189.29	1,305.03	1,300.77	1,308.86	1,308.78	1,307.01	1,306.14	6.93
P-10	I-3	MH-3	105.00	0.062857	1	30 inch	0.013	34.00	102.83	1,307.37	1,300.77	1,311.20	1,308.78	1,309.35	1,306.14	6.93
P-9	MH-5	MH-6	108.00	0.003056	1	30 inch	0.013	35.00	22.67	1,295.22	1,294.89	1,312.60	1,312.40	1,306.26	1,305.48	7.13
P-11	MH-3	MH-6	64.00	0.012031	1	36 inch	0.013	68.00	73.16	1,300.77	1,300.00	1,308.78	1,312.40	1,306.14	1,305.48	9.62
P-12	MH-6	MH-7	393.00	0.001908	1	48 inch	0.013	91.00	62.75	1,294.89	1,294.14	1,312.40	1,308.00	1,305.48	1,303.90	7.24
P-13	MH-7	MH-8	500.00	0.001900	1	48 inch	0.013	91.00	62.61	1,294.14	1,293.19	1,308.00	1,304.88	1,303.90	1,301.89	7.24
P-14	MH-8	MH-9	500.00	0.001900	1	48 inch	0.013	91.00	62.61	1,293.19	1,292.24	1,304.88	1,302.30	1,301.89	1,299.89	7.24
P-15	MH-9	MH-10	500.00	0.001900	1	48 inch	0.013	91.00	62.61	1,292.24	1,291.29	1,302.30	1,299.89	1,299.89	1,297.88	7.24
P-16	MH-10	MH-11	500.00	0.001900	1	48 inch	0.013	91.00	62.61	1,291.29	1,290.34	1,299.89	1,297.00	1,297.88	1,295.87	7.24
P-17	MH-11	MH-12	275.00	0.001891	2	36 inch	0.013	91.00	58.00	1,290.34	1,289.82	1,297.00	1,296.05	1,295.87	1,294.59	6.44
P-19	MH-12	CONC VA	190.00	0.001947	2	36 inch	0.013	91.00	58.86	1,289.82	1,289.45	1,296.05	1,294.50	1,294.59	1,293.71	6.44
P-18	CONC VA	HDWL-1	62.00	0.001774	2	36 inch	0.013	91.00	56.19	1,289.45	1,289.34	1,294.50	1,293.86	1,293.71	1,293.42	6.44

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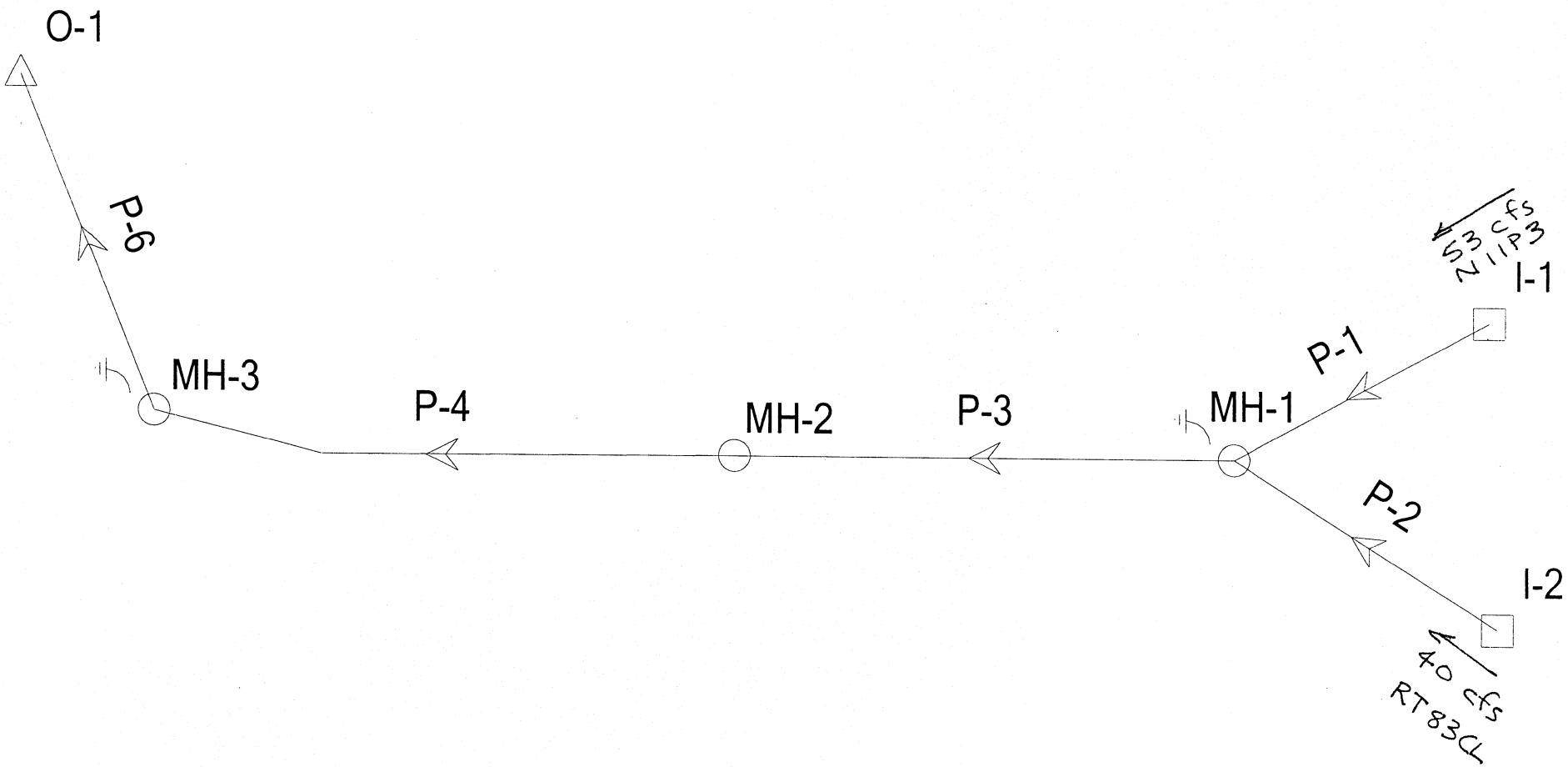
Scenario: Base



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Project Engineer: Pat Fyie
StormCAD v5.5 [5.5005]

Scenario: Base

Pipe Report

Label	Upstm Node	Dnstm Node	Length (ft)	Constructed Slope (ft/ft)	Number of Sections	Section Size	Mannings n	Total Flow (cfs)	Full Capacity (cfs)	Upstm Invert Elev (ft)	Dnstm Invert Elev (ft)	Upstm Ground Elev (ft)	Dnstm Ground Elev (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Velocity Out (ft/s)
P-2	I-2	MH-1	79.00	0.060253	1	36 inch	0.013	40.00	163.71	1,318.22	1,313.46	1,322.00	1,322.20	1,320.28	1,316.18	5.94
P-1	I-1	MH-1	33.00	0.127576	1	36 inch	0.013	53.00	238.22	1,317.67	1,313.46	1,322.55	1,322.20	1,320.04	1,316.18	7.87
P-3	MH-1	MH-2	396.00	0.008990	1	42 inch	0.013	92.00	95.39	1,313.21	1,309.65	1,322.20	1,317.85	1,316.18	1,312.41	11.29
P-4	MH-2	MH-3	364.00	0.009011	1	42 inch	0.013	92.00	95.50	1,309.65	1,306.37	1,317.85	1,316.25	1,312.62	1,309.13	11.31
P-6	MH-3	O-1	78.00	-0.004231	1	42 inch	0.013	76.00	-65.44	1,302.67	1,303.00	1,316.25	1,308.00	1,306.57	1,305.73	9.44

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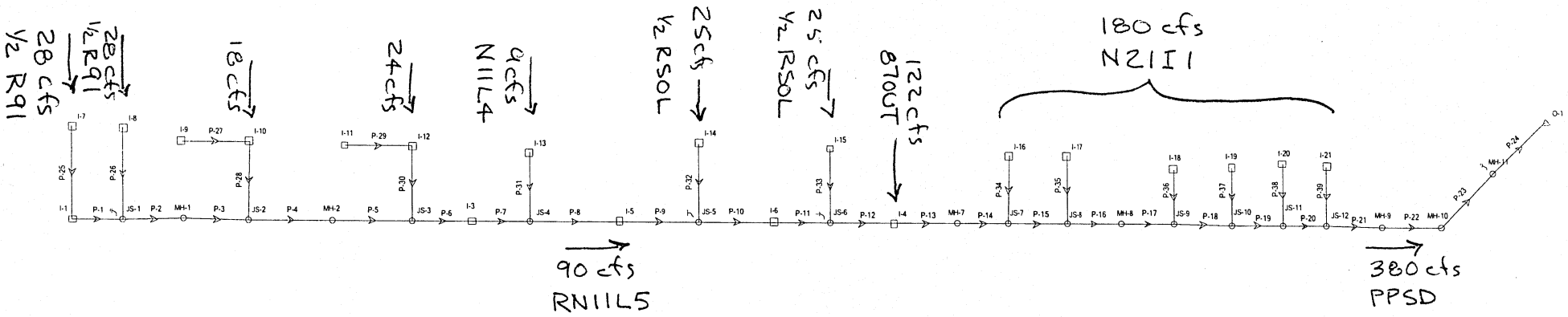
Appendix B-2

Pinnacle Peak Road Storm Drain

Scenario: Base



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Scenario: Base

Pipe Report

Label	Upstm Node	Dnstm Node	Length (ft)	Constructed Slope (ft/ft)	Number of Sections	Section Size	Mannings n	Total Flow (cfs)	Full Capacity (cfs)	Upstm Invert Elev (ft)	Dnstm Invert Elev (ft)	Upstm Ground Elev (ft)	Dnstm Ground Elev (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Velocity Out (ft/s)
P-25	I-7	I-1	70.00	0.016571	1	30 inch	0.013	28.00	52.80	1,312.37	1,311.21	1,316.20	1,315.96	1,314.17	1,313.89	5.70
P-26	I-8	JS-1	70.00	0.039429	1	30 inch	0.013	28.00	81.44	1,312.89	1,310.13	1,316.73	1,315.99	1,314.69	1,313.87	5.70
P-1	I-1	JS-1	85.00	0.002000	1	54 inch	0.013	28.00	87.94	1,309.21	1,309.04	1,315.96	1,315.99	1,313.89	1,313.87	1.76
P-27	I-9	I-10	38.00	0.018684	1	30 inch	0.013	9.00	56.06	1,310.82	1,310.11	1,315.82	1,316.11	1,313.59	1,313.57	1.83
P-2	JS-1	MH-1	455.00	0.002000	1	54 inch	0.013	55.00	87.94	1,309.04	1,308.13	1,315.99	1,316.35	1,313.87	1,313.51	3.46
P-3	MH-1	JS-2	200.00	0.002000	1	60 inch	0.013	55.00	116.47	1,308.13	1,307.73	1,316.35	1,315.86	1,313.51	1,313.42	2.80
P-28	I-10	JS-2	77.00	0.014156	1	30 inch	0.013	18.00	48.80	1,310.11	1,309.02	1,316.11	1,315.86	1,313.57	1,313.42	3.67
P-4	JS-2	MH-2	300.00	0.002000	1	60 inch	0.013	73.00	116.47	1,307.73	1,307.13	1,315.86	1,315.63	1,313.42	1,313.19	3.72
P-29	I-11	I-12	38.00	0.050526	1	30 inch	0.013	12.00	92.19	1,311.31	1,309.39	1,316.31	1,314.39	1,313.16	1,313.18	2.44
P-30	I-12	JS-3	77.00	0.021169	1	30 inch	0.013	24.00	59.67	1,309.39	1,307.76	1,314.39	1,315.20	1,313.18	1,312.92	4.89
P-5	MH-2	JS-3	340.00	0.002000	1	60 inch	0.013	73.00	116.47	1,307.13	1,306.45	1,315.63	1,315.20	1,313.19	1,312.92	3.72
P-6	JS-3	I-3	160.00	0.002000	1	60 inch	0.013	97.00	116.47	1,306.45	1,306.13	1,315.20	1,315.37	1,312.92	1,312.70	4.94
P-31	I-13	JS-4	23.00	0.060435	1	18 inch	0.013	9.00	25.82	1,309.38	1,307.99	1,315.38	1,315.49	1,312.84	1,312.67	5.09
P-7	I-3	JS-4	20.00	0.002000	1	60 inch	0.013	97.00	116.47	1,306.13	1,306.09	1,315.37	1,315.49	1,312.70	1,312.67	4.94
P-8	JS-4	I-5	430.00	0.002000	1	60 inch	0.013	106.00	116.47	1,306.09	1,305.23	1,315.49	1,315.42	1,312.67	1,311.96	5.40
P-32	I-14	JS-5	27.00	0.094074	1	30 inch	0.013	25.00	125.80	1,308.84	1,306.30	1,314.84	1,315.29	1,311.71	1,311.61	5.09
P-9	I-5	JS-5	210.00	0.002000	1	60 inch	0.013	106.00	116.47	1,305.23	1,304.81	1,315.42	1,315.29	1,311.96	1,311.61	5.40
P-10	JS-5	I-6	130.00	0.002000	1	60 inch	0.013	122.00	116.47	1,304.81	1,304.55	1,315.29	1,315.25	1,311.61	1,311.33	6.21
P-11	I-6	JS-6	10.00	0.002000	1	60 inch	0.013	147.00	116.47	1,304.55	1,304.53	1,315.25	1,315.22	1,311.33	1,311.29	7.49
P-33	I-15	JS-6	27.00	0.092222	1	30 inch	0.013	25.00	124.55	1,308.52	1,306.03	1,314.52	1,315.22	1,311.39	1,311.29	5.09
P-12	JS-6	I-4	364.00	0.002005	1	60 inch	0.013	147.00	116.63	1,304.53	1,303.80	1,315.22	1,313.33	1,311.29	1,310.13	7.49
P-13	I-4	MH-7	386.00	0.003342	1	72 inch	0.013	200.00	244.82	1,303.80	1,302.51	1,313.33	1,313.68	1,310.13	1,309.27	7.07
P-14	MH-7	JS-7	235.00	0.003362	1	72 inch	0.013	200.00	245.54	1,302.51	1,301.72	1,313.68	1,313.00	1,309.27	1,308.75	7.07
P-34	I-16	JS-7	32.00	0.111875	1	24 inch	0.013	24.00	75.66	1,307.65	1,304.07	1,313.15	1,313.00	1,309.39	1,308.75	7.64
P-15	JS-7	JS-8	195.00	0.003333	1	72 inch	0.013	224.00	244.50	1,301.72	1,301.07	1,313.00	1,313.13	1,308.75	1,308.20	7.92
P-35	I-17	JS-8	37.00	0.101081	1	24 inch	0.013	24.00	71.92	1,307.09	1,303.35	1,312.59	1,313.13	1,308.83	1,308.20	7.64
P-16	JS-8	MH-8	70.00	0.003286	1	72 inch	0.013	248.00	242.75	1,301.07	1,300.84	1,313.13	1,312.89	1,308.20	1,307.96	8.77
P-17	MH-8	JS-9	90.00	0.003333	1	78 inch	0.013	248.00	302.68	1,300.84	1,300.54	1,312.89	1,312.35	1,307.96	1,307.76	7.47
P-36	I-18	JS-9	22.00	0.227273	1	36 inch	0.013	60.00	317.95	1,308.03	1,303.03	1,312.37	1,312.35	1,310.53	1,307.76	8.49
P-37	I-19	JS-10	22.00	0.149091	1	24 inch	0.013	24.00	87.35	1,306.19	1,302.91	1,311.69	1,312.19	1,307.93	1,307.38	7.64
P-18	JS-9	JS-10	110.00	0.003364	1	78 inch	0.013	308.00	304.05	1,300.54	1,300.17	1,312.35	1,312.19	1,307.76	1,307.38	9.28
P-19	JS-10	JS-11	90.00	0.003444	1	78 inch	0.013	332.00	307.68	1,300.17	1,299.86	1,312.19	1,312.56	1,307.38	1,307.02	10.01
P-38	I-20	JS-11	22.00	0.176364	1	24 inch	0.013	24.00	95.00	1,306.56	1,302.68	1,312.06	1,312.56	1,308.30	1,307.02	7.64
P-39	I-21	JS-12	22.00	0.175909	1	24 inch	0.013	24.00	94.88	1,306.25	1,302.38	1,311.75	1,312.25	1,307.99	1,306.61	7.64
P-20	JS-11	JS-12	90.00	0.003333	1	78 inch	0.013	356.00	302.68	1,299.86	1,299.56	1,312.56	1,312.25	1,307.02	1,306.61	10.73

Scenario: Base

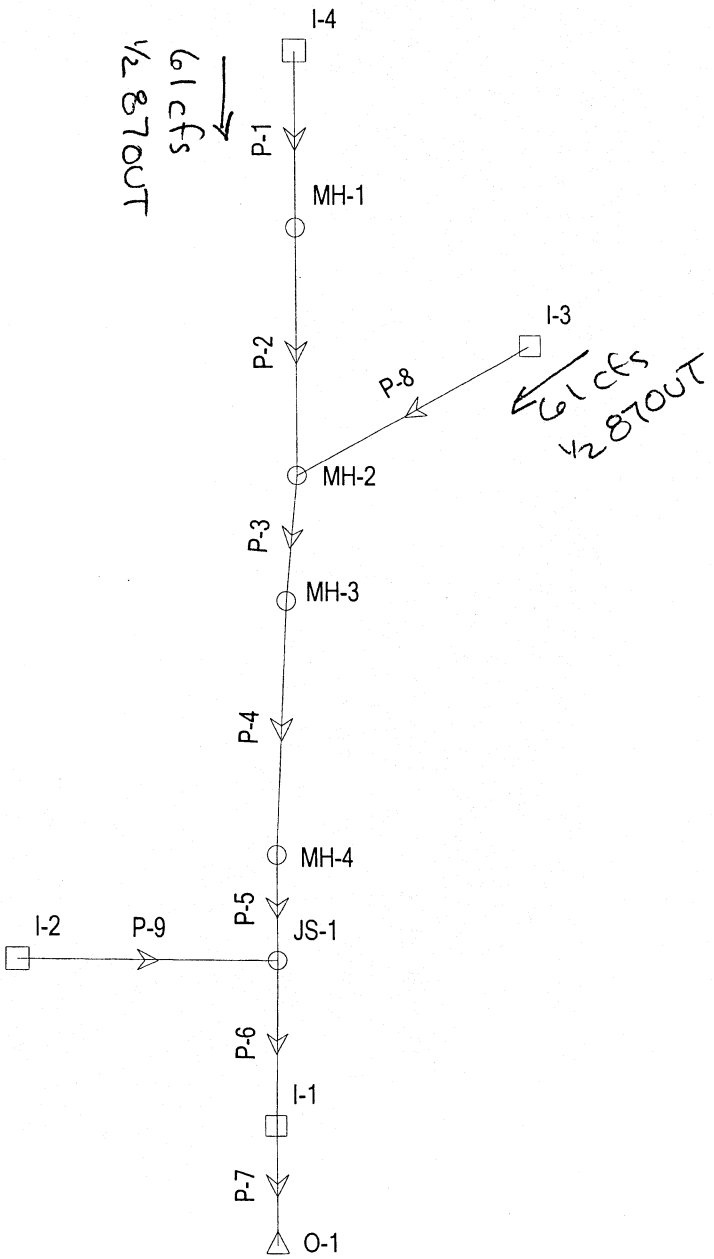
Pipe Report

Label	Upstm Node	Dnstm Node	Length (ft)	Constructed Slope (ft/ft)	Number of Sections	Section Size	Mannings n	Total Flow (cfs)	Full Capacity (cfs)	Upstm Invert Elev (ft)	Dnstm Invert Elev (ft)	Upstm Ground Elev (ft)	Dnstm Ground Elev (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Velocity Out (ft/s)
P-21	JS-12	MH-9	120.00	0.003250	1	78 inch	0.013	380.00	298.87	1,299.56	1,299.17	1,312.25	1,312.55	1,306.61	1,305.98	11.45
P-22	MH-9	MH-10	390.00	0.003359	1	78 inch	0.013	380.00	303.84	1,299.17	1,297.86	1,312.55	1,312.69	1,305.98	1,303.94	11.78
P-23	MH-10	MH-11	125.00	0.003440	1	84 inch	0.013	380.00	374.66	1,297.86	1,297.43	1,312.69	1,312.95	1,303.94	1,303.56	10.64
P-24	MH-11	O-1	64.00	-0.002500	1	84 inch	0.013	362.00	-319.40	1,297.43	1,297.59	1,312.95	1,306.76	1,303.56	1,302.61	12.27

Appendix B-3

87th Avenue Storm Drain

Scenario: Base



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Scenario: Base

Pipe Report

Label	Upstm Node	Dnstm Node	Length (ft)	Constructed Slope (ft/ft)	Number of Sections	Section Size	Mannings n	Total Flow (cfs)	Full Capacity (cfs)	Upstm Invert Elev (ft)	Dnstm Invert Elev (ft)	Upstm Ground Elev (ft)	Dnstm Ground Elev (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Velocity Out (ft/s)
P-1	I-4	MH-1	124.00	0.003387	1	42 inch	0.013	61.00	58.55	1,312.50	1,312.08	1,326.67	1,325.80	1,317.62	1,317.17	6.34
P-2	MH-1	MH-2	405.00	0.002914	1	42 inch	0.013	61.00	54.30	1,312.08	1,310.90	1,325.80	1,320.82	1,317.17	1,315.68	6.34
P-8	I-3	MH-2	191.00	0.008010	1	42 inch	0.013	61.00	90.04	1,312.43	1,310.90	1,317.43	1,320.82	1,316.38	1,315.68	6.34
P-3	MH-2	MH-3	120.00	0.007750	1	48 inch	0.013	122.00	126.45	1,310.90	1,309.97	1,320.82	1,319.50	1,315.68	1,314.81	9.71
P-4	MH-3	MH-4	330.00	0.007879	1	48 inch	0.013	122.00	127.49	1,309.97	1,307.37	1,319.50	1,315.60	1,314.81	1,312.43	9.71
P-5	MH-4	JS-1	220.00	0.007909	1	48 inch	0.013	122.00	127.74	1,307.37	1,305.63	1,315.60	1,314.01	1,312.43	1,310.85	9.71
P-9	I-2	JS-1	33.00	0.055758	1	24 inch	0.013	4.00	53.42	1,308.58	1,306.74	1,314.58	1,314.01	1,310.86	1,310.85	1.27
P-6	JS-1	I-1	20.00	0.008000	1	48 inch	0.013	126.00	128.47	1,305.63	1,305.47	1,314.01	1,313.85	1,310.85	1,310.69	10.03
P-7	I-1	O-1	60.00	0.007833	1	48 inch	0.013	130.00	127.13	1,305.47	1,305.00	1,313.85	1,313.34	1,310.69	1,310.20	10.35

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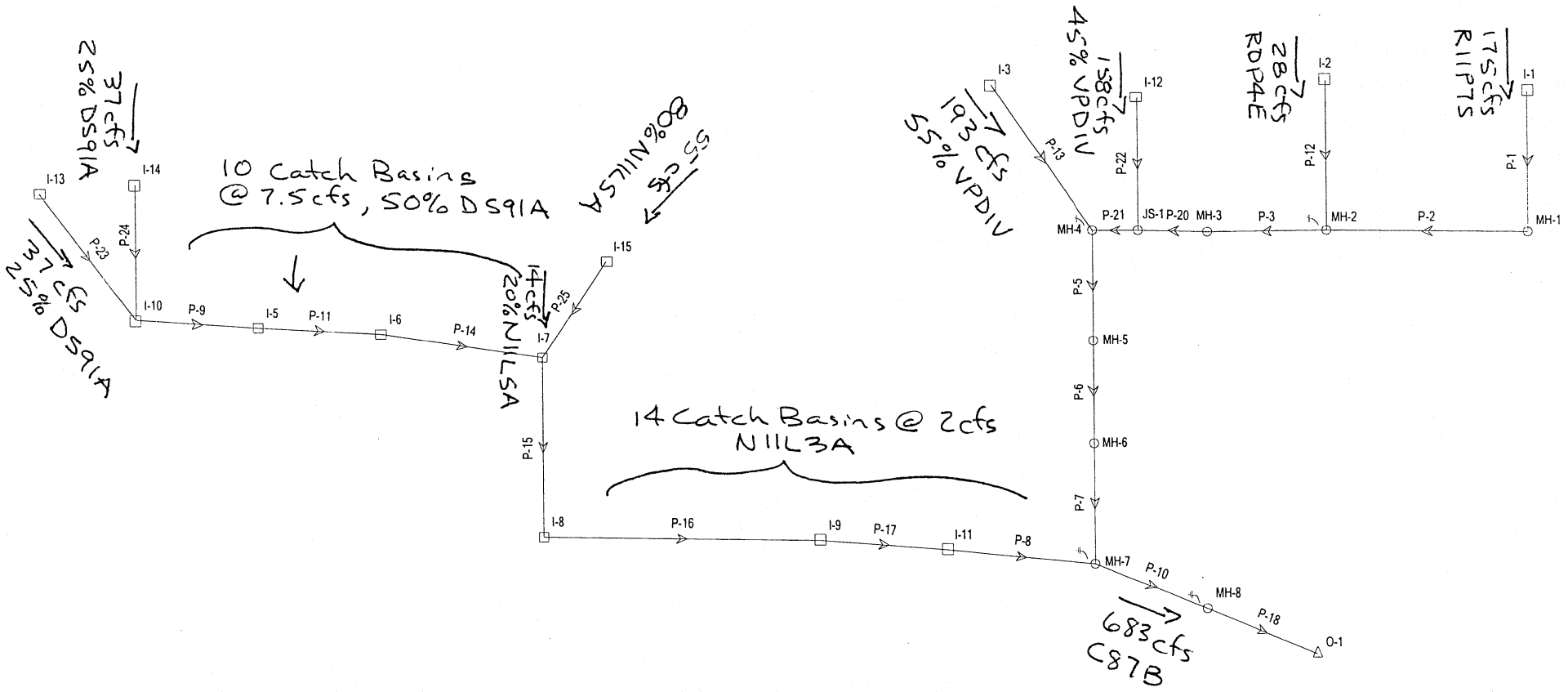
Appendix B-4

Cielo Grande Storm Drain

Scenario: Base



Jacob's Engineering Inc.
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Scenario: Base

Pipe Report

Label	Upstm Node	Dnstm Node	Length (ft)	Constructed Slope (ft/ft)	Number of Sections	Section Size	Mannings n	Total Flow (cfs)	Full Capacity (cfs)	Upstm Invert Elev (ft)	Dnstm Invert Elev (ft)	Upstm Ground Elev (ft)	Dnstm Ground Elev (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Velocity Out (ft/s)
P-13	I-3	MH-4	135.00	0.008889	1	60 inch	0.013	193.00	245.53	1,335.30	1,334.10	1,344.93	1,345.32	1,339.27	1,337.54	13.40
P-1	I-1	MH-1	65.00	0.007692	2	48 inch	0.013	175.00	251.95	1,332.08	1,331.58	1,337.61	1,337.32	1,336.79	1,336.55	6.96
P-2	MH-1	MH-2	300.00	0.004000	2	48 inch	0.013	175.00	181.69	1,331.58	1,330.38	1,337.32	1,339.09	1,336.55	1,335.44	6.96
P-12	I-2	MH-2	53.00	0.041321	1	30 inch	0.013	28.00	83.37	1,334.37	1,332.18	1,338.21	1,339.09	1,336.17	1,335.44	5.70
P-3	MH-2	MH-3	555.00	0.002000	1	72 inch	0.013	194.00	189.39	1,330.38	1,329.27	1,339.09	1,342.92	1,335.44	1,334.32	7.63
P-22	I-12	JS-1	67.00	0.075821	1	60 inch	0.013	158.00	717.11	1,333.93	1,328.85	1,341.93	1,345.05	1,337.53	1,333.99	8.05
P-20	MH-3	JS-1	382.00	0.003010	1	78 inch	0.013	194.00	287.64	1,329.27	1,328.12	1,342.92	1,345.05	1,334.32	1,333.99	6.15
P-21	JS-1	MH-4	78.00	0.003462	1	78 inch	0.013	352.00	308.44	1,328.12	1,327.85	1,345.05	1,345.32	1,333.99	1,333.64	11.28
P-5	MH-4	MH-5	447.00	0.008054	1	78 inch	0.013	491.00	470.47	1,327.85	1,324.25	1,345.32	1,337.85	1,333.64	1,329.88	16.09
P-24	I-14	I-10	43.00	0.045581	1	30 inch	0.013	37.00	87.57	1,325.45	1,323.49	1,329.29	1,329.05	1,329.25	1,328.90	7.54
P-23	I-13	I-10	88.00	0.019545	1	30 inch	0.013	37.00	57.34	1,324.70	1,322.98	1,328.53	1,329.05	1,329.61	1,328.90	7.54
P-9	I-10	I-5	470.00	0.002000	1	66 inch	0.013	85.00	150.17	1,321.42	1,320.48	1,329.05	1,330.52	1,328.90	1,328.60	3.58
P-11	I-5	I-6	450.00	0.002000	1	66 inch	0.013	111.00	150.17	1,320.48	1,319.58	1,330.52	1,330.80	1,328.60	1,328.10	4.67
P-25	I-15	I-7	44.00	0.137273	1	30 inch	0.013	55.00	151.96	1,326.37	1,320.33	1,330.85	1,330.21	1,328.72	1,327.48	11.20
P-14	I-6	I-7	373.00	0.001984	1	66 inch	0.013	137.00	149.57	1,319.58	1,318.84	1,330.80	1,330.21	1,328.10	1,327.48	5.77
P-6	MH-5	MH-6	400.00	0.007998	1	78 inch	0.013	491.00	468.84	1,324.25	1,321.05	1,337.85	1,332.37	1,330.04	1,326.71	16.02
P-15	I-7	I-8	303.00	0.002211	1	72 inch	0.013	218.00	199.14	1,318.84	1,318.17	1,330.21	1,327.52	1,327.48	1,326.68	7.71
P-16	I-8	I-9	444.00	0.002005	1	72 inch	0.013	223.00	189.60	1,318.17	1,317.28	1,327.52	1,328.22	1,326.68	1,325.45	7.89
P-17	I-9	I-11	475.00	0.002000	1	72 inch	0.013	233.00	189.39	1,317.28	1,316.33	1,328.22	1,328.76	1,325.45	1,324.01	8.24
P-7	MH-6	MH-7	448.00	0.007993	1	78 inch	0.013	491.00	468.69	1,321.05	1,317.47	1,332.37	1,327.99	1,326.84	1,323.13	16.01
P-8	I-11	MH-7	416.00	0.001995	1	78 inch	0.013	246.00	234.17	1,316.33	1,315.50	1,328.76	1,327.99	1,324.01	1,323.09	7.41
P-10	MH-7	MH-8	154.00	0.006429	1	84 inch	0.013	683.00	512.18	1,315.50	1,314.51	1,327.99	1,324.70	1,323.09	1,321.25	17.97
P-18	MH-8	O-1	27.00	0.005185	1	84 inch	0.013	621.00	459.99	1,314.51	1,314.37	1,324.70	1,326.00	1,321.25	1,320.71	16.95

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Appendix C

Design Calculations

Appendix C-1

Catch Basins

Jacobs Civil Inc.

HEC-22 Catch Basin Hydraulics
Grate Inlet (Sag)

Project:	83rd Avenue/Pinnacle Peak Road	**By:**	JPF
Subject:	Grate in Sag Hydraulics	**Date:**	12/8/05
	89th Avenue and Pinnacle Peak Road	**Checked:**	
	STA 35+80	**Project No.:**	W7X74300

Input:

Q10=	12.00	cfs	Q coming to concentration point
P=	14.25	ft	Perimeter of the grate : Refer to MAG 538, Type 'H', Double
Ag =	8.18	Sq. ft	Clear area of grate : Refer to ADOT C 15.80 for grate used
Grate Capture Ratio =	0.5		Capture Ratio - Percent of useable grate perimeter or area

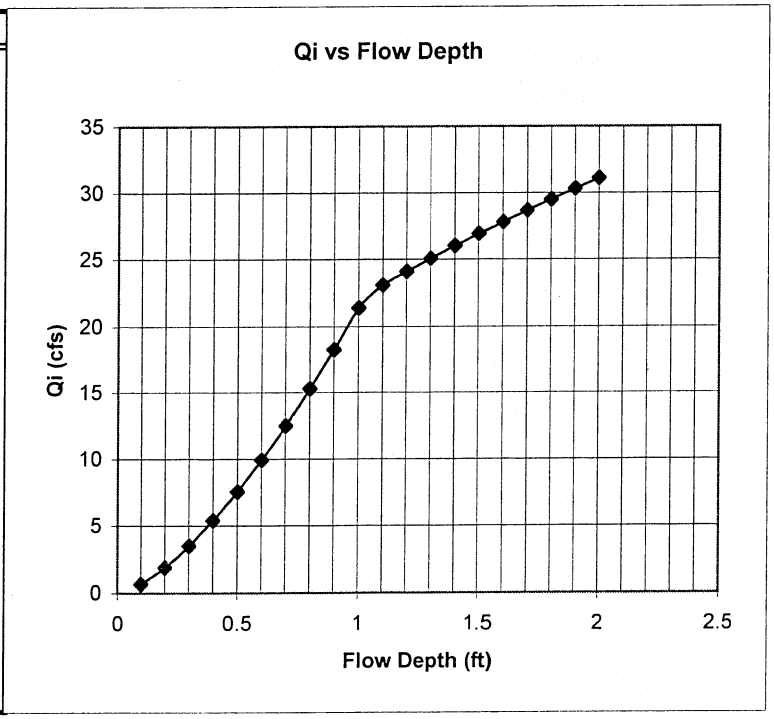
Delta D 0.1 ft

Output:

Depth for Q = 12 is 0.67 ft 8.00 Inches

Grate Inlet:

D	Q (weir)	Q (orifice)	Q (control)
0.1	1	7	1
0.2	2	10	2
0.3	4	12	4
0.4	5	14	5
0.5	8	16	8
0.6	10	17	10
0.7	13	18	13
0.8	15	20	15
0.9	18	21	18
1	21	22	21
1.1	25	23	23
1.2	28	24	24
1.3	32	25	25
1.4	35	26	26
1.5	39	27	27
1.6	43	28	28
1.7	47	29	29
1.8	52	30	30
1.9	56	30	30
2	60	31	31



Jacobs Civil Inc.

HEC-22 Catch Basin Hydraulics

Grate Inlet (Sag)

Project:	83rd Avenue/Pinnacle Peak Road	**By:**	JPF
Subject:	Grate in Sag Hydraulics	**Date:**	12/8/05
	89th Avenue and Pinnacle Peak Road	**Checked:**	
	STA 36+20	**Project No.:**	W7X74300

Input:

Q10=	12.00	cfs	Q coming to concentration point
P=	14.25	ft	Perimeter of the grate : Refer to MAG 538, Type 'H', Double
Ag =	8.18	Sq. ft	Clear area of grate : Refer to ADOT C 15.80 for grate used
Grate Capture Ratio =	0.5		Capture Ratio - Percent of useable grate perimeter or area

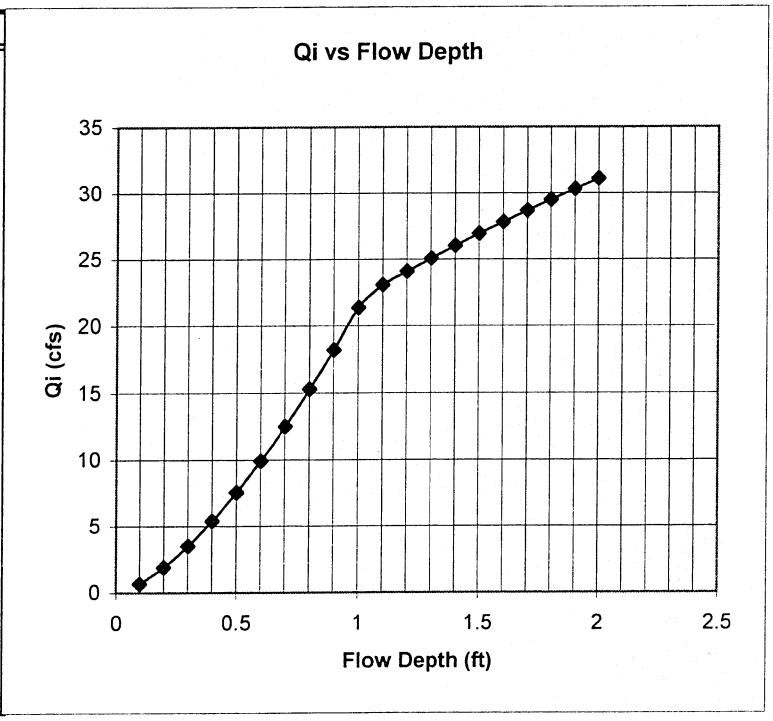
Delta D 0.1 ft

Output:

Depth for Q = 12 is 0.70 ft 8.40 Inches

Grate Inlet:

D	Q (weir)	Q (orifice)	Q (control)
0.1	1	7	1
0.2	2	10	2
0.3	4	12	4
0.4	5	14	5
0.5	8	16	8
0.6	10	17	10
0.7	13	18	13
0.8	15	20	15
0.9	18	21	18
1	21	22	21
1.1	25	23	23
1.2	28	24	24
1.3	32	25	25
1.4	35	26	26
1.5	39	27	27
1.6	43	28	28
1.7	47	29	29
1.8	52	30	30
1.9	56	30	30
2	60	31	31



Jacobs Civil Inc.

HEC-22 Catch Basin Hydraulics

Grate Inlet (Sag)

Project:	83rd Avenue/Pinnacle Peak Road	**By:**	JPF
Subject:	Grate in Sag Hydraulics	**Date:**	12/8/05
	90th Avenue and Pinnacle Peak Road	**Checked:**	
	STA 45+80	**Project No.:**	W7X74300

Input:

Q10=	9.00	cfs	Q coming to concentration point
P=	14.25	ft	Perimeter of the grate : Refer to MAG 538, Type 'H', Double
Ag =	8.18	Sq. ft	Clear area of grate : Refer to ADOT C 15.80 for grate used
Grate Capture Ratio =	0.5		Capture Ratio - Percent of useable grate perimeter or area

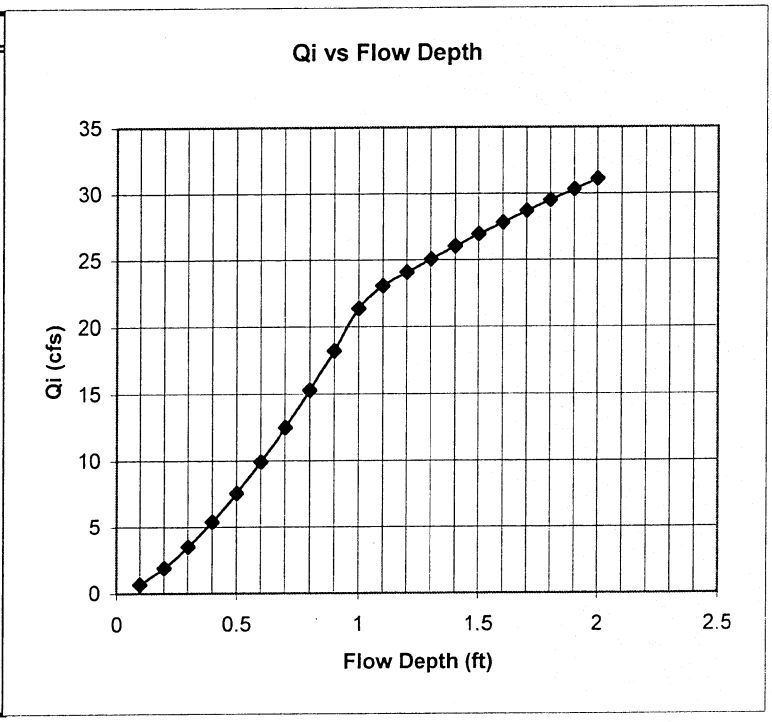
Delta D 0.1 ft

Output:

Depth for Q = 9 is 0.53 ft 6.30 Inches

Grate Inlet:

D	Q (weir)	Q (orifice)	Q (control)
0.1	1	7	1
0.2	2	10	2
0.3	4	12	4
0.4	5	14	5
0.5	8	16	8
0.6	10	17	10
0.7	13	18	13
0.8	15	20	15
0.9	18	21	18
1	21	22	21
1.1	25	23	23
1.2	28	24	24
1.3	32	25	25
1.4	35	26	26
1.5	39	27	27
1.6	43	28	28
1.7	47	29	29
1.8	52	30	30
1.9	56	30	30
2	60	31	31



Jacobs Civil Inc.

HEC-22 Catch Basin Hydraulics

Grate Inlet (Sag)

Project:	83rd Avenue/Pinnacle Peak Road	**By:**	JPF
Subject:	Grate in Sag Hydraulics	**Date:**	12/8/05
	90th Avenue and Pinnacle Peak Road	**Checked:**	
	STA 46+20	**Project No.:**	W7X74300

Input:

Q10=	9.00	cfs	Q coming to concentration point
P=	14.25	ft	Perimeter of the grate : Refer to MAG 538, Type 'H', Double
Ag =	8.18	Sq. ft	Clear area of grate : Refer to ADOT C 15.80 for grate used
Grate Capture Ratio =	0.5		Capture Ratio - Percent of useable grate perimeter or area

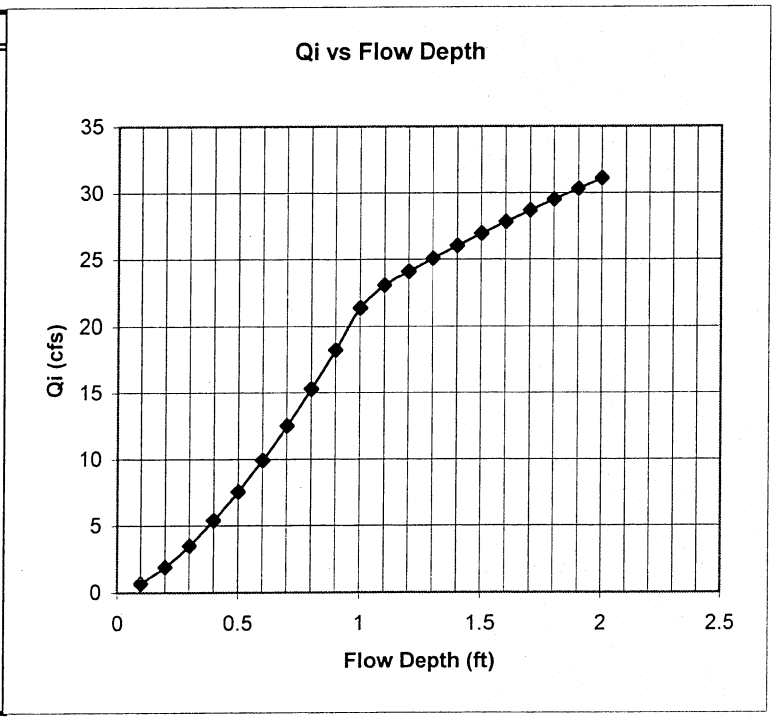
Delta D 0.1 ft

Output:

Depth for Q = 9 is 0.53 ft 6.30 Inches

Grate Inlet:

D	Q (weir)	Q (orifice)	Q (control)
0.1	1	7	1
0.2	2	10	2
0.3	4	12	4
0.4	5	14	5
0.5	8	16	8
0.6	10	17	10
0.7	13	18	13
0.8	15	20	15
0.9	18	21	18
1	21	22	21
1.1	25	23	23
1.2	28	24	24
1.3	32	25	25
1.4	35	26	26
1.5	39	27	27
1.6	43	28	28
1.7	47	29	29
1.8	52	30	30
1.9	56	30	30
2	60	31	31



Jacobs Civil Inc.

HEC-22 Catch Basin Hydraulics
Grate Inlet (Sag)

Project:	83rd Avenue/Pinnacle Peak Road	**By:**	JPF
Subject:	Grate in Sag Hydraulics	**Date:**	12/8/05
	Pinnacle Peak Road	**Checked:**	
	STA 215+20	**Project No.:**	W7X74300

Input:

Q10=	9.00	cfs	Q coming to concentration point
P=	14.25	ft	Perimeter of the grate : Refer to MAG 538, Type 'H', Double
Ag =	8.18	Sq. ft	Clear area of grate : Refer to ADOT C 15.80 for grate used
Grate Capture Ratio =	0.5		Capture Ratio - Percent of useable grate perimeter or area

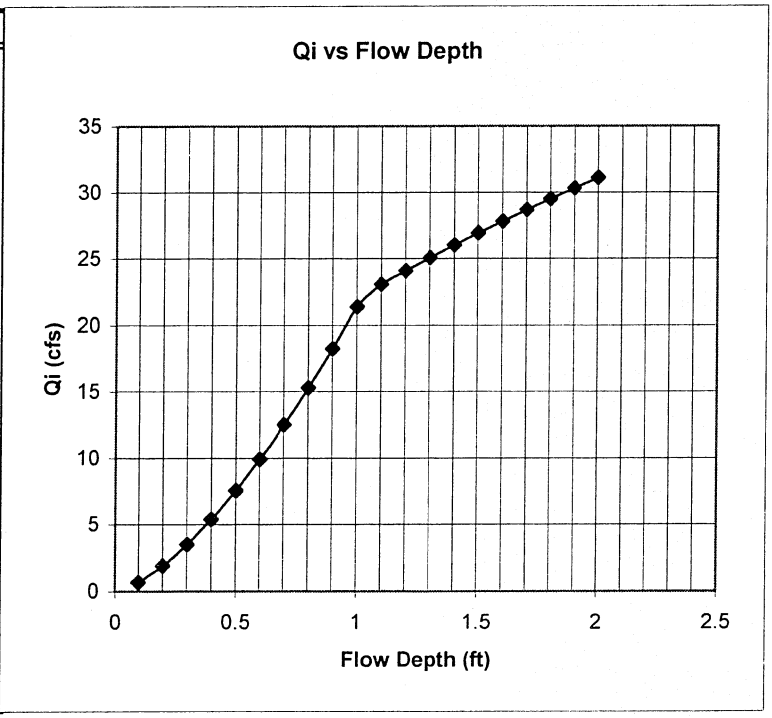
Delta D 0.1 ft

Output:

Depth for Q = 9 is 0.55 ft 6.60 Inches

Grate Inlet:

D	Q (weir)	Q (orifice)	Q (control)
0.1	1	7	1
0.2	2	10	2
0.3	4	12	4
0.4	5	14	5
0.5	8	16	8
0.6	10	17	10
0.7	13	18	13
0.8	15	20	15
0.9	18	21	18
1	21	22	21
1.1	25	23	23
1.2	28	24	24
1.3	32	25	25
1.4	35	26	26
1.5	39	27	27
1.6	43	28	28
1.7	47	29	29
1.8	52	30	30
1.9	56	30	30
2	60	31	31



Jacobs Civil Inc.

HEC-22 Catch Basin Hydraulics

Grate Inlet (Sag)

Project:	83rd Avenue/Pinnacle Peak Road	**By:**	JPF
Subject:	Grate in Sag Hydraulics	**Date:**	12/8/05
	Pinnacle Peak Road	**Checked:**	
	STA 221+60	**Project No.:**	W7X74300

Input:

Q10=	25.00	cfs	Q coming to concentration point
P=	14.25	ft	Perimeter of the grate : Refer to MAG 538, Type 'H', Double
Ag =	8.18	Sq. ft	Clear area of grate : Refer to ADOT C 15.80 for grate used
Grate Capture Ratio =	0.5		Capture Ratio - Percent of useable grate perimeter or area

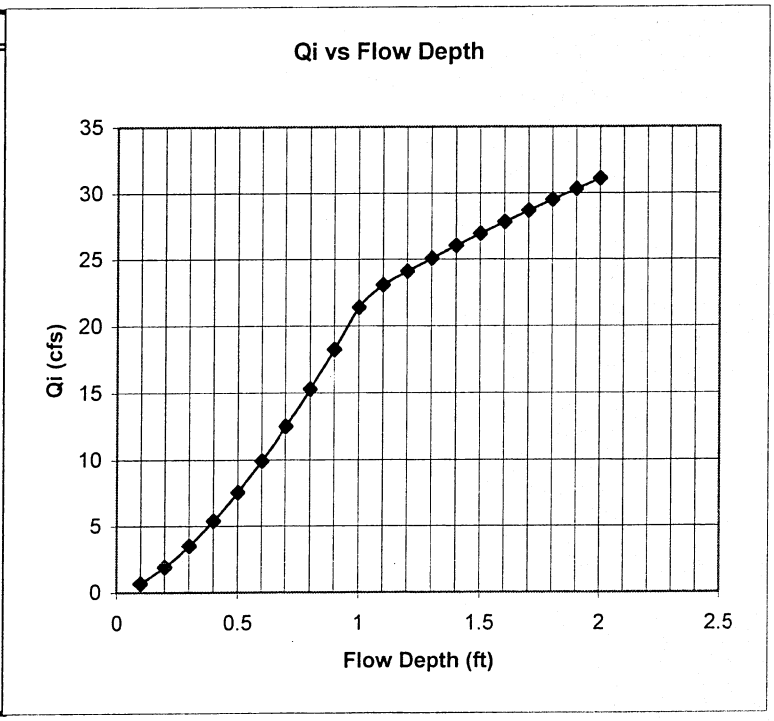
Delta D 0.1 ft

Output:

Depth for Q = 25 is 1.10 ft 13.20 Inches

Grate Inlet:

D	Q (weir)	Q (orifice)	Q (control)
0.1	1	7	1
0.2	2	10	2
0.3	4	12	4
0.4	5	14	5
0.5	8	16	8
0.6	10	17	10
0.7	13	18	13
0.8	15	20	15
0.9	18	21	18
1	21	22	21
1.1	25	23	23
1.2	28	24	24
1.3	32	25	25
1.4	35	26	26
1.5	39	27	27
1.6	43	28	28
1.7	47	29	29
1.8	52	30	30
1.9	56	30	30
2	60	31	31



Jacobs Civil Inc.

HEC-22 Catch Basin Hydraulics
Grate Inlet (Sag)

Project:	83rd Avenue/Pinnacle Peak Road	**By:**	JPF
Subject:	Grate in Sag Hydraulics	**Date:**	12/8/05
	Pinnacle Peak Road	**Checked:**	
	STA 222+90	**Project No.:**	W7X74300

Input:

Q10=	24.00	cfs	Q coming to concentration point
P=	14.25	ft	Perimeter of the grate : Refer to MAG 538, Type 'H', Double
Ag =	8.18	Sq. ft	Clear area of grate : Refer to ADOT C 15.80 for grate used
Grate Capture Ratio =	0.5		Capture Ratio - Percent of useable grate perimeter or area

Delta D 0.1 ft

Output:

Depth for Q = 24 is 1.07 ft 12.84 Inches

Grate Inlet:

D	Q (weir)	Q (orifice)	Q (control)
0.1	1	7	1
0.2	2	10	2
0.3	4	12	4
0.4	5	14	5
0.5	8	16	8
0.6	10	17	10
0.7	13	18	13
0.8	15	20	15
0.9	18	21	18
1	21	22	21
1.1	25	23	23
1.2	28	24	24
1.3	32	25	25
1.4	35	26	26
1.5	39	27	27
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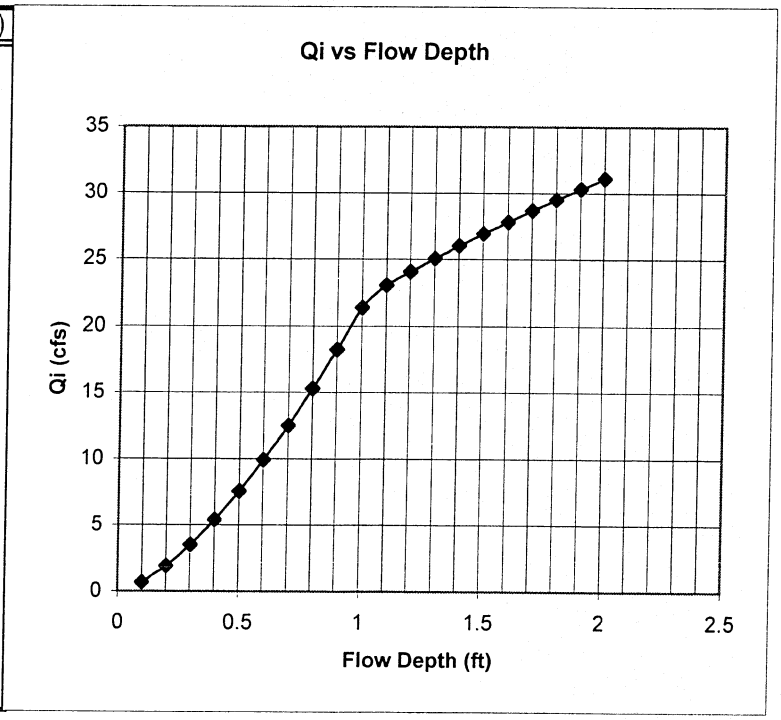
1.9	56	30	30
2	60	31	31



Jacobs Civil Inc.

HEC-22 Catch Basin Hydraulics
Grate Inlet (Sag)

Project:	83rd Avenue/Pinnacle Peak Road	**By:**	JPF
Subject:	Grate in Sag Hydraulics	**Date:**	12/8/05
	Pinnacle Peak Road	**Checked:**	
	STA 232+84, 234+60, 236+30, 237+37 and 239+30	**Project No.:**	W7X74300

Input:

Q100=	24.00	cfs	Q coming to concentration point
P=	14.25	ft	Perimeter of the grate : Refer to MAG 538, Type 'H', Double
Ag =	8.18	Sq. ft	Clear area of grate : Refer to ADOT C 15.80 for grate used
Grate Capture Ratio =	0.5		Capture Ratio - Percent of useable grate perimeter or area

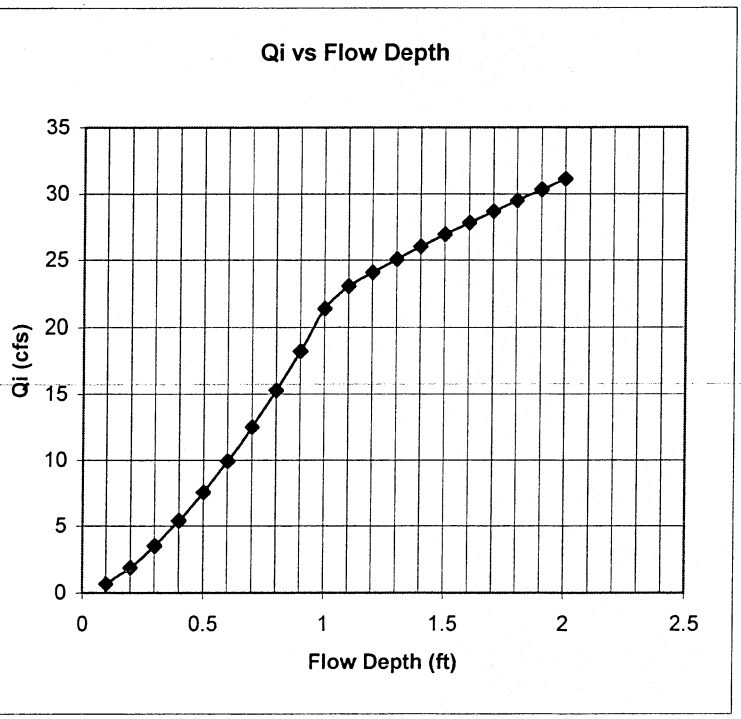
Delta D 0.1 ft

Output:

Depth for Q = 24 is 1.07 ft 12.84 Inches

Grate Inlet:

D	Q (weir)	Q (orifice)	Q (control)
0.1	1	7	1
0.2	2	10	2
0.3	4	12	4
0.4	5	14	5
0.5	8	16	8
0.6	10	17	10
0.7	13	18	13
0.8	15	20	15
0.9	18	21	18
1	21	22	21
1.1	25	23	23
1.2	28	24	24
1.3	32	25	25
1.4	35	26	26
1.5	39	27	27
1.6	43	28	28
1.7	47	29	29
1.8	52	30	30
1.9	56	30	30
2	60	31	31



Jacobs Civil Inc.

HEC-22 Catch Basin Hydraulics

Grate Inlet (Sag)

Project:	83rd Avenue/Pinnacle Peak Road	**By:**	JPF
Subject:	Grate in Sag Hydraulics	**Date:**	12/8/05
	87th Avenue	**Checked:**	
	STA 300+60 and 300+80	**Project No.:**	W7X74300

Input:

Q100=	4.00	cfs	Q coming to concentration point
P=	14.25	ft	Perimeter of the grate : Refer to MAG 538, Type 'H', Double
Ag =	8.18	Sq. ft	Clear area of grate : Refer to ADOT C 15.80 for grate used
Grate Capture Ratio =	0.5		Capture Ratio - Percent of useable grate perimeter or area

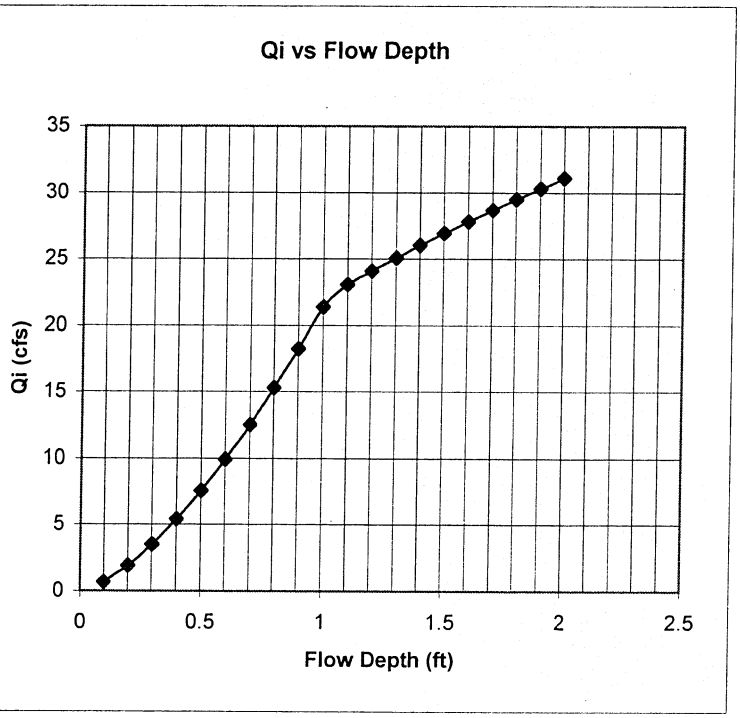
Delta D 0.1 ft

Output:

Depth for Q = 4 is 0.30 ft 3.60 Inches

Grate Inlet:

D	Q (weir)	Q (orifice)	Q (control)
0.1	1	7	1
0.2	2	10	2
0.3	4	12	4
0.4	5	14	5
0.5	8	16	8
0.6	10	17	10
0.7	13	18	13
0.8	15	20	15
0.9	18	21	18
1	21	22	21
1.1	25	23	23
1.2	28	24	24
1.3	32	25	25
1.4	35	26	26
1.5	39	27	27
1.6	43	28	28
1.7	47	29	29
1.8	52	30	30
1.9	56	30	30
2	60	31	31



Jacobs Civil Inc.

HEC-22 Catch Basin Hydraulics
Grate Inlet (Sag)

Project:	83rd Avenue/Pinnacle Peak Road	**By:**	JPF
Subject:	Grate in Sag Hydraulics	**Date:**	12/8/05
	87th Avenue	**Checked:**	
	STA 60+40	**Project No.:**	W7X74300

Input:

Q100=	20.00	cfs	Q coming to concentration point
P=	14.25	ft	Perimeter of the grate : Refer to MAG 538, Type 'H', Double
Ag =	8.18	Sq. ft	Clear area of grate : Refer to ADOT C 15.80 for grate used
Grate Capture Ratio =	0.5		Capture Ratio - Percent of useable grate perimeter or area

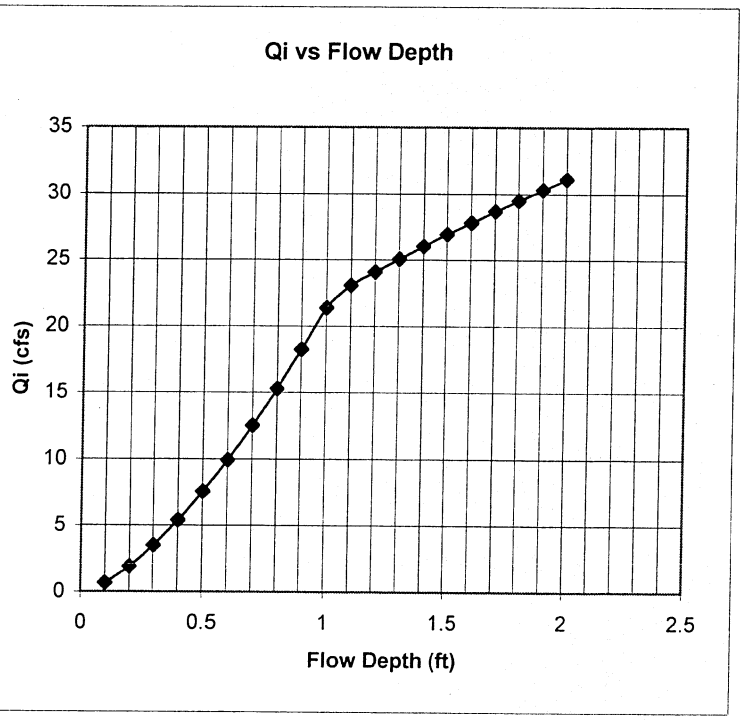
Delta D 0.1 ft

Output:

Depth for Q = 20 is 0.97 ft 11.64 Inches

Grate Inlet:

D	Q (weir)	Q (orifice)	Q (control)
0.1	1	7	1
0.2	2	10	2
0.3	4	12	4
0.4	5	14	5
0.5	8	16	8
0.6	10	17	10
0.7	13	18	13
0.8	15	20	15
0.9	18	21	18
1	21	22	21
1.1	25	23	23
1.2	28	24	24
1.3	32	25	25
1.4	35	26	26
1.5	39	27	27
1.6	43	28	28
1.7	47	29	29
1.8	52	30	30
1.9	56	30	30
2	60	31	31



Jacobs Civil Inc.

HEC-22 Catch Basin Hydraulics

Grate Inlet (Sag)

Project:	83rd Avenue/Pinnacle Peak Road	**By:**	JPF
Subject:	Grate in Sag Hydraulics	**Date:**	1/30/06
	Calle Lejos	**Checked:**	
	STA 335+07 and 336+36	**Project No.:**	W7X74300

Input:

Q50=	10.00	cfs	Q coming to concentration point
P=	14.25	ft	Perimeter of the grate : Refer to MAG 538, Type 'H', Double
Ag =	8.18	Sq. ft	Clear area of grate : Refer to ADOT C 15.80 for grate used
Grate Capture Ratio =	0.5		Capture Ratio - Percent of useable grate perimeter or area

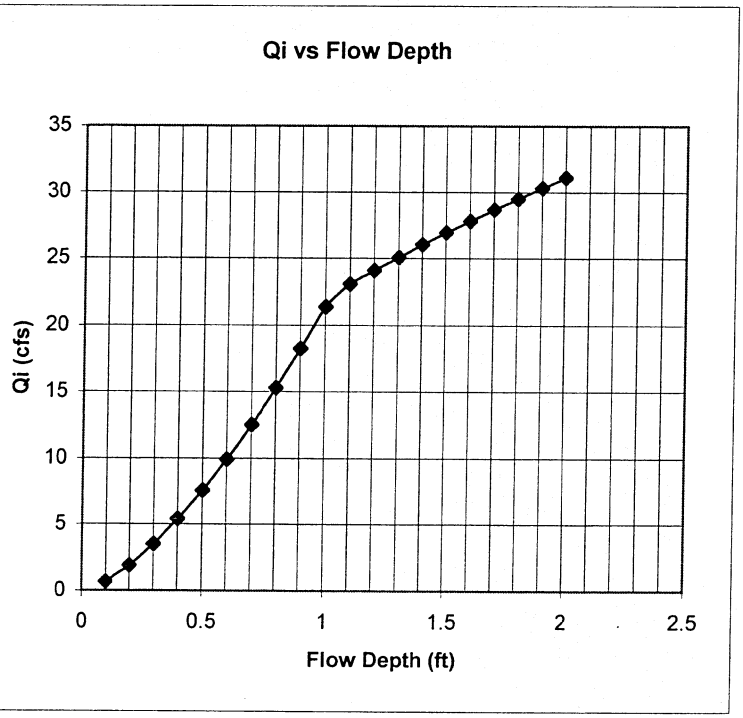
Delta D 0.1 ft

Output:

Depth for Q = 10 is 0.60 ft 7.20 Inches

Grate Inlet:

D	Q (weir)	Q (orifice)	Q (control)
0.1	1	7	1
0.2	2	10	2
0.3	4	12	4
0.4	5	14	5
0.5	8	16	8
0.6	10	17	10
0.7	13	18	13
0.8	15	20	15
0.9	18	21	18
1	21	22	21
1.1	25	23	23
1.2	28	24	24
1.3	32	25	25
1.4	35	26	26
1.5	39	27	27
1.6	43	28	28
1.7	47	29	29
1.8	52	30	30
1.9	56	30	30
2	60	31	31



Jacobs Civil Inc.

HEC-22 Catch Basin Hydraulics
Grate Inlet (Sag)

Project:	83rd Avenue/Pinnacle Peak Road	**By:**	JOF
Subject:	Grate in Sag Hydraulics	**Date:**	10/5/05
	Cielo Grande	**Checked:**	
	STA 402+00, 403+00, 404+10, 405+48, 4006+35,	**Project No.:**	W7X74300
	407+23, 408+65, 409+80, 411+10 and 412+35		

Input:

Q50=	7.50	cfs	Q coming to concentration point
P=	14.25	ft	Perimeter of the grate : Refer to MAG 538, Type 'H', Double
Ag =	8.18	Sq. ft	Clear area of grate : Refer to ADOT C 15.80 for grate used
Grate Capture Ratio =	0.5		Capture Ratio - Percent of useable grate perimeter or area

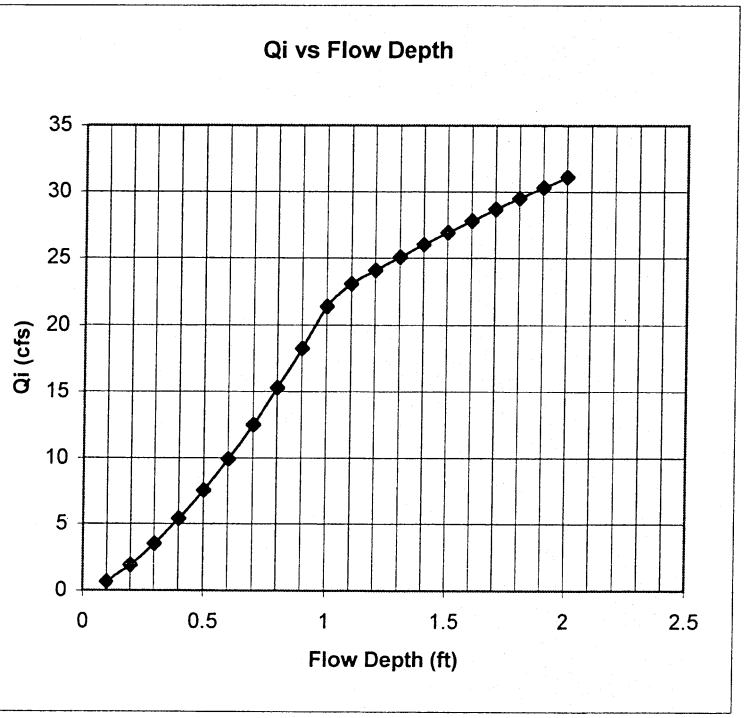
Delta D 0.1 ft

Output:

Depth for Q = 7.5 is 0.48 ft 5.76 Inches

Grate Inlet:

D	Q (weir)	Q (orifice)	Q (control)
0.1	1	7	1
0.2	2	10	2
0.3	4	12	4
0.4	5	14	5
0.5	8	16	8
0.6	10	17	10
0.7	13	18	13
0.8	15	20	15
0.9	18	21	18
1	21	22	21
1.1	25	23	23
1.2	28	24	24
1.3	32	25	25
1.4	35	26	26
1.5	39	27	27
1.6	43	28	28
1.7	47	29	29
1.8	52	30	30
1.9	56	30	30
2	60	31	31



Jacobs Civil Inc.

HEC-22 Catch Basin Hydraulics
Grate Inlet (Sag)

Project:	83rd Avenue/Pinnacle Peak Road	**By:**	JPF
Subject:	Grate in Sag Hydraulics	**Date:**	12/8/05
	Cielo Grande and 89th Avenue	**Checked:**	
	STA 413+03	**Project No.:**	W7X74300

Input:

Q10=	14.00	cfs	Q coming to concentration point
P=	14.25	ft	Perimeter of the grate : Refer to MAG 538, Type 'H', Double
Ag =	8.18	Sq. ft	Clear area of grate : Refer to ADOT C 15.80 for grate used
Grate Capture Ratio =	0.5		Capture Ratio - Percent of useable grate perimeter or area

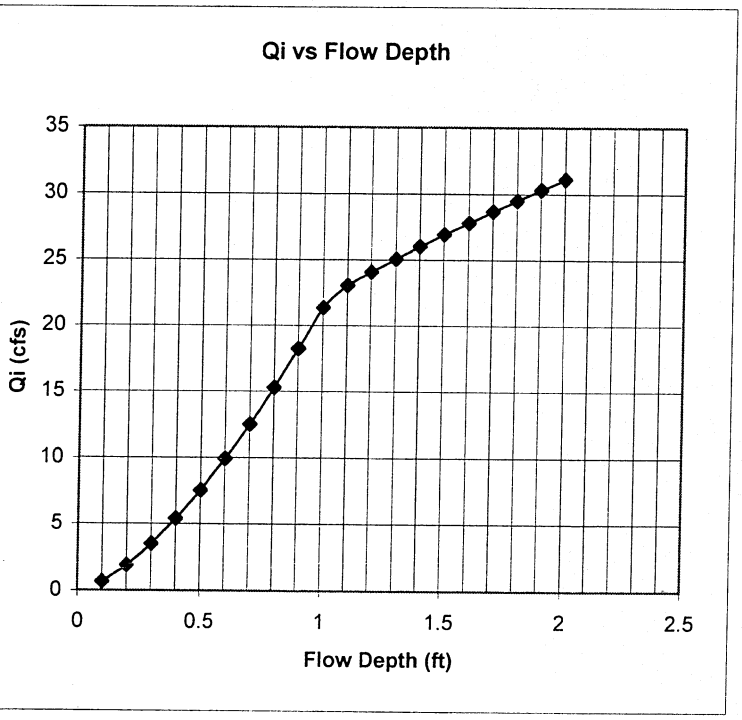
Delta D 0.1 ft

Output:

Depth for Q = 14 is 0.35 ft 4.20 Inches

Grate Inlet:

D	Q (weir)	Q (orifice)	Q (control)
0.1	1	7	1
0.2	2	10	2
0.3	4	12	4
0.4	5	14	5
0.5	8	16	8
0.6	10	17	10
0.7	13	18	13
0.8	15	20	15
0.9	18	21	18
1	21	22	21
1.1	25	23	23
1.2	28	24	24
1.3	32	25	25
1.4	35	26	26
1.5	39	27	27
1.6	43	28	28
1.7	47	29	29
1.8	52	30	30
1.9	56	30	30
2	60	31	31



Jacobs Civil Inc.

HEC-22 Catch Basin Hydraulics
Grate Inlet (Sag)

Project:	83rd Avenue/Pinnacle Peak Road	**By:**	JPF
Subject:	Grate in Sag Hydraulics	**Date:**	1/30/06
	Avenida del Sol	**Checked:**	
	STA 417+20, 418+52, 419+31, 419+95, 420+55,	**Project No.:**	W7X74300
	421+30, 422+27, 423+30, 425+17, 426+27, 427+20, 428+35 and 429+30		

Input:

Q50=	2.00	cfs	Q coming to concentration point
P=	14.25	ft	Perimeter of the grate : Refer to MAG 538, Type 'H', Double
Ag =	8.18	Sq. ft	Clear area of grate : Refer to ADOT C 15.80 for grate used
Grate Capture Ratio =	0.5		Capture Ratio - Percent of useable grate perimeter or area

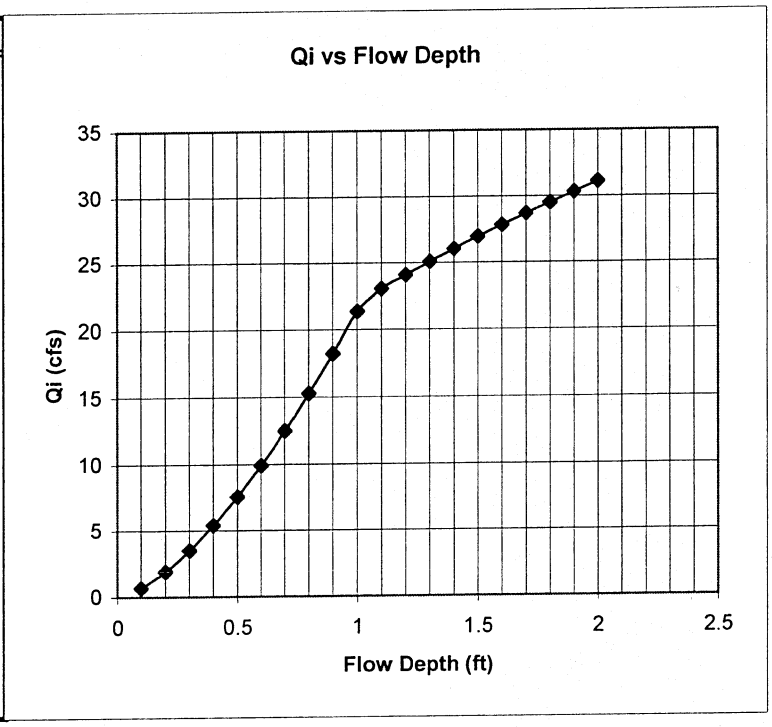
Delta D 0.1 ft

Output:

Depth for Q = 2 is 0.20 ft 2.40 Inches

Grate Inlet:

D	Q (weir)	Q (orifice)	Q (control)
0.1	1	7	1
0.2	2	10	2
0.3	4	12	4
0.4	5	14	5
0.5	8	16	8
0.6	10	17	10
0.7	13	18	13
0.8	15	20	15
0.9	18	21	18
1	21	22	21
1.1	25	23	23
1.2	28	24	24
1.3	32	25	25
1.4	35	26	26
1.5	39	27	27
1.6	43	28	28
1.7	47	29	29
1.8	52	30	30
1.9	56	30	30
2	60	31	31



Jacobs Civil Inc.

HEC-22 Catch Basin Hydraulics
Grate Inlet (Sag)

Project:	83rd Avenue/Pinnacle Peak Road	**By:**	JPF
Subject:	Grate in Sag Hydraulics	**Date:**	2/1/06
	Pinnacle Peak Road STA 236+54	**Checked:**	
	Trench Drain	**Project No.:**	W7X74300

Input:

Q10=	60.00	cfs	Q coming to concentration point
P=	43	ft	Perimeter of the grate : Refer to Dtl 26
Ag =	31.67	Sq. ft	Clear area of grate : 67% of grate area
Grate Capture Ratio =	0.5		Capture Ratio - Percent of useable grate perimeter or area

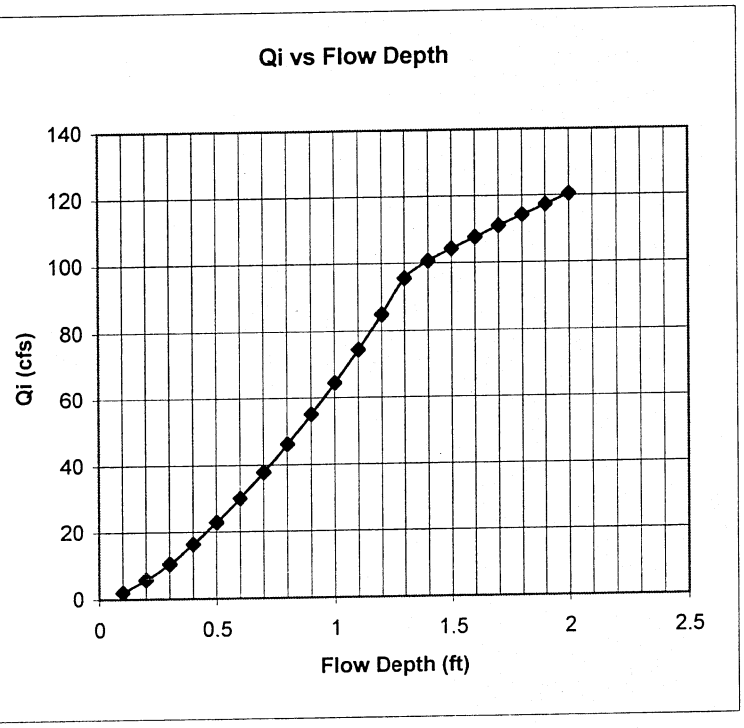
Delta D 0.1 ft

Output:

Depth for Q = 60 is 0.95 ft 11.40 Inches

Grate Inlet:

D	Q (weir)	Q (orifice)	Q (control)
0.1	2	27	2
0.2	6	38	6
0.3	11	47	11
0.4	16	54	16
0.5	23	60	23
0.6	30	66	30
0.7	38	71	38
0.8	46	76	46
0.9	55	81	55
1	65	85	65
1.1	74	89	74
1.2	85	93	85
1.3	96	97	96
1.4	107	101	101
1.5	118	104	104
1.6	131	108	108
1.7	143	111	111
1.8	156	114	114
1.9	169	117	117
2	182	120	120



Jacobs Civil Inc.

HEC-22 Catch Basin Hydraulics
Grate Inlet (Sag)

Project:	83rd Avenue/Pinnacle Peak Road	**By:**	JPF
Subject:	Grate in Sag Hydraulics	**Date:**	2/1/06
	89th Avenue	**Checked:**	
	Trench Drain	**Project No.:**	W7X74300

Input:

Q10=	55.00	cfs	Q coming to concentration point
P=	43	ft	Perimeter of the grate : Refer to Dtl 26
Ag =	31.67	Sq. ft	Clear area of grate : 67% of grate area
Grate Capture Ratio =	0.5		Capture Ratio - Percent of useable grate perimeter or area

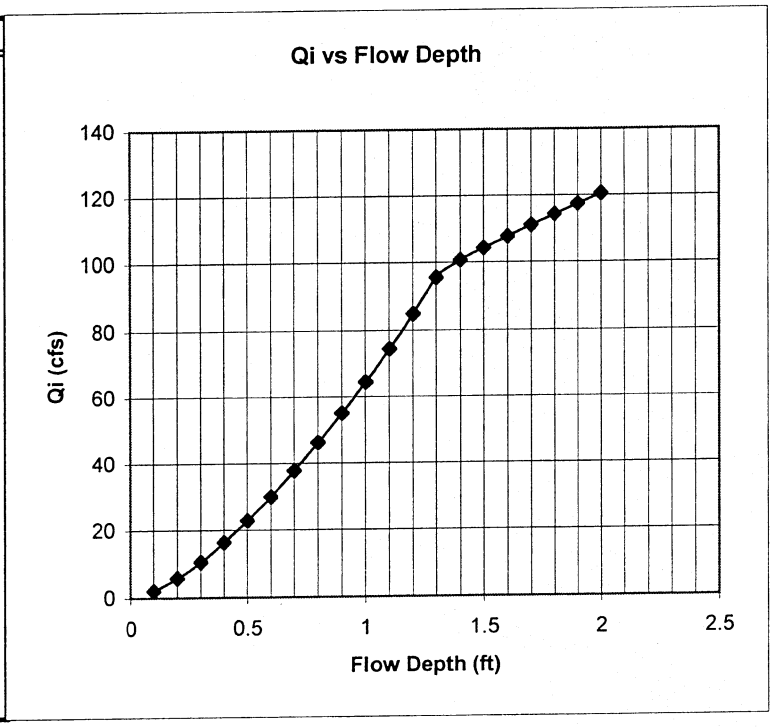
Delta D 0.1 ft

Output:

Depth for Q = 55 is 0.90 ft 10.80 Inches

Grate Inlet:

D	Q (weir)	Q (orifice)	Q (control)
0.1	2	27	2
0.2	6	38	6
0.3	11	47	11
0.4	16	54	16
0.5	23	60	23
0.6	30	66	30
0.7	38	71	38
0.8	46	76	46
0.9	55	81	55
1	65	85	65
1.1	74	89	74
1.2	85	93	85
1.3	96	97	96
1.4	107	101	101
1.5	118	104	104
1.6	131	108	108
1.7	143	111	111
1.8	156	114	114
1.9	169	117	117
2	182	120	120



Appendix C-2

Drop Inlets

Jacobs Civil Inc.

Drop Inlet Design

Project:	**83rd Avenue/Pinnacle Peak Road**	By:	**JPF**
Subject:	**83rd Avenue and Pinnacle Peak Road**	Date:	**12/8/2005**
	STA 10+64	Checked:	
		Jacobs Project No.:	**W7X74300**

Remarks: Peak flow is 100-year discharge at Pinnacle Peak Road.

Use single pipe with drop inlet from MAG 501-5.

Calculations:

Step 1) Determine peak discharge

Subbasin :	RESD	
Peak Discharge =	68.0	cfs
Percent to each Inlet =	50%	
Design Q =	34.0	cfs

Step 2) Select pipe size and drop inlet

Pipe Size, diameter =	30	in	No. of Pipes =	1
Weir length, MAAG 501-5 =	3.5	ft		
Weir Coefficient, Cw =	3.00			

Q = Cw x W x d^1.5

Flow Depth, d =	2.19	ft	OK
Weir height =	1.14	ft	Pipe Diameter + 1.33' - d - 0.5'

Step 3) Check Inlet Control for Pipe

Nomograph for Headwater Depth For Concrete Pipe Culverts With Inlet Control

Pipe Size, diameter =	30	in
Design Q =	34.0	cfs
HW/D, nomograph =	1.42	

HW = 3.6 ft OK

Jacobs Civil Inc.

Drop Inlet Design

Project:	**83rd Avenue/Pinnacle Peak Road**	By:	**JPF**
Subject:	**83rd Avenue and Pinnacle Peak Road**	Date:	**12/8/2005**
	STA 11+69	Checked:	
		Jacobs Project No.:	**W7X74300**

Remarks: Peak flow is 100-year discharge at Pinnacle Peak Road.

Use single pipe with drop inlet from MAG 501-5.

Calculations:

Step 1) Determine peak discharge

Subbasin :	RESD	
Peak Discharge =	68.0	cfs
Percent to each Inlet =	50%	
Design Q =	34.0	cfs

Step 2) Select pipe size and drop inlet

Pipe Size, diameter =	30	in	No. of Pipes =	1
Weir length, MAAG 501-5 =	3.5	ft		
Weir Coefficient, Cw =	3.00			

Q = Cw x W x d^1.5

Flow Depth, d =	2.19	ft	OK
Weir height =	1.14	ft	Pipe Diameter + 1.33' - d - 0.5'

Step 3) Check Inlet Control for Pipe

Nomograph for Headwater Depth For Concrete Pipe Culverts With Inlet Control

Pipe Size, diameter =	30	in
Design Q =	34.0	cfs
HW/D, nomograph =	1.42	

HW = 3.6 ft OK

Jacobs Civil Inc.

Drop Inlet Design

Project:	**83rd Avenue/Pinnacle Peak Road**	By:	**JPF**
Subject:	**83rd Avenue and Avenida del Sol**	Date:	**12/8/2005**
	STA 25+79	Checked:	
		Jacobs Project No.:	**W7X74300**

Remarks: Peak flow is 100-year discharge at Avenida del Sol.

Use single pipe with drop inlet from MAG 501-5.

Calculations:

Step 1) Determine peak discharge

Subbasin :	N11P3	
Peak Discharge =	53.0	cfs
Percent to each Inlet =	100%	
Design Q =	53.0	cfs

Step 2) Select pipe size and drop inlet

Pipe Size, diameter =	36	in	No. of Pipes =	1
Weir length, MAAG 501-5 =	4	ft		
Weir Coefficient, Cw =	3.00			

Q = Cw x W x d^1.5

Flow Depth, d =	2.69	ft	OK
Weir height =	1.14	ft	Pipe Diameter + 1.33' - d - 0.5'

Step 3) Check Inlet Control for Pipe

Nomograph for Headwater Depth For Concrete Pipe Culverts With Inlet Control

Pipe Size, diameter =	36	in
Design Q =	53.0	cfs
HW/D, nomograph =	1.42	

HW = 4.3 ft OK

Jacobs Civil Inc.

Drop Inlet Design

Project:	**83rd Avenue/Pinnacle Peak Road**	By:	**JPF**
Subject:	**83rd Avenue and Avenida del Sol**	Date:	**12/8/2005**
	STA 142+75, 15' RT	Checked:	
		Jacobs Project No.:	**W7X74300**

Remarks: Peak flow is 100-year discharge at Avenida del Sol.

Use single pipe with drop inlet from MAG 501-5.

Calculations:

Step 1) Determine peak discharge

Subbasin :	RT83CL	
Peak Discharge =	40.0	cfs
Percent to each Inlet =	100%	
Design Q =	40.0	cfs

Step 2) Select pipe size and drop inlet

Pipe Size, diameter =	36	in	No. of Pipes =	1
Weir length, MAAG 501-5 =	4	ft		
Weir Coefficient, Cw =	3.00			

Q = Cw x W x d^1.5

Flow Depth, d =	2.23	ft	OK
Weir height =	1.60	ft	Pipe Diameter + 1.33' - d - 0.5'

Step 3) Check Inlet Control for Pipe

Nomograph for Headwater Depth For Concrete Pipe Culverts With Inlet Control

Pipe Size, diameter =	36	in
Design Q =	40.0	cfs
HW/D, nomograph =	1.12	

HW = 3.4 ft OK

Jacobs Civil Inc.

Drop Inlet Design

Project:	**83rd Avenue/Pinnacle Peak Road**	By:	**JPF**
Subject:	**Pinnacle Peak Road and 91st Avenue**	Date:	**12/8/2005**
	STA 70+70	Checked:	
		Jacobs Project No.:	**W7X74300**

Remarks: Peak flow is 10-year discharge at 91st Avenue divided by 2 for each side of the street.

Use single pipe with drop inlet from MAG 501-5.

Calculations:

Step 1) Determine peak discharge

Subbasin :	D91	
Peak Discharge =	55.0	cfs
Percent to each Inlet =	50%	
Design Q =	27.5	cfs

Step 2) Select pipe size and drop inlet

Pipe Size, diameter =	30	in	No. of Pipes =	1
Weir length, MAAG 501-5 =	3.5	ft		
Weir Coefficient, Cw =	3.00			

Q = Cw x W x d^1.5

Flow Depth, d =	1.90	ft	OK
Weir height =	1.43	ft	Pipe Diameter + 1.33' - d - 05.'

Step 3) Check Inlet Control for Pipe

Nomograph for Headwater Depth For Concrete Pipe Culverts With Inlet Control

Pipe Size, diameter =	30	in
Design Q =	27.5	cfs
HW/D, nomograph =	1.20	

HW = 3.0 ft OK

Jacobs Civil Inc.

Drop Inlet Design

Project:	**83rd Avenue/Pinnacle Peak Road**	By:	**JPF**
Subject:	**Pinnacle Peak Road and 91st Avenue**	Date:	**12/8/2005**
	STA 75+70	Checked:	
		Jacobs Project No.:	**W7X74300**

Remarks: Peak flow is 10-year discharge at 91st Avenue divided by 2 for each side of the street.

Use single pipe with drop inlet from MAG 501-5.

Calculations:

Step 1) Determine peak discharge

Subbasin :	D91	
Peak Discharge =	55.0	cfs
Percent to each Inlet =	50%	
Design Q =	27.5	cfs

Step 2) Select pipe size and drop inlet

Pipe Size, diameter =	30	in	No. of Pipes =	1
Weir length, MAAG 501-5 =	3.5	ft		
Weir Coefficient, Cw =	3.00			

Q = Cw x W x d^1.5

Flow Depth, d =	1.90	ft	OK
Weir height =	1.43	ft	Pipe Diameter + 1.33' - d - 05.'

Step 3) Check Inlet Control for Pipe

Nomograph for Headwater Depth For Concrete Pipe Culverts With Inlet Control

Pipe Size, diameter =	30	in
Design Q =	27.5	cfs
HW/D, nomograph =	1.20	

HW = 3.0 ft OK

Jacobs Civil Inc.

Drop Inlet Design

Project:	**83rd Avenue/Pinnacle Peak Road**	By:	**JPF**
Subject:	**Calle Lejos**	Date:	**12/8/2005**
	STA 81+37	Checked:	
		Jacobs Project No.:	**W7X74300**

Remarks: Peak flow is 100-year discharge at Calle Lejos.

Use single pipe with drop inlet from MAG 501-5.
STD DROP INLET WILL NOT WORK - USE SPECIAL DESIGN

Calculations:

Step 1) Determine peak discharge

Subbasin :	VPDIV	
Peak Discharge =	351.0	cfs
Percent to each Inlet =	45%	
Design Q =	158.0	cfs

Step 2) Select pipe size and drop inlet

Pipe Size, diameter =	60	in	No. of Pipes =	1
Weir length, MAAG 501-5 =	6	ft		
Weir Coefficient, Cw =	3.00			

Q = Cw x W x d^1.5

Flow Depth, d =	4.25	ft	TOO DEEP
Weir height =	1.58	ft	Pipe Diameter + 1.33' - d - 0.5'

Step 3) Check Inlet Control for Pipe

Nomograph for Headwater Depth For Concrete Pipe Culverts With Inlet Control

Pipe Size, diameter =	60	in
Design Q =	351.0	cfs
HW/D, nomograph =	3.30	

HW = 16.5 ft TOO HIGH

Jacobs Civil Inc.

Drop Inlet Design

Project:	**83rd Avenue/Pinnacle Peak Road**	By:	**JPF**
Subject:	**Calle Lejos**	Date:	**12/8/2005**
	STA 85+70	Checked:	
		Jacobs Project No.:	**W7X74300**

Remarks: Peak flow is 100-year discharge at Calle Lejos.

Use single pipe with drop inlet from MAG 501-5.
STD DROP INLET WILL NOT WORK - USE SPECIAL DESIGN

Calculations:

Step 1) Determine peak discharge

Subbasin :	VPDIV	
Peak Discharge =	351.0	cfs
Percent to each Inlet =	55%	
Design Q =	193.1	cfs

Step 2) Select pipe size and drop inlet

Pipe Size, diameter =	60	in	No. of Pipes =	1
Weir length, MAAG 501-5 =	6	ft		
Weir Coefficient, Cw =	3.00			

Q = Cw x W x d^1.5

Flow Depth, d =	4.86	ft	TOO DEEP
Weir height =	0.97	ft	Pipe Diameter + 1.33' - d - 0.5'

Step 3) Check Inlet Control for Pipe

Nomograph for Headwater Depth For Concrete Pipe Culverts With Inlet Control

Pipe Size, diameter =	60	in
Design Q =	351.0	cfs
HW/D, nomograph =	3.30	

HW = 16.5 ft TOO HIGH

Jacobs Civil Inc.

Drop Inlet Design

Project:	**83rd Avenue/Pinnacle Peak Road**	By:	**JPF**
Subject:	**Calle Lejos**	Date:	**12/8/2005**
	STA 336+66	Checked:	
		Jacobs Project No.:	**W7X74300**

Remarks: Peak flow is 100-year discharge at Calle Lejos.

Use single pipe with drop inlet from MAG 501-5.

Calculations:

Step 1) Determine peak discharge

Subbasin :	RDP4E	
Peak Discharge =	28.0	cfs
Percent to each Inlet =	100%	
Design Q =	28.0	cfs

Step 2) Select pipe size and drop inlet

Pipe Size, diameter =	30	in	No. of Pipes =	1
Weir length, MAAG 501-5 =	3.5	ft		
Weir Coefficient, Cw =	3.00			

Q = Cw x W x d^1.5

Flow Depth, d =	1.92	ft	OK
Weir height =	1.41	ft	Pipe Diameter + 1.33' - d - 0.5'

Step 3) Check Inlet Control for Pipe

Nomograph for Headwater Depth For Concrete Pipe Culverts With Inlet Control

Pipe Size, diameter =	30	in
Design Q =	28.0	cfs
HW/D, nomograph =	1.20	

HW = 3.0 ft OK

Jacobs Civil Inc.

Drop Inlet Design

Project:	**83rd Avenue/Pinnacle Peak Road**	By:	**JPF**
Subject:	**Calle Lejos**	Date:	**12/8/2005**
	STA 340+27	Checked:	
		Jacobs Project No.:	**W7X74300**

Remarks: Peak flow is 100-year discharge at Calle Lejos.

Use double pipe with drop inlet from modified MAG 501-5.

Calculations:

Step 1) Determine peak discharge

Subbasin :	R11P7S	
Peak Discharge =	172.0	cfs
Percent to each Inlet =	100%	
Design Q =	172.0	cfs

Step 2) Select pipe size and drop inlet

Pipe Size, diameter =	48	in	No. of Pipes =	2
Weir length, MAAG 501-5 =	11.8	ft		
Weir Coefficient, Cw =	3.00			

Q = Cw x W x d^1.5

Flow Depth, d =	2.87	ft	OK
Weir height =	1.96	ft	Pipe Diameter + 1.33' - d - 0.5'

Step 3) Check Inlet Control for Pipe

Nomograph for Headwater Depth For Concrete Pipe Culverts With Inlet Control

Pipe Size, diameter =	48	in
Design Q =	86.0	cfs
HW/D, nomograph =	1.20	

HW = 4.8 ft OK

Jacobs Civil Inc.

Drop Inlet Design

Project:	**83rd Avenue/Pinnacle Peak Road**	By:	**JPF**
Subject:	**Cielo Grande and 91st Avenue**	Date:	**12/8/2005**
	STA 90+72	Checked:	
		Jacobs Project No.:	**W7X74300**

Remarks: Peak flow is 10-year discharge at 91st Avenue divided by 2 for each side of the street. 50% of subbasin flows to 91st Avenue, 50% sheet flows between 91st Avenue and 89th Avenue.
Use single pipe with drop inlet from MAG 501-5.

Calculations:

Step 1) Determine peak discharge

Subbasin :	RS91A	
Peak Discharge =	149.0	cfs
Percent to each Inlet =	25%	
Design Q =	37.3	cfs

Step 2) Select pipe size and drop inlet

Pipe Size, diameter =	30	in	No. of Pipes =	1
Weir length, MAAG 501-5 =	3.5	ft		
Weir Coefficient, Cw =	3.00			

Q = Cw x W x d^1.5

Flow Depth, d =	2.33	ft	OK
Weir height =	1.00	ft	Pipe Diameter + 1.33' - d - 0.5'

Step 3) Check Inlet Control for Pipe

Nomograph for Headwater Depth For Concrete Pipe Culverts With Inlet Control

Pipe Size, diameter =	30	in
Design Q =	37.3	cfs
HW/D, nomograph =	1.52	

HW = 3.8 ft OK

Jacobs Civil Inc.

Drop Inlet Design

Project:	**83rd Avenue/Pinnacle Peak Road**	By:	**JPF**
Subject:	**Cielo Grande and 91st Avenue**	Date:	**12/8/2005**
	STA 400+30	Checked:	
		Jacobs Project No.:	**W7X74300**

Remarks: Peak flow is 10-year discharge at 91st Avenue divided by 2 for each side of the street. 50% of subbasin flows to 91st Avenue, 50% sheet flows between 91st Avenue and 89th Avenue.
Use single pipe with drop inlet from MAG 501-5.

Calculations:

Step 1) Determine peak discharge

Subbasin :	RS91A	
Peak Discharge =	149.0	cfs
Percent to each Inlet =	25%	
Design Q =	37.3	cfs

Step 2) Select pipe size and drop inlet

Pipe Size, diameter =	30	in	No. of Pipes = 1
Weir length, MAAG 501-5 =	3.5	ft	
Weir Coefficient, Cw =	3.00		

Q = Cw x W x d^1.5

Flow Depth, d =	2.33	ft	OK
Weir height =	1.00	ft	Pipe Diameter + 1.33' - d - 0.5'

Step 3) Check Inlet Control for Pipe

Nomograph for Headwater Depth For Concrete Pipe Culverts With Inlet Control

Pipe Size, diameter =	30	in
Design Q =	37.3	cfs
HW/D, nomograph =	1.52	

HW = 3.8 ft OK

Appendix C-3

Outlet Protection

Jacobs Civil Inc.

Riprap Apron Design

By: JPF
Date: 12/29/05
Checked:
Jacobs Project No.: W7X74300

Culvert Detail No	Structure Location
83rd Avenue	99+36

Reference: Drainage Design Manual for Maricopa County, Volume 2: January 28, 1996

RESULTS			
D50 (in)	T (in)	La	Wa
6	18	47.0	28.0

From StormCAD Output

Q100 (per barrel) (cfs)	Number of Barrels	Pipe Diameter (ft)	Yo Outlet Depth (ft)	Vo Outlet Velocity (ft/s)	TW Tailwater Depth (ft)	Existing Channel Velocity (ft/s)
45	2	3	4.08	6.44	4.08	4.00

Riprap Apron Basin Design

Step 1: Determine TW condition (TW< D/2 or TW > D/2)

TW = 4.08 ft
D/2 = 1.5 ft

Condition: Hi TW TW>D/2

Step 2: Determine the lenghth of Apron, La

for low TW: La = 1.8*Q/D^(3/2)+7*D
for hi TW: La = 3.0*Q/D^(3/2)+7*D

La = 47 ft

Step 3: Determine Basin Width, Wa. Is to be used if there are no defined drainage channel dowstream.

for low TW: Wa = 3*D+La
for hi TW: Wa = 3*D+0.4*La

Wa = 28 ft

Step 4: Size D50

D50 = 0.02*Q^(4/3)/TW/D (no preformed scour hole)

D50 = 6 inches D50 calced is less than 6 inches, use 6 inches.

Thickness = 12 inches (2*D50)

Step 5: Estimate Quantities

Vol. Riprap = 32.20 yd^3 (3*D+Wa)/2*La*T/12/27

Jacobs Civil Inc.

Riprap Apron Design

By: JPF
Date: 12/29/05
Checked:
Jacobs Project No.: W7X74300

Culvert Detail No	Structure Location
83rd Avenue	245+65

Reference: Drainage Design Manual for Maricopa County, Volume 2: January 28, 1996

RESULTS			
D50 (in)	T (in)	La	Wa
6	12	108.0	64.0

From StormCAD Output

Q100 (per barrel) (cfs)	Number of Barrels	Pipe Diameter (ft)	Yo Outlet Depth (ft)	Vo Outlet Velocity (ft/s)	TW Tailwater Depth (ft)	Existing Channel Velocity (ft/s)
362	1	7	5.02	12.27	5.02	0.00

Riprap Apron Basin Design

Step 1: Determine TW condition (TW< D/2 or TW > D/2)

TW = 5.02 ft
D/2 = 3.5 ft

Condition: Hi TW TW>D/2

Step 2: Determine the lenghth of Apron, La

for low TW: La = 1.8*Q/D^(3/2)+7*D
for hi TW: La = 3.0*Q/D^(3/2)+7*D

La = 108 ft

Step 3: Determine Basin Width, Wa. Is to be used if there are no defined drainage channel dowstream.

for low TW: Wa = 3*D+La
for hi TW: Wa = 3*D+0.4*La

Wa = 64 ft

Step 4: Size D50

D50 = 0.02*Q^(4/3)/TW/D (no preformed scour hole)

D50 = 6 inches D50 calced is less than 6 inches, use 6 inches.

Thickness = 12 inches (2*D50)

Step 5: Estimate Quantities

Vol. Riprap = 170.00 yd^3 (3*D+Wa)/2*La*T/12/27

Jacobs Civil Inc.

Riprap Apron Design

By: JPF
Date: 10/5/05
Checked:
Jacobs Project No.: W7X74300

Culvert Detail No	Structure Location
83rd Avenue	311+55

Reference: Drainage Design Manual for Maricopa County, Volume 2: January 28, 1996

RESULTS			
D50 (in)	T (in)	La	Wa
6	12	160.0	85.0

TOO LARGE, USE STILLING BASIN

From StormCAD Output

Q100 (per barrel) (cfs)	Number of Barrels	Pipe Diameter (ft)	Yo Outlet Depth (ft)	Vo Outlet Velocity (ft/s)	TW Tailwater Depth (ft)	Existing Channel Velocity (ft/s)
683	1	7	6.39	17.75	6.39	0.00

Riprap Apron Basin Design

Step 1: Determine TW condition (TW< D/2 or TW > D/2)

TW = 6.39 ft
D/2 = 3.5 ft

Condition: Hi TW TW>D/2

Step 2: Determine the lenghth of Apron, La

for low TW: La = 1.8*Q/D^(3/2)+7*D
for hi TW: La = 3.0*Q/D^(3/2)+7*D

La = 160 ft

Step 3: Determine Basin Width, Wa. Is to be used if there are no defined drainage channel dowstream.

for low TW: Wa = 3*D+La
for hi TW: Wa = 3*D+0.4*La

Wa = 85 ft

Step 4: Size D50

D50 = 0.02*Q^(4/3)/TW/D (no preformed scour hole)

D50 = 6 inches D50 calced is less than 6 inches, use 6 inches.

Thickness = 12 inches (2*D50)

Step 5: Estimate Quantities

Vol. Riprap = 314.07 yd^3 (3*D+Wa)/2*La*T/12/27

Jacobs Civil Inc.

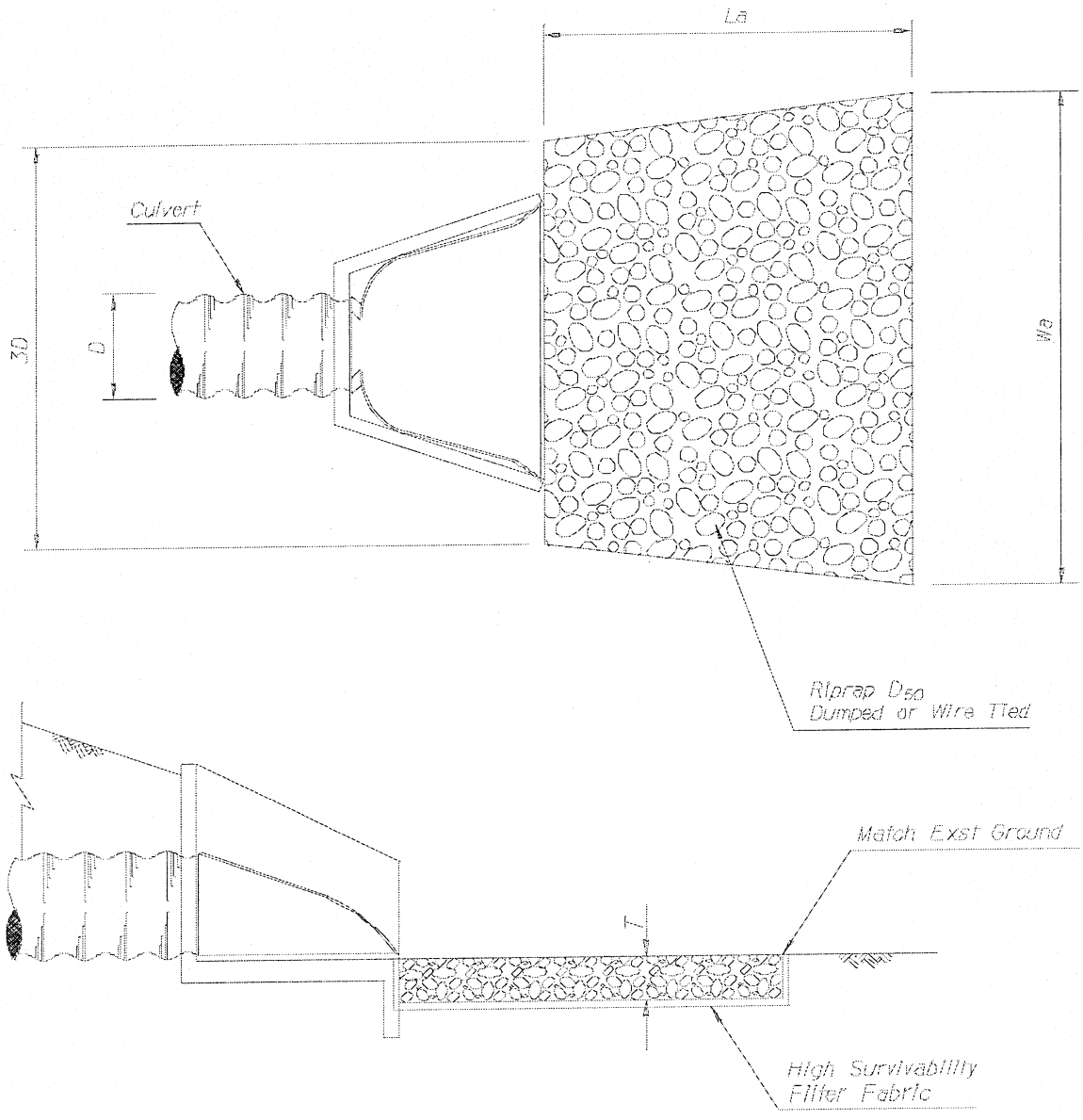
Riprap Apron Design

By: JPF

Date: 10/5/05

Checked:

Jacobs Project No.: W7X74300



Note:

The geometric shape of the apron may be warped to match the existing wash.

Jacobs Civil Inc.

Design of Small Canal Structures

Impact Basin Design

Project:	**83rd Avenue/Pinnacle Peak Road**	By:	**JPF**
Subject:	**87th Avenue Stilling Basin**	Date:	**10/5/2005**
		Checked:	
		Jacobs Project No.:	**W7X74300**

Remarks:

Calculations:

Steps:

Step 1) Compute the theorectical velocity in feet per second, V = (2*g*h)^0.5

G = 32.2 ft/sec^2

Inlet Invert = 1315.5
Outlet Invert = 1314.37
h = 1.13 ft (h= head = Inlet invert - Outlet invert)

Theorectical Velocity = 8.53
Calculated Velocity = 17.75 fps from a computer run of the culvert. HY-8 etc

Step 2) Compute the cross sectional area of the incoming flow.

A = Q/V

Q 683 cfs

Vel. 17.75 fps (theorectical velocity)

Area = 38.48 square feet

Project:	**83rd Avenue/Pinnacle Peak Road**	By:	**JPF**
Subject:	**87th Avenue Stilling Basin**	Date:	**10/5/2005**
		Checked:	
		Jacobs Project No.:	**W7X74300**

Step 3) Compute the depth of flow d, in feet (assume shape of the jet is square)

d = (A)^0.5

d = 6.2031 ft
d = 74.44 inches

Step 4) Compute the Froude number

Fr = V/(G*d)^0.5

Fr = 1.26

Step 5) Enter Figure 6-10 with Fr and read W/d

from Figure 6-10 in the Design of Small Canal structure, Fr and W/d values were read off of the graph. Then a straight line relationship was applied to the data points.

Fr	W/d	log (Fr)	log (W/d)
1.5	3.65	0.1761	0.5623
9	9.98	0.9542	0.9991

(log W/d) = m*(log Fr)+b

m= 0.5614
b= 0.4634

log (W/d)= 0.519
(W/d) = 3.3037
W = 20.493 ft

W (used) = 20.000 (5' minimum)

Project:	**83rd Avenue/Pinnacle Peak Road**	By:	**JPF**
Subject:	**87th Avenue Stilling Basin**	Date:	**10/5/2005**
		Checked:	
		Jacobs Project No.:	**W7X74300**

Step 6) Dimension the impact basin based upon Figure 6-10, "Design of Small Canal Structures."

L =	26.67 ft	4/3*W	= Length of basin
f =	3.33 ft	1/6*W	= Riprap thickness/ Height of sill
e =	1.67 ft	1/12*W	Refer to figure 6-10
H =	15.00 ft	3/4*W	= Height of impact basin
a =	10.00 ft	1/2*W	Refer to figure 6-10
b =	7.50 ft	3/8*W	Refer to figure 6-10
c=	10.00 ft	1/2*W	Refer to figure 6-10

Step 7) Determine rock diameter for protection.

Minimum Diameter of Rock protection =1/20*W

Diameter = 12 inches

Step 8) Design air vent if necessary.

Will both the inlet and the outlet be sealed? yes (yes or no)

Comment:

An air vent is necessary to prevent possible pressure fluctuations and the associated surging of flow in the system. (fr. Page 309).

Diameter of incoming pipe = 84 inches

BR recommended vent pipe D = 14 inches (1/6 of incoming pipe diameter)

Location = 25 ft from inlet (BR recommends that it be "close" to the inlet.

Project:	**83rd Avenue/Pinnacle Peak Road**	By:	**JPF**
Subject:	**87th Avenue Stilling Basin**	Date:	**10/5/2005**
		Checked:	
		Jacobs Project No.:	**W7X74300**

Step 9) Check that tailwater conditions do not degrade impact basin performance significantly

Impact basin does not depend on a tailwater to dissipate the energy of the flow.
However, for best results, the TW should be (b+/2+f) above the invert of the baffled outlet.
The height of the TW above the baffled should never exceed (b+f), otherwise
some of the water will never strike the baffle.

Tw =	6.39	ft	
Min TW for best results =	7.08	ft	(b/2+f)
Max TW =	10.83	ft	(b+f)

Appendix C-4

Detention Basins

83rd Avenue/Pinnacle Peak Road Drainage Improvements
FCDMC Contract No. 2003C060 Project No. 450.02.33
87th Avenue Basin

Elevation		Total (sq ft)	Volume (cu ft)	Volume (ac ft)	H1 (ft)	H2 (ft)	Discharge 1 (cfs)	Discharge 2 (cfs)	Total Discharge (cfs)	Bypass Flows (cfs)	Total Discharge (cfs)
1313	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1314	70,608	70,608	35,304	0.81	0.00	0.23	0.00	12.11	12.11	12.11	0.00
1315	157,478	157,478	149,347	3.43	1.23	1.23	27.85	27.85	55.70	21.57	34.13
1316	169,554	169,554	312,863	7.18	2.23	2.23	37.48	37.48	74.96	21.57	53.39
1317	180,871	180,871	488,076	11.20	3.23	3.23	45.10	45.10	90.19	21.57	68.62
1318	188,761	188,761	672,892	15.45	4.23	4.23	51.60	51.60	103.20	21.57	81.63
1319	196,472	196,472	865,508	19.87	5.23	5.23	57.37	57.37	114.74	21.57	93.17
1320	204,093	204,093	1,065,791	24.47	6.23	6.23	62.61	62.61	125.23	21.57	103.66
1321	211,648	211,648	1,273,661	29.24	7.23	7.23	67.45	67.45	134.90	21.57	113.33

Q = Cd x Ao x (2gh)^0.5
Cd = 0.62 2 Orifices - 1 at Elev 1312.50 and 1 at Elev 1312.50
Orifice Diameter each @ (in) = 30.4
Orifice Area each (sq ft) = Ao = 5.04
h = elevation - center of orifice
center of orifices = 1313.77 and 1313.77
bypass to elev = 0.00 and 1314.51
Revised 10/26/05

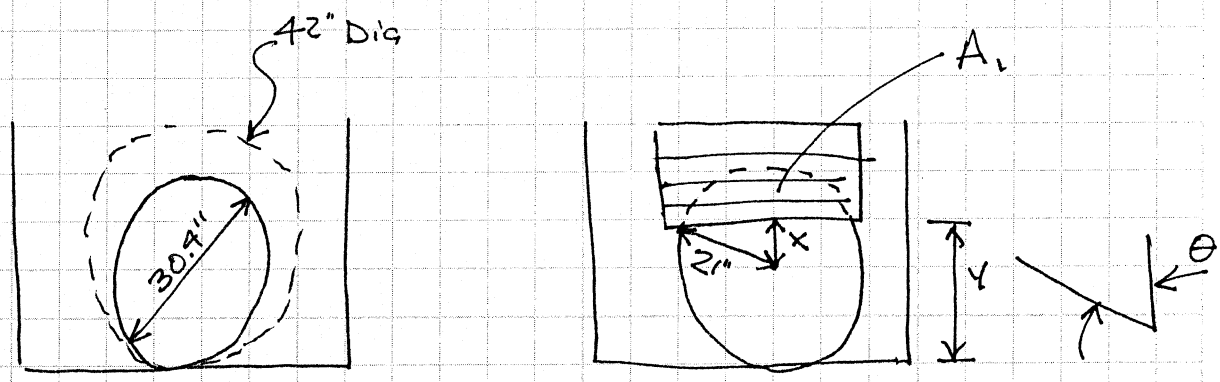
total bypass flow (cfs) = 21.57
bypass flows (cfs) = 0 and 21.57

87TH Avenue Basin

1314–70,608
1315–157,478
1316–169,554
1317–180,871
1318–188,761
1319–196,472
1320–204,093
1321–211,648

JACOBS

Subject 83rd Avenue Project W7X74300
Detention Basin Orifice Sheet No. 2 Of 2
Authored by JPF Date 12/4/05 Checked by _____ Date _____



Area = π x 15.2" x 15.2" = 725.8 sq in

Try X = 9" Cos θ = 9/21 = 0.4286 θ = 64.6231°

Area A_1 = π x 21" x 21" x 2 x 64.6231/360 − (9" x 21") = 497.4 − 189
= 308.4

Open Area = π x 21" x 21" − 308.4 sq in = 1077.0 sq in

Try X = 1" Cos θ = 1/21 = 0.0476 θ = 87.2706°

Area A_1 = π x 21" x 21" x 2 x 87.2706/360 − (1" x 21") = 650.7 sq in

Open Area = 734.7 sq in

Try X = 3/4" Cos θ = 0.75/21 = 0.0357 θ = 87.9533°

Area A_1 = π x 21" x 21" x 2 x 87.9533/360 − (0.75" x 21") = 677.0 − 15.75
= 661.2 sq in

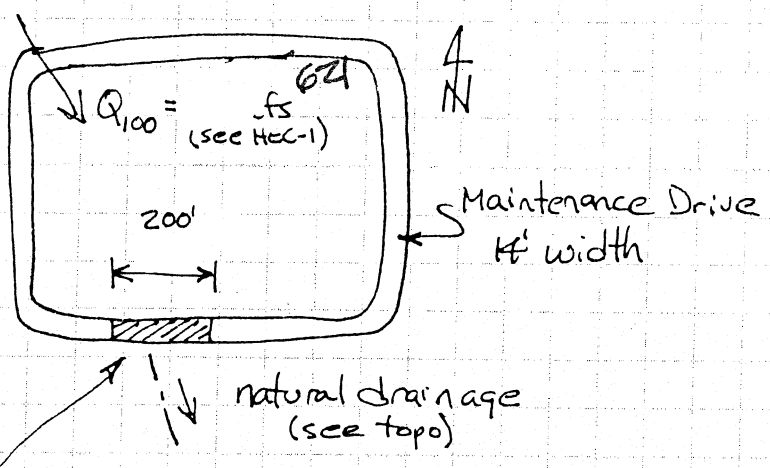
Open Area = 1385.4 sq in − 661.2 sq in = 724.2 sq in OK

Y = 21" + 3/4" = 21 3/4"

JACOBS

Subject 30% Plans Project W7X74300
Basin Emergency Spillway Sheet No. 1 Of 2
Authored by JPF Date 9/15/05 Checked by _____ Date _____

87th Avenue Basin



Emergency Spillway across maintenance drive - broad crested weir flow

$Q = C L H^{3/2}$

Trial #1

$Q = 621$ cfs
$L = 200$ ft
$C = 2.6$ broad crested
H_1 = flow depth (ft)

$621 = 2.6 \times 200 \times H_1^{3/2}$

$H_1^{3/2} = 1.19$ $\quad H_1 = 1.13$ ft

Trial #2

$Q = 683$ cfs
$L = 200$ ft
$C = 2.6$
H_2 = flow depth

$712 = 2.6 \times 200 \times H_2^{3/2}$

$H_2^{3/2} = 1.313$ $\quad H_2 = 1.20$ ft

* Use $H_2 = 1.20$ ft $\quad L = 200'$

83rd Avenue/Pinnacle Peak Road Drainage Improvements
FCDMC Contract No. 2003C060 Project No. 450.02.33
Pinnacle Peak Detention Basin - 4:1 slopes

Elevation		Total (sq ft)	Volume (cu ft)	Volume (ac ft)	H1 (ft)	H2 (ft)	Discharge 1 (cfs)	Discharge 2 (cfs)	Total Discharge (cfs)	Bypass Flows (cfs)	Total Discharge (cfs)
1298	35,628	35,628	17,814	0.41	0.00	0.85	0.00	4.55	4.55	4.55	0.00
1299	99,078	99,078	85,167	1.96	0.00	1.85	0.00	6.72	6.72	6.72	0.00
1300	106,887	106,887	188,150	4.32	0.00	2.85	0.00	8.35	8.35	8.35	0.00
1301	114,872	114,872	299,029	6.86	0.00	3.85	0.00	9.70	9.70	9.70	0.00
1302	123,002	123,002	417,966	9.60	0.00	4.85	0.00	10.89	10.89	9.86	1.03
1303	131,264	131,264	545,099	12.51	0.00	5.85	0.00	11.96	11.96	9.86	2.10
1304	139,655	139,655	680,559	15.62	2.77	6.85	8.23	12.94	21.17	9.86	11.31
1305	148,170	148,170	824,471	18.93	3.77	7.85	9.60	13.85	23.45	9.86	13.59
1306	156,872	156,872	976,992	22.43	4.77	8.85	10.80	14.71	25.51	9.86	15.65
1307	165,674	165,674	1,138,265	26.13	5.77	9.85	11.88	15.52	27.40	9.86	17.54
1308	174,577	174,577	1,308,391	30.04	6.77	10.85	12.87	16.29	29.15	9.86	19.29
1309	183,580	183,580	1,487,469	34.15	7.77	11.85	13.78	17.02	30.81	9.86	20.95
1310	192,684	192,684	1,675,601	38.47	8.77	12.85	14.64	17.73	32.37	9.86	22.51
1311	201,889	201,889	1,872,888	43.00	9.77	13.85	15.46	18.40	33.86	9.86	24.00
1312	211,193	211,193	2,079,429	47.74	10.77	14.85	16.23	19.06	35.29	9.86	25.43
1313	220,599	220,599	2,295,325	52.69	11.77	15.85	16.97	19.69	36.65	9.86	26.79

Q = Cd x Ao x (2gh)^0.5
Cd = 0.62 2 Orifices - 1 at Elev 1300.67 and 1 at Elev 1296.59
Orifice Diameter each @ (in) = 13.5
Orifice Area each (sq ft) = Ao = 0.99
h = elevation - center of orifice
center of orifices = 1301.23 and 1297.15
bypass to elev = 1303.00 and 1297.59
Revised 12/22/05

total bypass flow (cfs) = 9.86
bypass flows (cfs) = 6.58 and 3.28

Pinnacle Peak Basin

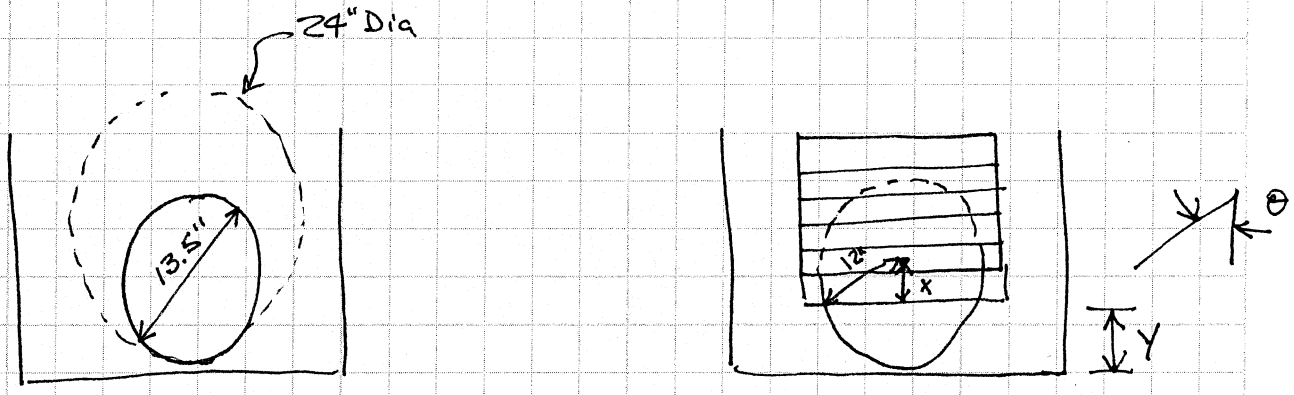
1298–35,628
1299–99,078
1300–106,887
1301–114,872
1302–123,002
1303–131,264
1304–139,655
1305–148,170
1306–156,872
1307–165,674
1308–174,577
1309–183,580
1310–192,684
1311–201,889
1312–211,193
1313–220,599

JACOBS

Subject 83rd Avenue Project W7X74300
Detention Basin Orifice Sheet No. 1 Of 2
Authored by JPF Date 12/14/05 Checked by _____ Date _____

Pinnacle Peak Basin – orifice dia = 13.5"

87th Avenue Basin – orifice dia = 30.4"



Area = $\pi \times 6.25" \times 6.25" =$ 122.7 sq in

Area =

Try X = 3" Cos θ = 3/12 = 0.25 θ = ~~74.930~~ 74.9299°

Area = $\pi \times 12" \times 12" \times 2 \times 74.9299/360$ – (3" x 12") = 152.3 sq in

Try X = 4" Cos θ = 4/12 = 0.333 θ = 70.5288°

Area = $\pi \times 12" \times 12" \times 2 \times 70.5288/360$ – (4" x 12") = 129.3 sq in

Try X = 4.25" Cos θ = 4.25/12 = 0.354 θ = 69.2576°

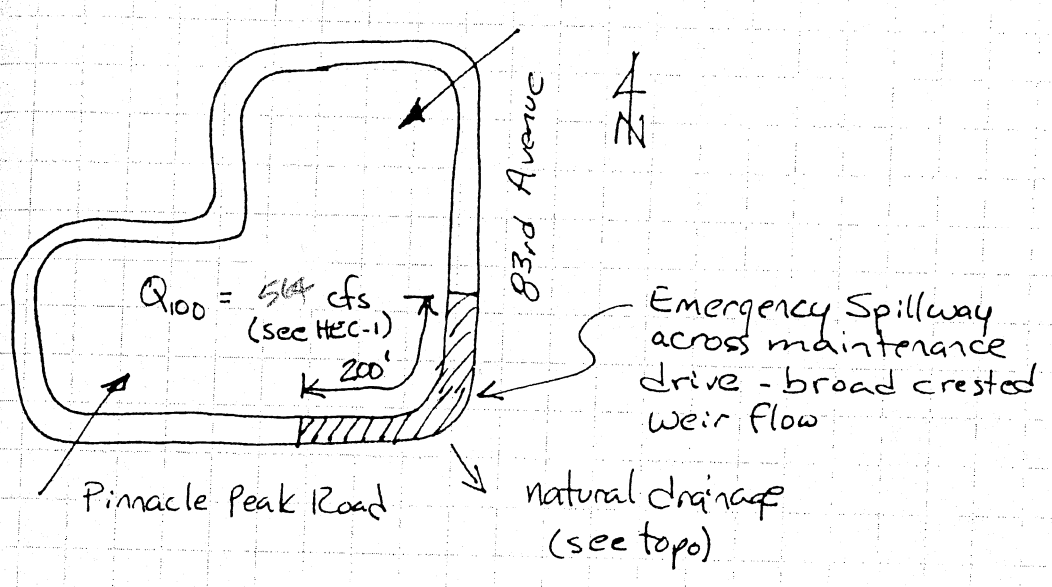
Area = $\pi \times 12" \times 12" \times 2 \times 69.2576/360$ – (4.25" x 12") = 174.1 – 51.0 = 123.1 sq in

Y = 12" – 4.25" = 7 3/4" close enough

JACOBS

Subject 30% Plans Project W7X74300
Basin Emergency Spillway Sheet No. 2 Of 2
Authored by JPF Date 9/15/05 Checked by _____ Date _____

Pinnacle Peak Basin



$Q = CL H^{3/2}$

Q = 514 cfs
L = 200 ft
C = 2.6
H = flow depth (ft)

$514 = 2.6 \times 200 \times H^{3/2}$

$H^{3/2}$ = 1.09

H = 1.06 ft

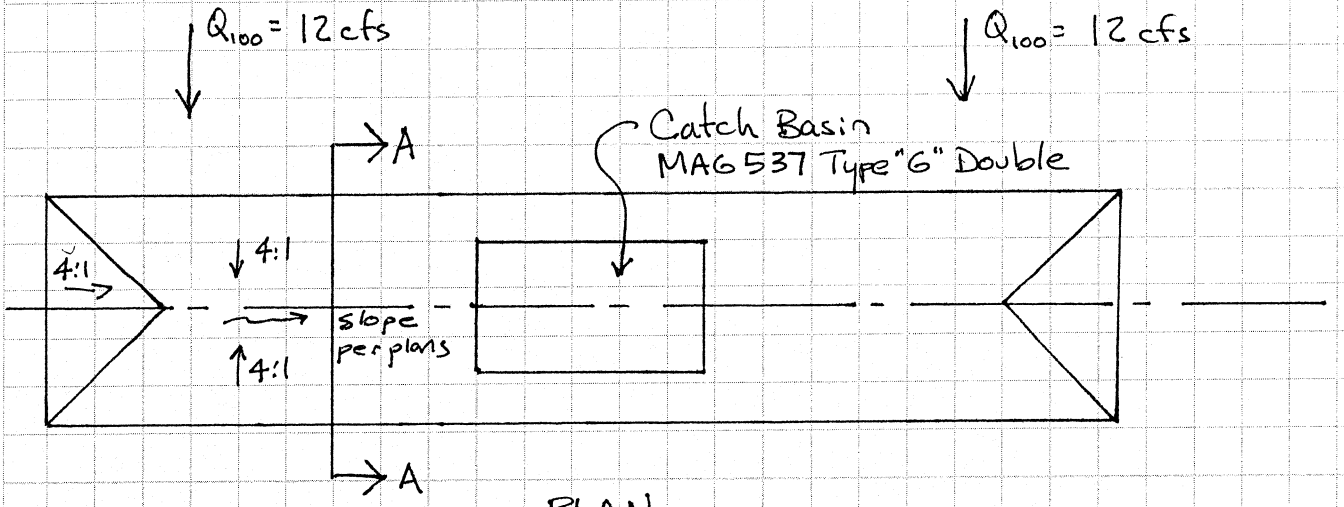
Appendix C-5

V-Ditches

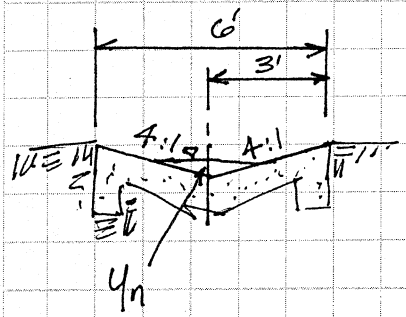
JACOBS

Subject 83rd Ave/Pinnacle Peak Project W7X74300
V-Ditch Design Sheet No. 1 Of 4
Authored by JPF Date 12-8-05 Checked by _____ Date _____

Catch Basins at STA 232+84, 234+60, 236+30, 237+37 and 239+30



PLAN



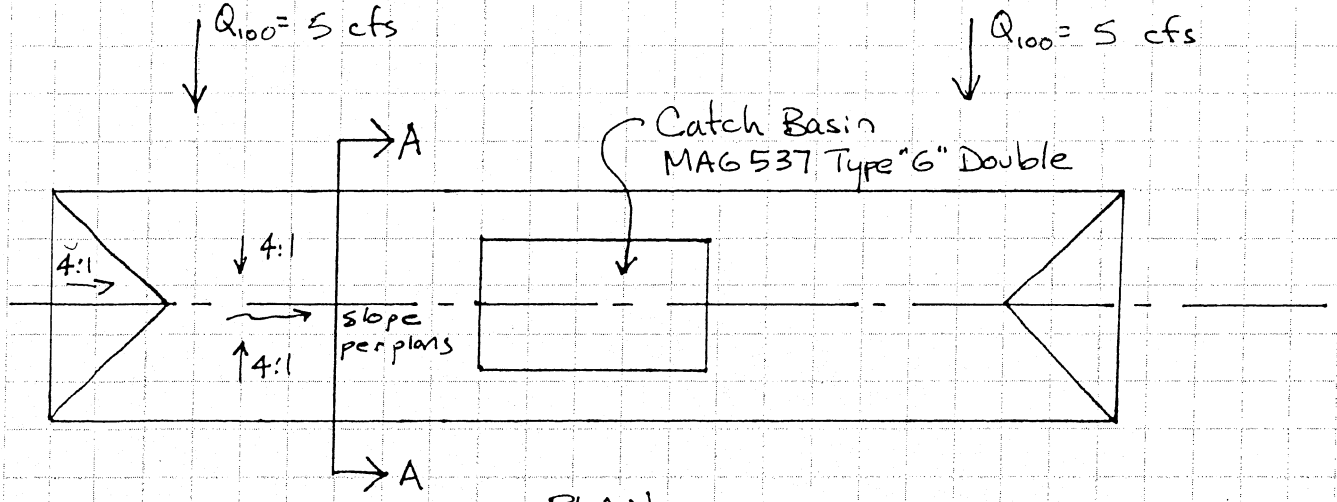
Q_{100} = 12 cfs

$n = 0.013$

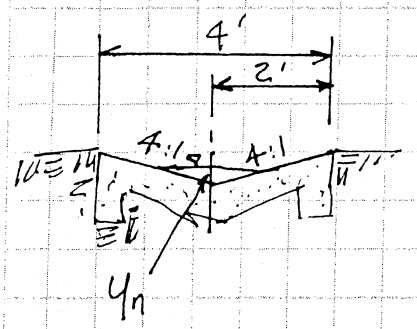
$S = 0.0100$ ft/ft

∴ Using Mannings $y_n = 0.61$ ft OK

Catch Basins at STA 335+07 and 336+36



PLAN



Q_{100} = 5 cfs

$n = 0.013$

$S = 0.0100$ ft/ft

∴ Using Mannings $y_n = 0.44$ ft OK

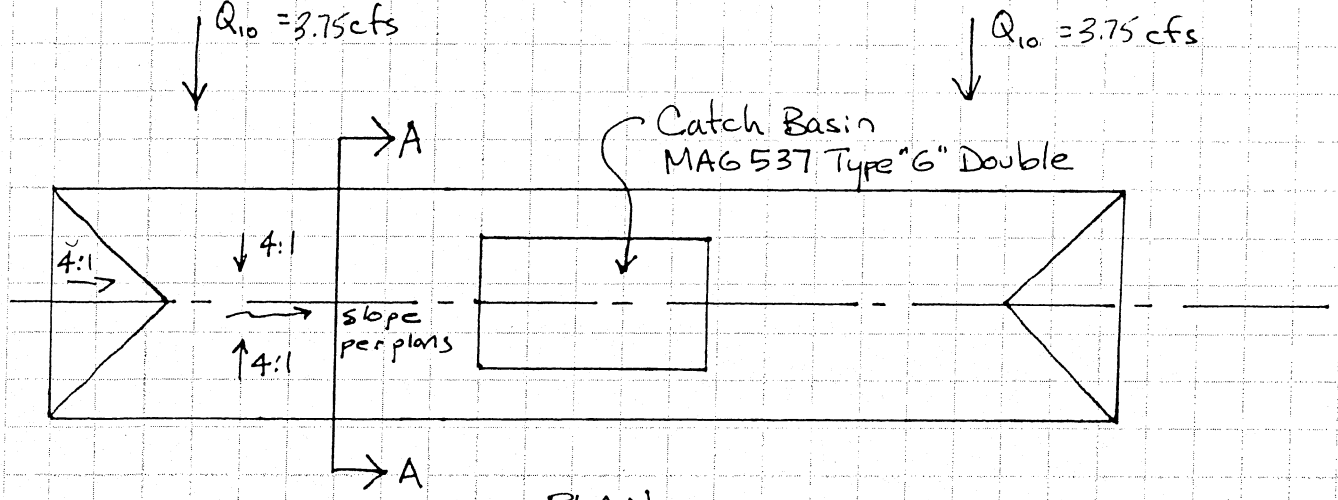
JACOBS

Subject 83rd Ave/Pinnacle Peak Project W7X74300

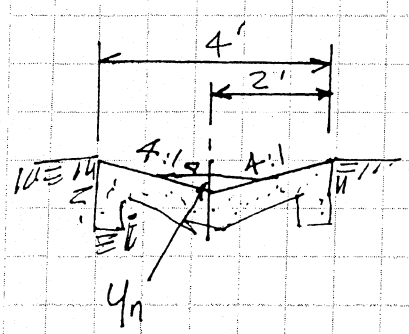
V-Ditch Design Sheet No. 3 Of 4

Authored by JPF Date 12-8-05 Checked by _____ Date _____

Catch Basins at STA 402+00 to 412+35



PLAN



Q_{10} = 3.75 cfs

$n = 0.013$

$S = 0.0150$ ft/ft

∴ Using Mannings $y_n = 0.37$ ft OK

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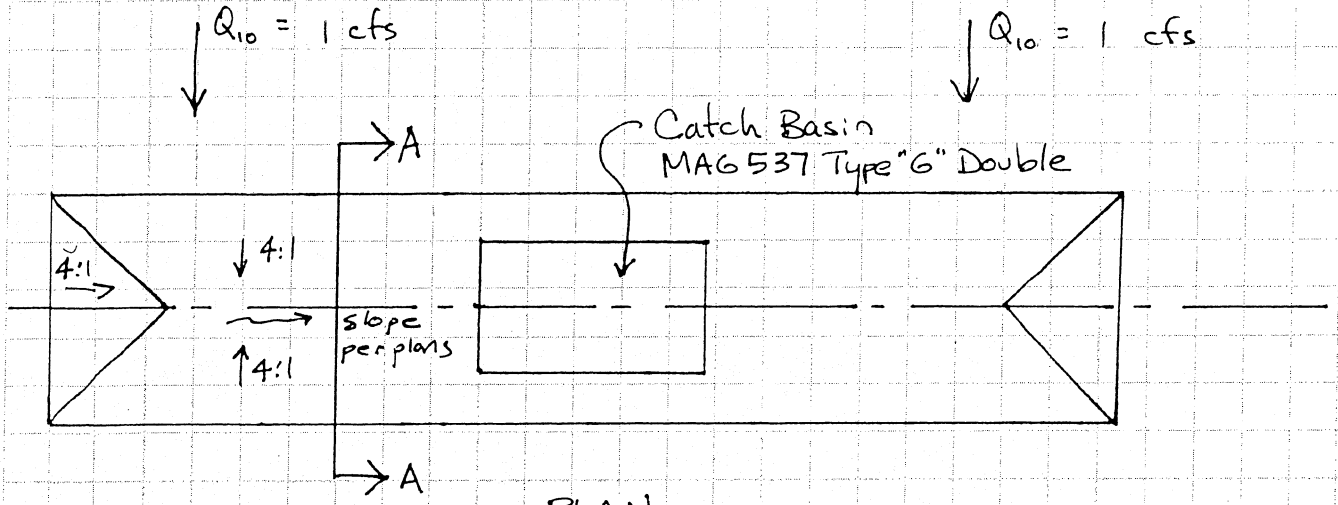
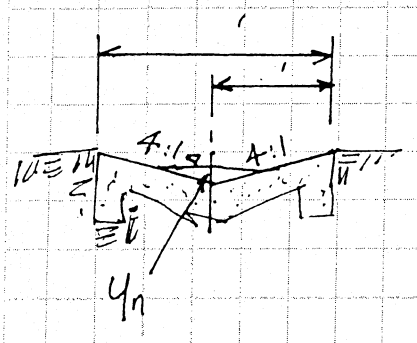
Subject 83rd Ave/Pinnacle Peak Project W7X74300
V-Ditch Design Sheet No. 4 Of 4
Authored by JPF Date 12-8-05 Checked by _____ Date _____

Catch Basins at STA 417+20 to 429+30



PLAN



Q_{10} = 1 cfs

$n = 0.013$

$S = 0.0150$ ft/ft

∴ Using Mannings $y_n = 0.23$ ft OK

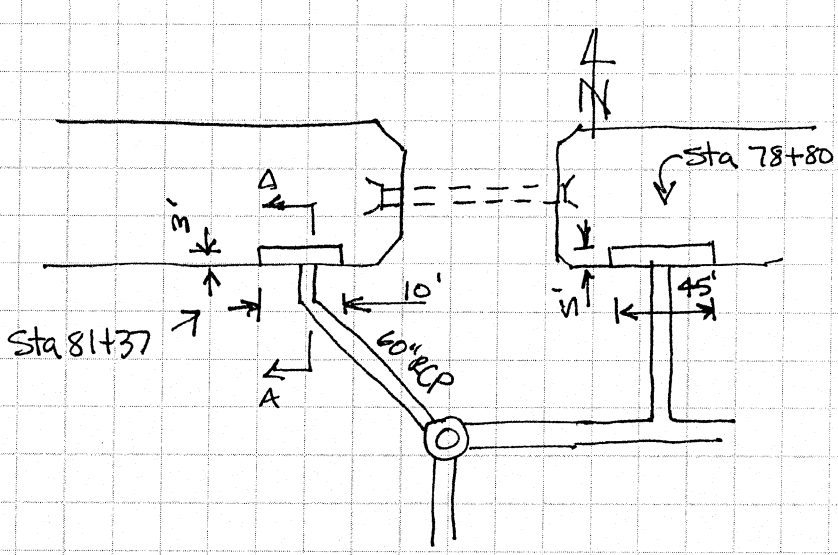
Appendix C-6

Inlet Structures

JACOBS

Subject 83rd Avenue Project W7X74300
Inlet Structures Design Sheet No. 1 Of 2
Authored by JPF Date 12/14/05 Checked by Date

Ventana Picachos Retention Basin - Sta 81+37



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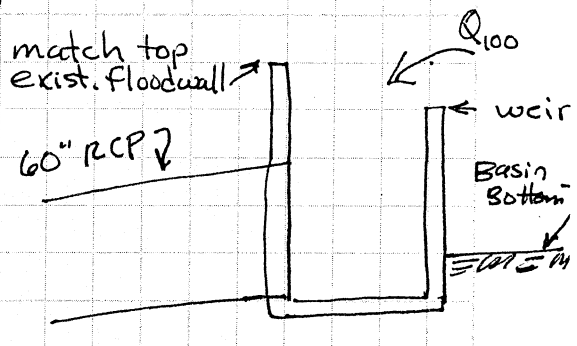

SECTION A-A

Q_{100} = 351 cfs to both inlet structures
Pro rate Q based on Ventana Picachos drainage report Q_s

$Q_{100} = 351 \times (246/550) = 168.5$ cfs

Per Ventana Picachos improvement plans:
Top of floodwall = 1344.93
Bottom of retention basin = 1340.73
Max WSE = 1343.73

Assume weir elevation = Max WSE - 12" = 1342.73
Flow depth over weir = H = 1344.93 - 1342.73 = 2.20'
For sharp crested weir: $Q = 3.3 L H^{3/2}$
Solve for L: $168.5 = 3.3 \times L \times (2.20)^{3/2} \Rightarrow L = 15.6'$ use 16'

Inlet control for 60" RCP, Q = 168.5 cfs HW/D = 1.28 ∴ HW = 6.40'
Set 60" RCP IE so that HW is 12" below weir elev
IE = 1342.73 - 1.0' - 6.40' = 1335.33 max

JACOBS

Subject 83rd Avenue Project W7X74300
Inlet Structures Design Sheet No. 2 Of 2
Authored by JPF Date 12/14/05 Checked by _____ Date _____

Ventana Picachos Retention Basin - Sta 78+80

Q_{100} = 351 cfs - 168.5 cfs = 182.5 cfs

Per Ventana Picachos improvement plans:
Top of floodwall = 1342.93
Bottom of retention basin = 1339.93
Max WSE = 1342.93

Assume weir elevation = Max WSE - 12" = 1341.93
Flow depth over weir = H = 1342.93 - 1341.93 = 1.00'
For sharp crested weir: $Q = 3.3 L H^{3/2}$
Solve for L: $182.5 = 3.3 \times L \times (1.00)^{3/2} \Rightarrow L = 55'$

Inlet control for 60" RCP, Q = 182.5 cfs HW/D = 1.40 ∴ HW = 7.00'
Set 60" RCP IE so that HW is 12" below weir
IE = 1341.93 - 1.0' - 7.0' = 1333.93 max