# 83rd Avenue/Pinnacle Peak Road Drainage Improvements

Prepared for:

## Flood Control District of Maricopa County

## City of Peoria

## Maricopa County Department of Transportation

# Final Drainage Report

FCDMC Contract No. 2003C060
Project Control No. 450.02.33

October, 2005


Prepared by:
Jacobs Civil Inc.
875 West Elliot Road, Suite 201
Tempe, AZ 85284
480.763.8600
Fax 480.763.8601

In Conjunction with:
J2 Engineering and Environmental Design
4649 East Cotton Gin Loop, Suite B2
Phoenix, AZ 85040
602.438.2221
Fax 602.438.2225

# 83rd Avenue/Pinnacle Peak Road Drainage Improvements

**Prepared for:**

## Flood Control District of Maricopa County

## City of Peoria

## Maricopa County Department of Transportation

# Final Drainage Report

**FCDMC Contract No. 2003C060**
**Project Control No. 450.02.33**

**October, 2005**

**Prepared by:**
**Jacobs Civil Inc.**
**875 West Elliot Road, Suite 201**
**Tempe, AZ 85284**
**480.763.8600**
**Fax 480.763.8601**

**In Conjunction with:**
**J2 Engineering and Environmental Design**
**4649 East Cotton Gin Loop, Suite B2**
**Phoenix, AZ 85040**
**602.438.2221**
**Fax 602.438.2225**

# Foreword

This Final Drainage Report has been prepared to summarize and document the drainage analyses and computations required for the 60% 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 60% 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.

# Table of Contents

Section 1
Introduction ..... 1.1
1.1 Project Site ..... 1.1
1.2 Description of Improvements ..... 1.4
1.3 Topographic Survey Data ..... 1.55
1.4 Geotechnical Investigations ..... 1.55
Section 2
Hydrology ..... 2.1
2.1 Topography and Land Use ..... 2.1
2.2 Vegetation and Soils ..... 2.3
2.3 FEMA Floodplains ..... 2.6
2.4 Existing Conditions ..... 2.7
2.5 Hydrologic Analysis of the Proposed Improvements ..... 2.8
Section 3
Hydraulic Design and Calculations ..... 3.11
3.1 Detention Basins ..... 3.2
3.2 Storm Drains ..... 3.5
3.3 Catch Basins ..... 3.6
3.4 Drop Inlets ..... 3.6
3.5 Outlet Protection ..... 3.6

18509
JOHN
PATRICK
FYIE
10/28/06
ARIZONA U.S.A.

LIST OF EXHIBITS

Figure 1-1 Location Map ..... 1.2
Figure 1-2 ADMP Update – Recommended Alternative ..... 1.3
Figure 1-3 Calle Lejos Storm Drain Sta 337+00 to Sta 340+27 ..... 1.5
Figure 1-4 Calle Lejos Storm Drain Sta 332+00 to Sta 337+00 ..... 1.6
Figure 1-5 Calle Lejos Storm Drain Sta 327+00 to Sta 332+00 ..... 1.7
Figure 1-6 87th Avenue Storm Drain Sta 324+00 to Sta 327+00 ..... 1.8
Figure 1-7 87th Avenue Storm Drain Sta 319+00 to Sta 324+00 ..... 1.10
Figure 1-8 87th Avenue Storm Drain Sta 314+00 to Sta 319+00 ..... 1.11
Figure 1-9 87th Avenue Storm Drain Sta 309+00 to Sta 314+00 ..... 1.12
Figure 1-10 Cielo Grande Storm Drain Sta 400+00 to Sta 404+00 ..... 1.13
Figure 1-11 Cielo Grande Storm Drain Sta 404+00 to Sta 409+00 ..... 1.14
Figure 1-12 Cielo Grande Storm Drain Sta 409+00 to Sta 413+00 ..... 1.15
Figure 1-13 89th Avenue Storm Drain Sta 413+00 to Sta 417+00 ..... 1.16
Figure 1-14 Avenida del Sol Storm Drain Sta 417+00 to Sta 422+00 ..... 1.17
Figure 1-15 Avenida del Sol Storm Drain Sta 422+00 to Sta 427+00 ..... 1.18
Figure 1-16 Avenida del Sol Storm Drain Sta 427+00 to Sta 429+91 ..... 1.19
Figure 1-17 87th Avenue Basin ..... 1.22

Figure 1-18 87th Avenue Basin Grading Plan....1.23
Figure 1-19 87th Avenue Storm Drain Sta 304+00 to Sta 309+00....1.25
Figure 1-20 87th Avenue Storm Drain Sta 300+00 to Sta 304+00....1.26
Figure 1-21 Pinnacle Peak Road Storm Drain Sta 200+00 to Sta 204+00....1.28
Figure 1-22 Pinnacle Peak Road Storm Drain Sta 204+00 to Sta 209+00....1.29
Figure 1-23 Pinnacle Peak Road Storm Drain Sta 209+00 to Sta 214+00....1.30
Figure 1-24 Pinnacle Peak Road Storm Drain Sta 214+00 to Sta 219+00....1.31
Figure 1-25 Pinnacle Peak Road Storm Drain Sta 219+00 to Sta 224+00....1.32
Figure 1-26 Pinnacle Peak Road Storm Drain Sta 224+00 to Sta 229+00....1.33
Figure 1-27 Pinnacle Peak Road Storm Drain Sta 229+00 to Sta 234+00....1.34
Figure 1-28 Pinnacle Peak Road Storm Drain Sta 234+00 to Sta 239+00....1.35
Figure 1-29 Pinnacle Peak Road Storm Drain Sta 239+00 to Sta 244+00....1.36
Figure 1-30 Pinnacle Peak Road Storm Drain Sta 244+00 to Sta 249+00....1.37
Figure 1-31 Pinnacle Peak Road Storm Drain Sta 249+00 to Sta 252+52....1.38
Figure 1-32 Pinnacle Peak Basin....1.41
Figure 1-33 Pinnacle Peak Basin Grading Plan....1.42
Figure 1-34 83rd Avenue Storm Drain Sta 141+00 to Sta 143+32....1.44
Figure 1-35 83rd Avenue Storm Drain Sta 136+00 to Sta 141+00....1.45
Figure 1-36 83rd Avenue Storm Drain Sta 131+00 to Sta 136+00....1.46
Figure 1-37 83rd Avenue Storm Drain Sta 126+00 to Sta 131+00....1.47
Figure 1-38 83rd Avenue Storm Drain Sta 121+00 to Sta 126+00....1.49
Figure 1-39 83rd Avenue Storm Drain Sta 116+00 to Sta 121+00....1.50
Figure 1-40 83rd Avenue Storm Drain Sta 111+00 to Sta 116+00....1.51
Figure 1-41 83rd Avenue Storm Drain Sta 106+00 to Sta 111+00....1.52
Figure 1-42 83rd Avenue Storm Drain Sta 101+00 to Sta 106+00....1.53
Figure 1-43 83rd Avenue Storm Drain Sta 99+36 to Sta 101+00....1.54
Figure 2-1 Project Watershed....2.2
Figure 2-2 Site Vegetation....2.3
Figure 2-3 Project Soils....2.5
Figure 2-4 FEMA Panel 04013C1180F....2.6


18509
JOHN
PATRICK
FYIE
10/8/06
ARIZONA, U.S.A.

LIST OF TABLES


Table 1-1 87th Avenue Detention Basin Data....1.21
Table 1-2 Pinnacle Peak Detention Basin Data....1.40
Table 2-1 HEC-1 Summary of Flows....2.10
Table 2-2 Detention Basin Summary....2.10
Table 3-1 Detention Basin Data....3.3
Table 3-2 Detention Basin Stage-Storage/Discharge....3.4


REFERENCES

LIST OF APPENDICES

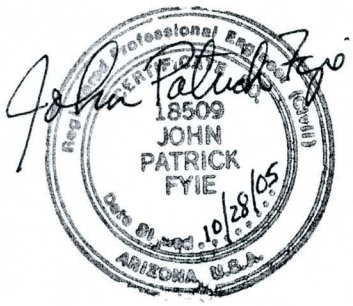
Appendix A HEC-1 Analyses

Appendix B StormCAD Analyses
- B-1 87th Avenue Storm Drain
- B-2 Cielo Grande Storm Drain
- B-3 Pinnacle Peak Road Storm Drain
- B-4 83rd Avenue Storm Drain

Appendix C Design Calculations
- C-1 Catch Basins
- C-2 Drop Inlets
- C-3 Outlet Protection
- C-4 Detention Basins

ATTACHED CD

HEC-1 Input and Output Files
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 – Level 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 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 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 drains along Calle Lejos, 87th Avenue, Avenida del Sol, 89th Avenue, Cielo Grande, Pinnacle Peak Road and 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.

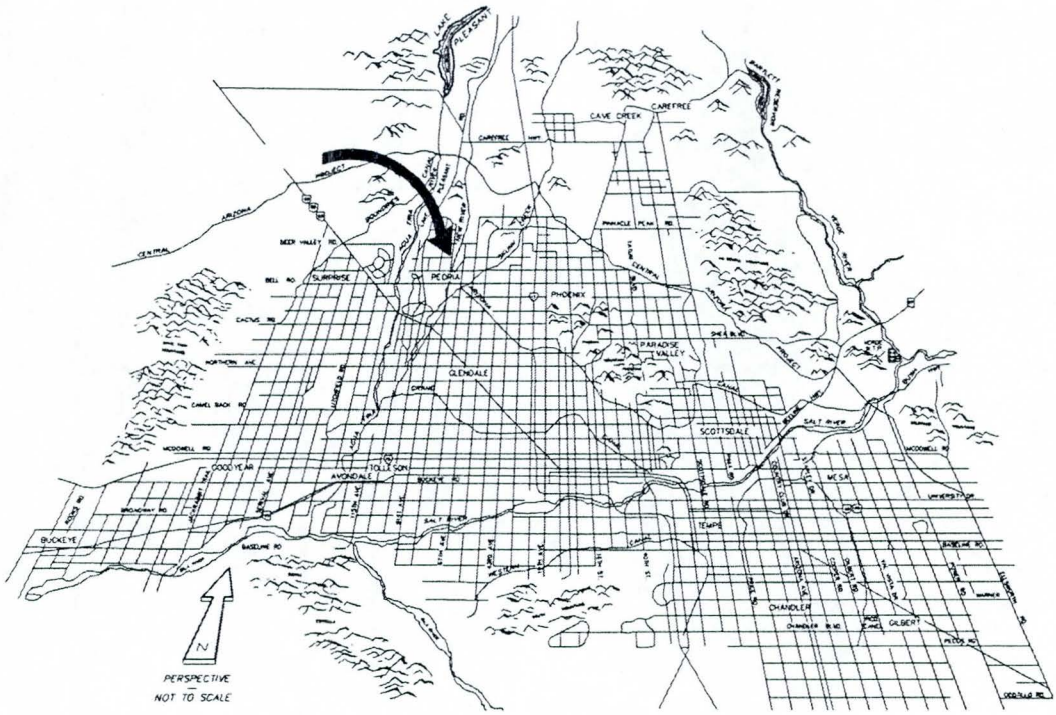



**Figure 1-1**
**Location Map**

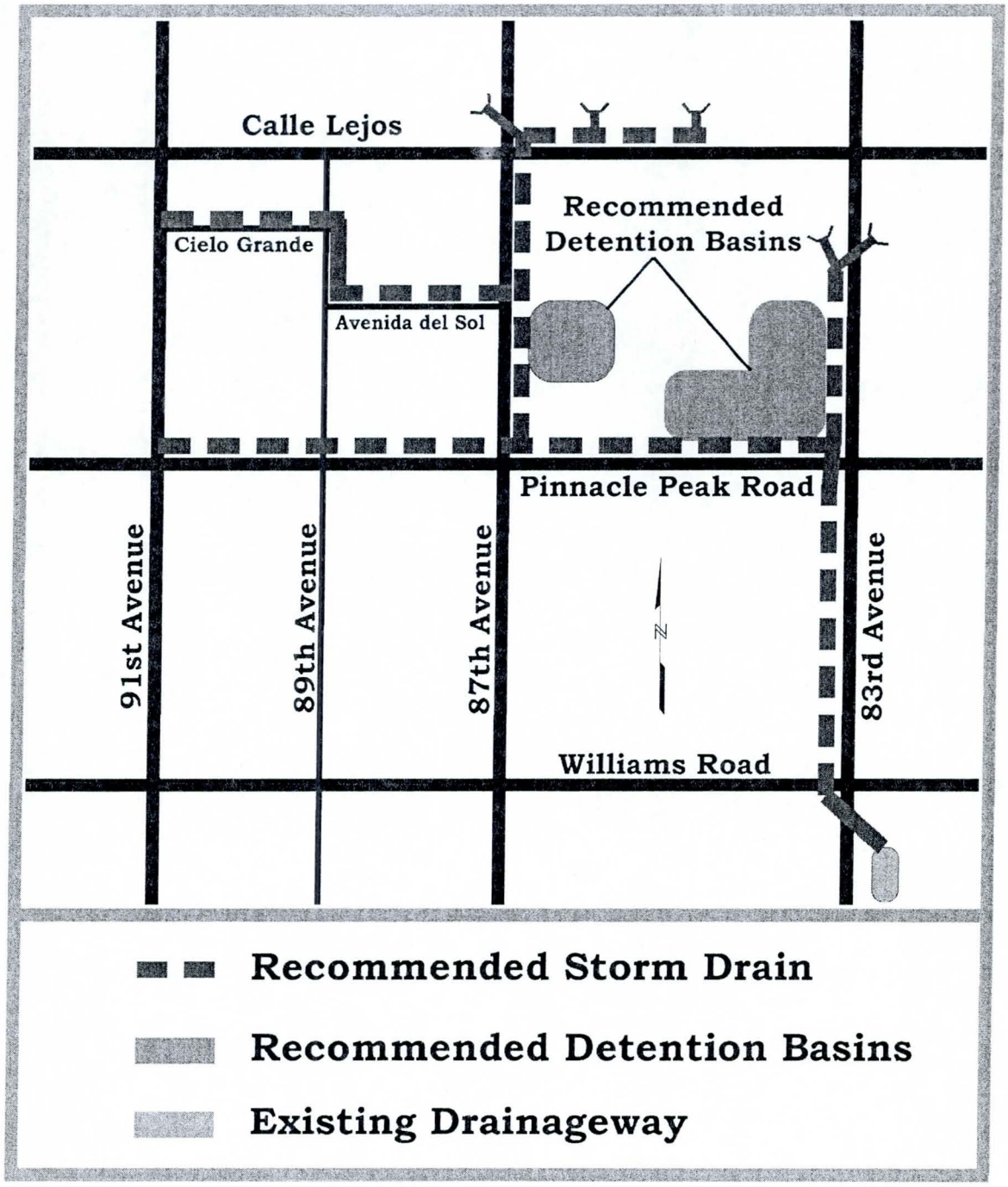



**Figure 1-2**
**ADMP Update – Recommended Alternative**

## 1.2 Description of Improvements

**Calle Lejos Storm Drain (Station 340+27 to Station 326+40)**

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 Summitt at Sunrise. 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). Another wash near Station 336+55 will be collected by a lateral pipe to a drop inlet. The Calle Lejos storm drain will be constructed of 2-48" RCP and 1-72" RCP. Due to the adverse grade along Calle Lejos, the storm drain will become deeper as it nears 87th Avenue. To attain adequate cover for the storm drains, invert elevations are matched at manholes where the pipe changes size. At Station 326+40 the storm drain will be directed south in 87th Avenue. At this location, 60"laterals will be constructed toward the northwest and northeast to intercept excess flows from the retention basins being constructed for the Ventana Picachos development. See Figures 1-3 to 1-6. Design flows were 194 cubic feet per second (cfs) between Station 326+40 and Station 336+55 and 175 cfs from Station 336+55 to Station 340+27. At the manhole to be constructed at the intersection of Calle Lejos and 87th Avenue, 351 cfs will be directed from the Ventana Picachos development.

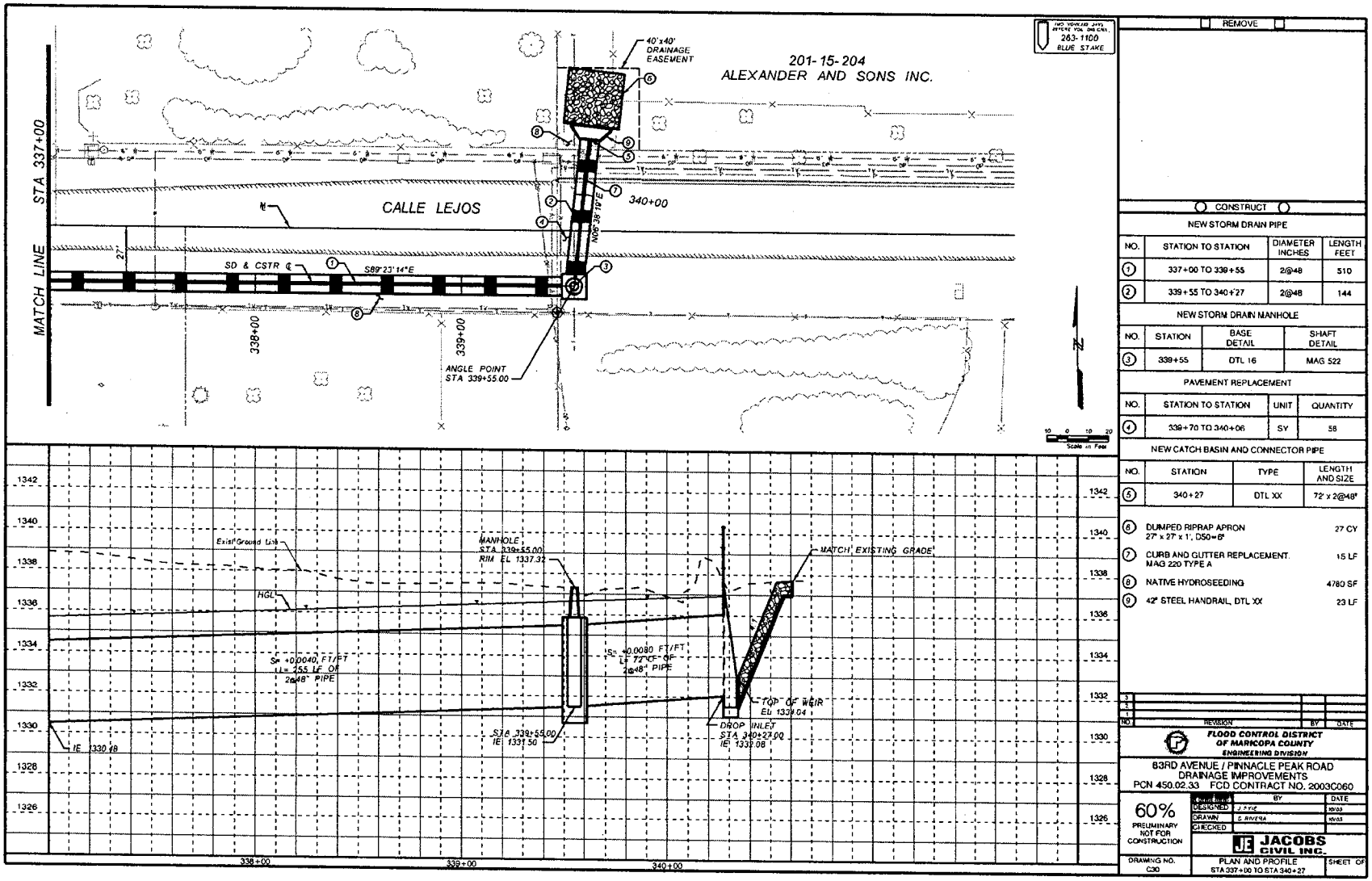
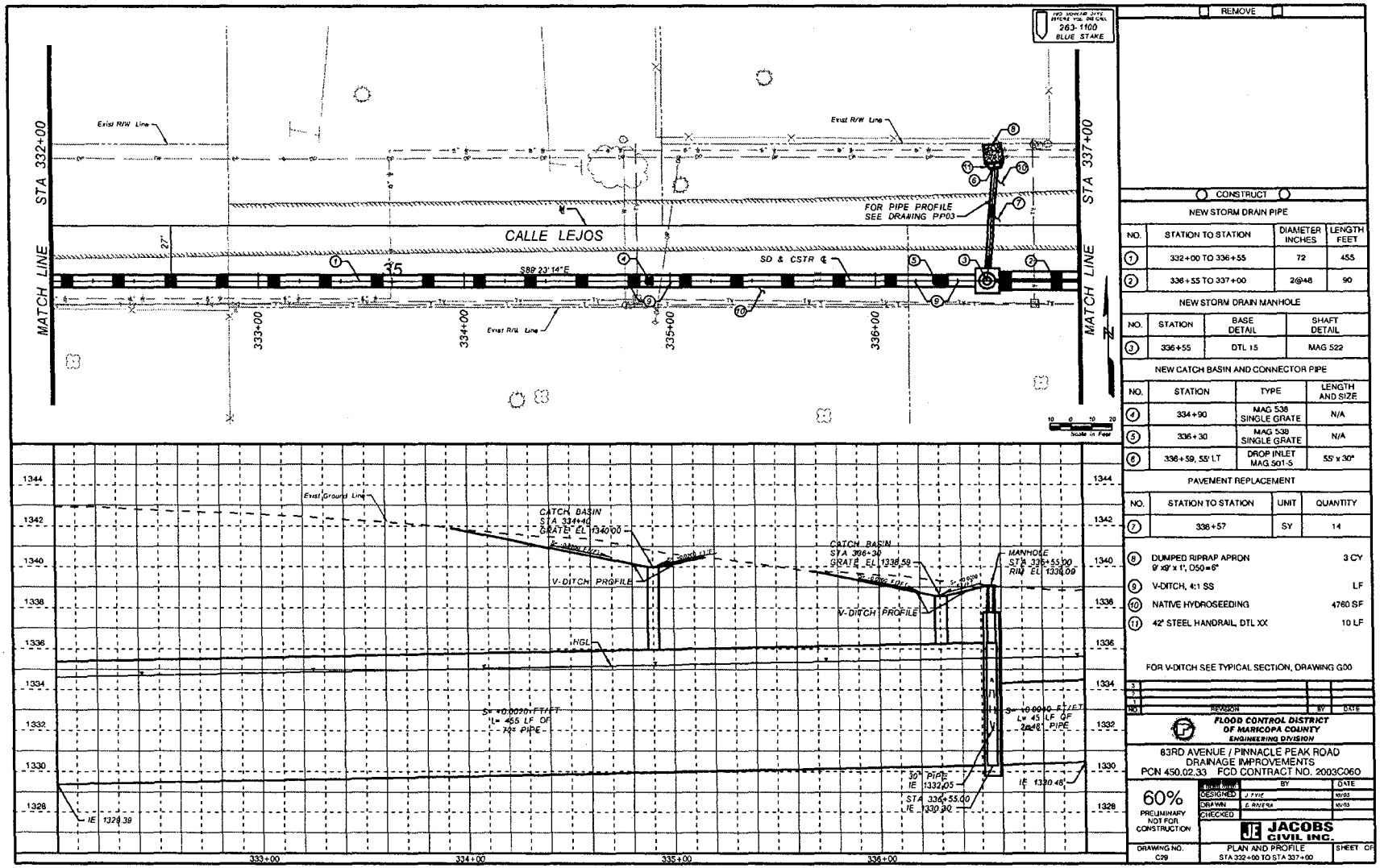

40'x40' DRAINAGE EASEMENT
201-15-204
ALEXANDER AND SONS INC.
263-1100
BLUE STAKE
STA 337+00
MATCH LINE
CALLE LEJOS
SD & CSTR ℄
S89°23'14"E
N00°38'19"E
340+00
338+00
339+00
ANGLE POINT
STA 339+55.00
Scale in Feet
Exist Ground Line
HGL
MANHOLE
STA 339+55.00
RIM EL 1337.32
MATCH EXISTING GRADE
S= +0.0040 FT/FT
L= 255 LF OF
2@48" PIPE
S= +0.0080 FT/FT
L= 77 LF OF
2@48" PIPE
TOP OF WEIR
EL 1334.04
IE 1330.48
STA 339+55.00
IE 1331.50
DROP INLET
STA 340+27.00
IE 1333.08
1342
1340
1338
1336
1334
1332
1330
1328
1326
338+00
339+00
340+00
REMOVE
CONSTRUCT
NEW STORM DRAIN PIPE
NO. | STATION TO STATION | DIAMETER INCHES | LENGTH FEET
1 | 337+00 TO 339+55 | 2@48 | 510
2 | 339+55 TO 340+27 | 2@48 | 144
NEW STORM DRAIN MANHOLE
NO. | STATION | BASE DETAIL | SHAFT DETAIL
3 | 339+55 | DTL 16 | MAG 522
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 XX | 72' x 2@48"
6 DUMPED RIPRAP APRON 27' x 27' x 1', D50=6" 27 CY
7 CURB AND GUTTER REPLACEMENT. MAG 220 TYPE A 15 LF
8 NATIVE HYDROSEEDING 4780 SF
9 42" STEEL HANDRAIL, DTL XX 23 LF
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
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED
DRAWN
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C30
PLAN AND PROFILE
STA 337+00 TO STA 340+27
SHEET OF

Figure 1-3




REMOVE

CONSTRUCT

NEW STORM DRAIN PIPE

| NO. | STATION TO STATION | DIAMETER INCHES | LENGTH FEET |
|---|---|---|---|
| 1 | 332+00 TO 336+55 | 72 | 455 |
| 2 | 336+55 TO 337+00 | 2@48 | 90 |

NEW STORM DRAIN MANHOLE

| NO. | STATION | BASE DETAIL | SHAFT DETAIL |
|---|---|---|---|
| 3 | 336+55 | DTL 15 | MAG 522 |

NEW CATCH BASIN AND CONNECTOR PIPE

| NO. | STATION | TYPE | LENGTH AND SIZE |
|---|---|---|---|
| 4 | 334+90 | MAG 538 SINGLE GRATE | N/A |
| 5 | 336+30 | MAG 538 SINGLE GRATE | N/A |
| 6 | 336+59, 55' LT | DROP INLET MAG 501-S | 55' x 30" |

PAVEMENT REPLACEMENT

| NO. | STATION TO STATION | UNIT | QUANTITY |
|---|---|---|---|
| 7 | 336+57 | SY | 14 |

| | | |
|---|---|---|
| 8 | DUMPED RIPRAP APRON 9' x9' x 1', D50=6" | 3 CY |
| 9 | V-DITCH, 4:1 SS | LF |
| 10 | NATIVE HYDROSEEDING | 4760 SF |
| 11 | 42" STEEL HANDRAIL, DTL XX | 10 LF |

FOR V-DITCH SEE TYPICAL SECTION, DRAWING G00

| 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

60% PRELIMINARY NOT FOR CONSTRUCTION

| DRAWING | BY | DATE |
|---|---|---|
| DESIGNED | J. FYVIE | 10/03 |
| DRAWN | E. RIVERA | 10/03 |
| CHECKED | | |

JACOBS CIVIL INC.

DRAWING NO. C29 — PLAN AND PROFILE STA 332+00 TO STA 337+00 — SHEET OF

**Figure 1-4**

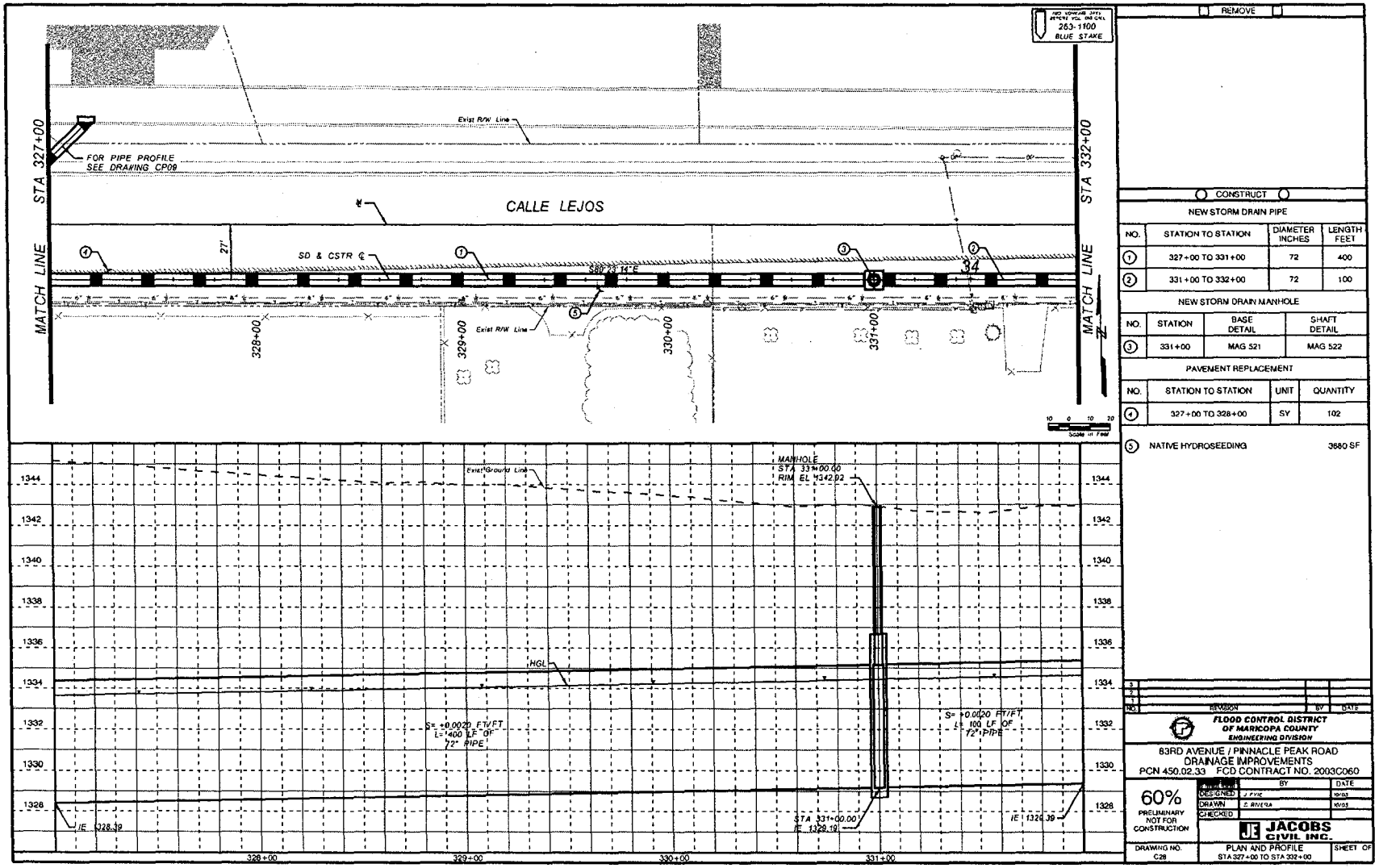

263-1100
BLUE STAKE
STA 327+00
STA 332+00
MATCH LINE
FOR PIPE PROFILE
SEE DRAWING CP09
Exist R/W Line
CALLE LEJOS
SD & CSTR ℄
27'
S89°33'14"E
328+00
329+00
330+00
331+00
Scale in Feet
Exist Ground Line
MANHOLE
STA 331+00.00
RIM EL 1342.92
HGL
S= +0.0020 FT/FT
L= 400 LF OF
72" PIPE
S= +0.0020 FT/FT
L= 100 LF OF
72" PIPE
IE 1328.32
STA 331+00.00
IE 1329.19
IE 1328.39
1344
1342
1340
1338
1336
1334
1332
1330
1328
REMOVE
CONSTRUCT
NEW STORM DRAIN PIPE
NO. | STATION TO STATION | DIAMETER INCHES | LENGTH FEET
1 | 327+00 TO 331+00 | 72 | 400
2 | 331+00 TO 332+00 | 72 | 100
NEW STORM DRAIN MANHOLE
NO. | STATION | BASE DETAIL | SHAFT DETAIL
3 | 331+00 | MAG 521 | MAG 522
PAVEMENT REPLACEMENT
NO. | STATION TO STATION | UNIT | QUANTITY
4 | 327+00 TO 328+00 | SY | 102
5 | NATIVE HYDROSEEDING | | 3680 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
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED J. FYVIE 10/03
DRAWN E. RIVERA 10/03
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C28
PLAN AND PROFILE
STA 327+00 TO STA 332+00
SHEET OF

Figure 1-5

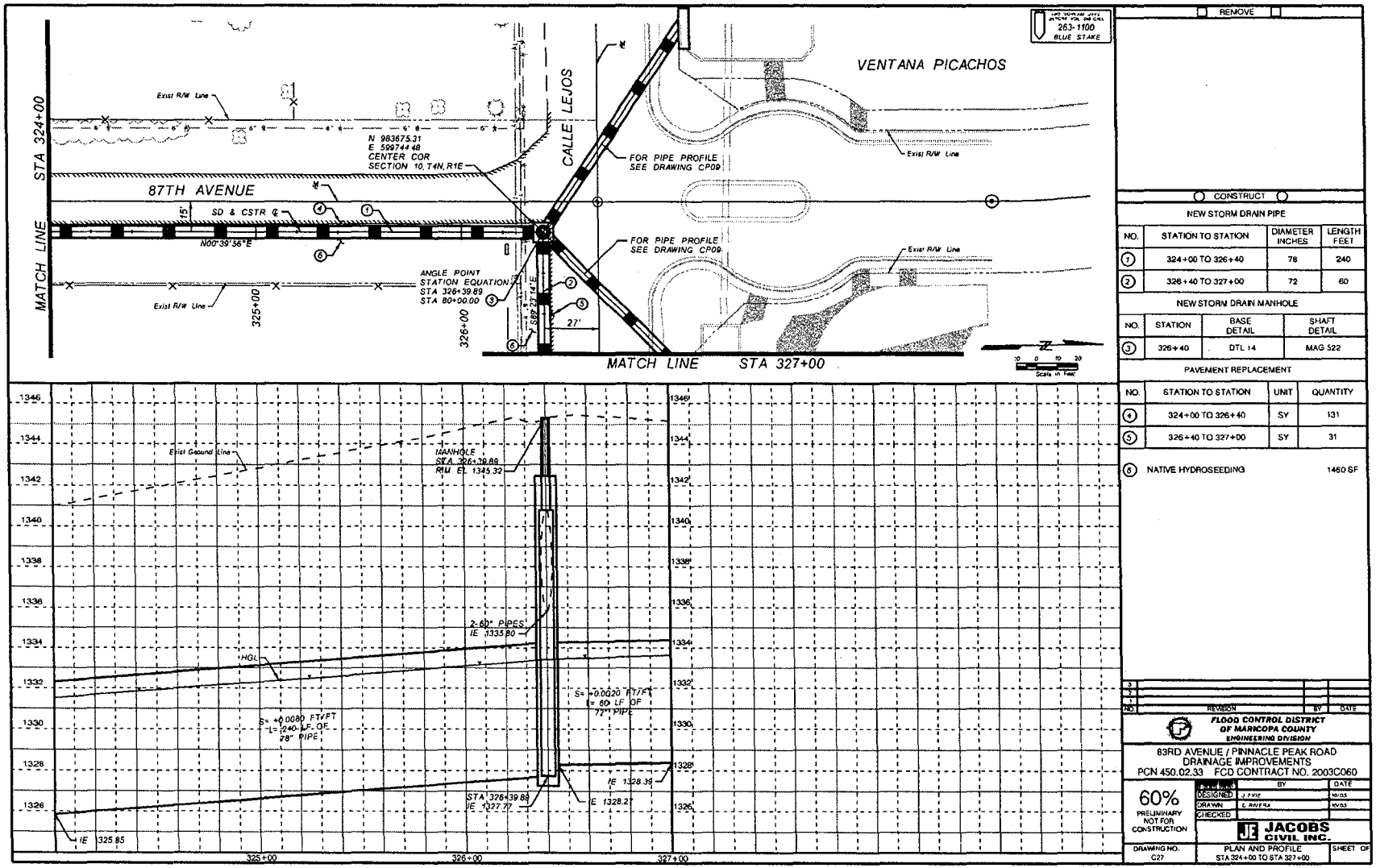

263-1100
BLUE STAKE
VENTANA PICACHOS
CALLE LEJOS
STA 324+00
MATCH LINE
87TH AVENUE
Exist R/W Line
N 983675.31
E 599744.48
CENTER COR
SECTION 10, T4N, R1E
SD & CSTR ℄
N00°39'56"E
ANGLE POINT
STATION EQUATION
STA 326+39.89
STA 80+00.00
S89°27'14"E
27'
FOR PIPE PROFILE
SEE DRAWING CP09
325+00
326+00
MATCH LINE STA 327+00
Scale in Feet
Exist Ground Line
MANHOLE
STA 326+39.89
RIM EL 1345.32
2-60" PIPES
IE 1335.80
HGL
S= +0.0080 FT/FT
L= 240 LF OF
78" PIPE
S= +0.0020 FT/FT
L= 60 LF OF
72" PIPE
IE 1328.39
STA 326+39.89
IE 1327.77
IE 1328.27
IE 1325.85
1346
1344
1342
1340
1338
1336
1334
1332
1330
1328
1326
325+00
326+00
327+00
REMOVE
CONSTRUCT
NEW STORM DRAIN PIPE
NO. | STATION TO STATION | DIAMETER INCHES | LENGTH FEET
1 | 324+00 TO 326+40 | 78 | 240
2 | 326+40 TO 327+00 | 72 | 60
NEW STORM DRAIN MANHOLE
NO. | STATION | BASE DETAIL | SHAFT DETAIL
3 | 326+40 | DTL 14 | MAG 522
PAVEMENT REPLACEMENT
NO. | STATION TO STATION | UNIT | QUANTITY
4 | 324+00 TO 326+40 | SY | 131
5 | 326+40 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
60%
PRELIMINARY
NOT FOR
CONSTRUCTION
DESIGNED
DRAWN
CHECKED
BY
DATE
JACOBS
CIVIL INC.
DRAWING NO.
C27
PLAN AND PROFILE
STA 324+00 TO STA 327+00
SHEET OF

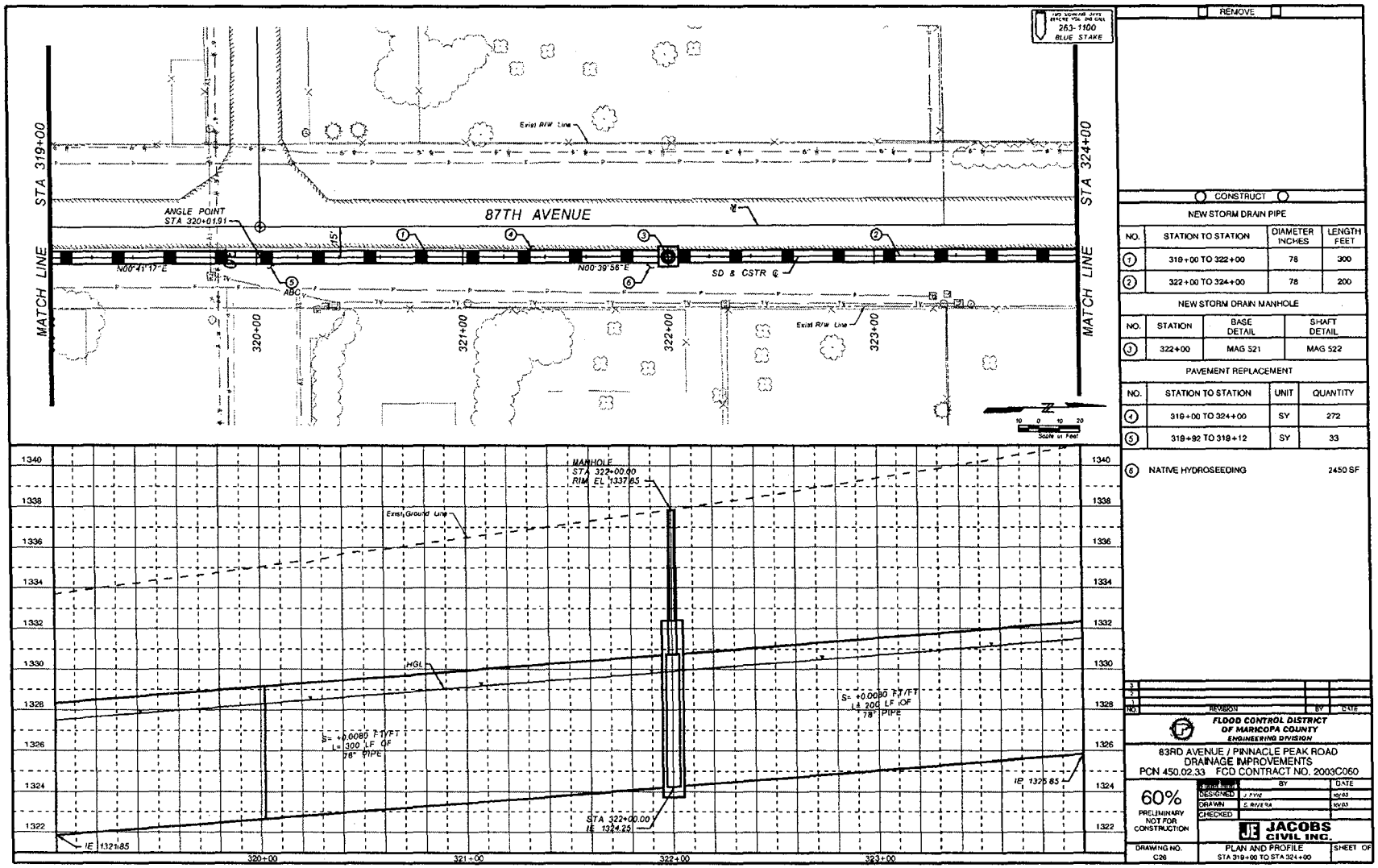
Figure 1-6

**87th Avenue Storm Drain (Station 326+40 to Station 313+52 and Station 60+00 to Station 61+62)**

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 junction structure at 87th Avenue and Avenida del Sol. From this junction structure at Station 60+00 to a manhole at Station 60+37 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. 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 1318.30 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+40 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+00 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 being concentrated in 91st Avenue and a smaller portion in 89th Avenue. Other nuisance flows will be collected in V-ditches along the north sides of Cielo Grande and Avenida del Sol with a series of catch basins to convey the runoff to the Cielo Grande storm drain. At 91st Avenue and 89th Avenue, storm water is primarily in roadside ditches. To intercept these flows, drop inlets will be provided. Again to maximize cover for the pipes the invert elevations were matched at the manhole where the pipe changes size. Design flows vary from 72 cfs to 246 cfs. See Figures 1-10 to 1-16.




REMOVE

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

| NO. | REVISION | BY | DATE |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

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

60% PRELIMINARY NOT FOR CONSTRUCTION

| | BY | DATE |
|---|---|---|
| DESIGNED | J. RYNE | 10/03 |
| DRAWN | C. RIVERA | 10/03 |
| CHECKED | | |

JACOBS CIVIL INC.

DRAWING NO. C26 — PLAN AND PROFILE STA 319+00 TO STA 324+00 — SHEET OF

**Figure 1-7**

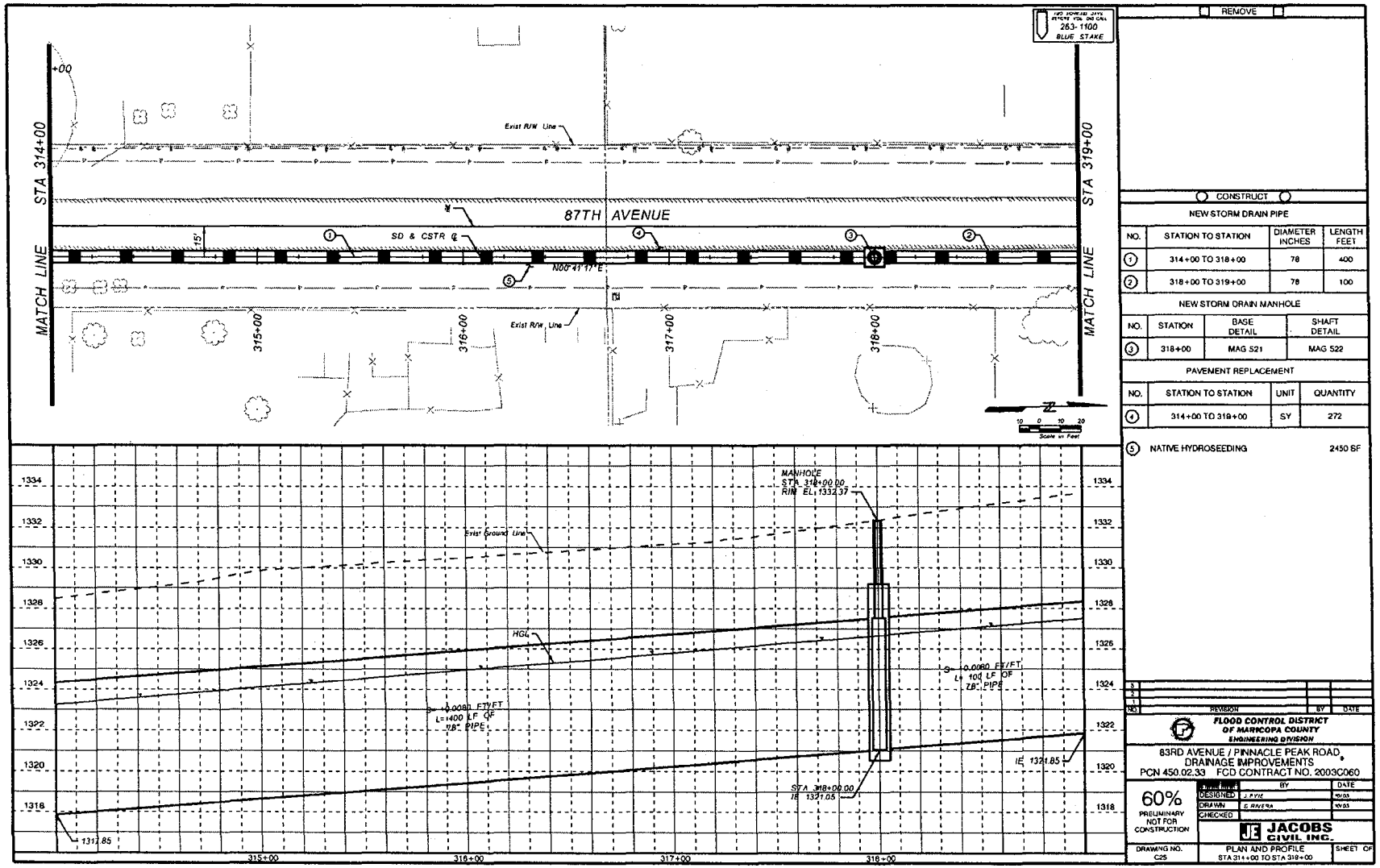

263-1100
BLUE STAKE
STA 314+00
STA 319+00
MATCH LINE
87TH AVENUE
Exist R/W Line
SD & CSTR ℄
N00°41'17"E
315+00
316+00
317+00
318+00
Scale in Feet
MANHOLE
STA 318+00.00
RIM EL 1332.37
Exist Ground Line
HGL
S= 0.0080 FT/FT
L=1400 LF OF
18" PIPE
S= 0.0060 FT/FT
L= 100 LF OF
18" PIPE
IE 1321.85
STA 318+00.00
IE 1321.05
1312.85
1334
1332
1330
1328
1326
1324
1322
1320
1318
REMOVE
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 319+00 | SY | 272
5 NATIVE HYDROSEEDING 2450 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
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED J. PYLE
DRAWN E. RIVERA
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C25
PLAN AND PROFILE
STA 314+00 TO STA 319+00
SHEET OF

Figure 1-8

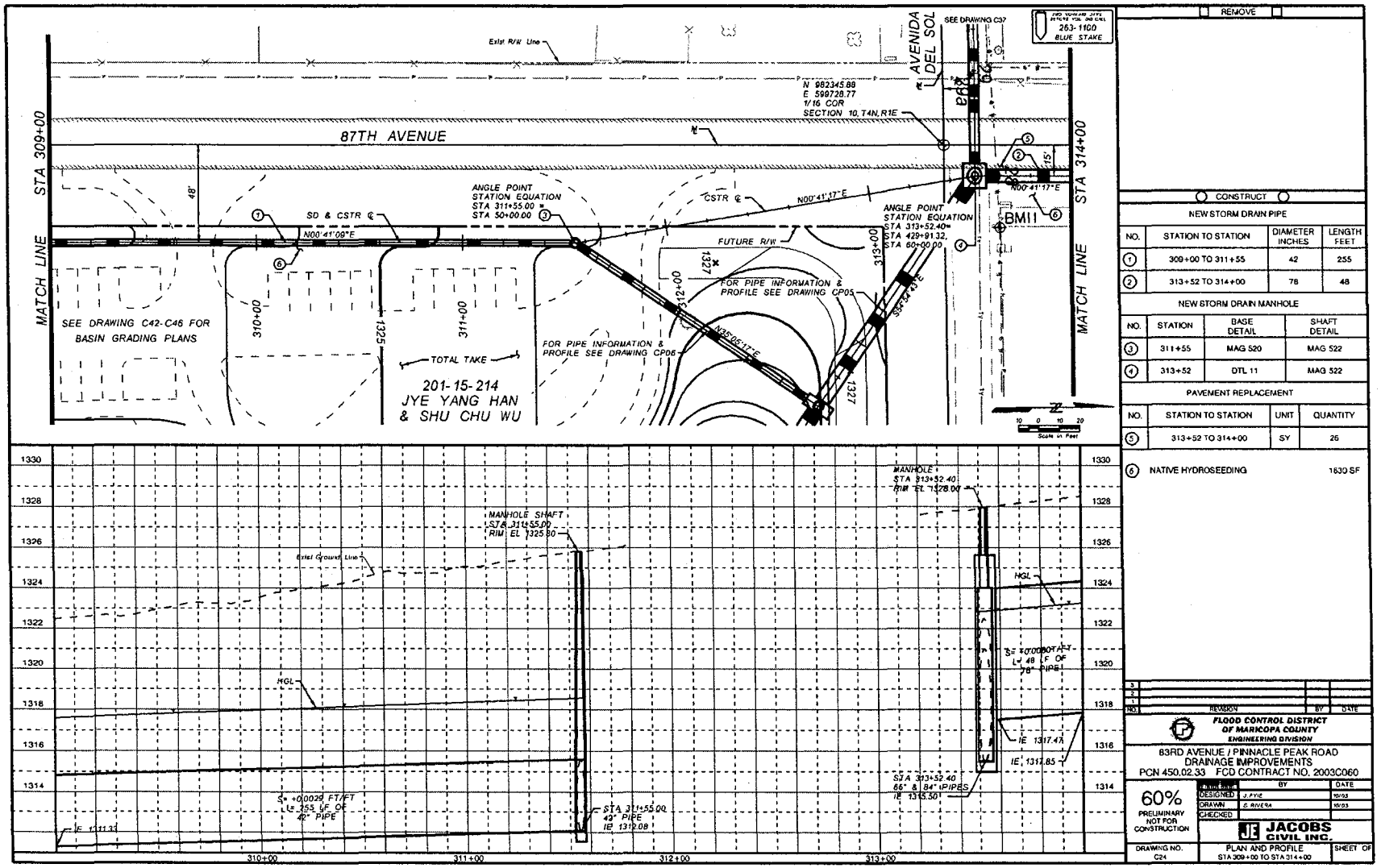

87TH AVENUE
STA 309+00
STA 314+00
MATCH LINE
AVENIDA DEL SOL
SEE DRAWING C37
263-1100 BLUE STAKE
N 982345.88
E 599726.77
1/16 COR
SECTION 10, T4N, R1E
ANGLE POINT
STATION EQUATION
STA 311+55.00 =
STA 30+00.00
SD & CSTR ℄
N00°41'09"E
CSTR ℄
N00°41'17"E
ANGLE POINT
STATION EQUATION
STA 313+52.40=
STA 429+91.32,
STA 60+00.00
BM11
FUTURE R/W
FOR PIPE INFORMATION & PROFILE SEE DRAWING CP05
FOR PIPE INFORMATION & PROFILE SEE DRAWING CP06
SEE DRAWING C42-C46 FOR BASIN GRADING PLANS
TOTAL TAKE
201-15-214
JYE YANG HAN
& SHU CHU WU
MANHOLE SHAFT
STA 311+55.00
RIM EL 1325.80
MANHOLE
STA 313+52.40
RIM EL 1328.00
HGL
S= +0.0029 FT/FT
L= 253 LF OF
42" PIPE
STA 311+55.00
42" PIPE
IE 1312.08
IE 1311.33
STA 313+52.40
66" & 84" PIPES
IE 1315.50
IE 1317.47
IE 1317.85
S= +0.0030 FT/FT
L= 48 LF OF
78" PIPE
310+00
311+00
312+00
313+00
REMOVE
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 | 26
6 | NATIVE HYDROSEEDING | | 1630 SF
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION
83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED J. FYIE
DRAWN S. RIVERA
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C24
PLAN AND PROFILE
STA 309+00 TO STA 314+00
SHEET OF

Figure 1-9

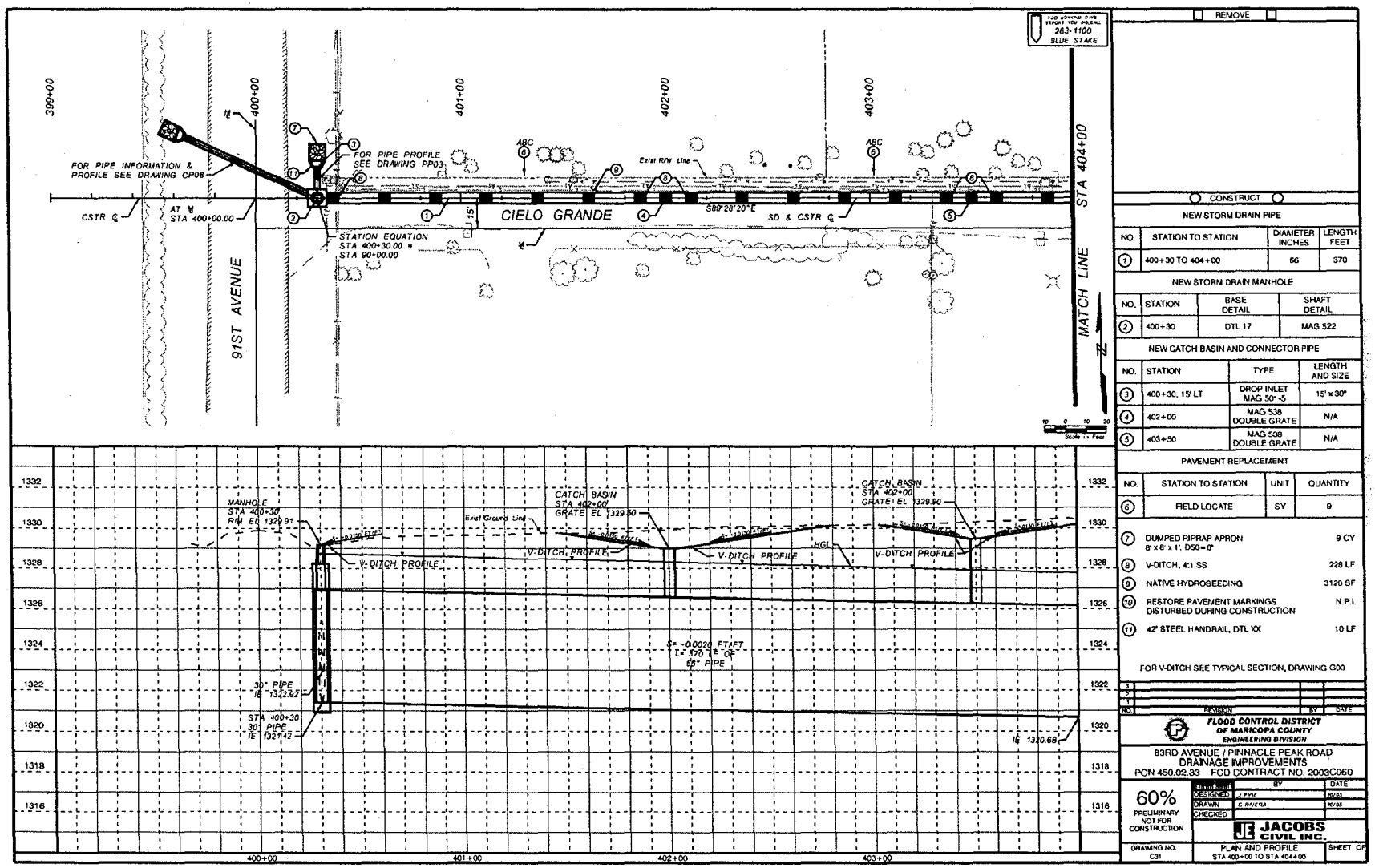
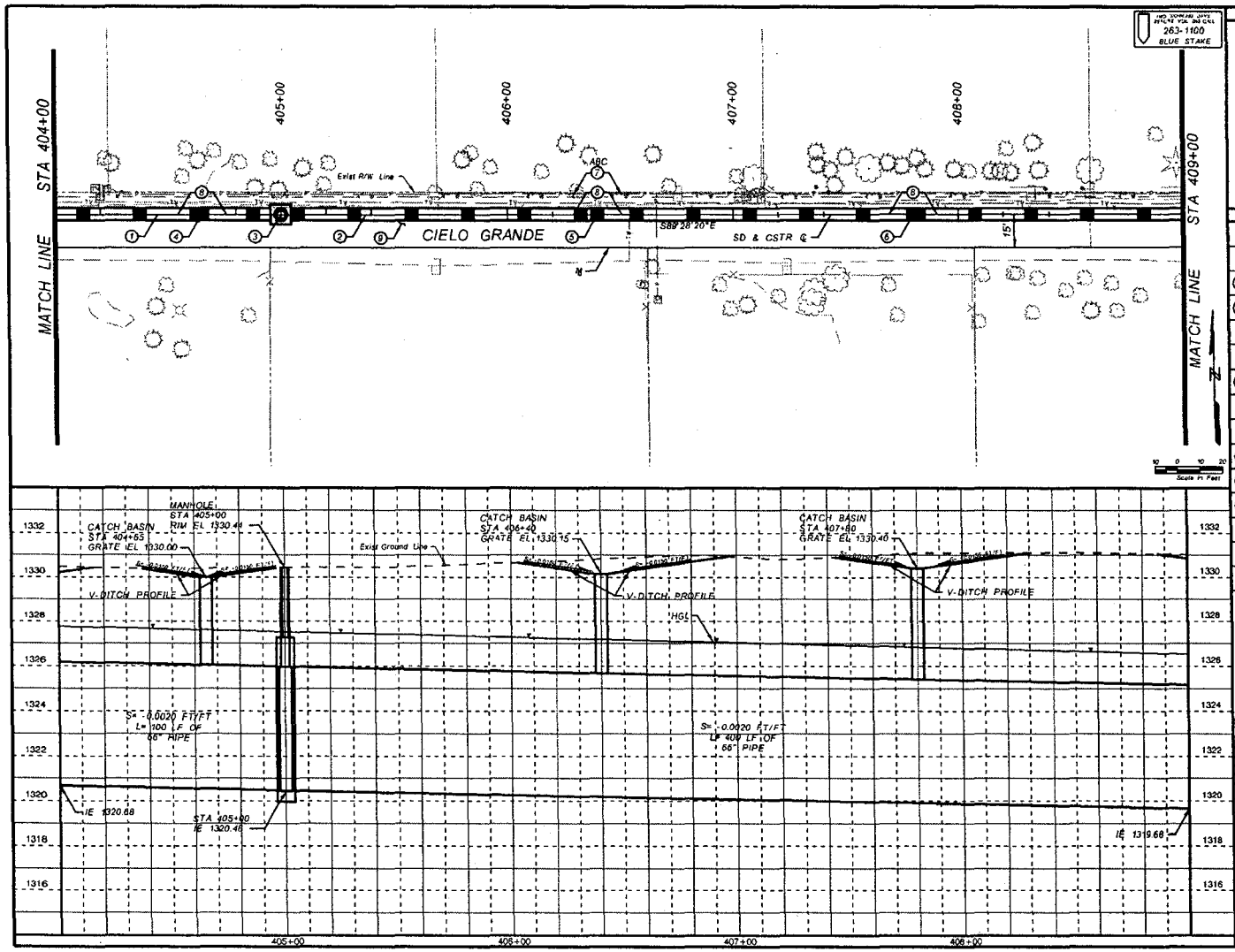

263-1100
BLUE STAKE
399+00
400+00
401+00
402+00
403+00
STA 404+00
FOR PIPE INFORMATION & PROFILE SEE DRAWING CP08
FOR PIPE PROFILE SEE DRAWING PP03
CSTR ℄
AT ⅊ STA 400+00.00
STATION EQUATION STA 400+30.00 = STA 90+00.00
91ST AVENUE
CIELO GRANDE
Exist R/W Line
S89°28'20"E
SD & CSTR ℄
MATCH LINE
N
Scale in Feet
MANHOLE STA 400+30 R/W EL 1329.91
CATCH BASIN STA 402+00 GRATE EL 1329.50
CATCH BASIN STA 402+00 GRATE EL 1329.90
Exist Ground Line
V-DITCH PROFILE
HGL
S= -.00020 FT/FT
L= 570 L= OF 58" PIPE
30" PIPE IE 1322.02
STA 400+30 30" PIPE IE 1321.42
IE 1320.68
1332
1330
1328
1326
1324
1322
1320
1318
1316
400+00
401+00
402+00
403+00
REMOVE
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 | MAG 522
NEW CATCH BASIN AND CONNECTOR PIPE
NO. | STATION | TYPE | LENGTH AND SIZE
3 | 400+30, 15' LT | DROP INLET MAG 501-5 | 15' x 30"
4 | 402+00 | MAG 538 DOUBLE GRATE | N/A
5 | 403+50 | MAG 538 DOUBLE GRATE | N/A
PAVEMENT REPLACEMENT
NO. | STATION TO STATION | UNIT | QUANTITY
6 | FIELD LOCATE | SY | 9
7 DUMPED RIPRAP APRON 8' x 8' x 1', D50=6" 9 CY
8 V-DITCH, 4:1 SS 228 LF
9 NATIVE HYDROSEEDING 3120 SF
10 RESTORE PAVEMENT MARKINGS DISTURBED DURING CONSTRUCTION N.P.I.
11 42" STEEL HANDRAIL, DTL XX 10 LF
FOR V-DITCH SEE TYPICAL SECTION, DRAWING G00
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
60% PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED | BY | DATE
DRAWN | E. RIVERA | 10/03
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C31
PLAN AND PROFILE STA 400+00 TO STA 404+00
SHEET OF

**Figure 1-10**




REMOVE

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+65 | MAG 538 DOUBLE GRATE | N/A |
| 5 | 406+40 | MAG 538 DOUBLE GRATE | N/A |
| 6 | 407+80 | MAG 538 DOUBLE GRATE | N/A |

PAVEMENT REPLACEMENT

| NO. | STATION TO STATION | UNIT | QUANTITY |
|---|---|---|---|
| 7 | FIELD LOCATE | SY | 66 |

8 V-DITCH, 4:1 SS 245 LF

9 NATIVE HYDROSEEDING 3940 SF

FOR V-DITCH SEE TYPICAL SECTION, DRAWING G00

| 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

60% PRELIMINARY NOT FOR CONSTRUCTION

| | BY | DATE |
|---|---|---|
| DESIGNED | J. KYLE | 10/03 |
| DRAWN | E. RIVERA | 10/03 |
| CHECKED | | |

JACOBS CIVIL INC.

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

**Figure 1-11**

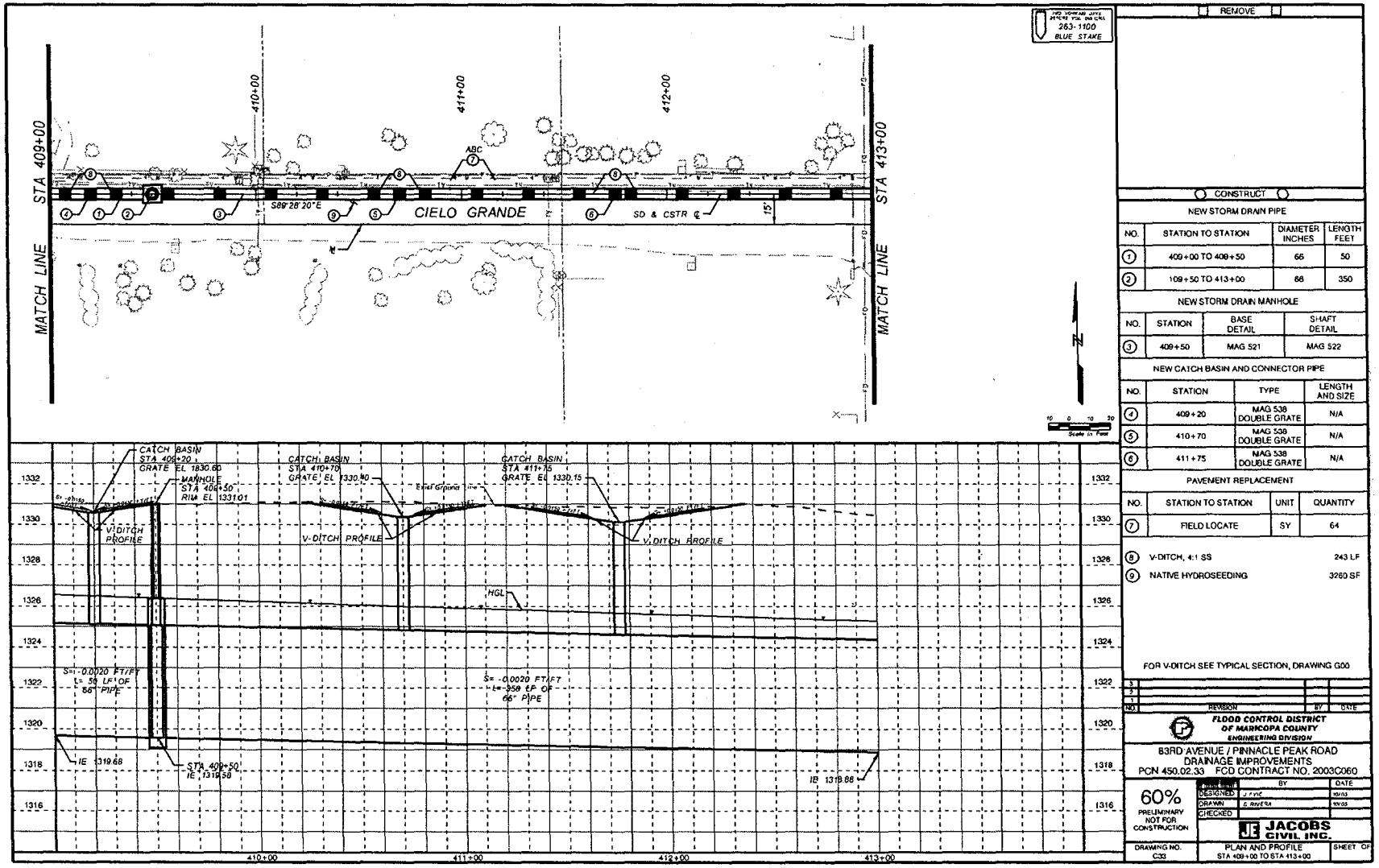
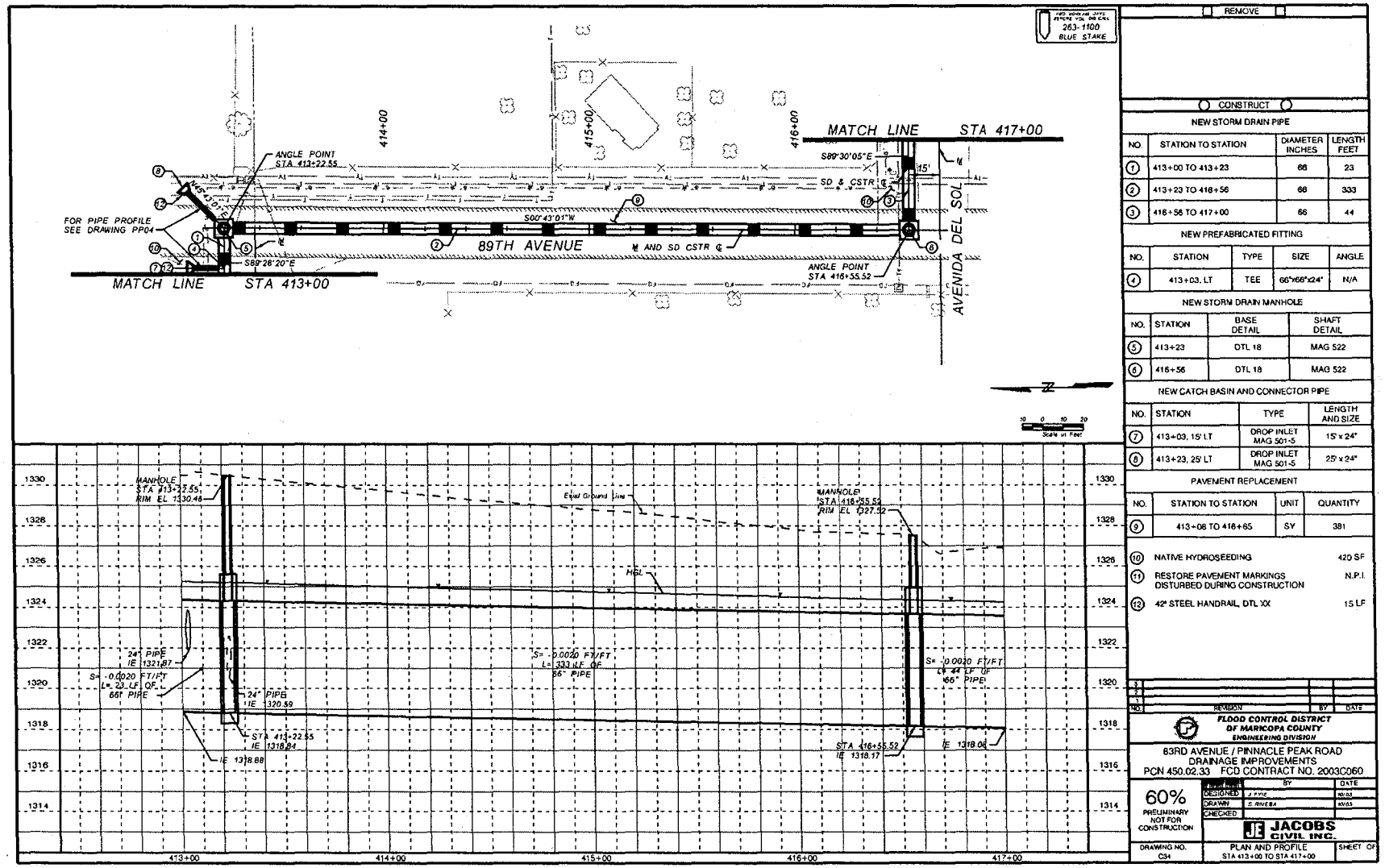

263-1100
BLUE STAKE
STA 409+00
STA 413+00
MATCH LINE
410+00
411+00
412+00
ABC
S89°28'20"E
CIELO GRANDE
SD & CSTR ℄
15'
CATCH BASIN
STA 409+20
GRATE EL 1330.60
MANHOLE
STA 409+50
RIM EL 1331.01
CATCH BASIN
STA 410+70
GRATE EL 1330.40
CATCH BASIN
STA 411+75
GRATE EL 1330.15
V-DITCH PROFILE
HGL
S=-0.0020 FT/FT
L= 56 LF OF
66" PIPE
S= -0.0020 FT/FT
L=350 LF OF
66" PIPE
IE 1319.68
STA 409+50
IE 1319.58
IE 1319.88
1332
1330
1328
1326
1324
1322
1320
1318
1316
410+00
411+00
412+00
413+00
REMOVE
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+20 | MAG 538 DOUBLE GRATE | N/A
5 | 410+70 | MAG 538 DOUBLE GRATE | N/A
6 | 411+75 | MAG 538 DOUBLE GRATE | N/A
PAVEMENT REPLACEMENT
NO. | STATION TO STATION | UNIT | QUANTITY
7 | FIELD LOCATE | SY | 64
8 V-DITCH, 4:1 SS 243 LF
9 NATIVE HYDROSEEDING 3260 SF
FOR V-DITCH SEE TYPICAL SECTION, DRAWING G00
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
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED J. FINE 10/03
DRAWN E. RIVERA 10/03
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C33
PLAN AND PROFILE
STA 409+00 TO STA 413+00
SHEET OF

Figure 1-12




REMOVE

CONSTRUCT

NEW STORM DRAIN PIPE

| NO. | STATION TO STATION | DIAMETER INCHES | LENGTH FEET |
|---|---|---|---|
| 1 | 413+00 TO 413+23 | 66 | 23 |
| 2 | 413+23 TO 416+56 | 66 | 333 |
| 3 | 416+56 TO 417+00 | 66 | 44 |

NEW PREFABRICATED FITTING

| NO. | STATION | TYPE | SIZE | ANGLE |
|---|---|---|---|---|
| 4 | 413+03, LT | TEE | 66"x66"x24" | N/A |

NEW STORM DRAIN MANHOLE

| NO. | STATION | BASE DETAIL | SHAFT DETAIL |
|---|---|---|---|
| 5 | 413+23 | DTL 18 | MAG 522 |
| 6 | 416+56 | DTL 18 | MAG 522 |

NEW CATCH BASIN AND CONNECTOR PIPE

| NO. | STATION | TYPE | LENGTH AND SIZE |
|---|---|---|---|
| 7 | 413+03, 15' LT | DROP INLET MAG 501-S | 15' x 24" |
| 8 | 413+23, 25' LT | DROP INLET MAG 501-S | 25' x 24" |

PAVEMENT REPLACEMENT

| NO. | STATION TO STATION | UNIT | QUANTITY |
|---|---|---|---|
| 9 | 413+08 TO 416+65 | SY | 391 |

| | | |
|---|---|---|
| 10 | NATIVE HYDROSEEDING | 420 SF |
| 11 | RESTORE PAVEMENT MARKINGS DISTURBED DURING CONSTRUCTION | N.P.I. |
| 12 | 42" STEEL HANDRAIL, DTL XX | 15 LF |

| 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

60% PRELIMINARY NOT FOR CONSTRUCTION

| | BY | DATE |
|---|---|---|
| DESIGNED | J. RYCE | 10/03 |
| DRAWN | S. RIVERA | 10/03 |
| CHECKED | | |

JACOBS CIVIL INC.

DRAWING NO. C34 | PLAN AND PROFILE STA 413+00 TO STA 417+00 | SHEET OF

**Figure 1-13**

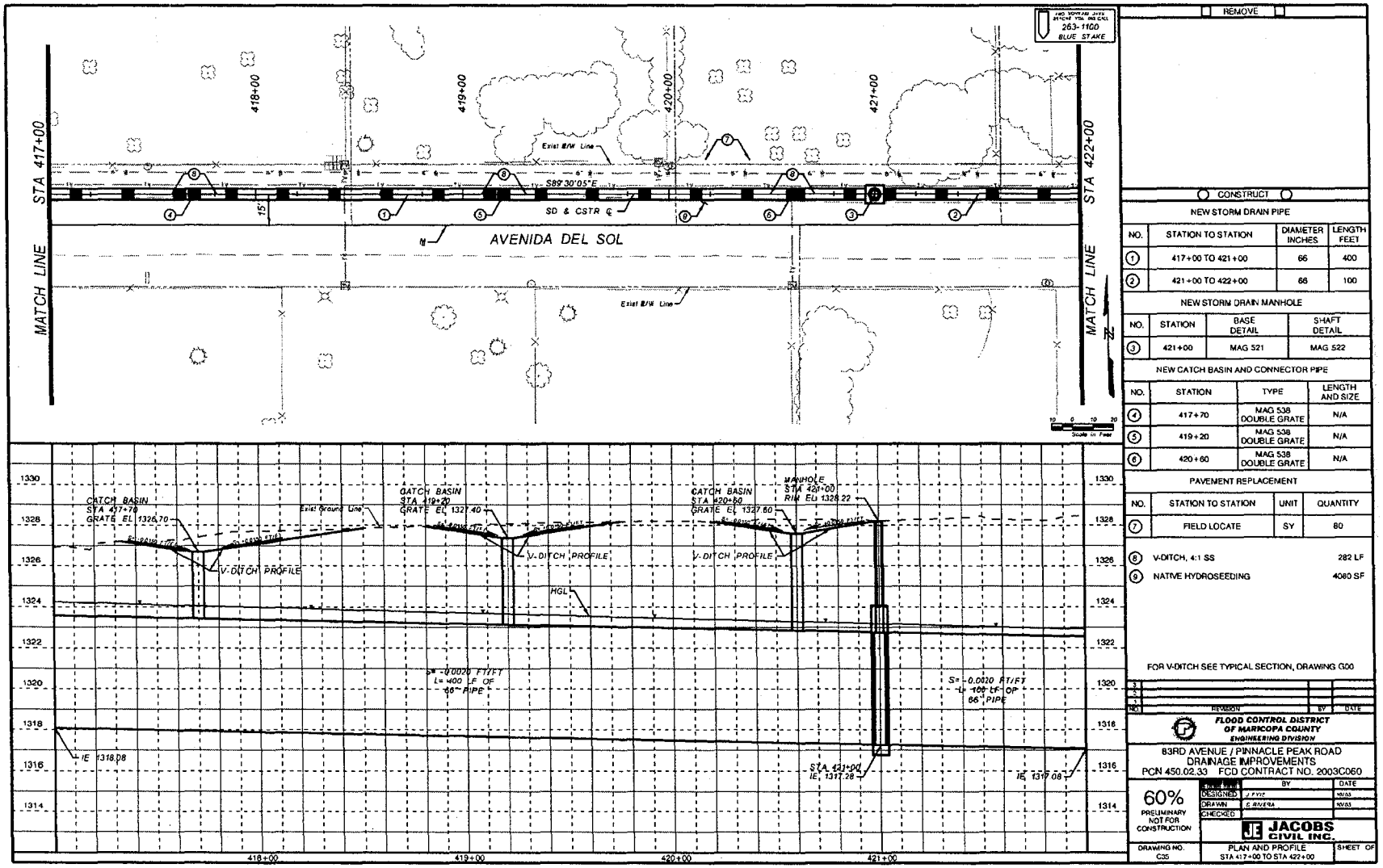

263-1100
BLUE STAKE
STA 417+00
STA 422+00
MATCH LINE
418+00
419+00
420+00
421+00
Exist R/W Line
S89°30'05"E
SD & CSTR ℄
AVENIDA DEL SOL
CATCH BASIN
STA 417+70
GRATE EL 1326.70
Exist Ground Line
CATCH BASIN
STA 419+20
GRATE EL 1327.40
CATCH BASIN
STA 420+60
GRATE EL 1327.60
MANHOLE
STA 421+00
RIM EL 1328.22
V-DITCH PROFILE
HGL
S= -0.0020 FT/FT
L= 400 LF OF
66" PIPE
IE 1318.08
STA 421+00
IE 1317.28
IE 1317.08
REMOVE
CONSTRUCT
NEW STORM DRAIN PIPE
NO. | STATION TO STATION | DIAMETER INCHES | LENGTH FEET
1 | 417+00 TO 421+00 | 66 | 400
2 | 421+00 TO 422+00 | 66 | 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+70 | MAG 538 DOUBLE GRATE | N/A
5 | 419+20 | MAG 538 DOUBLE GRATE | N/A
6 | 420+60 | MAG 538 DOUBLE GRATE | N/A
PAVEMENT REPLACEMENT
NO. | STATION TO STATION | UNIT | QUANTITY
7 | FIELD LOCATE | SY | 80
8 V-DITCH, 4:1 SS 282 LF
9 NATIVE HYDROSEEDING 4080 SF
FOR V-DITCH SEE TYPICAL SECTION, DRAWING G00
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION
83RD AVENUE / PINNACLE PEAK ROAD DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060
60% PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED
DRAWN
CHECKED
JACOBS CIVIL INC.
DRAWING NO. G05
PLAN AND PROFILE
STA 417+00 TO STA 422+00
SHEET OF

**Figure 1-14**

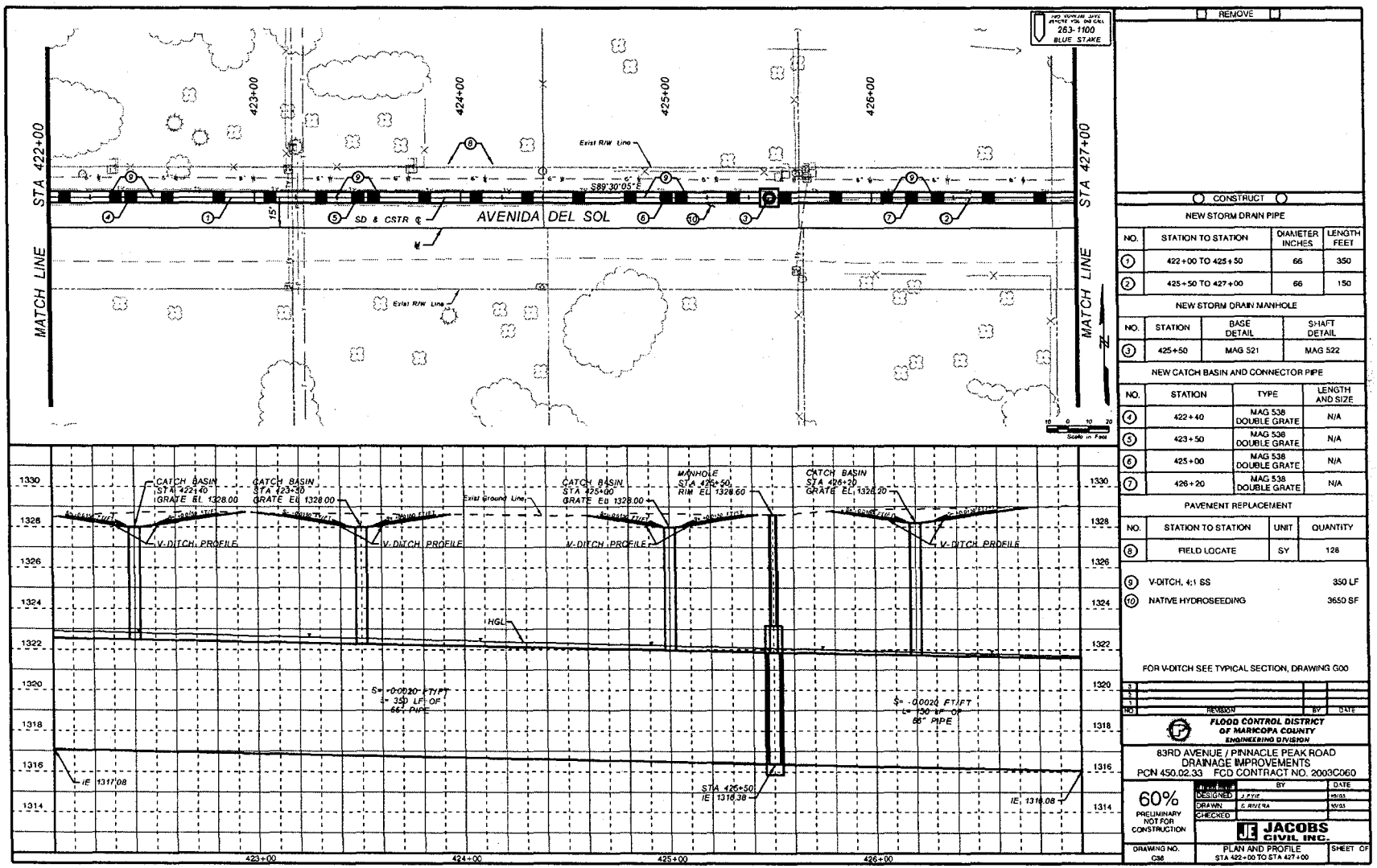

263-1100
BLUE STAKE
STA 422+00
STA 427+00
MATCH LINE
423+00
424+00
425+00
426+00
Exist R/W Line
S89°30'05"E
SD & CSTR ℄
AVENIDA DEL SOL
15'
Scale in Feet
CATCH BASIN
STA 422+40
GRATE EL 1328.00
CATCH BASIN
STA 423+30
GRATE EL 1328.00
Exist Ground Line
CATCH BASIN
STA 425+00
GRATE EL 1328.00
MANHOLE
STA 425+50
RIM EL 1328.60
CATCH BASIN
STA 426+20
GRATE EL 1328.20
V-DITCH PROFILE
HGL
S= -0.0020 FT/FT
L= 350 LF OF
66" PIPE
S= -0.0020 FT/FT
L= 150 LF OF
66" PIPE
IE 1317.08
STA 425+50
IE 1318.38
IE 1318.08
1330
1328
1326
1324
1322
1320
1318
1316
1314
REMOVE
CONSTRUCT
NEW STORM DRAIN PIPE
NO. | STATION TO STATION | DIAMETER INCHES | LENGTH FEET
1 | 422+00 TO 425+50 | 66 | 350
2 | 425+50 TO 427+00 | 66 | 150
NEW STORM DRAIN MANHOLE
NO. | STATION | BASE DETAIL | SHAFT DETAIL
3 | 425+50 | MAG 521 | MAG 522
NEW CATCH BASIN AND CONNECTOR PIPE
NO. | STATION | TYPE | LENGTH AND SIZE
4 | 422+40 | MAG 538 DOUBLE GRATE | N/A
5 | 423+50 | MAG 538 DOUBLE GRATE | N/A
6 | 425+00 | MAG 538 DOUBLE GRATE | N/A
7 | 426+20 | MAG 538 DOUBLE GRATE | N/A
PAVEMENT REPLACEMENT
NO. | STATION TO STATION | UNIT | QUANTITY
8 | FIELD LOCATE | SY | 128
9 V-DITCH, 4:1 SS 350 LF
10 NATIVE HYDROSEEDING 3650 SF
FOR V-DITCH SEE TYPICAL SECTION, DRAWING G00
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
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED
DRAWN
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C36
PLAN AND PROFILE
STA 422+00 TO STA 427+00
SHEET OF

Figure 1-15

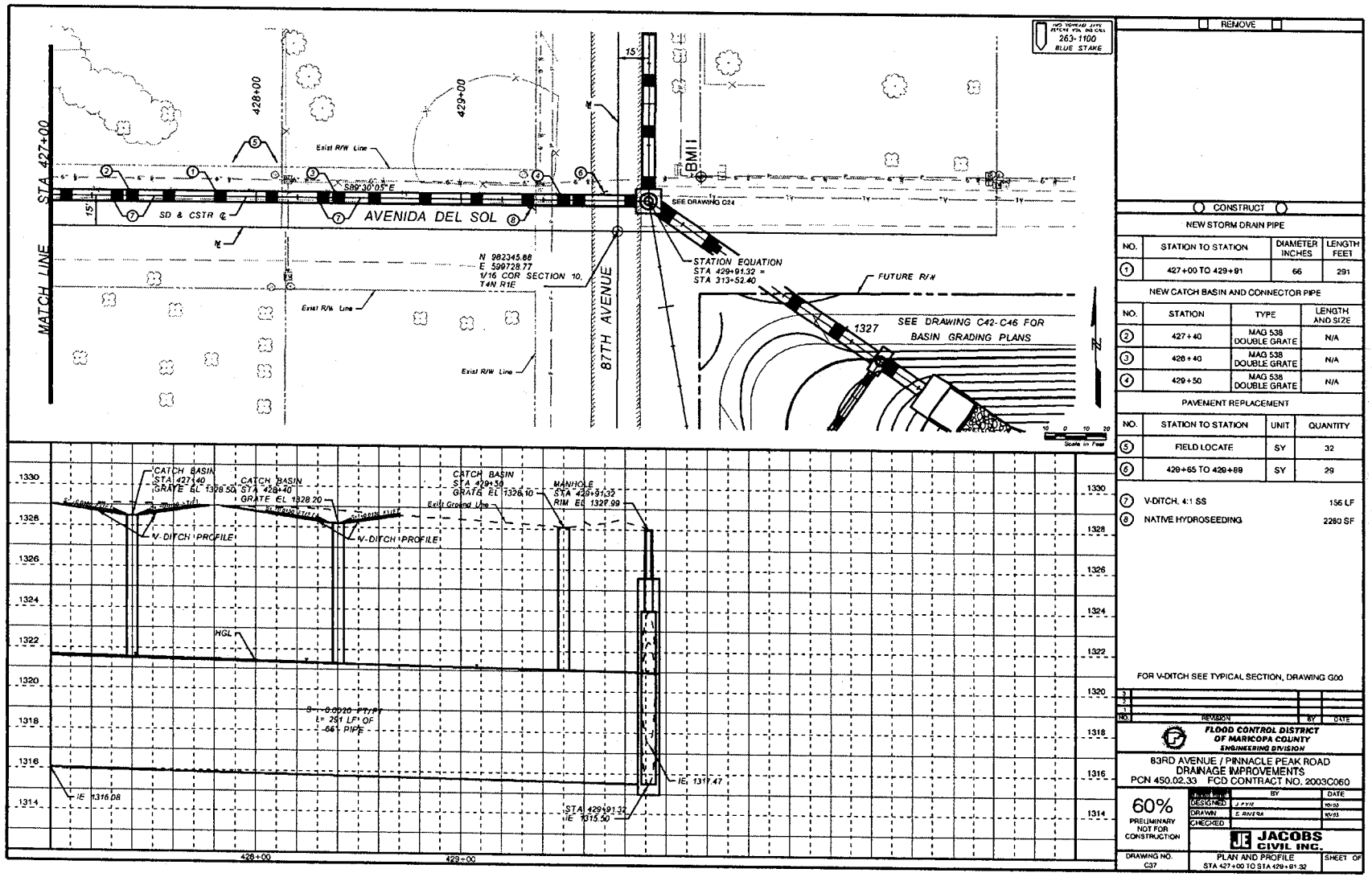

MATCH LINE
STA 427+00
428+00
429+00
15'
Exist R/W Line
S89°30'05"E
SD & CSTR ℄
AVENIDA DEL SOL
N 982345.88
E 599728.77
1/16 COR SECTION 10,
T4N R1E
87TH AVENUE
BM11
SEE DRAWING C24
STATION EQUATION
STA 429+91.32 =
STA 313+52.40
FUTURE R/W
1327
SEE DRAWING C42-C46 FOR
BASIN GRADING PLANS
263-1100
BLUE STAKE
CATCH BASIN
STA 427+40
GRATE EL 1328.50
CATCH BASIN
STA 428+40
GRATE EL 1328.20
CATCH BASIN
STA 429+30
GRATE EL 1326.10
MANHOLE
STA 429+91.32
RIM EL 1327.99
Exist Ground Line
V-DITCH PROFILE
HGL
S = 0.0020 FT/FT
L= 291 LF OF
66" PIPE
IE 1316.08
IE 1317.47
STA 429+91.32
IE 1315.50
1330
1328
1326
1324
1322
1320
1318
1316
1314
428+00
429+00
REMOVE
CONSTRUCT
NEW STORM DRAIN PIPE
NO. | STATION TO STATION | DIAMETER INCHES | LENGTH FEET
1 | 427+00 TO 429+91 | 66 | 291
NEW CATCH BASIN AND CONNECTOR PIPE
NO. | STATION | TYPE | LENGTH AND SIZE
2 | 427+40 | MAG 538 DOUBLE GRATE | N/A
3 | 428+40 | MAG 538 DOUBLE GRATE | N/A
4 | 429+50 | MAG 538 DOUBLE GRATE | N/A
PAVEMENT REPLACEMENT
NO. | STATION TO STATION | UNIT | QUANTITY
5 | FIELD LOCATE | SY | 32
6 | 429+65 TO 429+89 | SY | 29
7 V-DITCH, 4:1 SS 156 LF
8 NATIVE HYDROSEEDING 2280 SF
FOR V-DITCH SEE TYPICAL SECTION, DRAWING G00
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
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED J. PYLE
DRAWN E. RIVERA
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 construction, the ultimate right-of-way limits were identified and shown on the plans. These limits are 80' for 87th Avenue, 60' for Avenida del Sol and Camino de Oro and 50' for 86th Avenue. The property is presently unimproved with grades sloping to the south. Existing washes were delineated in the aerial mapping. Future multi-use opportunities include equestrian facilities and parking along the west side and recreational facilities within the basin. A 15' 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. 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 30.6 acre-feet of runoff. The basin will be dewatered through two 42" RCP storm drains each being regulated through a 30.4" diameter orifice plate. The maximum water surface elevation is 1319.65. 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

| Elevation | | Total (sq ft) | Volume (cu ft) | Volume (ac ft) | H1 (ft) | H2 (ft) | Discharge 1 (cfs) | Discharge 2 (cfs) | Total Discharge (cfs) |
|---|---|---|---|---|---|---|---|---|---|
| 1313 | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1314 | 97,805 | 97,805 | 48,903 | 1.12 | 0.00 | 0.23 | 0.00 | 12.11 | 12.11 |
| 1315 | 142,128 | 142,128 | 168,869 | 3.88 | 1.23 | 1.23 | 27.85 | 27.85 | 55.70 |
| 1316 | 157,880 | 157,880 | 318,873 | 7.32 | 2.23 | 2.23 | 37.48 | 37.48 | 74.96 |
| 1317 | 174,332 | 174,332 | 484,979 | 11.13 | 3.23 | 3.23 | 45.10 | 45.10 | 90.19 |
| 1318 | 192,398 | 192,398 | 668,344 | 15.34 | 4.23 | 4.23 | 51.60 | 51.60 | 103.20 |
| 1319 | 200,788 | 200,788 | 864,937 | 19.86 | 5.23 | 5.23 | 57.37 | 57.37 | 114.74 |
| 1320 | 243,067 | 243,067 | 1,086,865 | 24.95 | 6.23 | 6.23 | 62.61 | 62.61 | 125.23 |
| 1321 | 252,291 | 252,291 | 1,334,544 | 30.64 | 7.23 | 7.23 | 67.45 | 67.45 | 134.90 |

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

Revised 10/26/05

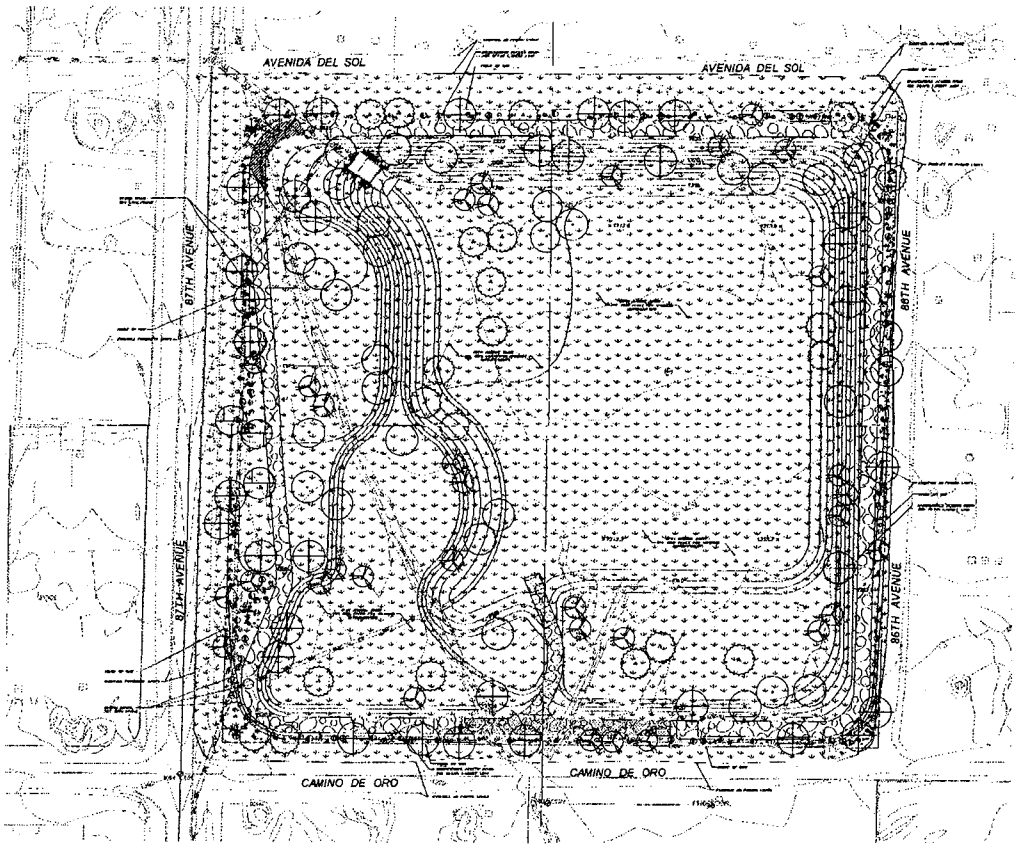



**Figure 1-17**
**87th Avenue Basin**

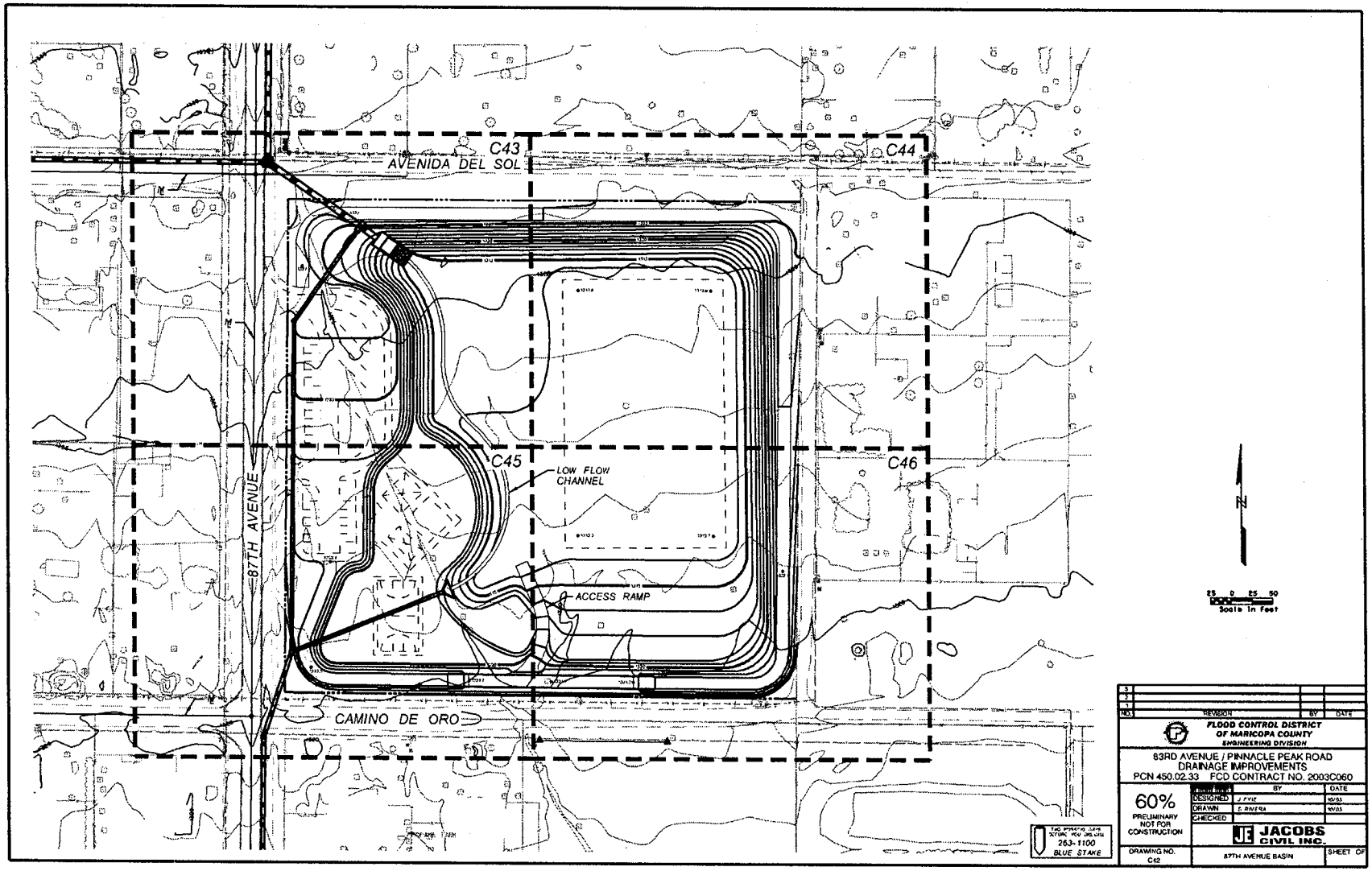
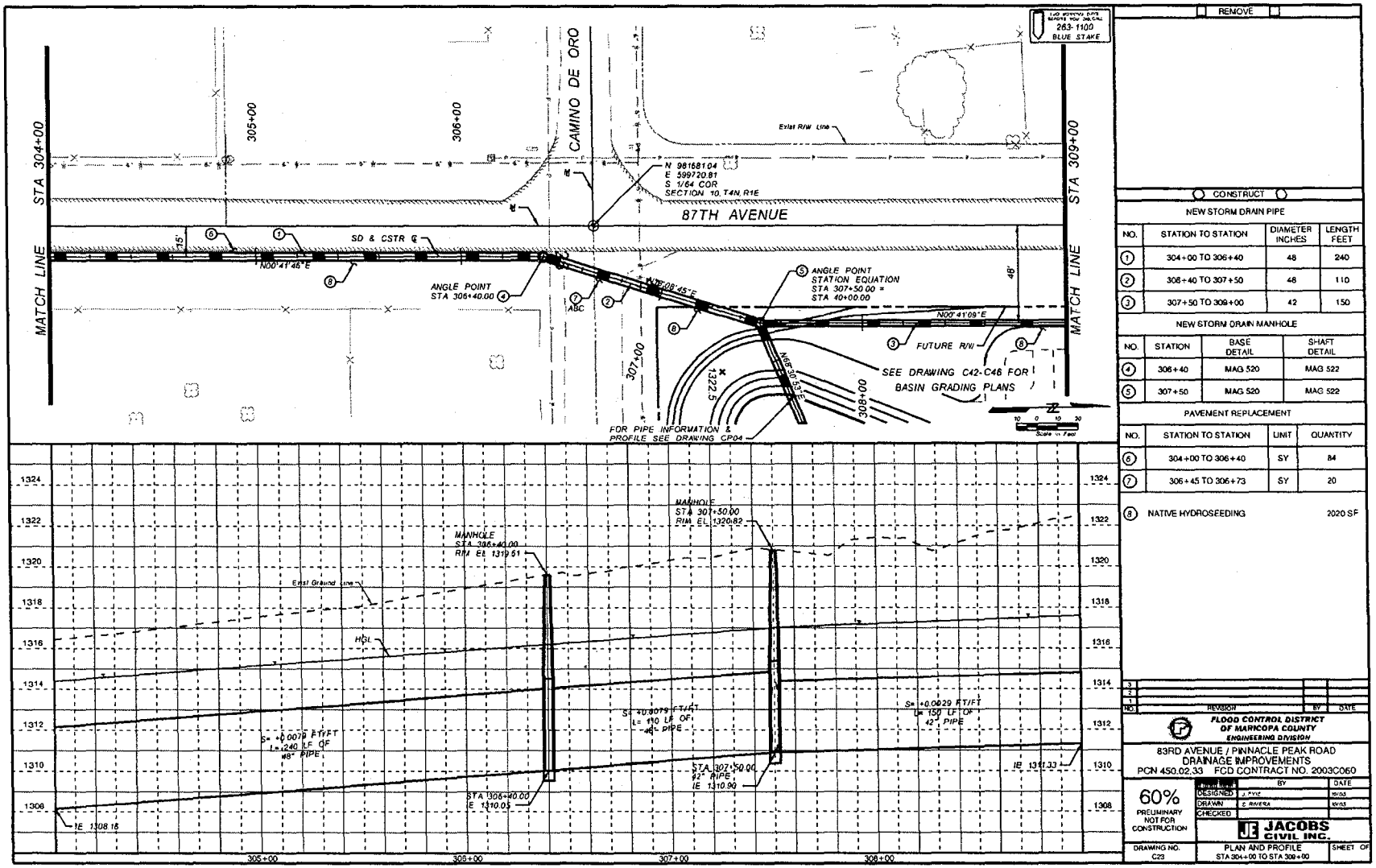

C43
C44
C45
C46
AVENIDA DEL SOL
87TH AVENUE
CAMINO DE ORO
LOW FLOW CHANNEL
ACCESS RAMP
N
25 0 25 50
Scale In Feet
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION
83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED
DRAWN
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C42
87TH AVENUE BASIN
SHEET OF
263-1100
BLUE STAKE

Figure 1-18

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 1311.45. See Figures 1-19 and 1-20.




RENOVE

CONSTRUCT

NEW STORM DRAIN PIPE

| NO. | STATION TO STATION | DIAMETER INCHES | LENGTH FEET |
|---|---|---|---|
| 1 | 304+00 TO 306+40 | 48 | 240 |
| 2 | 306+40 TO 307+50 | 48 | 110 |
| 3 | 307+50 TO 309+00 | 42 | 150 |

NEW STORM DRAIN MANHOLE

| NO. | STATION | BASE DETAIL | SHAFT DETAIL |
|---|---|---|---|
| 4 | 306+40 | MAG 520 | MAG 522 |
| 5 | 307+50 | MAG 520 | MAG 522 |

PAVEMENT REPLACEMENT

| NO. | STATION TO STATION | UNIT | QUANTITY |
|---|---|---|---|
| 6 | 304+00 TO 306+40 | SY | 84 |
| 7 | 306+45 TO 306+73 | SY | 20 |

8 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

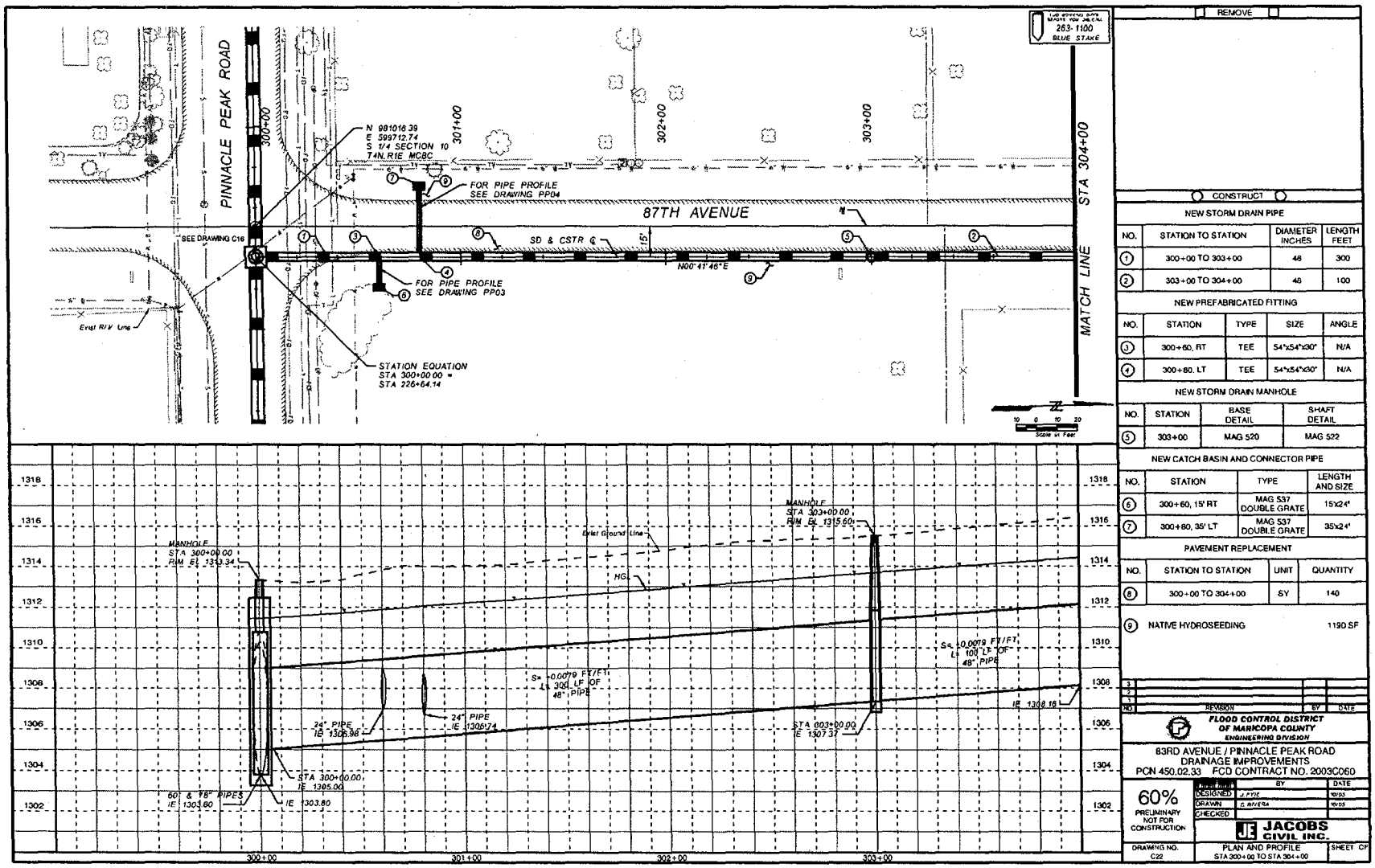
60% PRELIMINARY NOT FOR CONSTRUCTION

| | BY | DATE |
|---|---|---|
| DESIGNED | J. PYLE | 10/03 |
| DRAWN | E. RIVERA | 10/03 |
| CHECKED | | |

JACOBS CIVIL INC.

DRAWING NO. C23 | PLAN AND PROFILE STA 304+00 TO STA 308+00 | SHEET OF

**Figure 1-19**




REMOVE

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+60, RT | TEE | 54"x54"x30" | N/A |
| 4 | 300+80, LT | TEE | 54"x54"x30" | N/A |

NEW STORM DRAIN MANHOLE

| NO. | STATION | BASE DETAIL | SHAFT DETAIL |
|---|---|---|---|
| 5 | 303+00 | MAG 520 | MAG 522 |

NEW CATCH BASIN AND CONNECTOR PIPE

| NO. | STATION | TYPE | LENGTH AND SIZE |
|---|---|---|---|
| 6 | 300+60, 15' RT | MAG 537 DOUBLE GRATE | 15'x24" |
| 7 | 300+80, 35' LT | MAG 537 DOUBLE GRATE | 35'x24" |

PAVEMENT REPLACEMENT

| NO. | STATION TO STATION | UNIT | QUANTITY |
|---|---|---|---|
| 8 | 300+00 TO 304+00 | SY | 140 |

9 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

60% PRELIMINARY NOT FOR CONSTRUCTION

| | BY | DATE |
|---|---|---|
| DESIGNED | J. PYLE | 10/03 |
| DRAWN | D. RIVERA | 10/03 |
| 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 245+65)**

60" 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 and a smaller portion in 89th Avenue. Other nuisance flows will be collected in catch basins at 90th Avenue and 89th Avenue and catch basins at Stations 215+00 and 233+40 and drop inlets at Stations 220+70, 223+60 and convey the runoff through pipe laterals to the Pinnacle Peak storm drain. Prefabricated pipe tees will be provided for future street catch basins when Pinnacle Peak is improved. The location and size of the tees will be provided in the final design. This system consists of 60" 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 84 cfs at 89th Avenue and 379 cfs at 87th Avenue. At the Pinnacle Peak basin, a 24" RCP bypass/dewater storm drain will continue to the east ending at a manhole in the 83rd Avenue storm drain. See Figures 1-21 to 1-31.

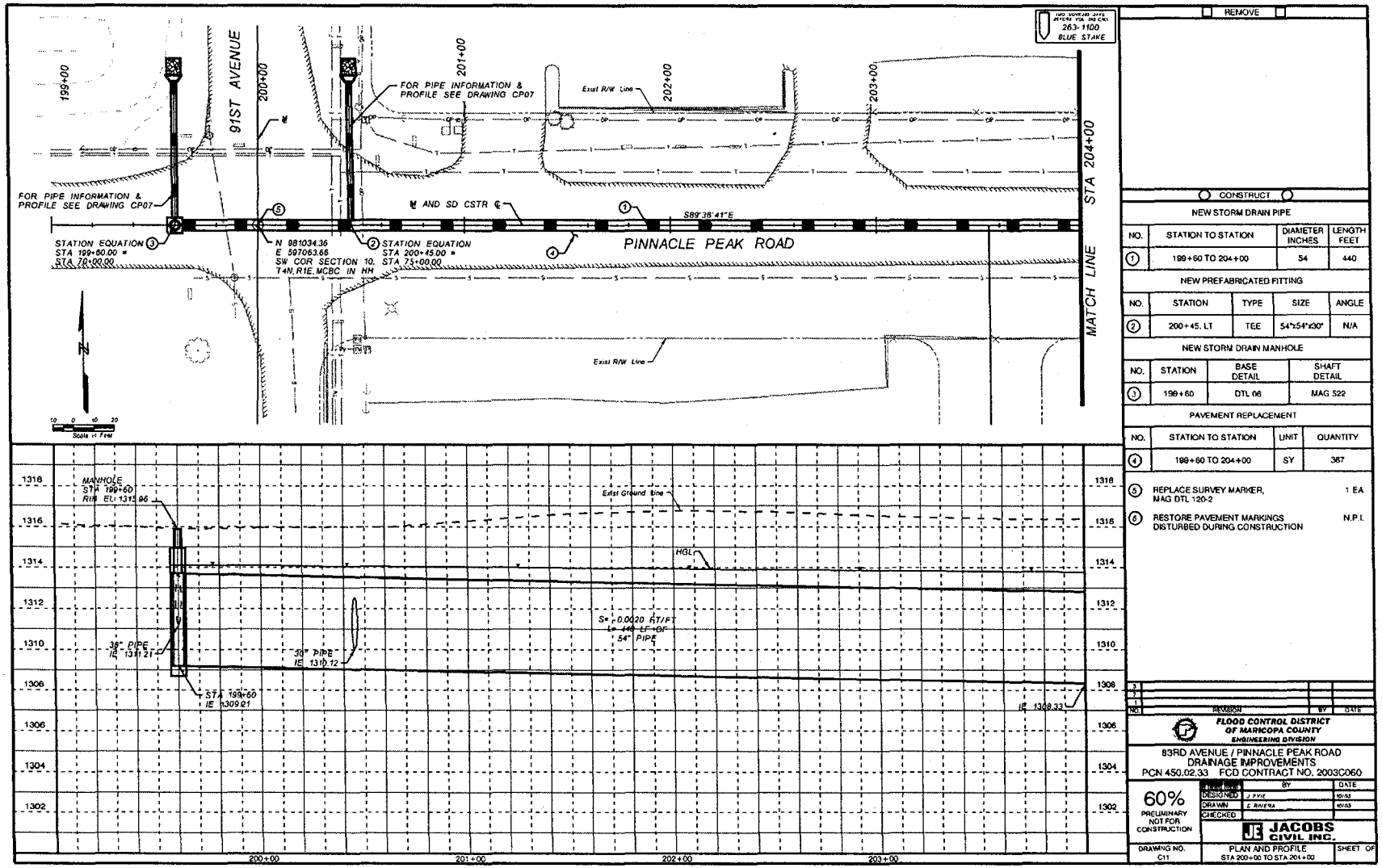
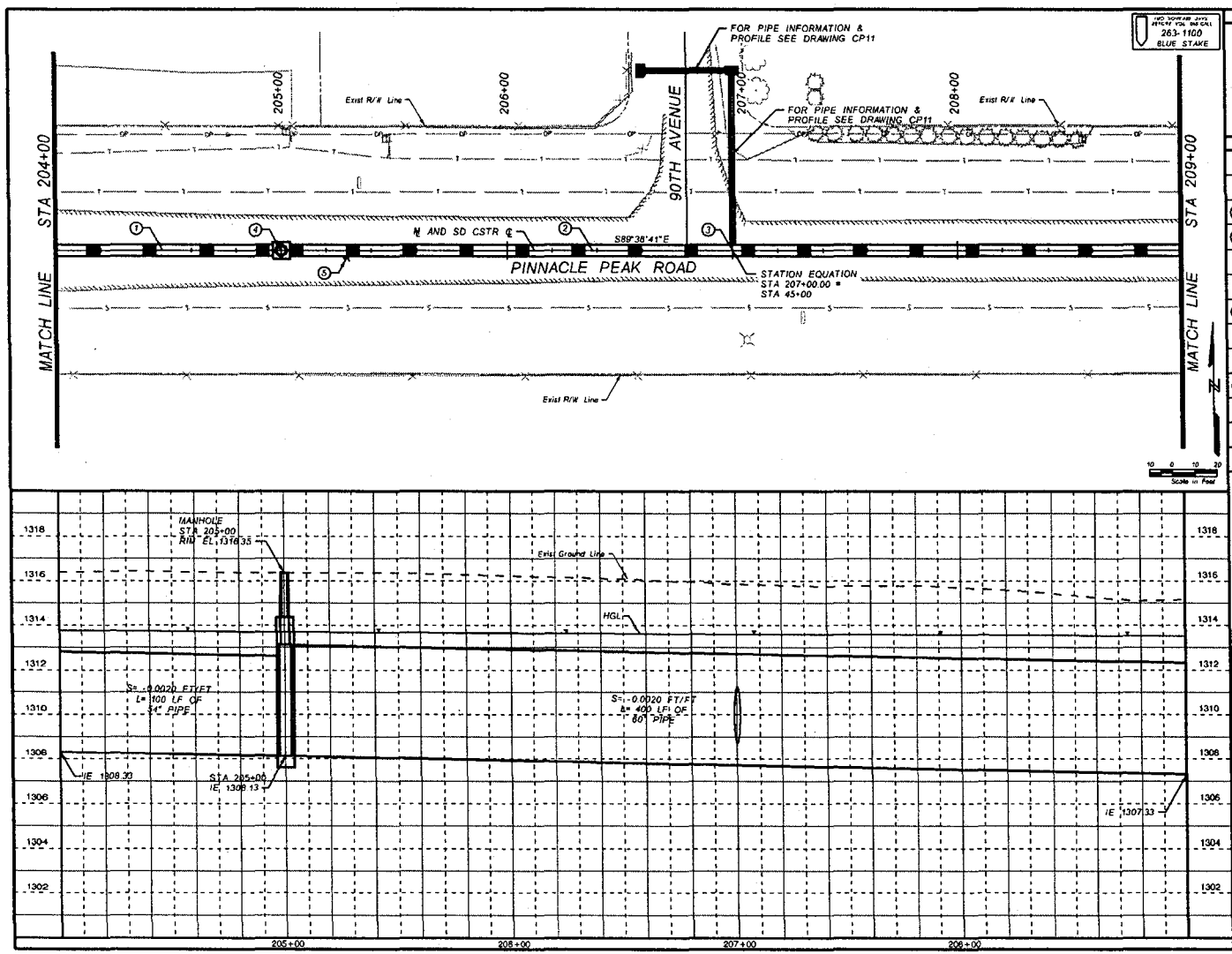

263-1100
BLUE STAKE
91ST AVENUE
199+00
200+00
201+00
202+00
203+00
STA 204+00
MATCH LINE
FOR PIPE INFORMATION & PROFILE SEE DRAWING CP07
Exist R/W Line
℄ AND SD CSTR ℄
S89°36'41"E
PINNACLE PEAK ROAD
STATION EQUATION
STA 199+60.00 =
STA 70+00.00
N 981034.36
E 597063.66
SW COR SECTION 10,
T4N,R1E,MCBC IN HH
STATION EQUATION
STA 200+45.00 =
STA 75+00.00
Scale in Feet
MANHOLE
STA 199+60
RIM EL. 1315.96
Exist Ground Line
HGL
S= -0.0020 FT/FT
L= 146 LF OF
54" PIPE
36" PIPE
IE 1311.21
36" PIPE
IE 1310.12
STA 199+60
IE 1309.01
IE 1308.33
1318
1316
1314
1312
1310
1308
1306
1304
1302
200+00
201+00
202+00
203+00
REMOVE
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 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
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED
DRAWN
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C11
PLAN AND PROFILE
STA 200+00 TO STA 204+00
SHEET OF

Figure 1-21




REMOVE

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"x24" | N/A |

NEW STORM DRAIN MANHOLE

| NO. | STATION | BASE DETAIL | SHAFT DETAIL |
|---|---|---|---|
| 4 | 205+00 | MAG S21 | MAG S22 |

PAVEMENT REPLACEMENT

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

6 RESTORE PAVEMENT MARKINGS 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

60% PRELIMINARY NOT FOR CONSTRUCTION

| | BY | DATE |
|---|---|---|
| DESIGNED | J. FYHE | 10/03 |
| DRAWN | E. RIVERA | 10/03 |
| CHECKED | | |

JACOBS CIVIL INC.

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

**Figure 1-22**

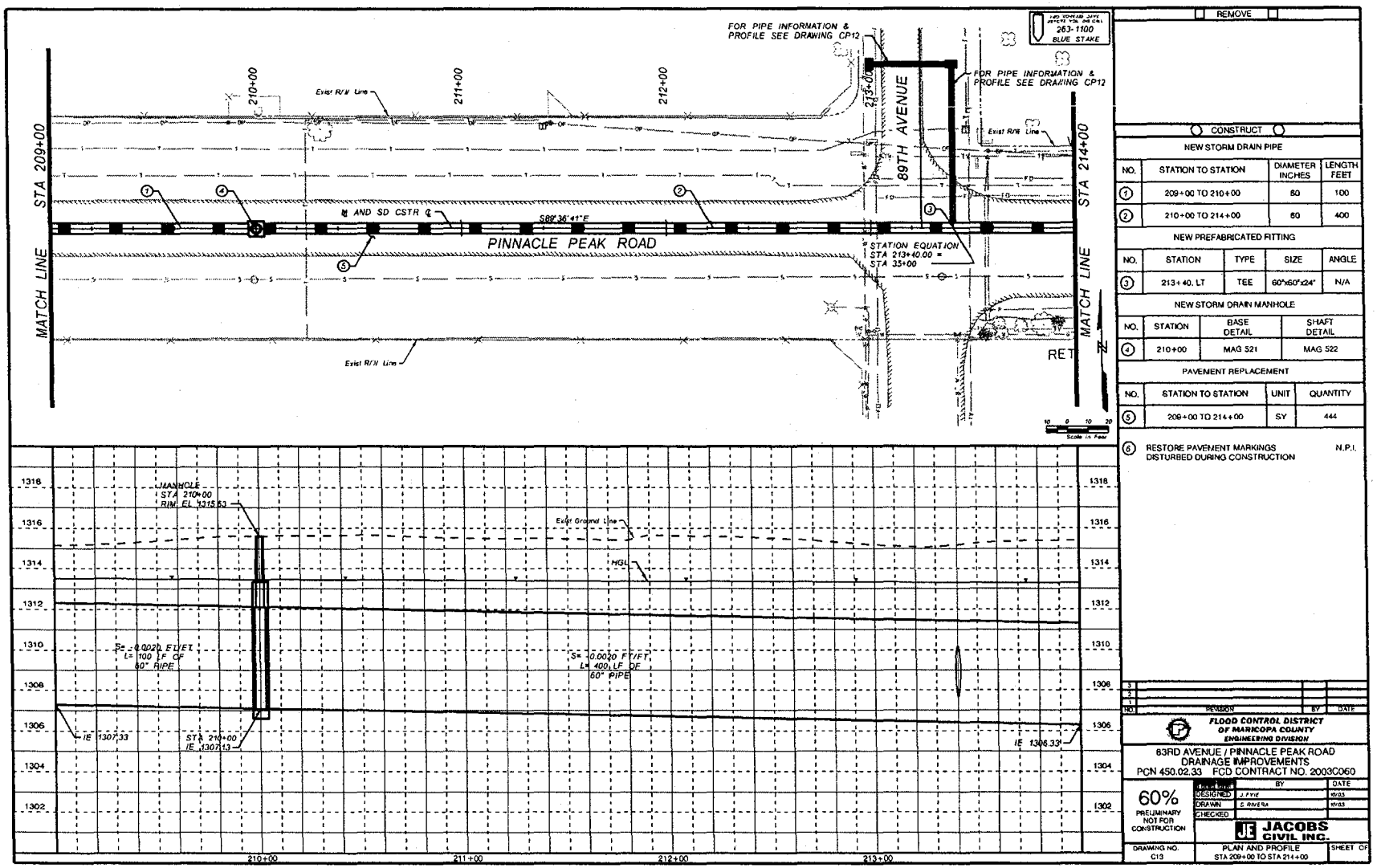

FOR PIPE INFORMATION & PROFILE SEE DRAWING CP12
263-1100 BLUE STAKE
STA 209+00
MATCH LINE
210+00
211+00
212+00
213+00
Exist R/W Line
89TH AVENUE
STA 214+00
AND SD CSTR ℄
S89°36'41"E
PINNACLE PEAK ROAD
STATION EQUATION
STA 213+40.00 =
STA 35+00
RETURN
N
Scale in Feet
MANHOLE
STA 210+00
RIM EL 1315.53
Exist Ground Line
HGL
S= 0.0020 FT/FT
L= 100 LF OF
60" PIPE
S= 0.0020 FT/FT
L= 400 LF OF
60" PIPE
IE 1307.33
STA 210+00
IE 1307.13
IE 1306.33
1318
1316
1314
1312
1310
1308
1306
1304
1302
REMOVE
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"x24" | 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 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
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED J. FYIE
DRAWN S. RIVERA
CHECKED
BY | DATE
JACOBS CIVIL INC.
DRAWING NO. C13
PLAN AND PROFILE STA 209+00 TO STA 214+00
SHEET OF

Figure 1-23

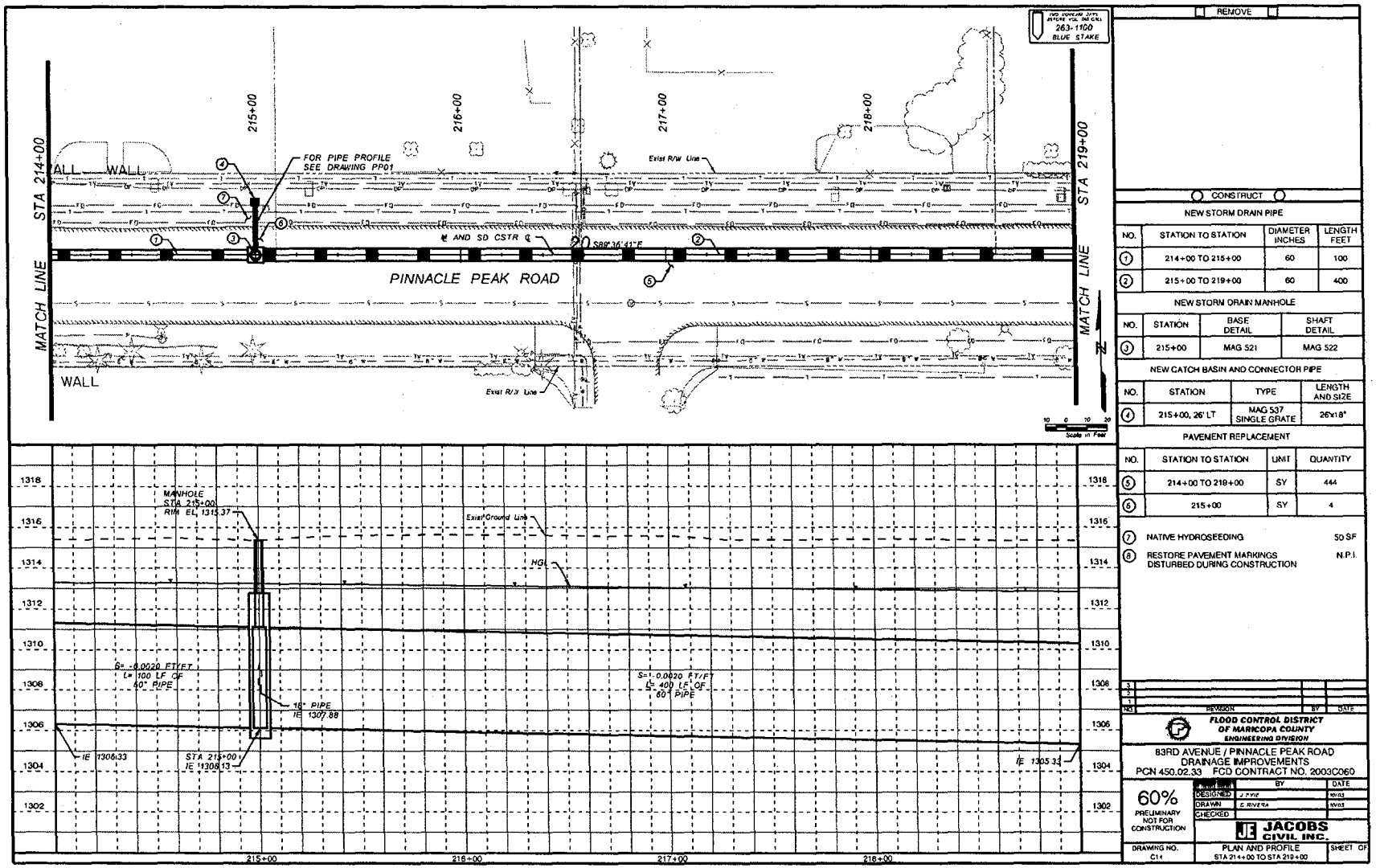
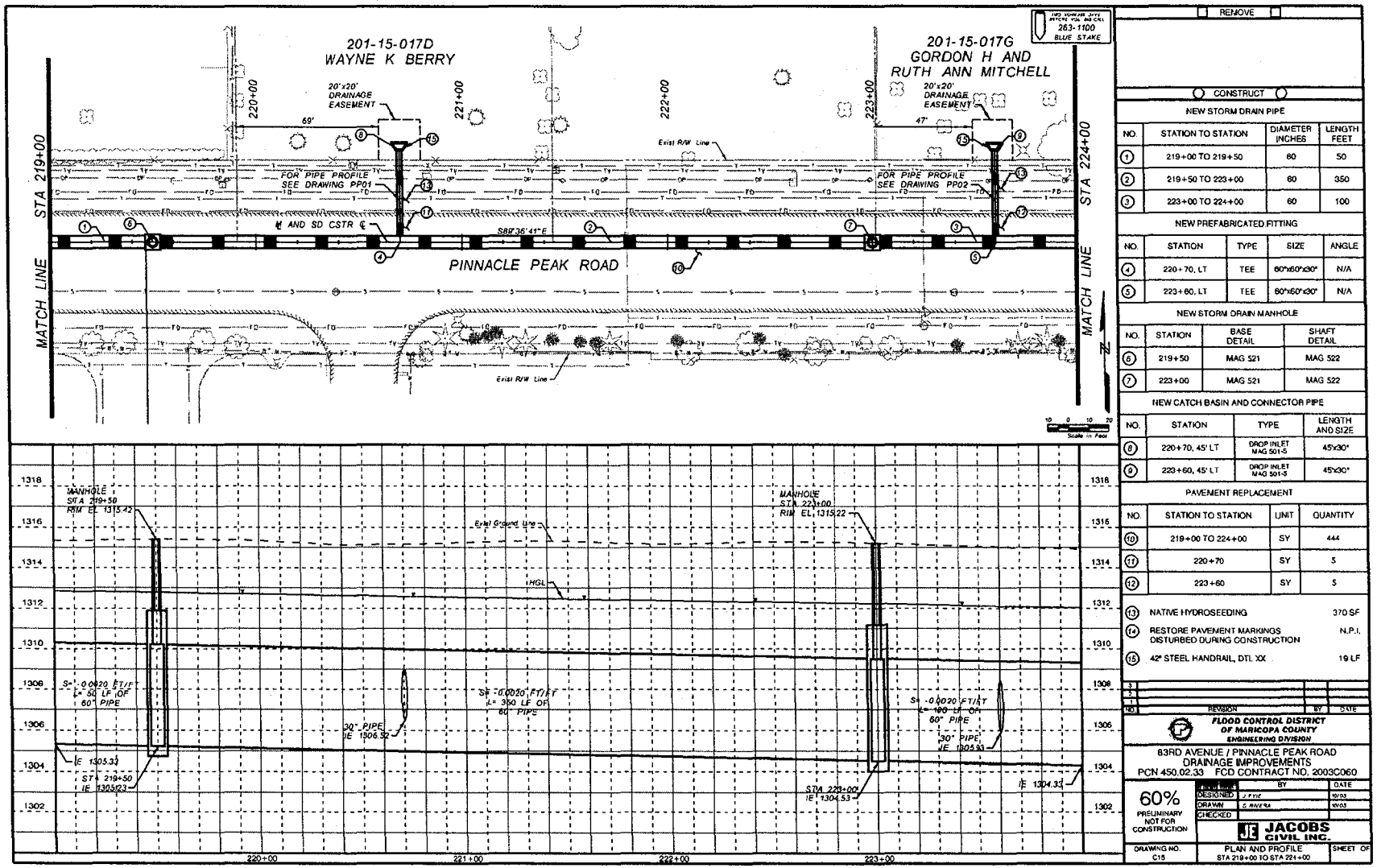

263-1100
BLUE STAKE
STA 214+00
STA 219+00
MATCH LINE
WALL
215+00
216+00
217+00
218+00
FOR PIPE PROFILE
SEE DRAWING PP01
Exist R/W Line
℄ AND SD CSTR ℄
S86°36'41"E
PINNACLE PEAK ROAD
Scale in Feet
MANHOLE
STA 215+00
RIM EL 1315.37
Exist Ground Line
HGL
S= -0.0020 FT/FT
L= 100 LF OF
60" PIPE
16" PIPE
IE 1307.88
IE 1306.33
STA 215+00
IE 1308.13
S=-0.0020 FT/FT
L= 400 LF OF
60" PIPE
IE 1305.33
1318
1316
1314
1312
1310
1308
1306
1304
1302
REMOVE
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+00, 26' LT | MAG 537 SINGLE GRATE | 26'x18"
PAVEMENT REPLACEMENT
NO. | STATION TO STATION | UNIT | QUANTITY
5 | 214+00 TO 218+00 | SY | 444
6 | 215+00 | SY | 4
7 NATIVE HYDROSEEDING 50 SF
8 RESTORE PAVEMENT MARKINGS DISTURBED DURING CONSTRUCTION N.P.I.
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
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED J. RIVERA 10/03
DRAWN E. RIVERA 10/03
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C14
PLAN AND PROFILE
STA 214+00 TO STA 219+00
SHEET OF

Figure 1-24




REMOVE

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 | 220+70, LT | TEE | 60"x60"x30" | N/A |
| 5 | 223+60, 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 | 220+70, 45' LT | DROP INLET MAG 501-S | 45'x30" |
| 9 | 223+60, 45' LT | DROP INLET MAG 501-S | 45'x30" |

PAVEMENT REPLACEMENT

| NO. | STATION TO STATION | UNIT | QUANTITY |
|---|---|---|---|
| 10 | 219+00 TO 224+00 | SY | 444 |
| 11 | 220+70 | SY | 5 |
| 12 | 223+60 | SY | 5 |

| | | |
|---|---|---|
| 13 | NATIVE HYDROSEEDING | 370 SF |
| 14 | RESTORE PAVEMENT MARKINGS DISTURBED DURING CONSTRUCTION | N.P.I. |
| 15 | 42" STEEL HANDRAIL, DTL XX | 19 LF |

| 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

60% PRELIMINARY NOT FOR CONSTRUCTION

| | BY | DATE |
|---|---|---|
| DESIGNED | J. FYIE | 10/03 |
| DRAWN | S. RIVERA | 10/03 |
| CHECKED | | |

JACOBS CIVIL INC.

DRAWING NO. C15 | PLAN AND PROFILE STA 219+00 TO STA 224+00 | SHEET OF

**Figure 1-25**

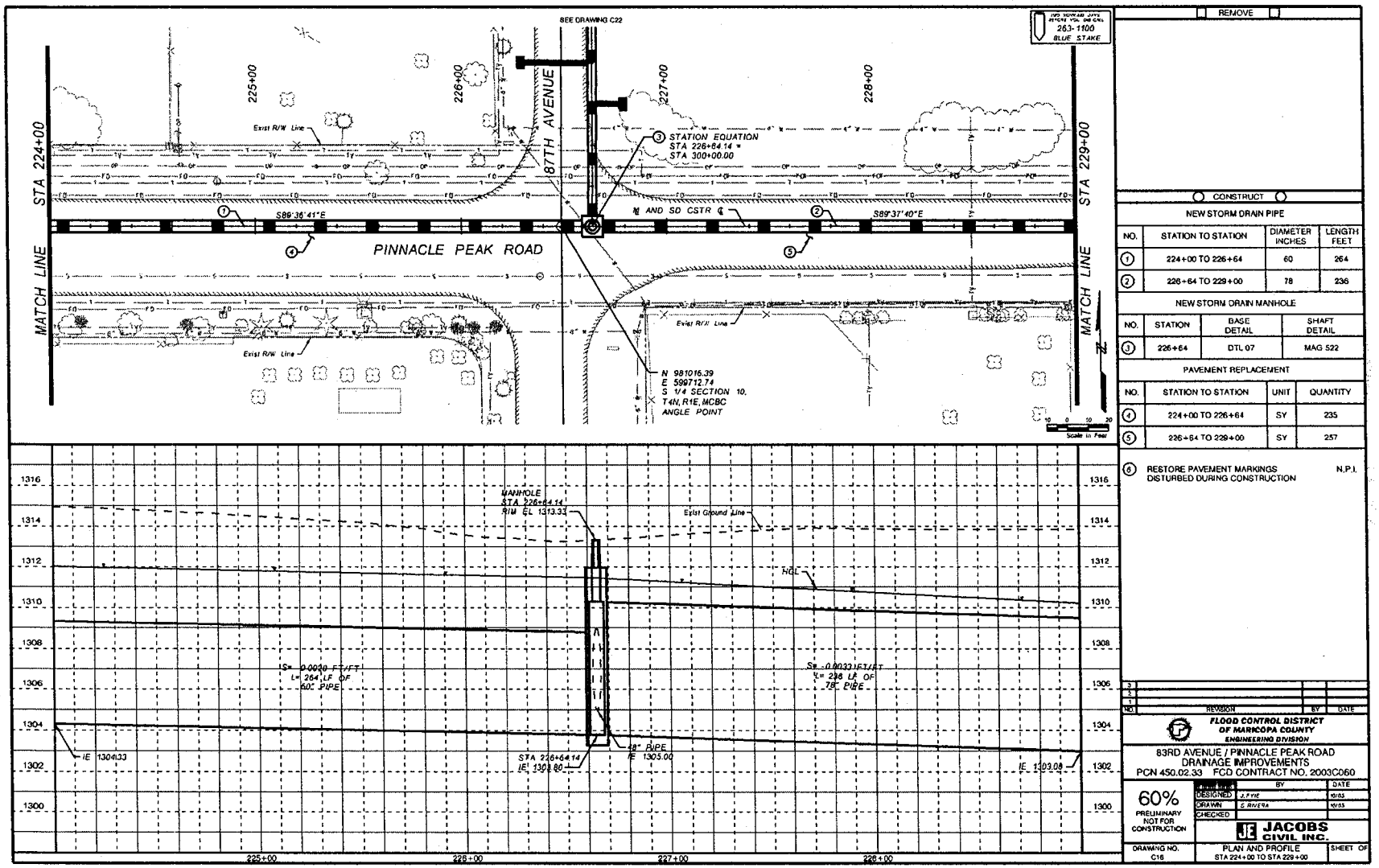

SEE DRAWING C22
263-1100
BLUE STAKE
225+00
226+00
227+00
228+00
STA 224+00
STA 229+00
MATCH LINE
87TH AVENUE
Exist R/W Line
STATION EQUATION
STA 226+64.14 =
STA 300+00.00
S89°36'41"E
S89°37'40"E
PINNACLE PEAK ROAD
N 981016.39
E 599712.74
S 1/4 SECTION 10,
T4N, R1E, MCBC
ANGLE POINT
MANHOLE
STA 226+64.14
RIM EL 1313.33
Exist Ground Line
HGL
S= 0.0020 FT/FT
L= 264 LF OF
60" PIPE
S= 0.0033 FT/FT
L= 236 LF OF
78" PIPE
IE 1304.33
STA 226+64.14
IE 1303.80
48" PIPE
IE 1305.00
IE 1303.08
1316
1314
1312
1310
1308
1306
1304
1302
1300
REMOVE
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 | 78 | 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 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
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED J. FYFE
DRAWN S. RIVERA
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C16
PLAN AND PROFILE
STA 224+00 TO STA 229+00
SHEET OF

Figure 1-26

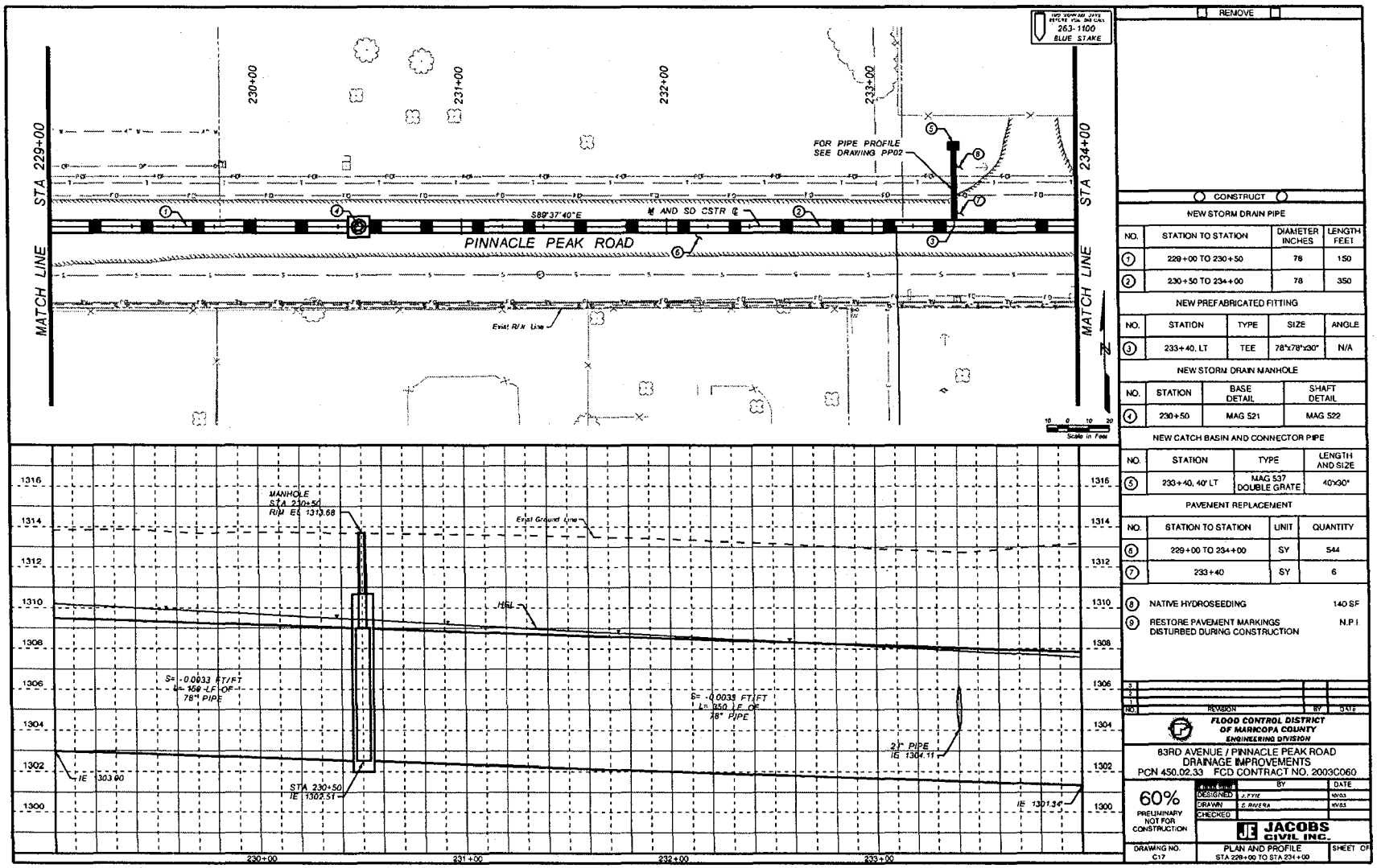

263-1100
BLUE STAKE
STA 229+00
STA 234+00
MATCH LINE
230+00
231+00
232+00
233+00
FOR PIPE PROFILE
SEE DRAWING PP02
S89°37'40"E
M AND SD CSTR ℄
PINNACLE PEAK ROAD
Exist R/W Line
N
Scale in Feet
MANHOLE
STA 230+50
R/M EL 1313.68
Exist Ground Line
HGL
S= -0.0033 FT/FT
L= 150 LF OF
78" PIPE
S= -0.0033 FT/FT
L= 250 LF OF
78" PIPE
21" PIPE
IE 1304.11
IE 1303.00
STA 230+50
IE 1302.51
IE 1301.34
1316
1314
1312
1310
1308
1306
1304
1302
1300
230+00
231+00
232+00
233+00
REMOVE
CONSTRUCT
NEW STORM DRAIN PIPE
NO. | STATION TO STATION | DIAMETER INCHES | LENGTH FEET
1 | 229+00 TO 230+50 | 78 | 150
2 | 230+50 TO 234+00 | 78 | 350
NEW PREFABRICATED FITTING
NO. | STATION | TYPE | SIZE | ANGLE
3 | 233+40, LT | TEE | 78"x78"x30" | 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 | 233+40, 40' LT | MAG 537 DOUBLE GRATE | 40'x30"
PAVEMENT REPLACEMENT
NO. | STATION TO STATION | UNIT | QUANTITY
6 | 229+00 TO 234+00 | SY | 544
7 | 233+40 | SY | 6
8 NATIVE HYDROSEEDING 140 SF
9 RESTORE PAVEMENT MARKINGS 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
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED
DRAWN
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C17
PLAN AND PROFILE
STA 229+00 TO STA 234+00
SHEET OF

Figure 1-27

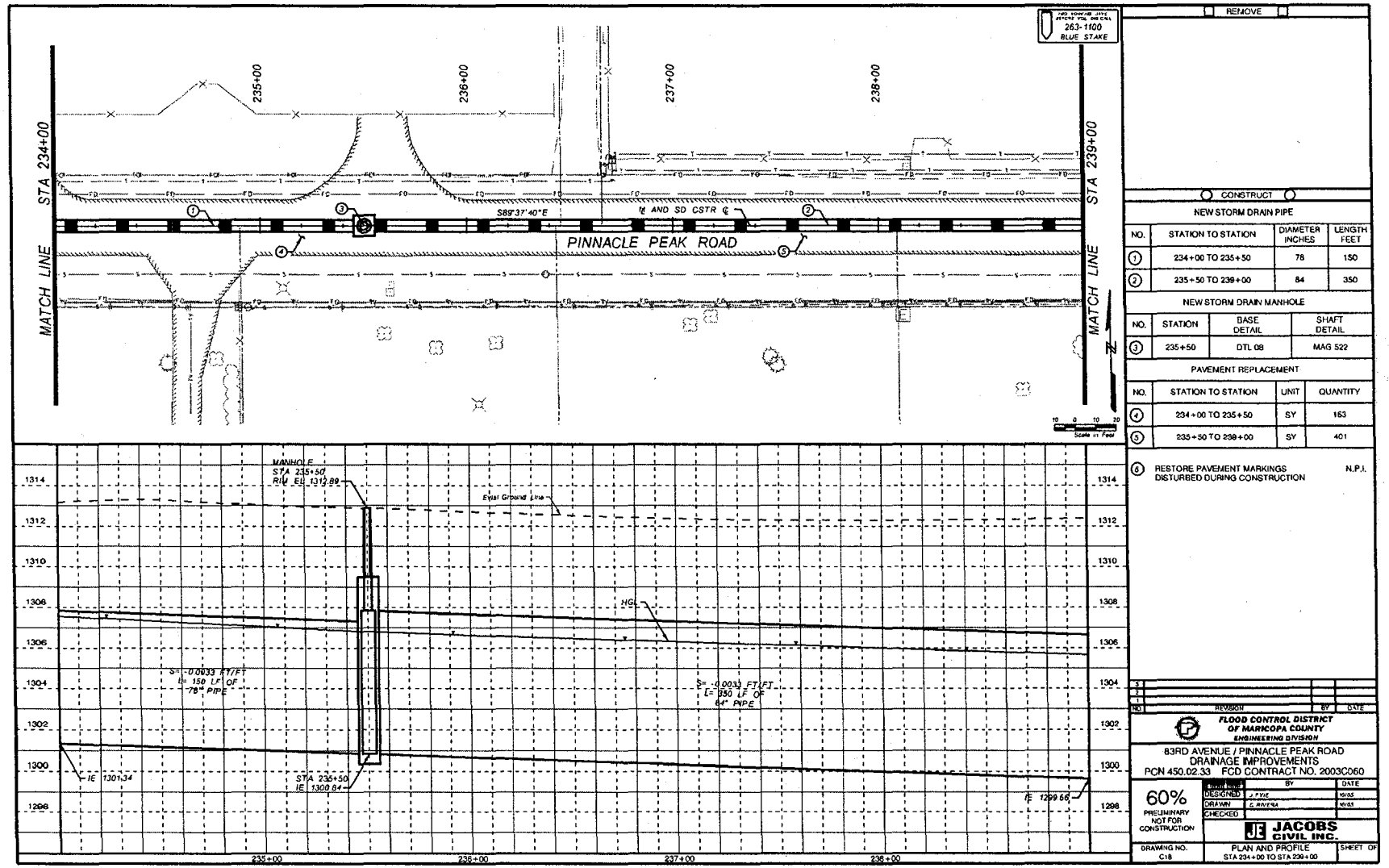

263-1100
BLUE STAKE
235+00
236+00
237+00
238+00
STA 234+00
STA 239+00
MATCH LINE
S89°37'40"E
℄ AND SD CSTR ℄
PINNACLE PEAK ROAD
Scale in Feet
MANHOLE
STA 235+50
RIM EL 1312.89
Exist Ground Line
HGL
S= -0.0033 FT/FT
L= 150 LF OF
78" PIPE
S= -0.0033 FT/FT
L= 350 LF OF
84" PIPE
IE 1301.34
STA 235+50
IE 1300.64
IE 1299.66
1314
1312
1310
1308
1306
1304
1302
1300
1298
235+00
236+00
237+00
238+00
REMOVE
CONSTRUCT
NEW STORM DRAIN PIPE
NO. | STATION TO STATION | DIAMETER INCHES | LENGTH FEET
1 | 234+00 TO 235+50 | 78 | 150
2 | 235+50 TO 239+00 | 84 | 350
NEW STORM DRAIN MANHOLE
NO. | STATION | BASE DETAIL | SHAFT DETAIL
3 | 235+50 | DTL 08 | MAG 522
PAVEMENT REPLACEMENT
NO. | STATION TO STATION | UNIT | QUANTITY
4 | 234+00 TO 235+50 | SY | 163
5 | 235+50 TO 239+00 | SY | 401
6 RESTORE PAVEMENT MARKINGS 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
60%
PRELIMINARY NOT FOR CONSTRUCTION
BY DATE
DESIGNED J. PYLE 10/05
DRAWN C. RIVERA 10/05
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C18
PLAN AND PROFILE STA 234+00 TO STA 239+00
SHEET OF

Figure 1-28

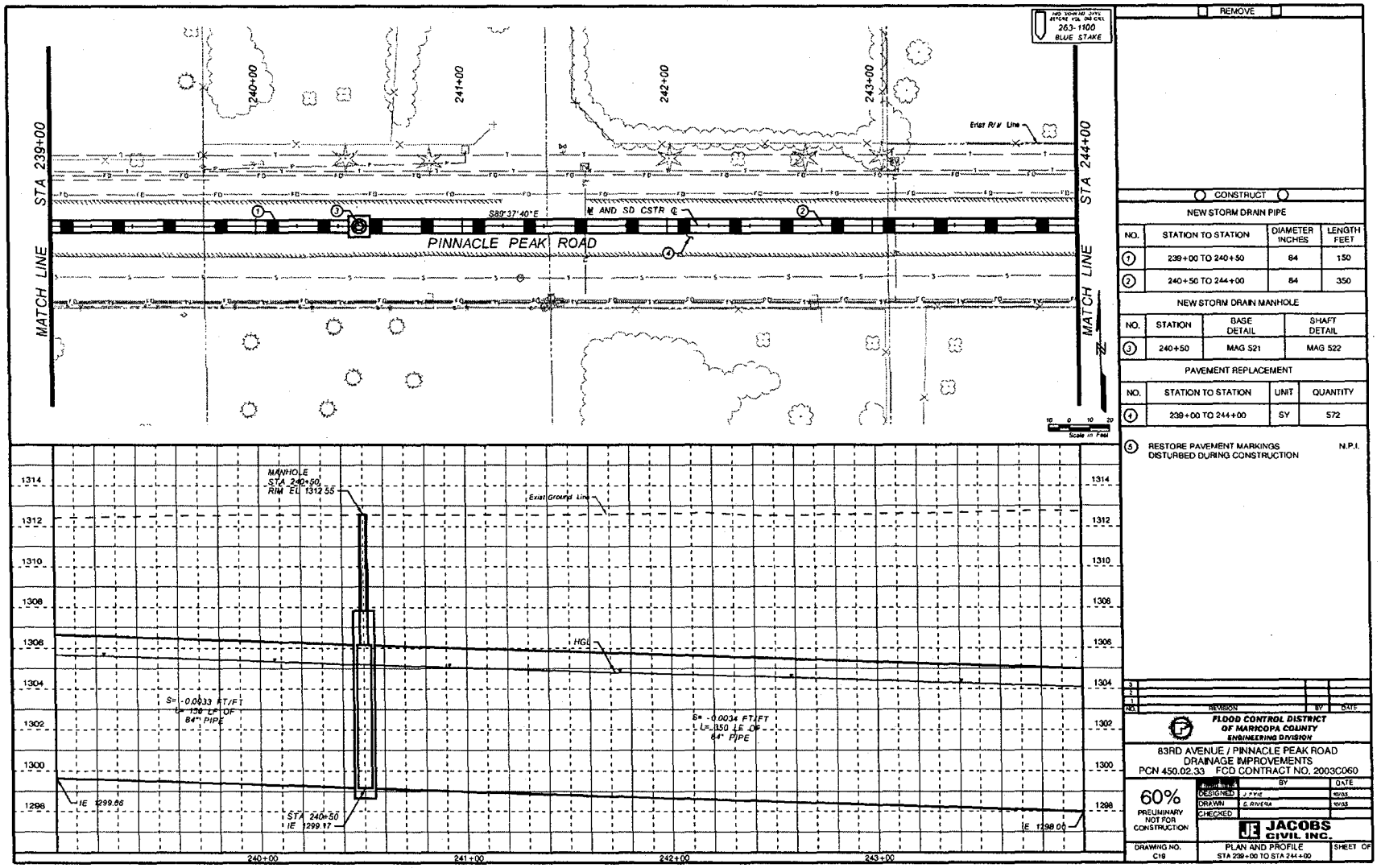
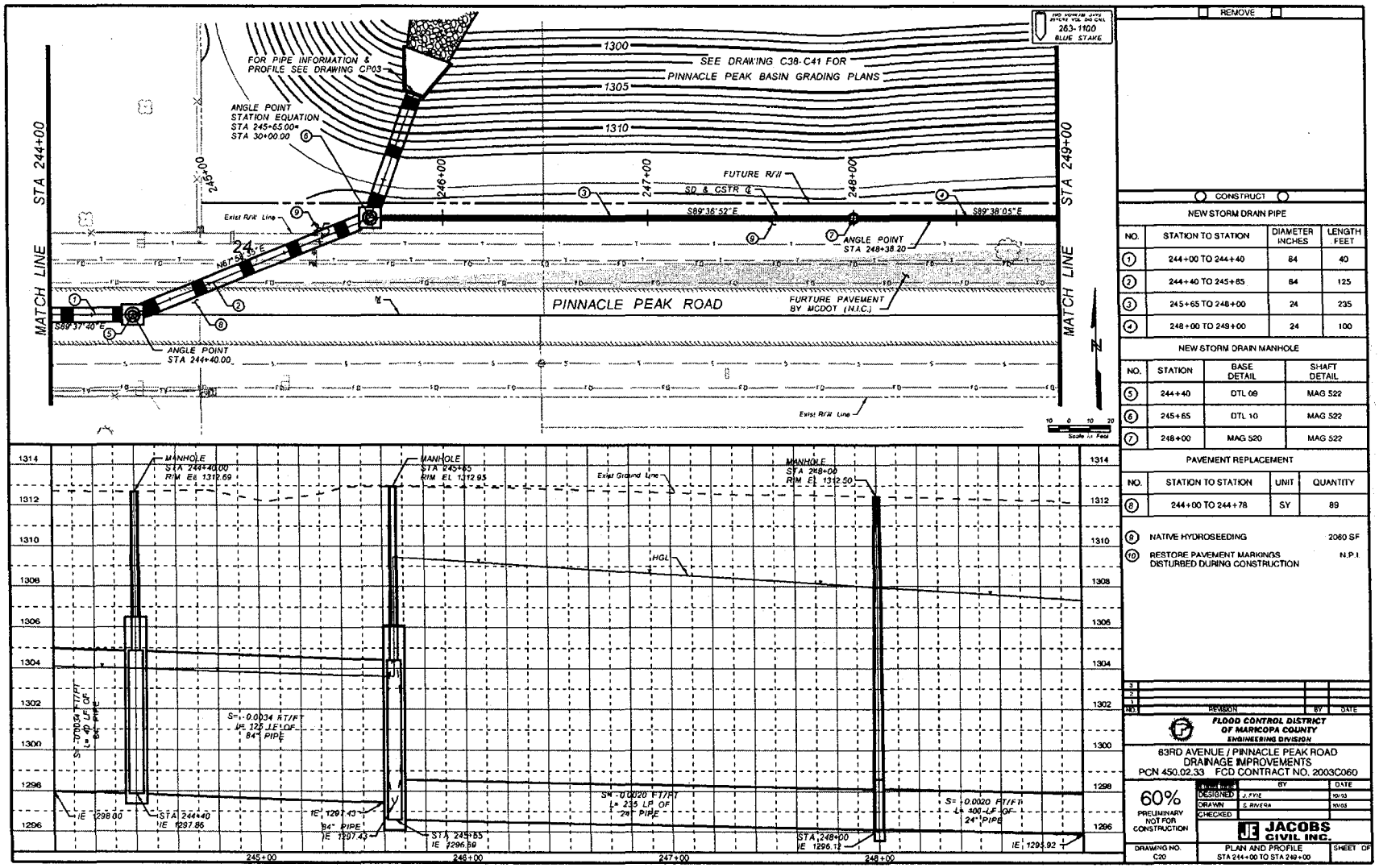

STA 239+00
MATCH LINE
240+00
241+00
242+00
243+00
STA 244+00
MATCH LINE
Exist R/W Line
S80°37'40"E
M AND SD CSTR ℄
PINNACLE PEAK ROAD
263-1100
BLUE STAKE
Scale in Feet
MANHOLE
STA 240+50
RIM EL 1312.55
Exist Ground Line
HGL
S= -0.0033 FT/FT
L= 150 LF OF
84" PIPE
S= -0.0034 FT/FT
L= 350 LF OF
84" PIPE
IE 1299.66
STA 240+50
IE 1299.17
IE 1298.00
1314
1312
1310
1308
1306
1304
1302
1300
1298
240+00
241+00
242+00
243+00
REMOVE
CONSTRUCT
NEW STORM DRAIN PIPE
NO. | STATION TO STATION | DIAMETER INCHES | LENGTH FEET
1 | 239+00 TO 240+50 | 84 | 150
2 | 240+50 TO 244+00 | 84 | 350
NEW STORM DRAIN MANHOLE
NO. | STATION | BASE DETAIL | SHAFT DETAIL
3 | 240+50 | MAG 521 | MAG 522
PAVEMENT REPLACEMENT
NO. | STATION TO STATION | UNIT | QUANTITY
4 | 239+00 TO 244+00 | SY | 572
5 RESTORE PAVEMENT MARKINGS DISTURBED DURING CONSTRUCTION N.P.I.
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
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED J. PYLE 10/03
DRAWN G. RIVERA 10/03
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C19
PLAN AND PROFILE
STA 239+00 TO STA 244+00
SHEET OF

Figure 1-29




REMOVE

CONSTRUCT

NEW STORM DRAIN PIPE

| NO. | STATION TO STATION | DIAMETER INCHES | LENGTH FEET |
|---|---|---|---|
| 1 | 244+00 TO 244+40 | 84 | 40 |
| 2 | 244+40 TO 245+85 | 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 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

60% PRELIMINARY NOT FOR CONSTRUCTION

| | BY | DATE |
|---|---|---|
| DESIGNED | J. RYE | 10/03 |
| DRAWN | S. RIVERA | 10/03 |
| CHECKED | | |

JACOBS CIVIL INC.

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

**Figure 1-30**

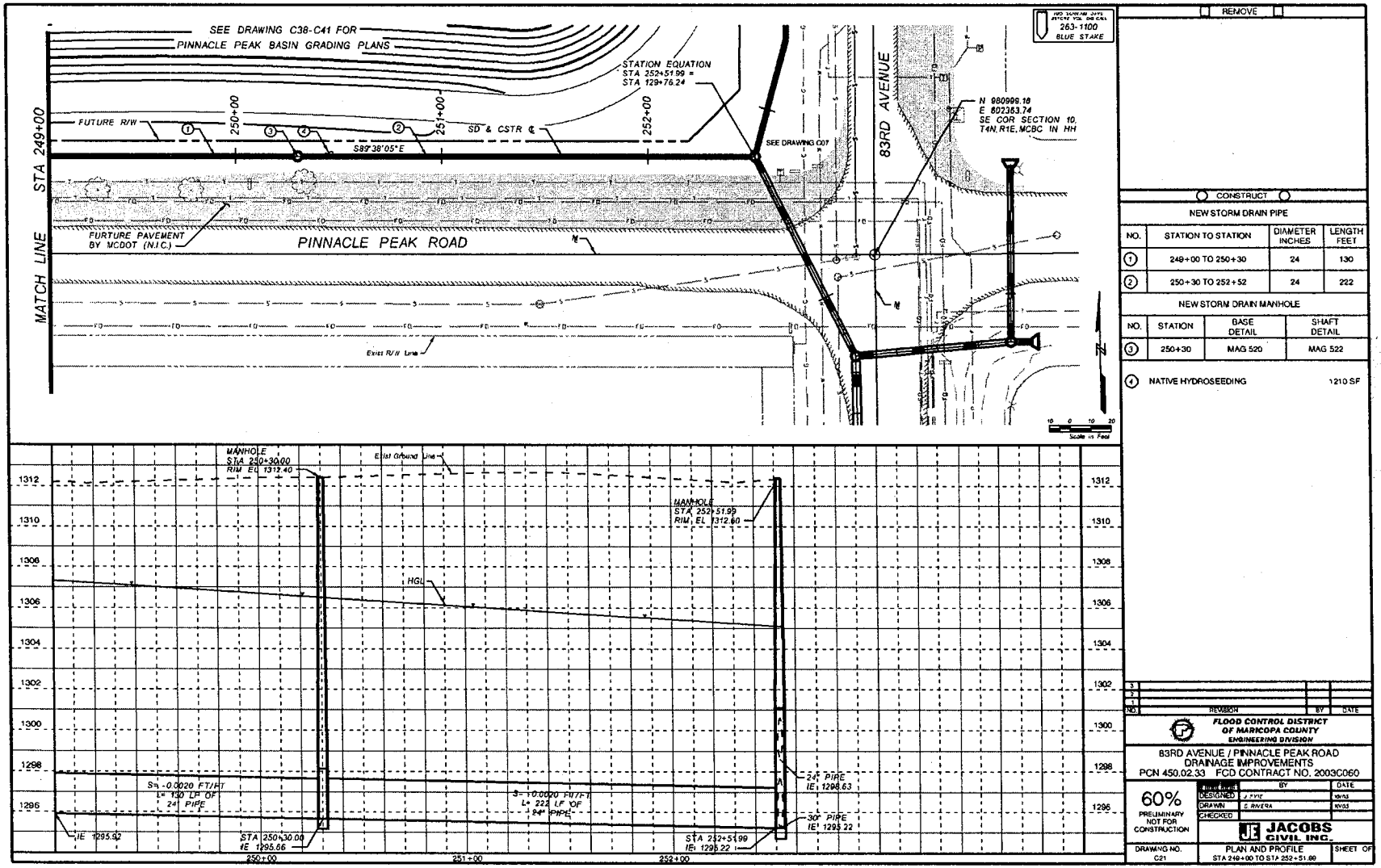

SEE DRAWING C38-C41 FOR
PINNACLE PEAK BASIN GRADING PLANS
STATION EQUATION
STA 252+51.99 =
STA 129+76.24
FUTURE R/W
250+00
251+00
252+00
SD & CSTR ℄
S89°38'05"E
SEE DRAWING C07
83RD AVENUE
N 980999.16
E 802363.74
SE COR SECTION 10,
T4N,R1E,MCBC IN HH
STA 249+00
MATCH LINE
FURTURE PAVEMENT
BY MCDOT (N.I.C.)
PINNACLE PEAK ROAD
Exist R/W Line
263-1100
BLUE STAKE
Scale in Feet
MANHOLE
STA 250+30.00
RIM EL 1312.40
Exist Ground Line
MANHOLE
STA 252+51.99
RIM EL 1312.60
HGL
S= -0.0020 FT/FT
L= 130 LF OF
24" PIPE
S= -0.0020 FT/FT
L= 222 LF OF
24" PIPE
24" PIPE
IE= 1298.63
30" PIPE
IE= 1295.22
IE 1295.92
STA 250+30.00
IE 1295.66
STA 252+51.99
IE= 1295.22
1312
1310
1308
1306
1304
1302
1300
1298
1296
250+00
251+00
252+00
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
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION
83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED J. FYFE
DRAWN S. RIVERA
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 would 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 initial layout provides a 14 foot access area on the perimeter and varied slopes to the bottom with a 13 foot depth. Project landscape architects have determined this basin is unsuitable for multi-use opportunities. Since grading will include up to 3:1 slopes, the 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 construction, 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 property is presently unimproved with grades sloping to the southeast.

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

The proposed layout provides storage for approximately 51.4 acre-feet of runoff. The basin will be dewatered through two 24" RCP storm drains each being regulated through 13.5" diameter orifice plates. The maximum water surface elevation is 1311.16. The basin will provide a minimum 12" freeboard and an emergency spillway in the southeastern end. Peak discharge through the dewater storm drains is 30 cfs total. 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

| Elevation | | Total (sq ft) | Volume (cu ft) | Volume (ac ft) | H1 (ft) | H2 (ft) | Discharge 1 (cfs) | Discharge 2 (cfs) | Total Discharge (cfs) |
|---|---|---|---|---|---|---|---|---|---|
| 1298 | 35,074 | 35,074 | 17,537 | 0.40 | 0.00 | 0.85 | 0.00 | 4.55 | 4.55 |
| 1299 | 95,948 | 95,948 | 83,048 | 1.91 | 0.00 | 1.85 | 0.00 | 6.72 | 6.72 |
| 1300 | 104,030 | 104,030 | 183,037 | 4.20 | 0.00 | 2.85 | 0.00 | 8.35 | 8.35 |
| 1301 | 112,212 | 112,212 | 291,158 | 6.68 | 0.00 | 3.85 | 0.00 | 9.70 | 9.70 |
| 1302 | 120,495 | 120,495 | 407,512 | 9.36 | 0.00 | 4.85 | 0.00 | 10.89 | 10.89 |
| 1303 | 128,878 | 128,878 | 532,198 | 12.22 | 0.00 | 5.85 | 0.00 | 11.96 | 11.96 |
| 1304 | 137,362 | 137,362 | 665,318 | 15.27 | 2.77 | 6.85 | 8.23 | 12.94 | 21.17 |
| 1305 | 145,946 | 145,946 | 806,972 | 18.53 | 3.77 | 7.85 | 9.60 | 13.85 | 23.45 |
| 1306 | 154,631 | 154,631 | 957,261 | 21.98 | 4.77 | 8.85 | 10.80 | 14.71 | 25.51 |
| 1307 | 163,417 | 163,417 | 1,116,285 | 25.63 | 5.77 | 9.85 | 11.88 | 15.52 | 27.40 |
| 1308 | 172,303 | 172,303 | 1,284,145 | 29.48 | 6.77 | 10.85 | 12.87 | 16.29 | 29.15 |
| 1309 | 181,289 | 181,289 | 1,460,941 | 33.54 | 7.77 | 11.85 | 13.78 | 17.02 | 30.81 |
| 1310 | 190,376 | 190,376 | 1,646,773 | 37.80 | 8.77 | 12.85 | 14.64 | 17.73 | 32.37 |
| 1311 | 199,564 | 199,564 | 1,841,743 | 42.28 | 9.77 | 13.85 | 15.46 | 18.40 | 33.86 |
| 1312 | 208,852 | 208,852 | 2,045,951 | 46.97 | 10.77 | 14.85 | 16.23 | 19.06 | 35.29 |
| 1313 | 218,236 | 218,236 | 2,259,495 | 51.87 | 11.77 | 15.85 | 16.97 | 19.69 | 36.65 |

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

Revised 9/28/05

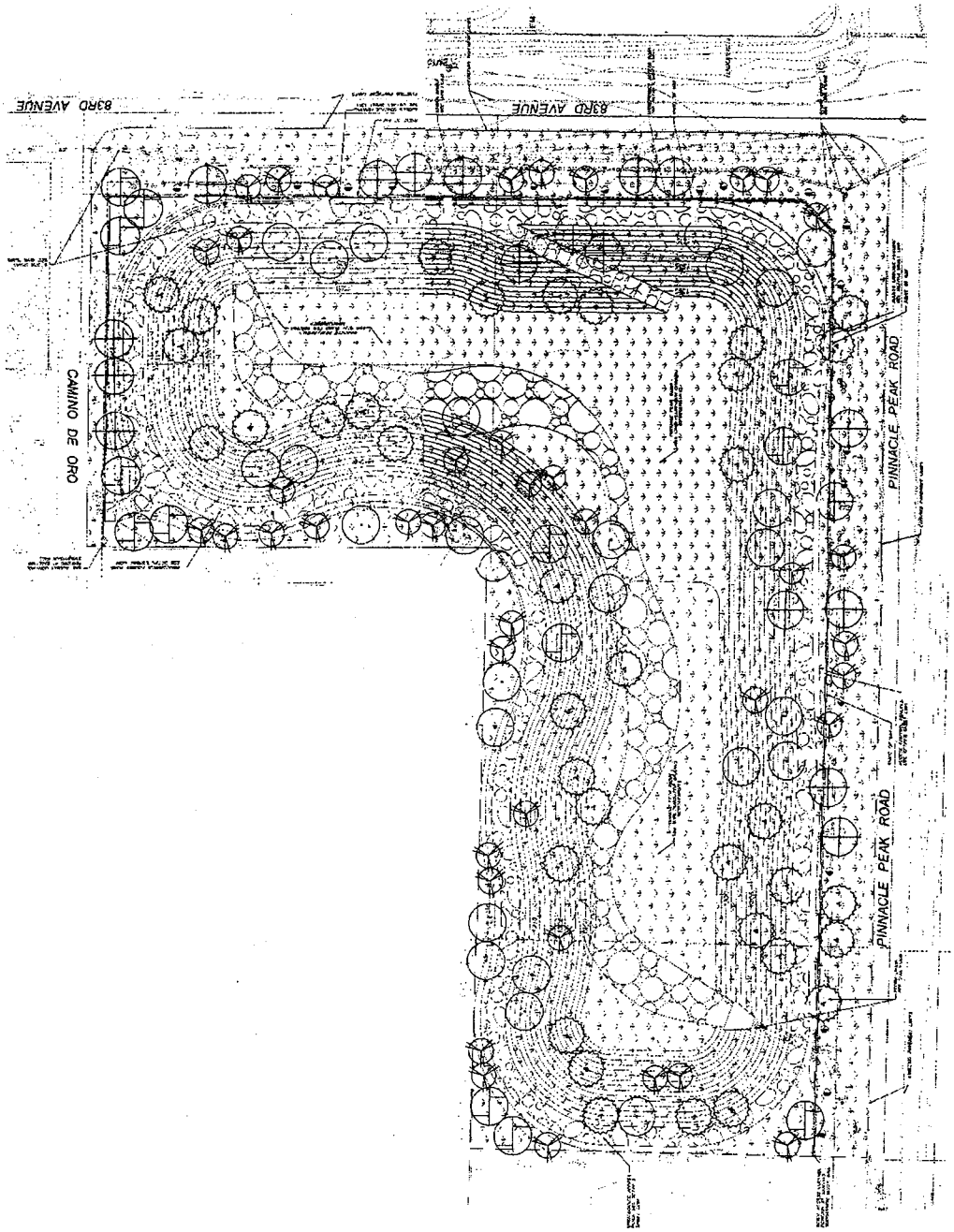



**Figure 1-32**
**Pinnacle Peak Basin**

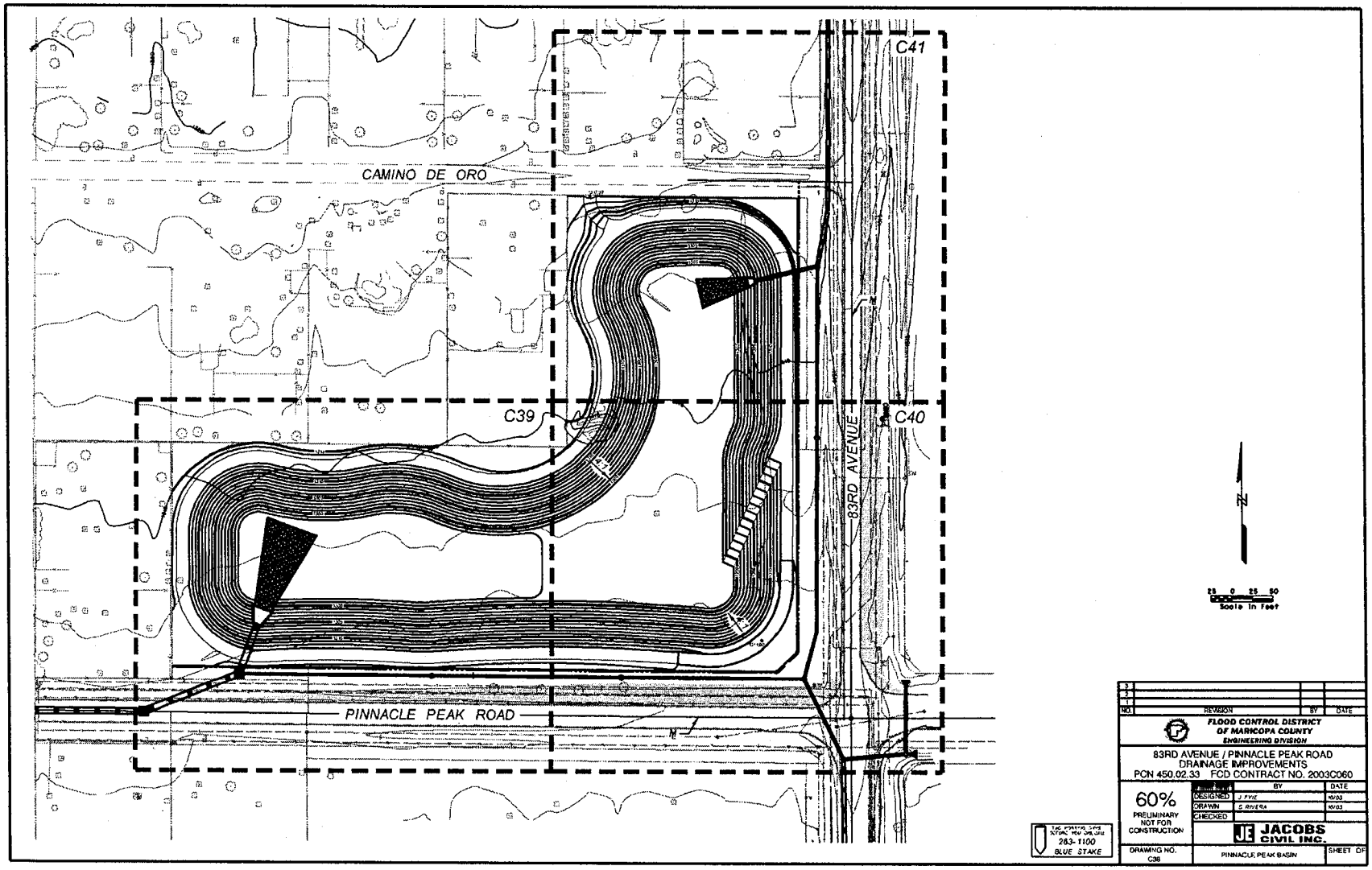
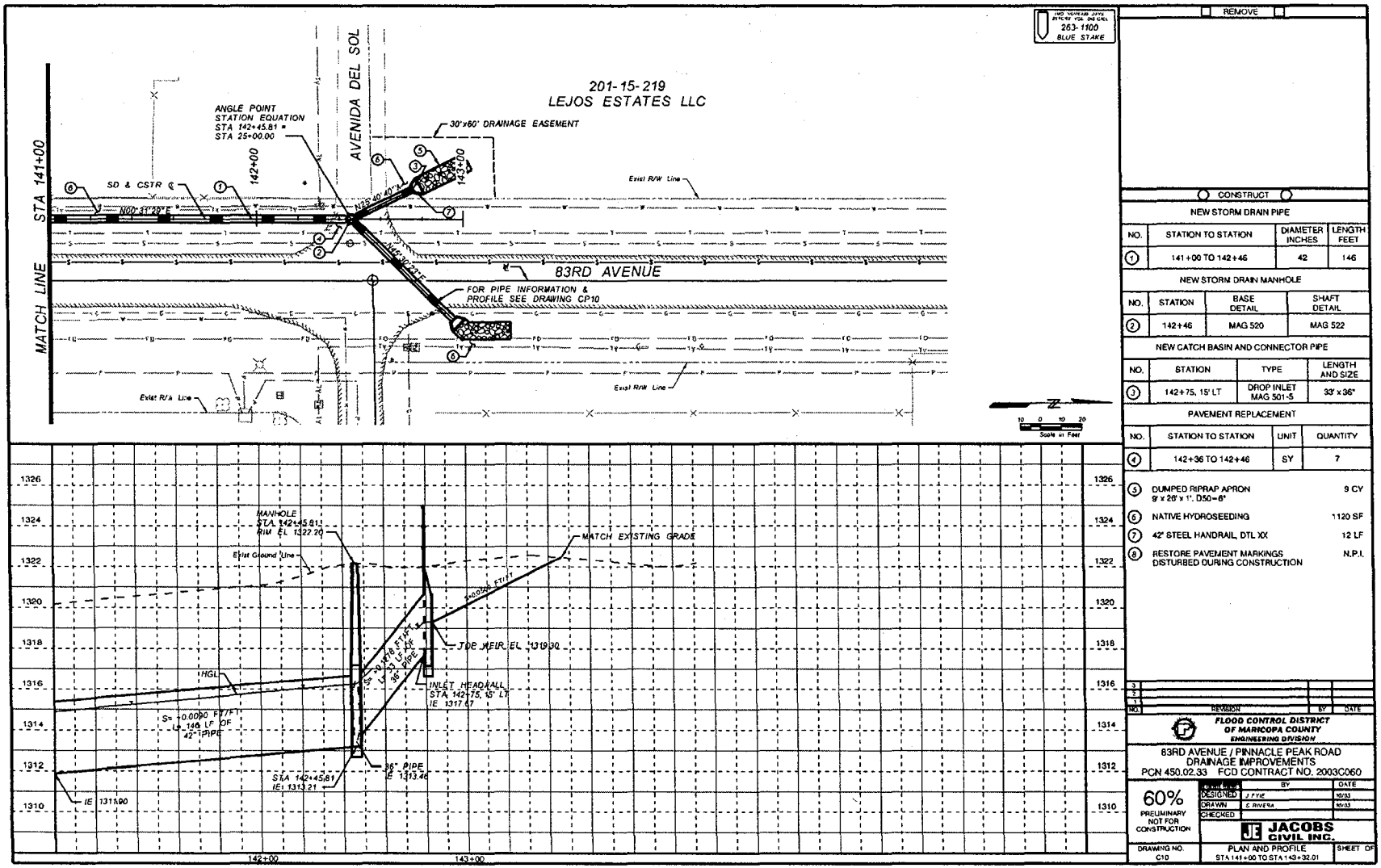

C41
CAMINO DE ORO
C39
C40
83RD AVENUE
PINNACLE PEAK ROAD
N
25 0 25 50
Scale In Feet
NO.
REVISION
BY
DATE
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION
83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060
60%
PRELIMINARY
NOT FOR
CONSTRUCTION
DESIGNED
DRAWN
CHECKED
JACOBS
CIVIL INC.
DRAWING NO.
C39
PINNACLE PEAK BASIN
SHEET OF
283-1100
BLUE STAKE

Figure 1-33

## 83rd Avenue Storm Drain (Station 143+32 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 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 be collected directly into the Pinnacle Peak basin. This system consists of 30" RCP and 42" RCP. Design flows vary from 53 cfs to 91 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

CONSTRUCT

NEW STORM DRAIN PIPE

| NO. | STATION TO STATION | DIAMETER INCHES | LENGTH FEET |
|---|---|---|---|
| 1 | 141+00 TO 142+46 | 42 | 146 |

NEW STORM DRAIN MANHOLE

| NO. | STATION | BASE DETAIL | SHAFT DETAIL |
|---|---|---|---|
| 2 | 142+46 | MAG 520 | MAG 522 |

NEW CATCH BASIN AND CONNECTOR PIPE

| NO. | STATION | TYPE | LENGTH AND SIZE |
|---|---|---|---|
| 3 | 142+75, 15' LT | DROP INLET MAG 501-5 | 33' x 36" |

PAVEMENT REPLACEMENT

| NO. | STATION TO STATION | UNIT | QUANTITY |
|---|---|---|---|
| 4 | 142+36 TO 142+46 | SY | 7 |

| | | |
|---|---|---|
| 5 | DUMPED RIPRAP APRON 9' x 26' x 1', D50=6" | 9 CY |
| 6 | NATIVE HYDROSEEDING | 1120 SF |
| 7 | 42" STEEL HANDRAIL, DTL XX | 12 LF |
| 8 | RESTORE PAVEMENT MARKINGS 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

60% PRELIMINARY NOT FOR CONSTRUCTION

| | BY | DATE |
|---|---|---|
| DESIGNED | J. FYIE | 10/03 |
| DRAWN | S. RIVERA | 10/03 |
| CHECKED | | |

JE JACOBS CIVIL INC.

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

**Figure 1-34**

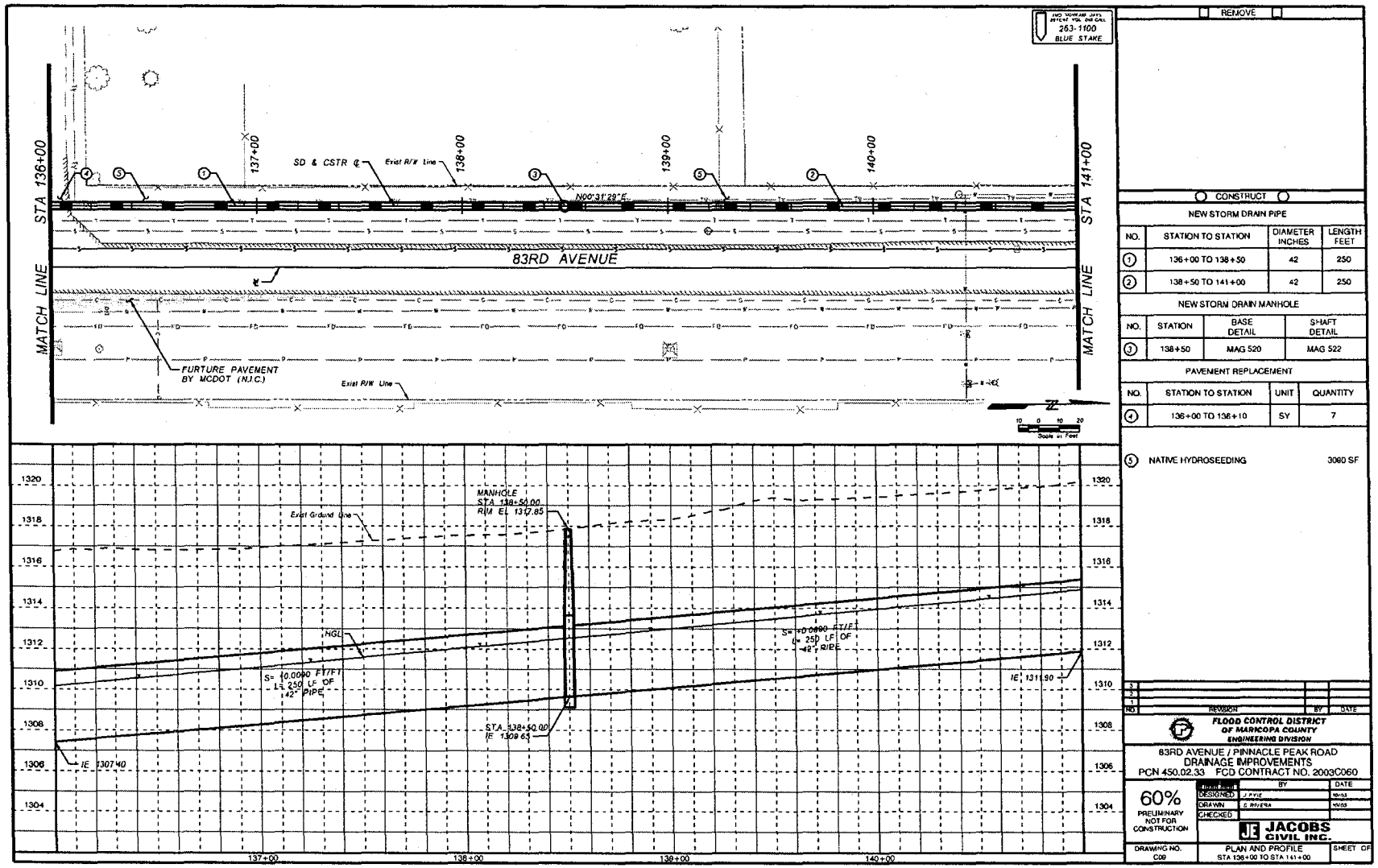
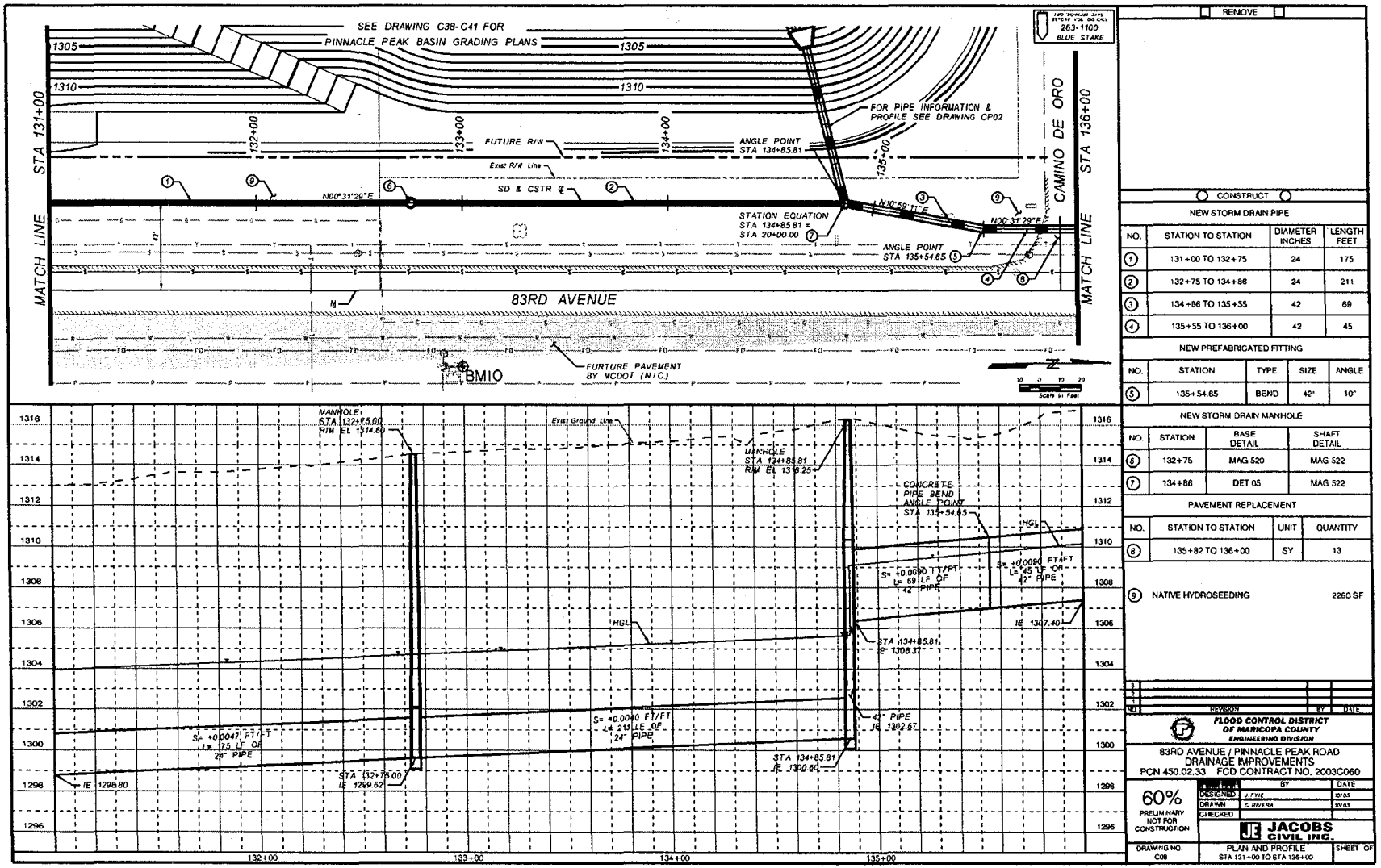

263-1100
BLUE STAKE
STA 136+00
MATCH LINE
137+00
138+00
139+00
140+00
STA 141+00
MATCH LINE
SD & CSTR ℄
Exist R/W Line
N00°31'29"E
83RD AVENUE
FURTURE PAVEMENT
BY MCDOT (N.I.C.)
Exist R/W Line
Scale in Feet
Exist Ground Line
MANHOLE
STA 138+50.00
R/M EL 1317.85
HGL
S= 0.0060 FT/FT
L= 250 LF OF
42" PIPE
S= 0.0060 FT/FT
L= 250 LF OF
42" PIPE
IE 1311.90
STA 138+50.00
IE 1309.65
IE 1307.40
1320
1318
1316
1314
1312
1310
1308
1306
1304
137+00
138+00
139+00
140+00
REMOVE
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 3060 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
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED J. PYLE
DRAWN E. RIVERA
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C09
PLAN AND PROFILE
STA 136+00 TO STA 141+00
SHEET OF

Figure 1-35




REMOVE

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 | DET 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 |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

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

60% PRELIMINARY NOT FOR CONSTRUCTION

| | BY | DATE |
|---|---|---|
| DESIGNED | J. FYIE | 10/03 |
| DRAWN | S. RIVERA | 10/03 |
| CHECKED | | |

JACOBS CIVIL INC.

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

**Figure 1-36**

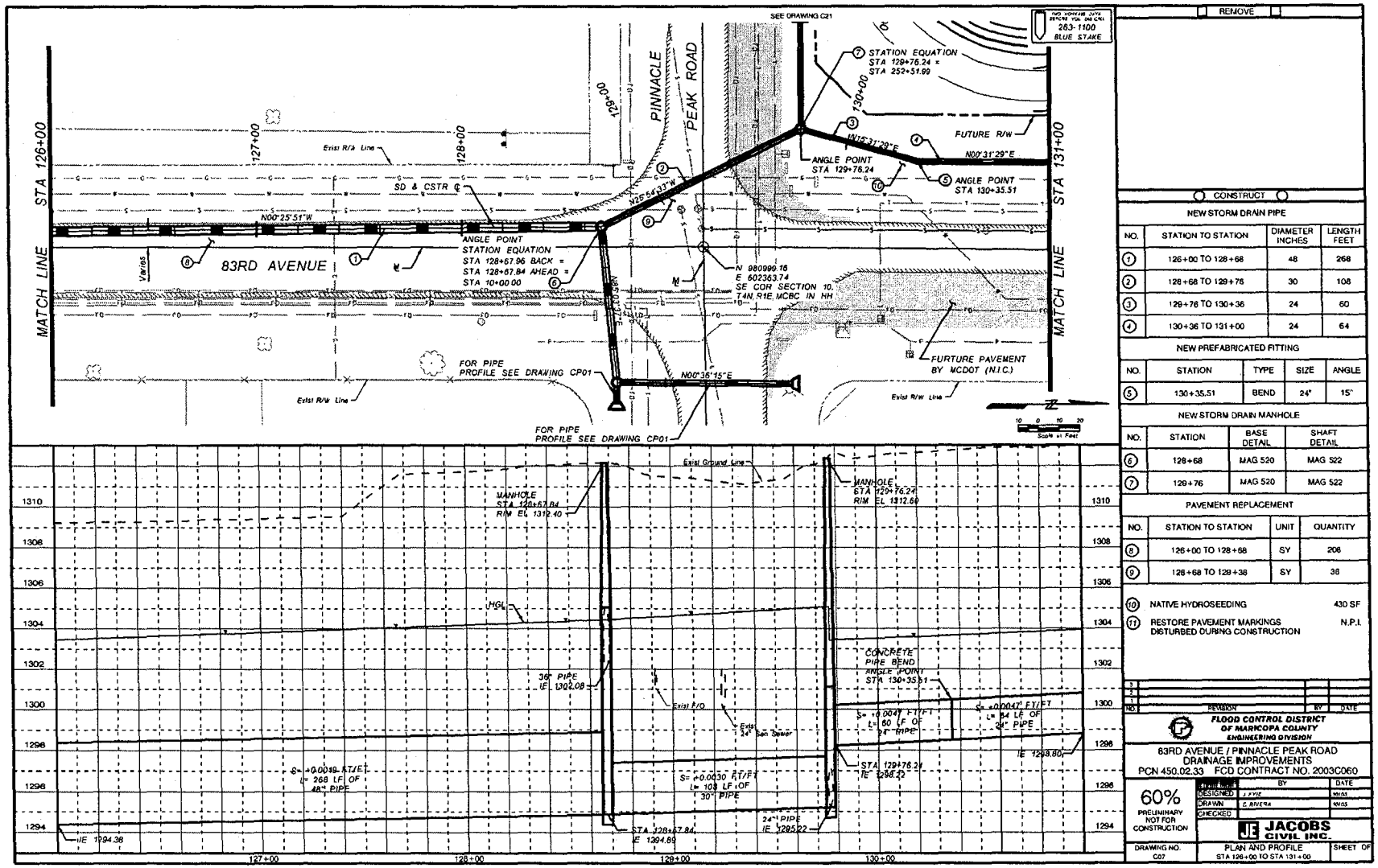

SEE DRAWING C21
263-1100
BLUE STAKE
STA 126+00
MATCH LINE
83RD AVENUE
PINNACLE PEAK ROAD
STA 131+00
MATCH LINE
127+00
128+00
129+00
130+00
Exist R/W Line
SD & CSTR
N00°25'51"W
Varies
ANGLE POINT
STATION EQUATION
STA 128+67.96 BACK =
STA 128+67.84 AHEAD =
STA 10+00.00
N 980999.16
E 602363.74
SE COR SECTION 10,
T4N, R1E, MCBC IN HH
STATION EQUATION
STA 128+76.24 =
STA 252+31.99
FUTURE R/W
N00°31'29"E
ANGLE POINT
STA 129+76.24
ANGLE POINT
STA 130+35.51
N25°54'33"W
N00°36'15"E
FOR PIPE
PROFILE SEE DRAWING CP01
FURTURE PAVEMENT
BY MCDOT (N.I.C.)
Scale in Feet
Exist Ground Line
MANHOLE
STA 128+67.84
R/IM EL 1312.40
MANHOLE
STA 129+76.24
R/IM EL 1312.60
HGL
36" PIPE
IE 1302.08
Exist F/O
Exist 24" San Sewer
CONCRETE
PIPE BEND
ANGLE POINT
STA 130+35.51
S= +0.0047 FT/FT
L= 60 LF OF
24" PIPE
S= +0.0047 FT/FT
L= 94 LF OF
24" PIPE
IE 1298.80
STA 129+76.24
IE 1298.22
S= +0.0039 FT/FT
L= 268 LF OF
48" PIPE
S= +0.0030 FT/FT
L= 108 LF OF
30" PIPE
24" PIPE
IE 1295.22
STA 128+67.84
IE 1294.89
IIE 1294.36
1310
1308
1306
1304
1302
1300
1298
1296
1294
127+00
128+00
129+00
130+00
REMOVE
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 | 206
9 | 128+68 TO 129+38 | SY | 36
10 NATIVE HYDROSEEDING 430 SF
11 RESTORE PAVEMENT MARKINGS 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
60%
PRELIMINARY NOT FOR CONSTRUCTION
DRAWN BY DATE
DESIGNED J. KYLE 10/03
DRAWN C. RIVERA 10/03
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C07
PLAN AND PROFILE
STA 126+00 TO STA 131+00
SHEET OF

Figure 1-37

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 32 cfs for the 30" storm drain and 87 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 1291.49. This is the water surface elevation of the landscaped channel flowing full. See Figures 1-38 to 1-43.

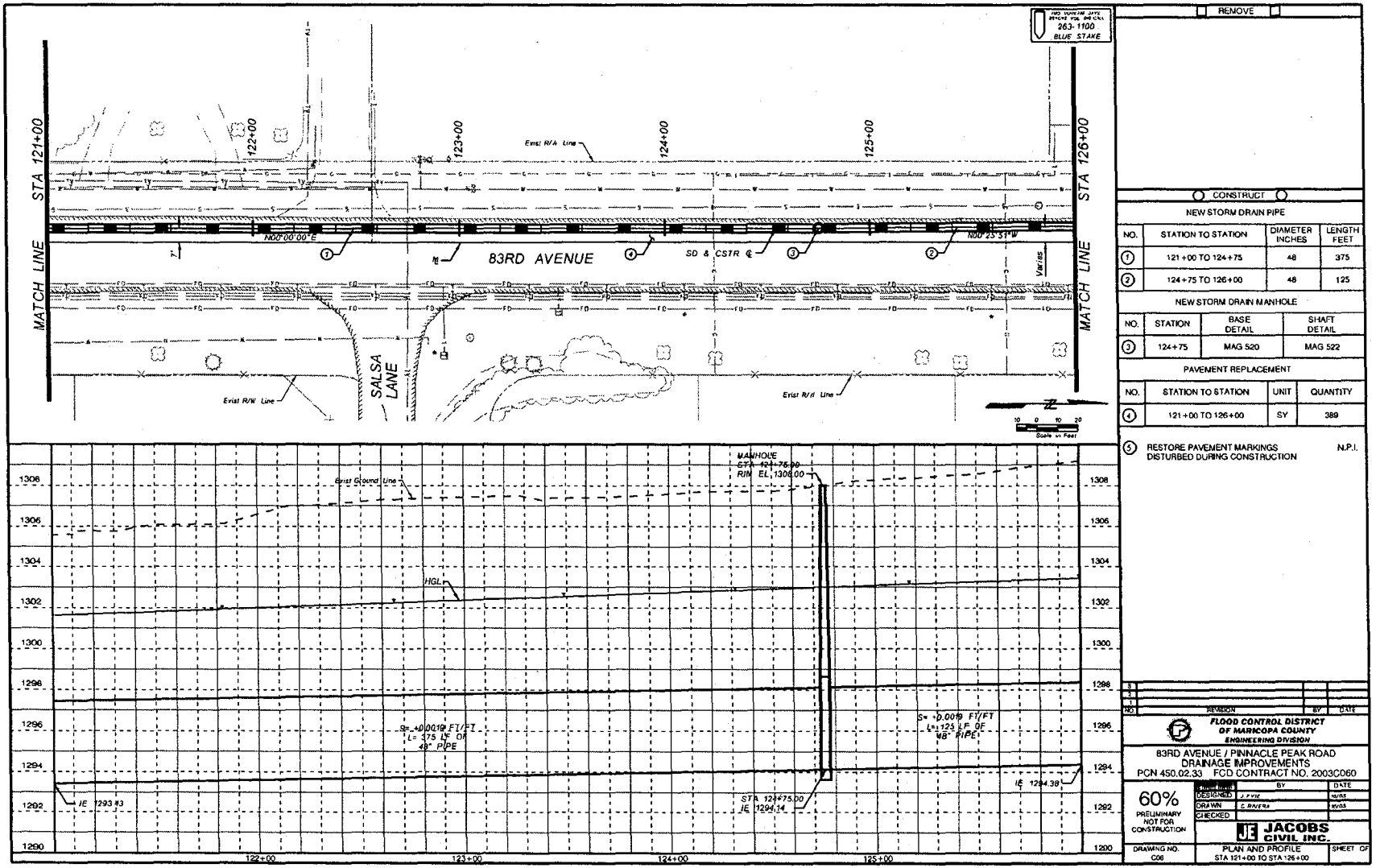
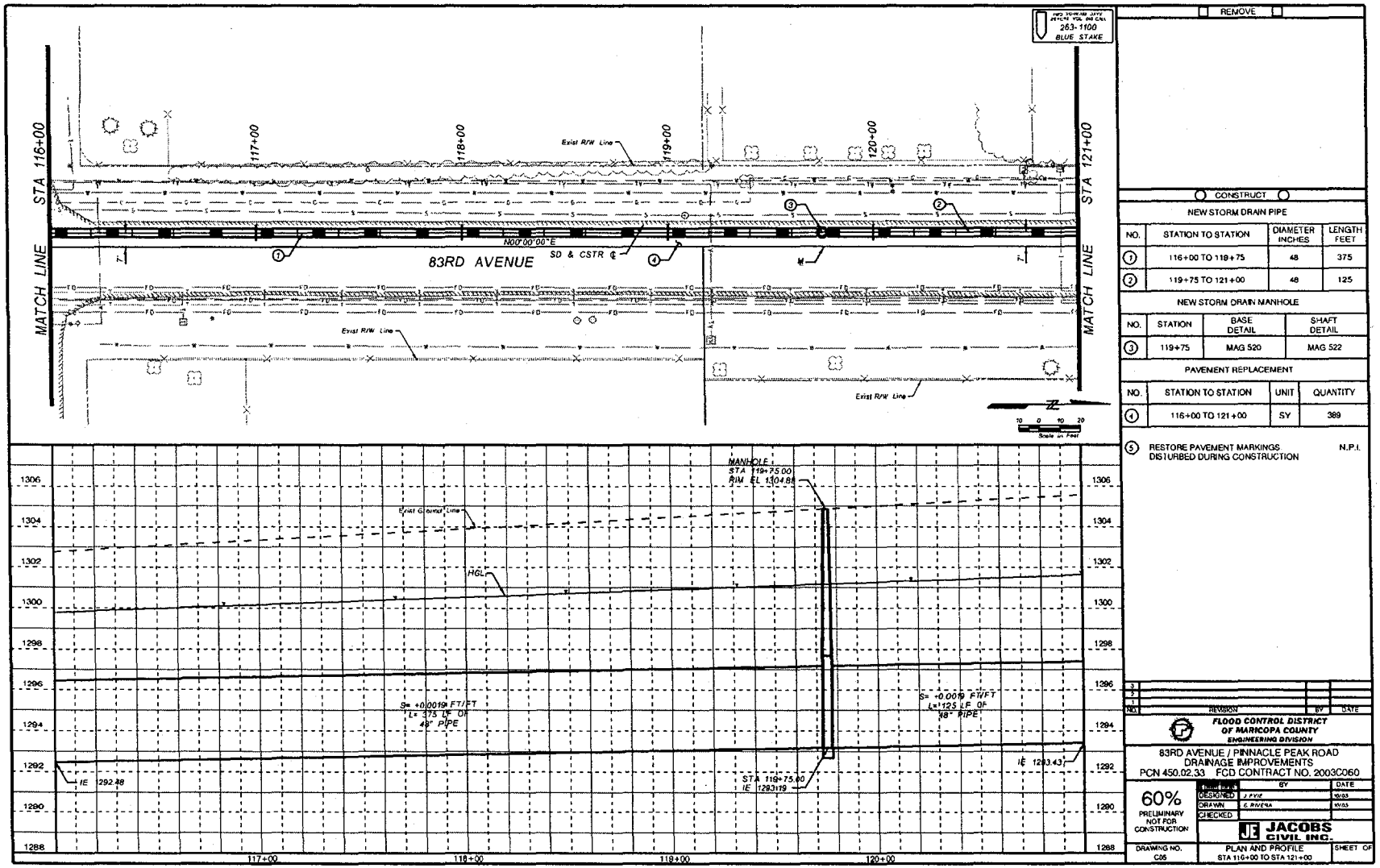

263-1100
BLUE STAKE
STA 121+00
STA 126+00
MATCH LINE
122+00
123+00
124+00
125+00
Exist R/W Line
N00°00'00"E
N00°25'51"W
83RD AVENUE
SD & CSTR ℄
Varies
SALSA LANE
Exist R/W Line
Exist R/W Line
Scale in Feet
MANHOLE
STA 124+75.00
RIM EL. 1308.00
Exist Ground Line
HGL
S= +0.0019 FT/FT
L= 375 LF OF
48" PIPE
S= +0.0019 FT/FT
L= 125 LF OF
48" PIPE
IE 1293.83
STA 124+75.00
IE 1294.14
IE 1294.38
1308
1306
1304
1302
1300
1298
1296
1294
1292
1290
122+00
123+00
124+00
125+00
REMOVE
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 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
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED
DRAWN
CHECKED
BY
DATE
JACOBS CIVIL INC.
DRAWING NO. C06
PLAN AND PROFILE
STA 121+00 TO STA 126+00
SHEET OF

Figure 1-38




REMOVE

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 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

60% PRELIMINARY NOT FOR CONSTRUCTION

| | BY | DATE |
|---|---|---|
| DESIGNED | J. PYLE | 10/03 |
| DRAWN | C. RIVERA | 10/03 |
| CHECKED | | |

JACOBS CIVIL INC.

DRAWING NO. C05 | PLAN AND PROFILE STA 116+00 TO STA 121+00 | SHEET OF

**Figure 1-39**

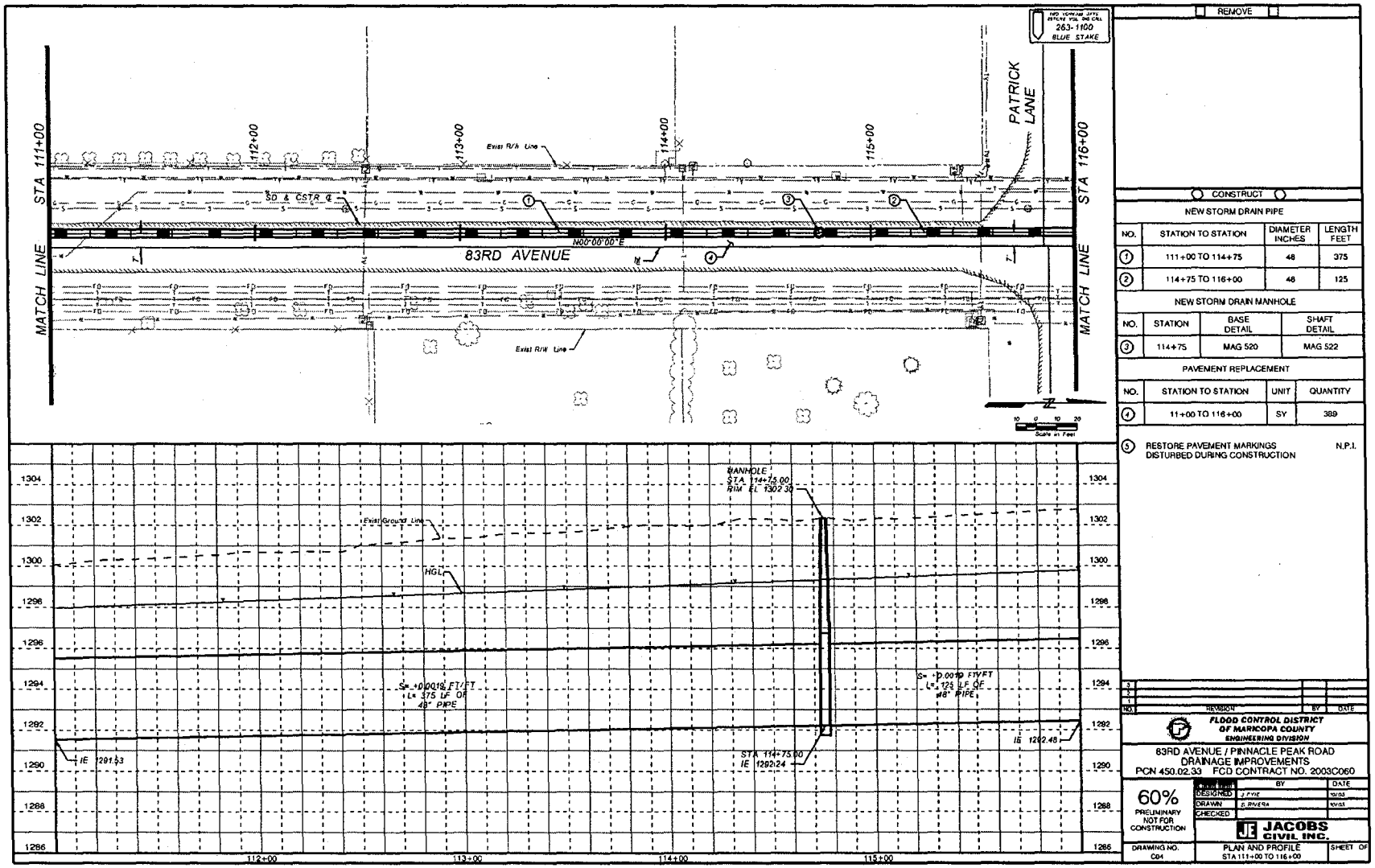

STA 111+00
MATCH LINE
112+00
113+00
114+00
115+00
STA 116+00
MATCH LINE
PATRICK LANE
83RD AVENUE
N00°00'00"E
SD & CSTR ℄
Exist R/W Line
263-1100
BLUE STAKE
REMOVE
CONSTRUCT
NEW STORM DRAIN PIPE
NO. | STATION TO STATION | DIAMETER INCHES | LENGTH FEET
1 | 111+00 TO 114+75 | 48 | 375
2 | 114+75 TO 116+00 | 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 | 11+00 TO 116+00 | SY | 389
5 RESTORE PAVEMENT MARKINGS DISTURBED DURING CONSTRUCTION N.P.I.
MANHOLE STA 114+75.00 RIM EL 1302.30
Exist Ground Line
HGL
S= +0.0019 FT/FT L= 375 LF OF 48" PIPE
S= +0.0010 FT/FT L= 125 LF OF 48" PIPE
IE 1291.53
STA 114+75.00 IE 1292.24
IE 1292.48
1304
1302
1300
1298
1296
1294
1292
1290
1288
1286
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
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED
DRAWN
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C04
PLAN AND PROFILE STA 111+00 TO 116+00
SHEET OF

Figure 1-40

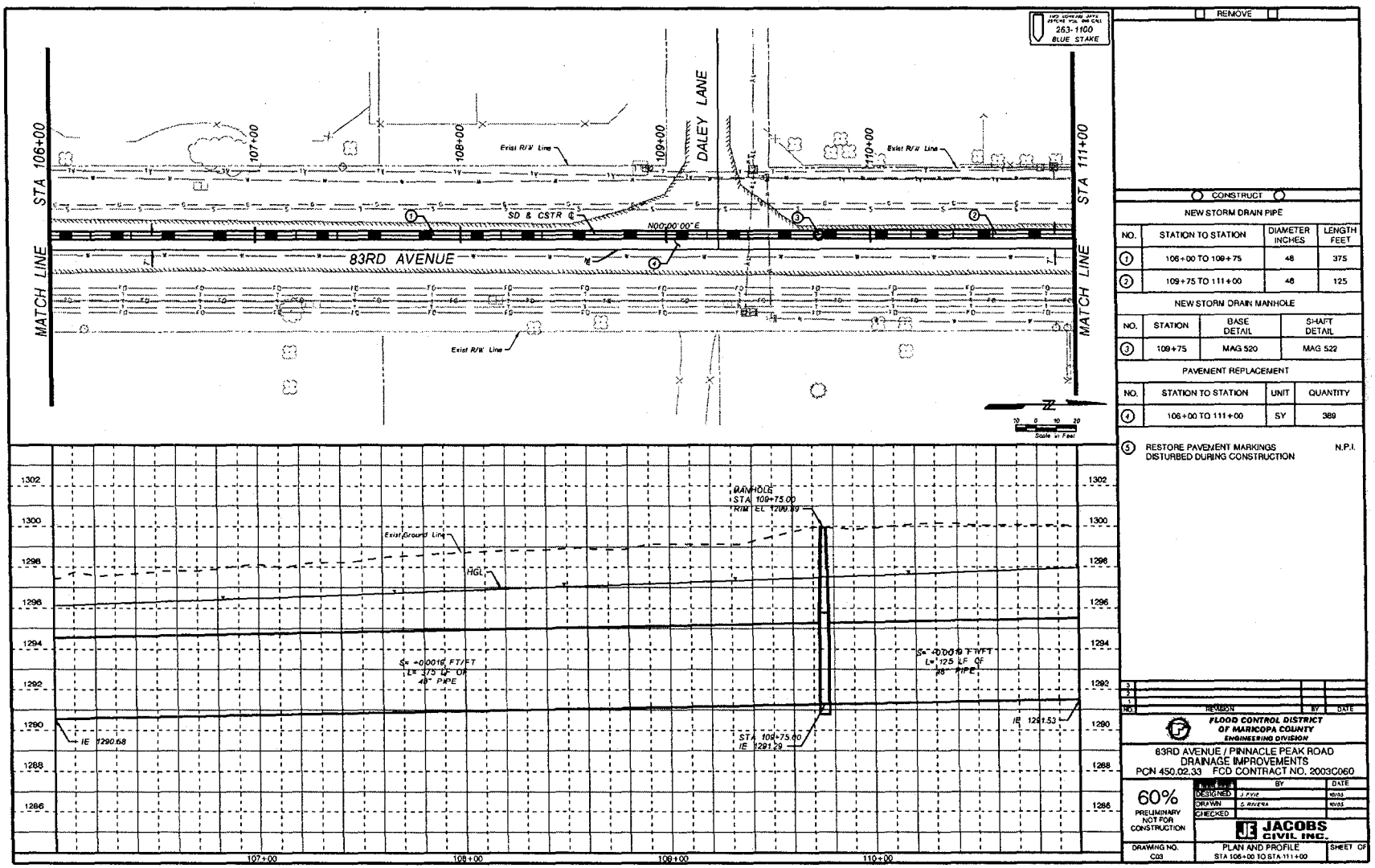

263-1100
BLUE STAKE
STA 106+00
STA 111+00
MATCH LINE
107+00
108+00
109+00
110+00
DALEY LANE
Exist R/W Line
SD & CSTR ℄
N00°00'00"E
83RD AVENUE
Scale in Feet
MANHOLE
STA 109+75.00
R/W EL 1298.39
Exist Ground Line
HGL
S= +0.0016 FT/FT
L= 375 LF OF
48" PIPE
S= +0.0010 FT/FT
L= 125 LF OF
48" PIPE
IE 1290.68
STA 109+75.00
IE 1291.29
IE 1291.53
1302
1300
1298
1296
1294
1292
1290
1288
1286
REMOVE
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 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
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED
DRAWN
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C03
PLAN AND PROFILE
STA 106+00 TO STA 111+00
SHEET OF

Figure 1-41

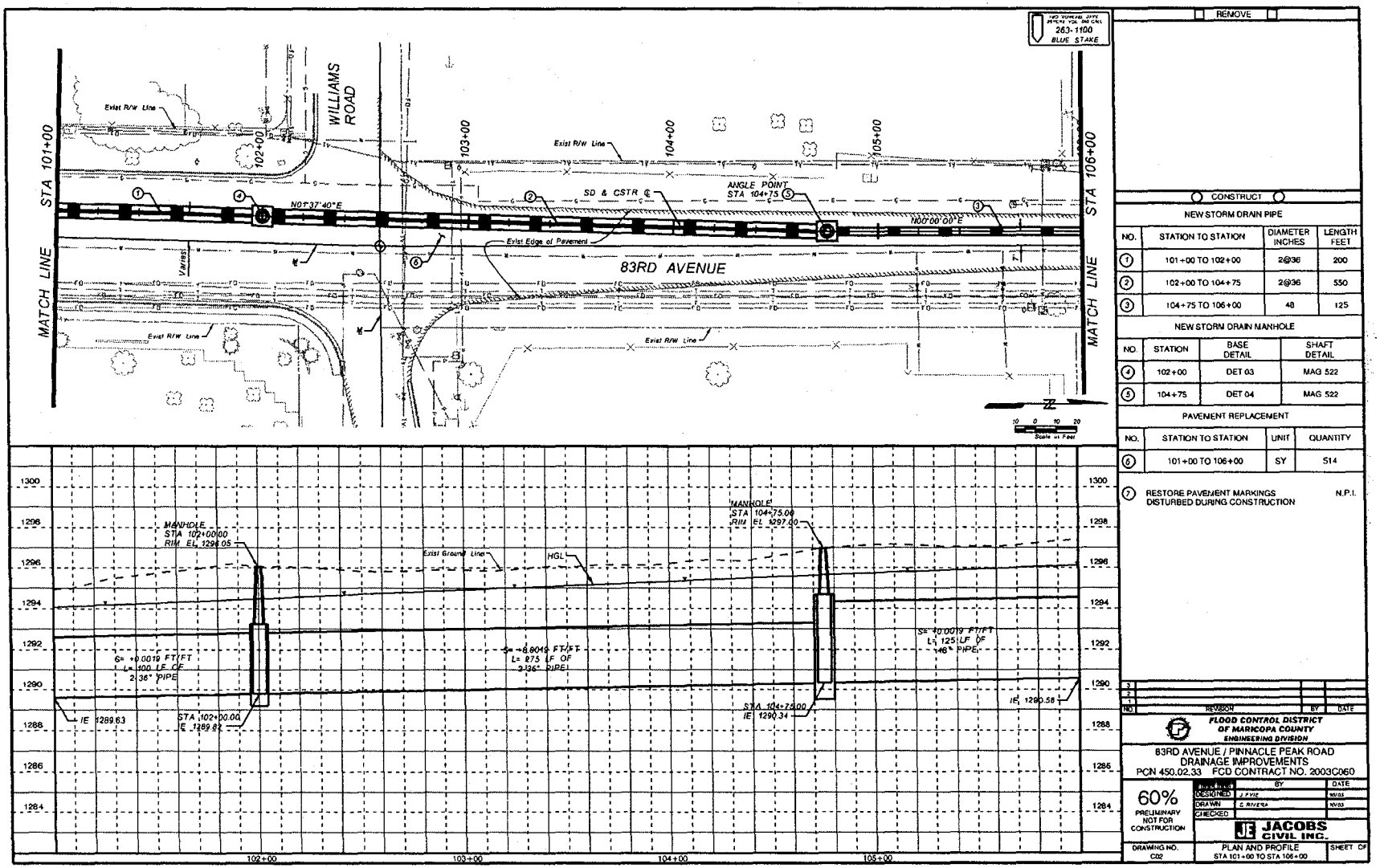
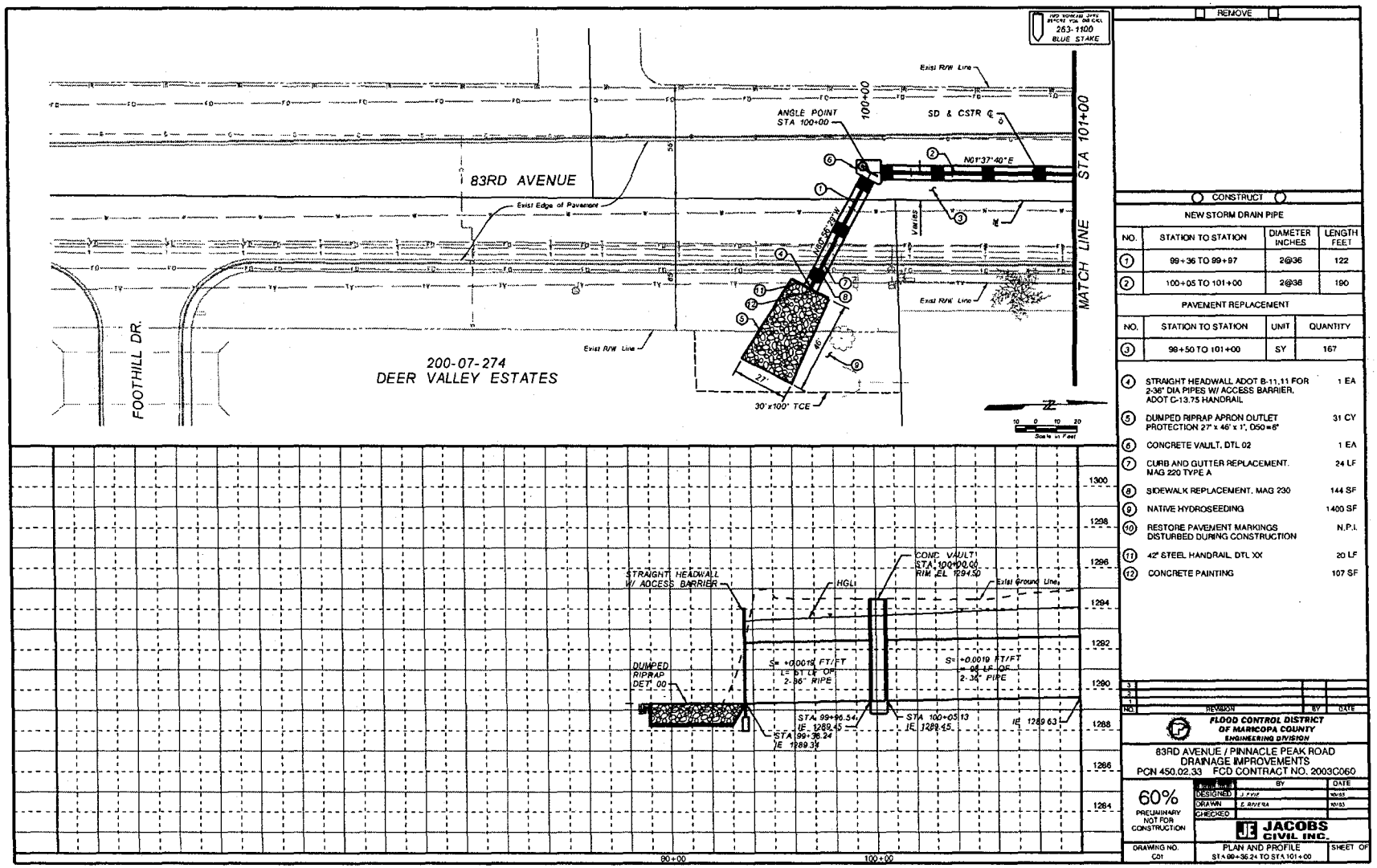

263-1100
BLUE STAKE
WILLIAMS ROAD
STA 101+00
MATCH LINE
102+00
103+00
104+00
105+00
STA 106+00
MATCH LINE
Exist R/W Line
N01°37'40"E
N00°00'00"E
SD & CSTR
ANGLE POINT
STA 104+75
Exist Edge of Pavement
83RD AVENUE
Varies
Scale in Feet
MANHOLE
STA 102+00.00
RIM EL 1296.05
Exist Ground Line
HGL
MANHOLE
STA 104+75.00
RIM EL 1297.00
S= +0.0019 FT/FT
L= 100 LF OF
2-36" PIPE
S= -0.0019 FT/FT
L= 275 LF OF
2-36" PIPE
S= +0.0019 FT/FT
L= 125 LF OF
48" PIPE
IE 1289.63
STA 102+00.00
E 1289.82
STA 104+75.00
IE 1290.34
IE 1290.58
1300
1298
1296
1294
1292
1290
1288
1286
1284
102+00
103+00
104+00
105+00
REMOVE
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 | DET 03 | MAG 522
5 | 104+75 | DET 04 | MAG 522
PAVEMENT REPLACEMENT
NO. | STATION TO STATION | UNIT | QUANTITY
6 | 101+00 TO 106+00 | SY | 514
7 RESTORE PAVEMENT MARKINGS 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
60%
PRELIMINARY NOT FOR CONSTRUCTION
DRAWING | BY | DATE
DESIGNED | J. FYVIE | 10/03
DRAWN | C. RIVERA | 10/03
CHECKED
JACOBS CIVIL INC.
DRAWING NO. C02
PLAN AND PROFILE
STA 101+00 TO STA 106+00
SHEET OF

Figure 1-42




REMOVE

CONSTRUCT

NEW STORM DRAIN PIPE

| NO. | STATION TO STATION | DIAMETER INCHES | LENGTH FEET |
|---|---|---|---|
| 1 | 99+36 TO 99+97 | 2@36 | 122 |
| 2 | 100+05 TO 101+00 | 2@36 | 190 |

PAVEMENT REPLACEMENT

| NO. | STATION TO STATION | UNIT | QUANTITY |
|---|---|---|---|
| 3 | 99+50 TO 101+00 | SY | 167 |

| | | |
|---|---|---|
| 4 | STRAIGHT HEADWALL ADOT B-11.11 FOR 2-36" DIA PIPES W/ ACCESS BARRIER. ADOT C-13.75 HANDRAIL | 1 EA |
| 5 | DUMPED RIPRAP APRON OUTLET PROTECTION 27' x 46' x 1', D50=6" | 31 CY |
| 6 | CONCRETE VAULT, DTL 02 | 1 EA |
| 7 | CURB AND GUTTER REPLACEMENT. MAG 220 TYPE A | 24 LF |
| 8 | SIDEWALK REPLACEMENT, MAG 230 | 144 SF |
| 9 | NATIVE HYDROSEEDING | 1400 SF |
| 10 | RESTORE PAVEMENT MARKINGS DISTURBED DURING CONSTRUCTION | N.P.I. |
| 11 | 42" STEEL HANDRAIL DTL XX | 20 LF |
| 12 | CONCRETE PAINTING | 107 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

60% PRELIMINARY NOT FOR CONSTRUCTION

| | BY | DATE |
|---|---|---|
| DESIGNED | J. FYVE | 10/03 |
| DRAWN | E. RIVERA | 10/03 |
| 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 was retained to provide 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 were retained by Jacobs Civil to perform 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 So. 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.

# 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.

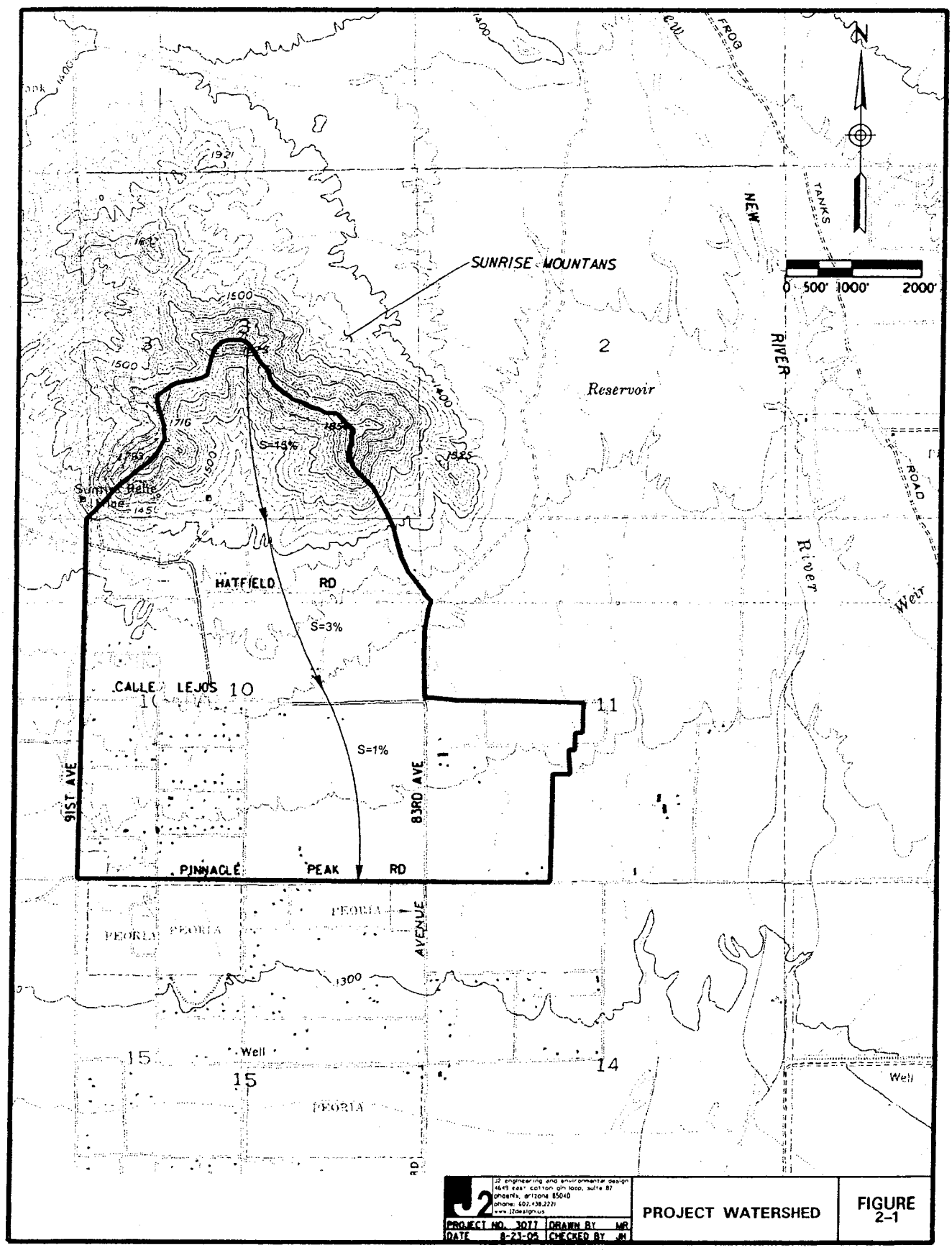
The area has been previously studied as part of the *Glendale-Peoria Area Drainage Master Plan,* the *Glendale-Peoria Area Drainage Master Plan Update,* and most recently, the *Final Pre-Design Report* (November 2004) for the current project.

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.


SUNRISE MOUNTANS
Reservoir
NEW
RIVER
TANKS
ROAD
River
Weir
HATFIELD RD
S=15%
S=3%
S=1%
CALLE LEJOS
91ST AVE
83RD AVE
PINNACLE PEAK RD
PEORIA
AVENUE
Well
0 500' 1000' 2000'
N
J2 engineering and environmental design
4649 east cotton gin loop, suite 87
phoenix, arizona 85040
phone: 602.438.2221
www.j2design.us
PROJECT NO. 3077
DRAWN BY MR
DATE 8-23-05
CHECKED BY JH
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.

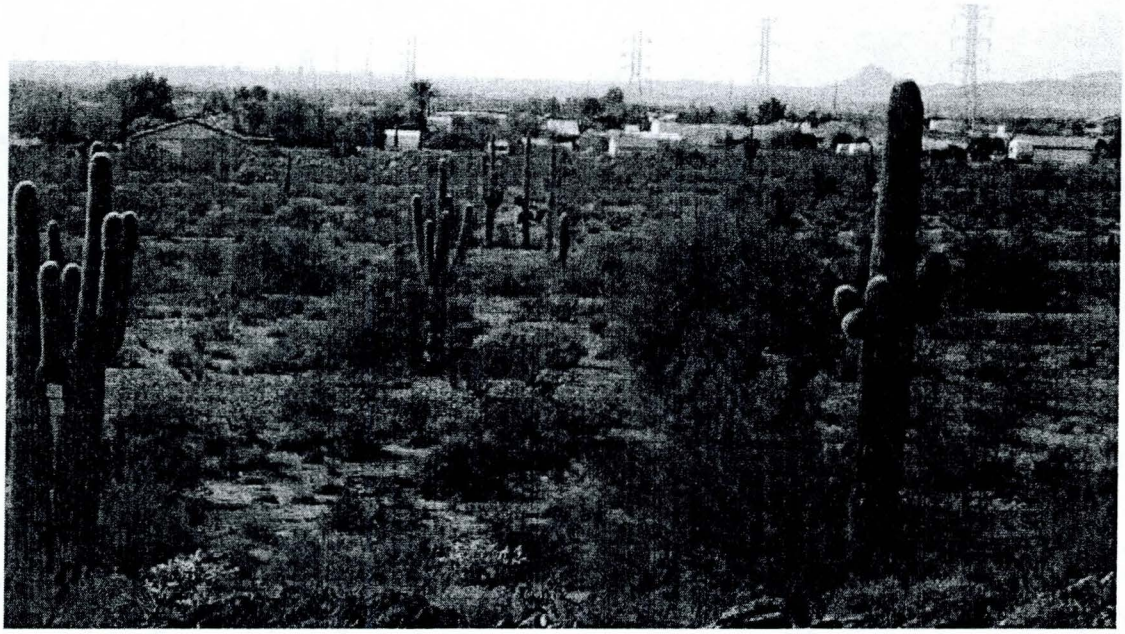


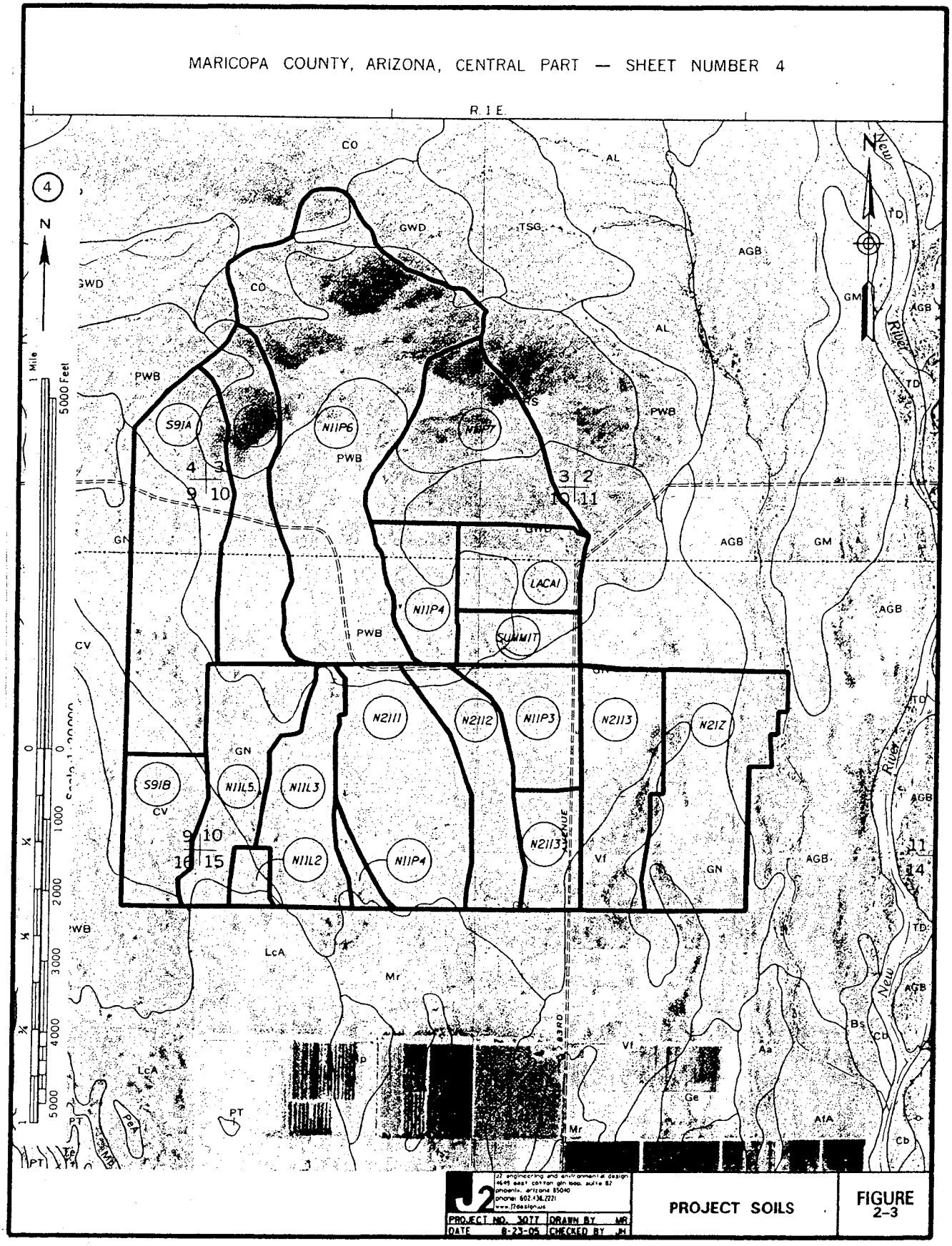
**Figure 2-2**
**Site Vegetation**

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
CO
AL
GWD
TSG
AGB
GM
TD
PWB
S91A
N11P6
N11P7
LACAI
N11P4
SUMMIT
CV
N2111
N2112
N11P3
N2113
N21Z
S91B
N11L5
N11L3
N11L2
GN
Vf
LcA
Mr
Ge
Aa
AlA
Bs
Cb
PT
New River
83RD AVENUE
J2 engineering and environmental design
4645 east cotton gin loop, suite B2
phoenix, arizona 85040
phone: 602.436.2221
www.j2design.us
PROJECT NO. 3077
DATE 8-23-05
DRAWN BY MR
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 (FIS) Map panel 1180 of 4350. The FIS 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 FIS map.

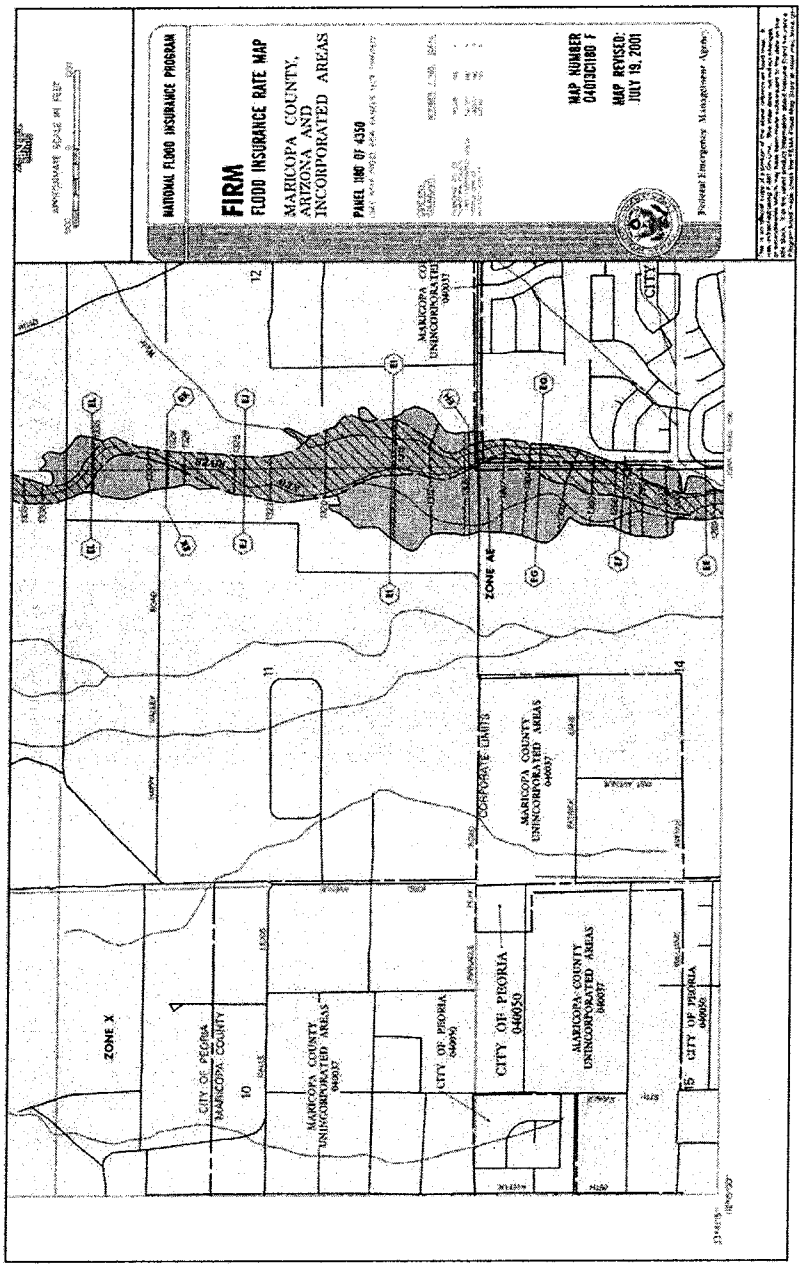



**Figure 2-4**
**FIRM Panel 04013C1180F**

## 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 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 | 123 |
| 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 87TH AV | 379 |
| RPPSD | PINNACLE PEAK ROAD STORM DRAIN AT PP BASIN | 379 |
| US_BSN | TOTAL INFLOW INTO PINNACLE PEAK BASIN | 567 |
| 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 |

## Table 2-2
## Detention Basin Summary

| BASIN HEC-1 ID | DESCRIPTION | 100-YEAR PEAK STAGE | 100-YEAR PEAK OUTFLOW, CFS |
|---|---|---|---|
| 87BA | 87TH AVENUE BASIN | 1319.65 | 123 |
| R83BSN | PINNACLE PEAK BASIN | 1311.84 | 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, 89th 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 3:1 were used only where needed 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 crown elevations were matched, where possible, 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 channels will not be used.
- 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 3:1 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 | 1319.65 | 1311.84 |
| 100 Year Maximum Storage Volume (ac-ft) | 30.64 | 51.87 |
| 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 | 31.70 |

# 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) |
|---|---|---|---|---|---|---|---|---|---|
| 1313 | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1314 | 97,805 | 97,805 | 48,903 | 1.12 | 0.00 | 0.23 | 0.00 | 12.11 | 12.11 |
| 1315 | 142,128 | 142,128 | 168,869 | 3.88 | 1.23 | 1.23 | 27.85 | 27.85 | 55.70 |
| 1316 | 157,880 | 157,880 | 318,873 | 7.32 | 2.23 | 2.23 | 37.48 | 37.48 | 74.96 |
| 1317 | 174,332 | 174,332 | 484,979 | 11.13 | 3.23 | 3.23 | 45.10 | 45.10 | 90.19 |
| 1318 | 192,398 | 192,398 | 668,344 | 15.34 | 4.23 | 4.23 | 51.60 | 51.60 | 103.20 |
| 1319 | 200,788 | 200,788 | 864,937 | 19.86 | 5.23 | 5.23 | 57.37 | 57.37 | 114.74 |
| 1320 | 243,067 | 243,067 | 1,086,865 | 24.95 | 6.23 | 6.23 | 62.61 | 62.61 | 125.23 |
| 1321 | 252,291 | 252,291 | 1,334,544 | 30.64 | 7.23 | 7.23 | 67.45 | 67.45 | 134.90 |

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

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) |
|---|---|---|---|---|---|---|---|---|---|
| 1298 | 35,074 | 35,074 | 17,537 | 0.40 | 0.00 | 0.85 | 0.00 | 4.55 | 4.55 |
| 1299 | 95,948 | 95,948 | 83,048 | 1.91 | 0.00 | 1.85 | 0.00 | 6.72 | 6.72 |
| 1300 | 104,030 | 104,030 | 183,037 | 4.20 | 0.00 | 2.85 | 0.00 | 8.35 | 8.35 |
| 1301 | 112,212 | 112,212 | 291,158 | 6.68 | 0.00 | 3.85 | 0.00 | 9.70 | 9.70 |
| 1302 | 120,495 | 120,495 | 407,512 | 9.36 | 0.00 | 4.85 | 0.00 | 10.89 | 10.89 |
| 1303 | 128,878 | 128,878 | 532,198 | 12.22 | 0.00 | 5.85 | 0.00 | 11.96 | 11.96 |
| 1304 | 137,362 | 137,362 | 665,318 | 15.27 | 2.77 | 6.85 | 8.23 | 12.94 | 21.17 |
| 1305 | 145,946 | 145,946 | 806,972 | 18.53 | 3.77 | 7.85 | 9.60 | 13.85 | 23.45 |
| 1306 | 154,631 | 154,631 | 957,261 | 21.98 | 4.77 | 8.85 | 10.80 | 14.71 | 25.51 |
| 1307 | 163,417 | 163,417 | 1,116,285 | 25.63 | 5.77 | 9.85 | 11.88 | 15.52 | 27.40 |
| 1308 | 172,303 | 172,303 | 1,284,145 | 29.48 | 6.77 | 10.85 | 12.87 | 16.29 | 29.15 |
| 1309 | 181,289 | 181,289 | 1,460,941 | 33.54 | 7.77 | 11.85 | 13.78 | 17.02 | 30.81 |
| 1310 | 190,376 | 190,376 | 1,646,773 | 37.80 | 8.77 | 12.85 | 14.64 | 17.73 | 32.37 |
| 1311 | 199,564 | 199,564 | 1,841,743 | 42.28 | 9.77 | 13.85 | 15.46 | 18.40 | 33.86 |
| 1312 | 208,852 | 208,852 | 2,045,951 | 46.97 | 10.77 | 14.85 | 16.23 | 19.06 | 35.29 |
| 1313 | 218,236 | 218,236 | 2,259,495 | 51.87 | 11.77 | 15.85 | 16.97 | 19.69 | 36.65 |

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

Revised 9/28/05

## 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 drain 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 catch basins 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, 537 Double and 538 Double 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.

## 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 was 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.

Carefree Partners LLC. *Deer Valley Estates Final Drainage Plan*, Prepared by MX Group Inc., Revised February 1997.

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.

Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona Volume I Hydrology*. January 1, 1995.

Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona Volume II Hydraulics*. January 28, 1996.

Flood Control District of Maricopa County, *Phase I Environmental Site Assessment Proposed Detention Basin and Associated Additional Areas 83rd Avenue and Pinnacle Peak Road*. Prepared by URS, September 21, 2004.

Flood Control District of Maricopa County, *Cultural Resource Survey for Geotechnical Investigations of the 83rd Avenue and Pinnacle Peak Road Drainage Project*. Prepared by URS, July, 2004.

Flood Control District of Maricopa County, *Supplemental Cultural Resource Survey for the 83rd Avenue and Pinnacle Peak Road Drainage Project*. Prepared by URS, September, 2004.

Flood Control District of Maricopa County, *Report on Geotechnical Evaluation – Draft for 83rd Ave Drainage Improvements*. Prepared by Speedie and Associates, August 16, 2004.

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

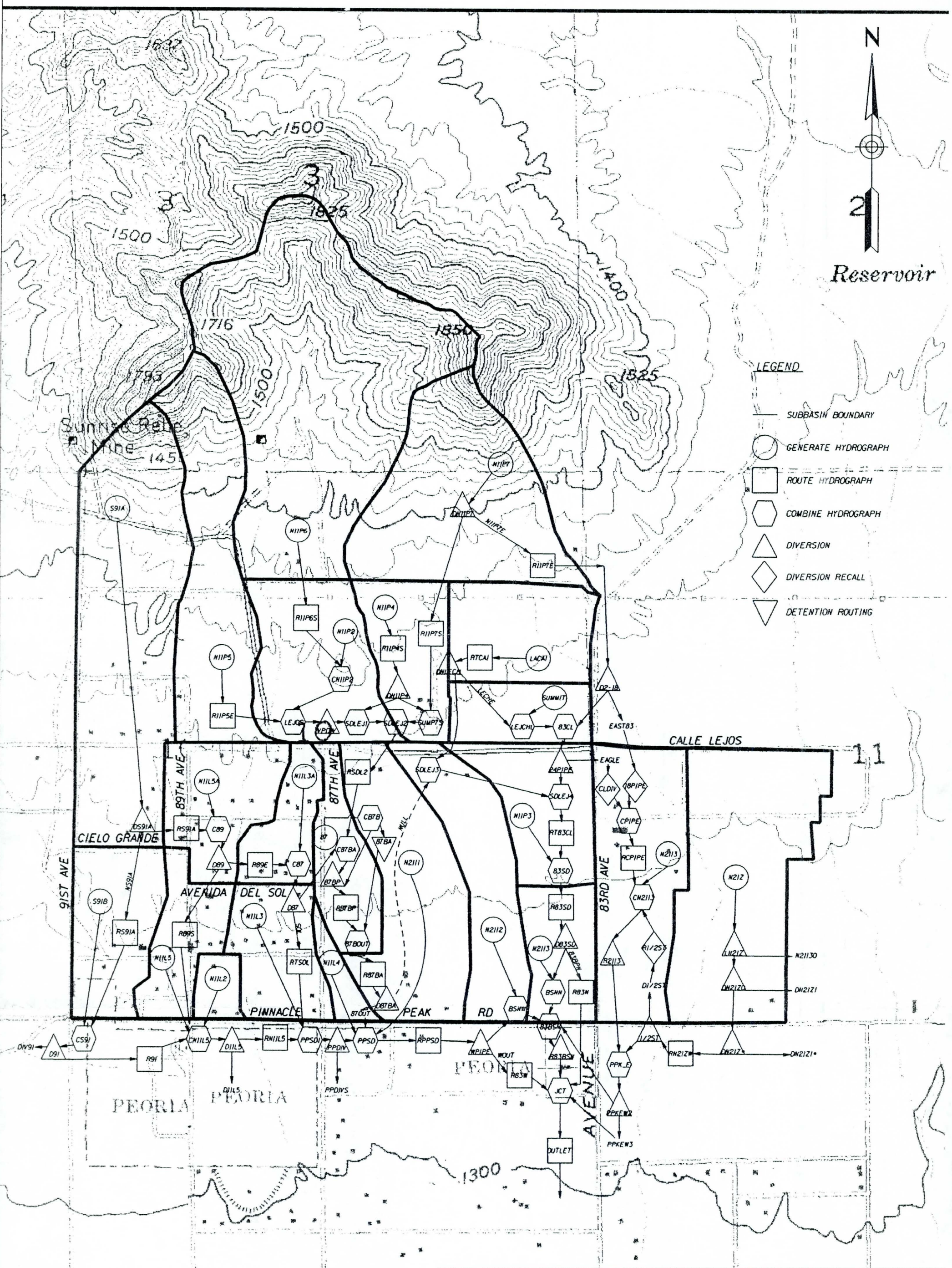
Hancock Communities, *Final Drainage Report for Clearview Estates*. Prepared by Sage Engineering Corporation, April 7, 1999.

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

.\91st Ave Drainage MapV8.dgn 9/29/2005 5:18:14 PM

```
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *              JUN   1998              *
 *            VERSION 4.1               *
 *                                      *
 *  RUN DATE   28OCT05  TIME  13:29:16  *
 *                                      *
 ****************************************
```

```
****************************************
*                                      *
*    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   83DES4.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
34          ID          TO ADD IN WITH CLPIPE (ROUTED OUTFLOW FROM RBSN).
35          ID   REVISED 12/07/04 BY DES TO CHANGE LEJOS DETEN BASIN
36          ID          STAGE STORAGE INPUT RECORD, BOTTOM AT 1337.
37          ID          INCLUDES A 10-FOOT O&M ROAD WITH 4:1 BACKSLOPES
38          ID          INCLUDES CHANGES BY J2 SUBMITTED 12-07-04.
39          ID   REVISED 11/16/04 BY JPF TO REMOVE DIVERSIONS NPIPE, WPIPE AND PPKES
40          ID   REVISED 11/15/04 BY JPF FOR PINNACLE PEAK BASIN MODIFICATIONS
41          ID   REVISED 11/4/04 BY JPF FOR CHANGES IN FAX TO JEFF H 11/2/04
42          ID   83RD AVENUE AND PINNACLE PEAK DRAINAGE IMPROVEMENTS
43          ID   THIS FILE MODELS THE HYDRYOLOGY FOR THE PROPOSED
44          ID   DRAINAGE IMPROVEMENTS FROM THE SUNRISE MOUNTAINS SOUTH TO
45          ID   TO PINNACLE PEAK ROAD AND FROM 89TH AVE WEST TO 81ST AVE
46          ID
47          ID   J2 MODIFIED THE ENTELLUS GLENDALE/PEORIA ADMP UPDATE
48          ID   LEVEL3.DAT
49          ID   J2 UPDATED THE HYDROLOGY MODEL AND REDUCED THE LIMITS TO AREAS PERTINENT
50          ID   TO THIS PROJECT.
51          ID
52          ID   PREPARED BY: KBD
53          ID   DATE: SEPTEMBER 2004
54          ID   REVISED OCTOBER 2004
55          ID   UPDATED FOR FCD PREDESIGN COMMENTS FROM STEVE TUCKER
1                                   HEC-1 INPUT                                    PAGE  2

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

56          ID
57          ID   STEVE TUCKER COMMENTS:
58          ID
59          ID   1) In the schematic, all triangles should have 2 arrows going outward.
60          ID      All other symbols should have 1 arrow pointing outward.
61          ID      Specifically, QINCL - CLBRK, RN21ZW - 1/2ST,
62          ID      and PPK_E - 83_S are drawn incorrectly.
63          ID
64          ID      J2 RESPONSE: AGREE WILL UPDATE THE HEC-1 DIAGRAM
65          ID
66          ID   2) The diamond RI1/2ST should be moved to the southside of R21I3 for clarity.
67          ID
68          ID      J2 RESPONSE: AGREE WILL UPDATE THE HEC-1 DIAGRAM
69          ID
70          ID   3) The model should include the total areas that contribute to the channel
71          ID      at the downstream exit of the storm drain (at Deer Valley Estates).
72          ID      I think this should involve no more than cut and paste of the original
73          ID      Model.
74          ID
75          ID      J2 RESPONSE: THE ADDITIONAL AREAS WERE ADDED. THE SUBBASINS ADDED FROM
76          ID                   THE LEVEL3.DAT FILE WERE N22B AND N21F.
77          ID
78          ID   4) The alternative of taking flows from east of 83rd Avenue and
79          ID      Pinnacle Peak should be addressed, advantages and disadvantages.
80          ID
81          ID      J2 RESPONSE: THE FLOWS ARRIVEING ALONG PINNACLE PEAK FORM THE EAST AT
82          ID                   83RD AVENUE AND PINNACLE PEAK WERE ROUTED INTO PINNACLE
83          ID                   PEAK BASIN.
84          ID
85          ID   5) The diversions east and south for N212 do not appear to conform to what
86          ID      I saw in the field. It says that at 300 cfs, the entire flow would turn to
87          ID      the west, and at 400 cfs, almost all the flow would travel west. It
88          ID      appeared to me that there would be significant flows east and south.
```

```
 89          ID
 90          ID      J2 RESPONSE: THROUGH DISCUSIONS WITH THE FCD AND BY CONDUCTING A SITE
 91          ID                   VISIT 10-26-2004, THE DESIGN TEAM DETERMINED THAT THE
 92          ID                   FLOW SPLIT OCCURRING AT 81ST AVE AND PINNACLE PEAK HAD
 93          ID                   A RATIO OF 50% TRAVELING SOUTH AND 50% WEST. SEE "DN21Z*"
 94          ID
 95          ID
 96          ID
 97          ID   MODEL ID: 83REV.DAT
 98          ID
 99          ID   ==========================================================================
100          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
             *
```



```
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
1                                        HEC-1 INPUT                                                    PAGE  6

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
             *
```

```
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
              *

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

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

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



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

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

```
299          KK    87BP
300          KM   DIVERT FLOW IN EXCESS OF BYPASS PIPE CAPACITY INTO 87TH AVE BASIN
301          DT   87BAS
302          DI       0   10000
303          DQ       0   10000
             *

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

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

314          KK    R87B
315          KM   RETRIEVE DIVERTED FLOW 87BAS
316          DR   87BAS
             *

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

320          KK    87BA
321          KM   ROUTE C87B THROUGH NEW BASIN AT 87TH AVENUE (LAST UPDATED 10/26/05)
322          RS       1    STOR       0
323          SV    1.12    3.88    7.32   11.13   15.34   19.86   24.98   30.64
324          SE    1314    1315    1316    1317    1318    1319    1320    1321
325          SQ   12.11   55.70   74.96   90.19  103.20  114.74  125.23  134.90
             *
             * 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
             *
```



```
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
             *
```



```
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
             *

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

```
387          UA     100
             *

388          KK  RDLECH
389          KM   DIVERSION RECOVER LECHE
390          KM   FLOWS ALONG NORTH SIDE OF CALLE LEJOS
391          DR   LECHE
             *

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

395          KK  RDP7E
396          KM   DIVERSION RECOVER N11P7E
397          KM   RECOVER FLOWS FROM DN11P7 (EASTERN DIVERT)
398          DR  N11P7E
             *

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



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

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

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

420          KK  24PIPE
421          KM   DIVERT FLOWS THAT PASS THRU EXISTING 3-24" CMPS (PASSED TO EAGLE CANYON
422          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
             *
```



```
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
             *
```



```
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
             *

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

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

565          KK   N21I3
566          KM   ADMP UPDATE BASIN N21I3 RE-DELINEATED
567          KM   ORIGINAL BASIN SIZE WAS 0.115 SQ MILES
568          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
569          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF 1.000
570          KM     L =  .17  Kb = .063  Adj. Slope =   38.0
571          BA    .027
572          LG    .330    .350   2.650   1.300   8.000
573          UC    .221    .131
574          UA       0       5      16      30      65      77      84      90      94      97
575          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.
             *
```



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

576          KK    N21Z   BASIN
577          KM   APPEARS THAT FLOWS FROM N21J ARE DIVERTED BY WALL AROUND
578          KM   CALLE LEJOS ESTATES TO WASH ON WEST
579          KM   CALLE LEJOS PICKS UP REST OF FLOWS GENERATED NORTH AND DIVERTS EAST
580          KM   THEREFORE N21J HAS BEEN ELIMINATED FROM THE PROJECT WATERSHED
```

```
581          KM   THIS SUB-BASIN INCLUDES EAGLE DEV
582          KM     L =  .52  Kb = .038  Adj. Slope =   33.0
583          BA    .109
584          LG    0.18    0.35    6.40    0.14       6
585          UC   0.300   0.203
586          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
587          UA     100
             *

588          KK   LN21Z
589          KM   EAST SIDE OF EAGLE STORAGE ACCOUNTED FOR
590          KM   EAGLE WEST OF 81ST AVE AVAILABLE RETENTION = 3.42 ACRE-FT
591          DT  N21I3O    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
             *
```



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

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

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



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

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

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

664          KK  PPKEW2
665          KM   DIVERSION PPKEW2 AT PINNACLE PEAK RD AND 83RD AVE
666          DT  PPKEW3
667          DI       0       10       20       30       40       50       70      100
668          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  R83BSN
KM   STORAGE ROUTING REGIONAL BASIN ON 83RD AVENUE AND PINNACLE PEAK (LAST UPDATED
KO       0                                   22
RS       1    STOR       0
SV    1.40    1.91    4.20    6.68    9.36   12.22   15.27   18.53   21.98   25.63
SV   29.48   33.54   37.80   42.28   46.97   51.87
SE    1298    1299    1300    1301    1302    1303    1304    1305    1306    1307
SE    1308    1309    1310    1311    1312    1313
SQ    4.55    6.72    8.35    9.70   10.89   11.96   21.17   23.45   25.51   27.40
SQ   29.15   30.81   32.37   33.86   35.29   36.65
SE    1298    1299    1300    1301    1302    1303    1304    1305    1306    1307
SE    1308    1309    1310    1311    1312    1313
*

KK    RESD
KM   RETRIEVE FLOWS DIVERTED IN EAST PIPE
DR  PPKEW3
*
```



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

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

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

KK    N22B   BASIN
KM   SUB-BASIN N22B
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  .998
KM     L =  .53  Kb = .052  Adj. Slope =   34.0
BA    .185
LG    0.30    0.17    7.00    0.12       5
UC   0.342   0.177
UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
UA     100
*
* MAIN TO 83RD AVE & SPLIT SOUTH TO DEER VALLEY RD

KK   DN22B
DT   N22BI
DI       0       1      10     100     200     300     400
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)
                    *

        712         KK  RN22BE
        713         RS       1    FLOW       0
        714         RC    0.05    0.04    0.05    1403   .0007
        715         RX       0     500     525     526     556     557     567     568
        716         RY    4.25    1.25    0.25       0       0    0.25    1.25    9.25
                    *
                    * BASIN N21F
                    *
1                                                HEC-1 INPUT                                                    PAGE 20

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

        717         KK    N21F   BASIN
        718         KM   SUB-BASIN N21F
        719         KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
        720         KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .999
        721         KM     L =  .34  Kb = .055  Adj. Slope =   15.0
        722         BA    .104
        723         LG    0.30    0.10   11.20    0.03      15
        724         UC   0.554   0.507
        725         UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
        726         UA     100
                    *

        727         KK   CN21F
        728         KM   COMBINE N22B, CN21I, N21F, RPPKES
        729         KM   INTERSECTION OF 83RD AVE. AND WILLIAMS RD.
        730         HC       3
                    *
        731         ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

   128       N11P5
                V
                V
   146      R11P5E
                .
                .
   150           .       N11P6
                 .           V
                 .           V
   156           .      R11P6S
                 .           .
                 .           .
   164           .           .       N11P2
                 .           .           .
                 .           .           .
   170           .      CN11P2............
                 .           .
                 .           .
   175       LEJOS............
                .
                .
```

```
181          .-------->   VPRET
179      VPDIV
             .
             .
184          .       N11P4
             .           V
             .           V
196          .      R11P4S
             .           .
             .           .
207          .           .-------->  N11P4E
202          .      DN11P4
             .           .
             .           .
210     SDLEJ1............
             .
             .
212          .       N11P7
             .           .
             .           .
224          .           .-------->  N11P7E
219          .      DN11P7
             .           V
             .           V
227          .      R11P7S
             .           .
             .           .
239          .           .           .<-------  N11P4E
236          .           .      RDP4E
             .           .           .
             .           .           .
240          .      SUMP7S............
             .           .
             .           .
243     SDLEJ2............
             V
             V
245      RSDL2
             .
             .
248          .        S91A
             .           .
             .           .
257          .           .-------->   NS91A
255          .       DS91A
             .           V
             .           V
260          .       RS91A
             .           .
             .           .
263          .           .      N11L5A
             .           .           .
             .           .           .
270          .         C89............
             .           .
             .           .
275          .           .-------->    ED89
273          .         D89
             .           V
             .           V
278          .        R89E
             .           .
             .           .
281          .           .      N11L3A
             .           .           .
```

```
                .          .          .
288             .        C87............
                .          .
                .          .
293             .          .-------->     SOL
291             .        D87
                .          .
                .          .
296         C87BA............
                .
                .
301             .-------->   87BAS
299          87BP
                V
                V
304         R87BP
                .
                .
307             .          87
                .          .
                .          .
316             .          .            .<-------   87BAS
314             .          .        R87B
                .          .            .
                .          .            .
317             .        C87B............
                .          V
                .          V
320             .        87BA
                .          .
                .          .
326        87BOUT............
                V
                V
329         R87BA
                .
                .
334             .-------->   87OUT
332         D87BA
                .
                .
337             .       LACAI
                .          V
                .          V
354             .       RTCAI
                .          .
                .          .
365             .          .-------->   LECHE
361             .      DNLECH
                .          .
                .          .
368        SDLEJ3............
                .
                .
372             .      SUMMIT
                .          .
                .          .
391             .          .            .<-------   LECHE
388             .          .      RDLECH
                .          .            .
                .          .            .
392             .      LEJCHL............
                .          .
                .          .
398             .          .            .<-------  N11P7E
```

```
395          .           .      RDP7E
             .           .          V
             .           .          V
399          .           .      R11P7E
             .           .          .
             .           .          .
411          .           .          .-------> EAST83
407          .           .       D2-18
             .           .          .
             .           .          .
414          .        83CL............
             .           .
             .           .
428          .           .------->  EAGLE
420          .      24PIPE
             .           .
             .           .
431     SDLEJ4............
             V
             V
435     RT83CL
             .
             .
442          .       N11P3
             .           .
             .           .
448       83SD............
             V
             V
452      R83SD
             .
             .
457          .           .<-------  NS91A
455          .      RNS91A
             .           V
             .           V
458          .       RS91A
             .           .
             .           .
461          .           .        S91B
             .           .          .
             .           .          .
468          .        CS91............
             .           .
             .           .
473          .           .------->  DIV91
471          .         D91
             .           V
             .           V
476          .         R91
             .           .
             .           .
479          .           .       N11L5
             .           .          .
             .           .          .
490          .           .          .          .<-------    ED89
488          .           .          .      RED89
             .           .          .          V
             .           .          .          V
491          .           .          .       R89S
             .           .          .          .
             .           .          .          .
494          .           .          .          .      N11L2
             .           .          .          .          .
             .           .          .          .          .
```

```
502          .      CN11L5.................................
             .          .
             .          .
507          .          .-------->    NULL
505          .       D11L5
             .          V
             .          V
510          .      RN11L5
             .          .
             .          .
513          .          .       N11L3
             .          .           .
             .          .           .
522          .          .           .           .<-------     SOL
520          .          .           .        RSOL
             .          .           .           V
             .          .           .           V
523          .          .           .       RTSOL
             .          .           .           .
             .          .           .           .
526          .       PPSD1......................
             .          .
             .          .
531          .          .-------->  PPDIVS
529          .       PPDIV
             .          .
             .          .
534          .          .       N11L4
             .          .           .
             .          .           .
542          .          .           .       N21I1
             .          .           .           .
             .          .           .           .
551          .          .           .           .           .<-------   87OUT
549          .          .           .           .       87OUT
             .          .           .           .           .
             .          .           .           .           .
552          .        PPSD.................................
             .          V
             .          V
555          .       RPPSD
             .          .
             .          .
558          .          .       N21I2
             .          .           .
             .          .           .
565          .          .           .       N21I3
             .          .           .           .
             .          .           .           .
576          .          .           .           .        N21Z
             .          .           .           .           .
             .          .           .           .           .
591          .          .           .           .           .-------->  N21I3O
588          .          .           .           .       LN21Z
             .          .           .           .           .
             .          .           .           .           .
600          .          .           .           .           .-------->  DN21ZI
594          .          .           .           .      DN21ZO
             .          .           .           .           .
             .          .           .           .           .
607          .          .           .           .           .-------->  N21ZI*
603          .          .           .           .      DN21Z*
             .          .           .           .           V
             .          .           .           .           V
610          .          .           .           .      RN21ZW
```

```
623                                                  .-------> D1/2ST
620                                          1/2ST
628                                                            .<------- D1/2ST
626                                                   R1/2ST
632                                                                     .<------- EAST83
629                                                            18PIPE
636                                                                                .<------- EAGLE
633                                                                       CLDIV
637                                                             CPIPE............
                                                                    V
                                                                    V
640                                                            RCPIPE
643                                                                       N21I3
650                                                   CN21I3........................
657                                                            .-------> N21I3O
653                                                   R21I3
660                                            PPK_E............
666                                                  .-------> PPKEW3
664                                          PPKEW2
669      US_BSN.............................................
             V
             V
674      R83BSN
688                  .<-------  PPKEW3
686                RESD
689            JCT............
             V
             V
692      OUTLET
698                RESD
709                  .-------> N22BI
708               DN22B
                     V
                     V
712              RN22BE
```

```
                .          .
                .          .
   717          .          .        N21F
                .          .          .
                .          .          .
   727       CN21F.......................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   28OCT05  TIME  13:29:16  *
*                                      *
****************************************
```

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

83DES4.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

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

           **************
           *            *
 674 KK    *    R83BSN  *
           *            *
           **************

 676 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

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

```
              **************
              *            *
692 KK        *   OUTLET   *
              *            *
              **************

696 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

697 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       2.17    779.25     24.68    383.48        .57       6.31

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4143E+02  EXCESS= .0000E+00 OUTFLOW= .4136E+02 BASIN STORAGE= .4359E-01 PERCENT ERROR=     .1

                                     INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

                  MAIN         3.40      1.25       2.00               24.68    384.00        .57

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

                       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)
+     25.       6.37            24.         17.         15.          15.
                         (INCHES)       .161        .472        .569         .569
                          (AC-FT)        12.         34.         41.          41.

                       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 | 1.86 | 779.25 | 52.72 | 266.29 | .72 | 7.35 |

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5258E+02 EXCESS= .0000E+00 OUTFLOW= .5251E+02 BASIN STORAGE= .4623E-01 PERCENT ERROR= .0

INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

| | | | | | | |
|---|---|---|---|---|---|---|
| MAIN | 3.40 | 1.25 | 2.00 | 52.48 | 266.00 | .72 |

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

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) | | | | |
| + 52. | 4.43 | | 29. | 23. | 19. | 19. |
| | | (INCHES) | .200 | .621 | .722 | .722 |
| | | (AC-FT) | 15. | 45. | 52. | 52. |

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 | 2.00 | 1039.00 | 71.66 | 263.07 | .87 | 7.81 |

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6304E+02 EXCESS= .0000E+00 OUTFLOW= .6299E+02 BASIN STORAGE= .3350E-01 PERCENT ERROR= .0

INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

| | | | | | | |
|---|---|---|---|---|---|---|
| MAIN | 3.40 | 1.25 | 2.00 | 71.35 | 264.00 | .87 |

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

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) | | | | |
| + 71. | 4.40 | | 34. | 27. | 23. | 23. |
| | | (INCHES) | .230 | .749 | .866 | .866 |

| | | | | |
|---|---|---|---|---|
| (AC-FT) | 17. | 54. | 63. | 63. |

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 | 2.22 | 1039.00 | 91.30 | 261.18 | 1.00 | 8.20 |

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7266E+02 EXCESS= .0000E+00 OUTFLOW= .7255E+02 BASIN STORAGE= .6561E-01 PERCENT ERROR= .1

INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

| | | | | | |
|---|---|---|---|---|---|
| MAIN | 3.40 | 1.25 | 2.00 | 90.89 | 262.00 | 1.00 |

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

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) | | | |
| + | 91. | 4.37 | 38. | 31. | 26. | 26. |
| | | | (INCHES) .257 | .845 | .998 | .998 |
| | | | (AC-FT) 19. | 61. | 73. | 73. |

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        282.      353.      411.      683.
                                        TIME        4.10      4.17      4.17      4.30

 HYDROGRAPH AT
+                  87BP       .70    1  FLOW          0.        0.        0.        0.
                                        TIME         .00       .00       .00       .00

 ROUTED TO
+                 R87BP       .70    1  FLOW          0.        0.        0.        0.
                                        TIME         .00       .00       .00       .00

 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        282.      353.      411.      683.
                                        TIME        4.10      4.17      4.17      4.30

  2 COMBINED AT
+                  C87B       .03    1  FLOW        329.      404.      463.      716.
                                        TIME        4.10      4.13      4.17      4.30

 ROUTED TO
+                  87BA       .03    1  FLOW         80.       94.      109.      122.
                                        TIME        4.47      4.50      4.67      4.70

                                     ** PEAK STAGES IN FEET **
                                     1  STAGE     1316.34   1317.27   1318.47   1319.65
                                        TIME        4.47      4.50      4.67      4.70

  2 COMBINED AT
+                87BOUT       .73    1  FLOW         80.       94.      109.      122.
                                        TIME        4.47      4.50      4.67      4.70

 ROUTED TO
+                 R87BA       .73    1  FLOW         80.       94.      109.      122.
                                        TIME        4.47      4.50      4.70      4.73

 DIVERSION TO
+                 87OUT       .73    1  FLOW         80.       94.      109.      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. | 94. | 109. | 122. |
| | | | | TIME | 4.47 | 4.50 | 4.70 | 4.73 |
| 4 COMBINED AT | | | | | | | | |
| + | PPSD | .21 | 1 | FLOW | 260. | 310. | 344. | 377. |
| | | | | TIME | 4.10 | 4.07 | 4.07 | 4.07 |
| ROUTED TO | | | | | | | | |
| + | RPPSD | .21 | 1 | FLOW | 259. | 309. | 342. | 375. |
| | | | | TIME | 4.13 | 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         320.     415.     489.     564.
                                         TIME        4.13     4.13     4.13     4.10

 ROUTED TO
+               R83BSN      1.36     1   FLOW          25.      29.      32.      35.
                                         TIME        6.27     6.80     7.43     8.00

                                     ** PEAK STAGES IN FEET **
                                     1   STAGE     1305.60  1307.95  1309.97  1311.84
                                         TIME        6.30     6.83     7.47     8.00

 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          25.      53.      72.      91.
                                         TIME        6.27     4.33     4.30     4.27

 ROUTED TO
+               OUTLET      1.36     1   FLOW          25.      52.      71.      91.
                                         TIME        6.37     4.43     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.     176.     223.     267.
                                             TIME        4.27     4.40     4.33     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


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

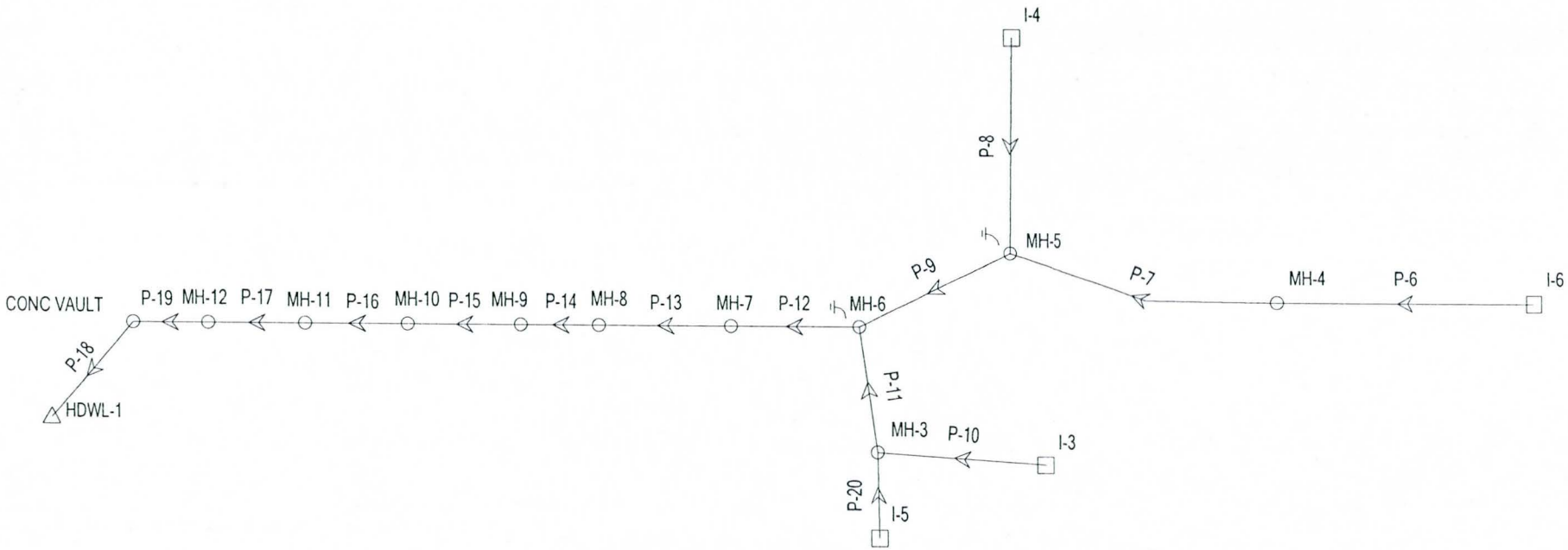
# Appendix B

## StormCAD Analyses

# Appendix B-1

## 83rd Avenue Storm Drain

## Scenario: Base




Title: 83rd Avenue/Pinnacle Peak
p:\...\610drain\610fstorm\83aves 10-6-05.stm
10/06/05 01:45:05 PM

**Jacob's Engineering Inc.**
© Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 USA +1-203-755-1666

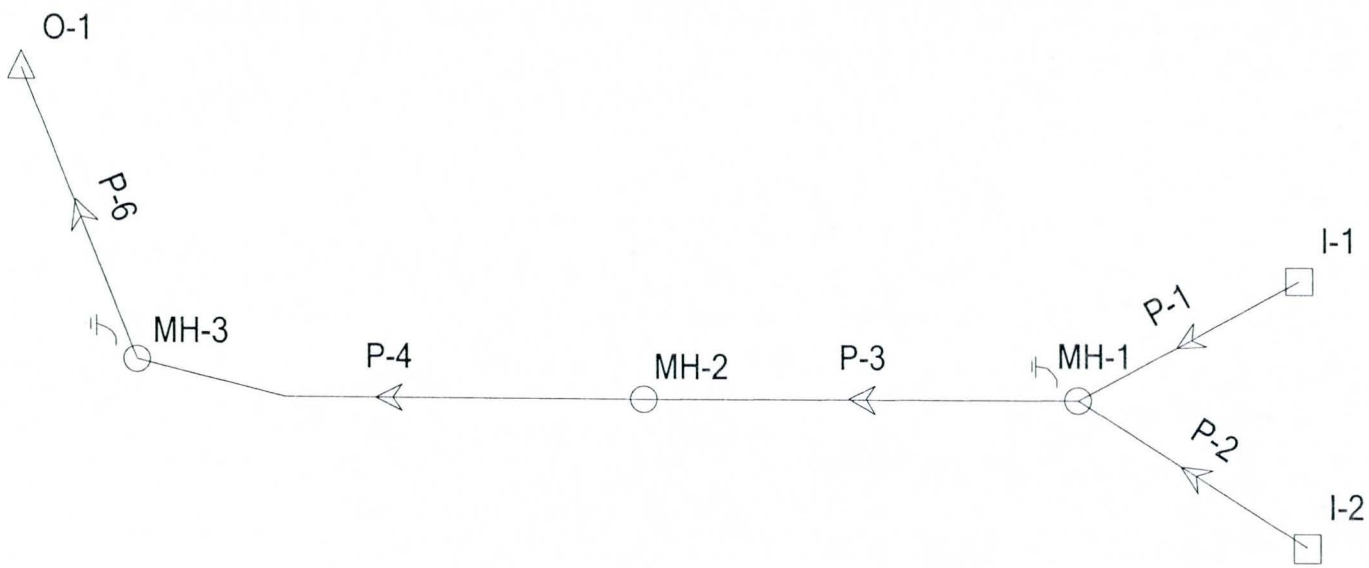
Project Engineer: Pat Fyie
StormCAD v5.5 [5.5005]
Page 1 of 1

## 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 | 15.00 | 15.42 | 1,300.60 | 1,299.62 | 1,316.25 | 1,314.60 | 1,307.35 | 1,306.43 | 4.77 |
| P-20 | I-5 | MH-3 | 10.00 | -0.050000 | 1 | 30 inch | 0.013 | 34.00 | -91.71 | 1,301.14 | 1,301.64 | 1,310.00 | 1,310.00 | 1,305.31 | 1,305.24 | 6.93 |
| P-10 | I-3 | MH-3 | 85.00 | 0.053294 | 1 | 30 inch | 0.013 | 34.00 | 94.69 | 1,306.17 | 1,301.64 | 1,310.00 | 1,310.00 | 1,308.15 | 1,305.24 | 6.93 |
| P-7 | MH-4 | MH-5 | 299.00 | 0.011371 | 1 | 24 inch | 0.013 | 15.00 | 24.12 | 1,301.62 | 1,298.22 | 1,314.60 | 1,312.60 | 1,306.43 | 1,305.11 | 4.77 |
| P-8 | I-4 | MH-5 | 687.00 | 0.004047 | 1 | 24 inch | 0.013 | 18.00 | 14.39 | 1,298.00 | 1,295.22 | 1,313.67 | 1,312.60 | 1,309.46 | 1,305.11 | 5.73 |
| P-11 | MH-3 | MH-6 | 76.00 | 0.010000 | 1 | 36 inch | 0.013 | 68.00 | 66.69 | 1,301.39 | 1,300.63 | 1,310.00 | 1,312.40 | 1,305.24 | 1,304.45 | 9.62 |
| P-9 | MH-5 | MH-6 | 108.00 | 0.003056 | 1 | 30 inch | 0.013 | 32.00 | 22.67 | 1,295.22 | 1,294.89 | 1,312.60 | 1,312.40 | 1,305.11 | 1,304.45 | 6.52 |
| P-12 | MH-6 | MH-7 | 393.00 | 0.001908 | 1 | 48 inch | 0.013 | 87.00 | 62.75 | 1,294.89 | 1,294.14 | 1,312.40 | 1,308.00 | 1,304.45 | 1,303.01 | 6.92 |
| P-13 | MH-7 | MH-8 | 500.00 | 0.001900 | 1 | 48 inch | 0.013 | 87.00 | 62.61 | 1,294.14 | 1,293.19 | 1,308.00 | 1,304.88 | 1,303.01 | 1,301.18 | 6.92 |
| P-14 | MH-8 | MH-9 | 500.00 | 0.001900 | 1 | 48 inch | 0.013 | 87.00 | 62.61 | 1,293.19 | 1,292.24 | 1,304.88 | 1,302.30 | 1,301.18 | 1,299.34 | 6.92 |
| P-15 | MH-9 | MH-10 | 500.00 | 0.001900 | 1 | 48 inch | 0.013 | 87.00 | 62.61 | 1,292.24 | 1,291.29 | 1,302.30 | 1,299.89 | 1,299.34 | 1,297.51 | 6.92 |
| P-16 | MH-10 | MH-11 | 500.00 | 0.001900 | 1 | 48 inch | 0.013 | 87.00 | 62.61 | 1,291.29 | 1,290.34 | 1,299.89 | 1,297.00 | 1,297.51 | 1,295.67 | 6.92 |
| P-17 | MH-11 | MH-12 | 275.00 | 0.001891 | 2 | 36 inch | 0.013 | 87.00 | 58.00 | 1,290.34 | 1,289.82 | 1,297.00 | 1,296.05 | 1,295.67 | 1,294.50 | 6.15 |
| P-19 | MH-12 | CONC V/ | 195.00 | 0.001897 | 2 | 36 inch | 0.013 | 87.00 | 58.10 | 1,289.82 | 1,289.45 | 1,296.05 | 1,294.50 | 1,294.50 | 1,293.68 | 6.15 |
| P-18 | CONC VA | HDWL-1 | 60.00 | 0.001833 | 2 | 36 inch | 0.013 | 87.00 | 57.11 | 1,289.45 | 1,289.34 | 1,294.50 | 1,293.86 | 1,293.68 | 1,293.42 | 6.15 |

## Scenario: Base




Title: 83rd Avenue/Pinnacle Peak
p:\...\610drain\610fstorm\83aven 10-6-05.stm
10/06/05 01:12:56 PM

Jacob's Engineering Inc.
© Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 USA +1-203-755-1666

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

## Scenario: Base

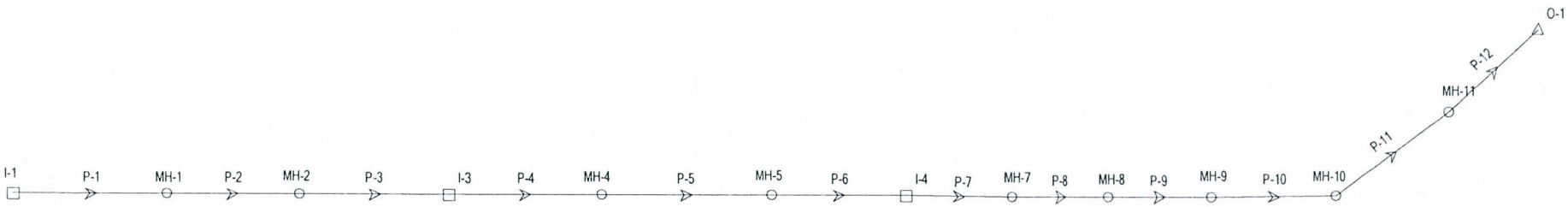
## Pipe Report

| 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-1 | I-1 | MH-1 | 33.00 | 0.127576 | 1 | 36 inch | 0.013 | 53.00 | 238.22 | 1,317.67 | 1,313.46 | 1,322.00 | 1,322.20 | 1,320.04 | 1,316.43 | 7.51 |
| P-2 | I-2 | MH-1 | 69.00 | 0.061014 | 1 | 36 inch | 0.013 | 40.00 | 164.74 | 1,317.67 | 1,313.46 | 1,322.00 | 1,322.20 | 1,319.73 | 1,316.43 | 5.67 |
| P-3 | MH-1 | MH-2 | 396.00 | 0.009621 | 1 | 42 inch | 0.013 | 92.00 | 98.68 | 1,313.46 | 1,309.65 | 1,322.20 | 1,317.85 | 1,316.43 | 1,312.33 | 11.65 |
| 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 | 87.00 | -0.003793 | 1 | 42 inch | 0.013 | 77.00 | -61.96 | 1,302.67 | 1,303.00 | 1,316.25 | 1,310.00 | 1,306.65 | 1,305.75 | 9.51 |

# Appendix B-2

## Pinnacle Peak Road Storm Drain

## Scenario: Base



## Scenario: Base

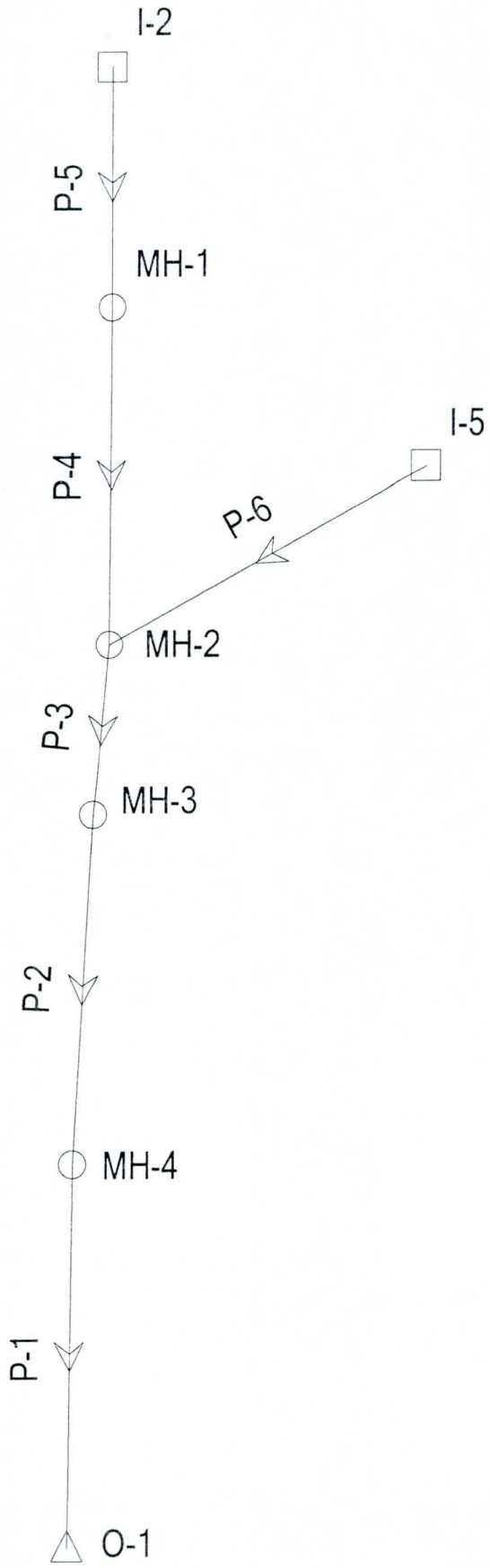
## Pipe Report

| 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-1 | MH-1 | 500.00 | 0.002000 | 1 | 54 inch | 0.013 | 55.00 | 87.94 | 1,309.13 | 1,308.13 | 1,315.96 | 1,316.35 | 1,314.10 | 1,313.71 | 3.46 |
| P-2 | MH-1 | MH-2 | 500.00 | 0.002000 | 1 | 60 inch | 0.013 | 55.00 | 116.47 | 1,308.13 | 1,307.13 | 1,316.35 | 1,315.63 | 1,313.71 | 1,313.48 | 2.80 |
| P-3 | MH-2 | I-3 | 500.00 | 0.002000 | 1 | 60 inch | 0.013 | 55.00 | 116.47 | 1,307.13 | 1,306.13 | 1,315.63 | 1,315.37 | 1,313.48 | 1,313.26 | 2.80 |
| P-4 | I-3 | I-5 | 450.00 | 0.002000 | 1 | 60 inch | 0.013 | 84.00 | 116.47 | 1,306.13 | 1,305.23 | 1,315.37 | 1,315.42 | 1,313.26 | 1,312.79 | 4.28 |
| P-5 | I-5 | I-6 | 350.00 | 0.002000 | 1 | 60 inch | 0.013 | 103.00 | 116.47 | 1,305.23 | 1,304.53 | 1,315.42 | 1,315.22 | 1,312.79 | 1,312.25 | 5.25 |
| P-6 | I-6 | I-4 | 364.14 | 0.002005 | 1 | 60 inch | 0.013 | 122.00 | 116.60 | 1,304.53 | 1,303.80 | 1,315.22 | 1,313.33 | 1,312.25 | 1,311.45 | 6.21 |
| P-7 | I-4 | MH-7 | 385.86 | 0.003343 | 1 | 78 inch | 0.013 | 379.00 | 303.12 | 1,303.80 | 1,302.51 | 1,313.33 | 1,313.68 | 1,311.45 | 1,309.43 | 11.42 |
| P-8 | MH-7 | MH-8 | 500.00 | 0.003340 | 1 | 78 inch | 0.013 | 379.00 | 302.98 | 1,302.51 | 1,300.84 | 1,313.68 | 1,312.89 | 1,309.43 | 1,306.81 | 11.88 |
| P-9 | MH-8 | MH-9 | 500.00 | 0.003340 | 1 | 84 inch | 0.013 | 379.00 | 369.18 | 1,300.84 | 1,299.17 | 1,312.89 | 1,312.55 | 1,306.81 | 1,305.20 | 10.74 |
| P-10 | MH-9 | MH-10 | 390.00 | 0.003359 | 1 | 84 inch | 0.013 | 379.00 | 370.23 | 1,299.17 | 1,297.86 | 1,312.55 | 1,312.69 | 1,305.20 | 1,304.00 | 10.59 |
| P-11 | MH-10 | MH-11 | 125.00 | 0.003440 | 1 | 84 inch | 0.013 | 379.00 | 374.66 | 1,297.86 | 1,297.43 | 1,312.69 | 1,312.95 | 1,304.00 | 1,303.63 | 10.51 |
| P-12 | MH-11 | O-1 | 80.00 | -0.002000 | 1 | 84 inch | 0.013 | 361.00 | -285.68 | 1,297.43 | 1,297.59 | 1,312.95 | 1,311.00 | 1,303.63 | 1,302.60 | 12.25 |

# Appendix B-3

## 87th Avenue Storm Drain

## Scenario: Base



## Scenario: Base

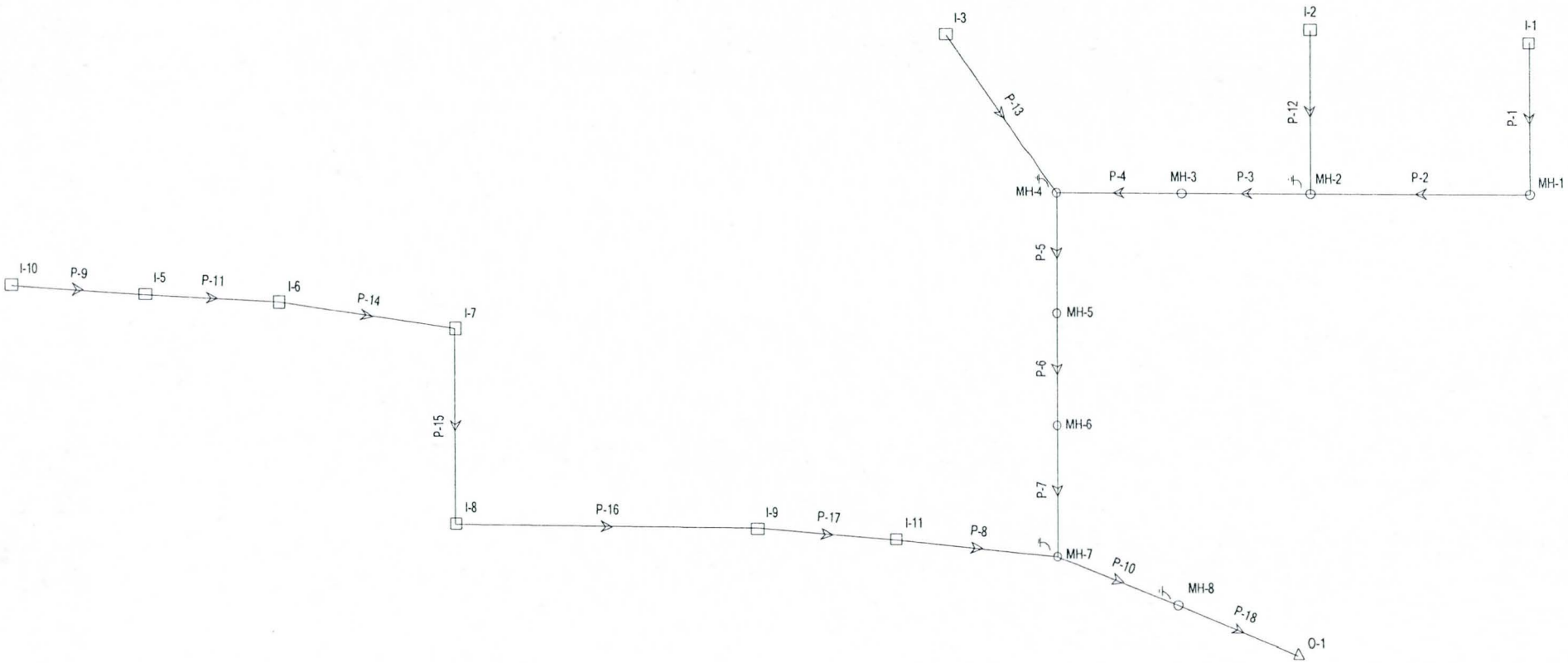
# Pipe Report

| 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-5 | I-2 | MH-1 | 142.00 | 0.002958 | 1 | 42 inch | 0.013 | 62.00 | 54.71 | 1,312.50 | 1,312.08 | 1,325.00 | 1,325.80 | 1,319.12 | 1,318.58 | 6.44 |
| P-6 | I-5 | MH-2 | 225.00 | 0.007111 | 1 | 42 inch | 0.013 | 62.00 | 84.84 | 1,312.50 | 1,310.90 | 1,317.70 | 1,320.82 | 1,317.89 | 1,317.04 | 6.44 |
| P-4 | MH-1 | MH-2 | 406.00 | 0.002906 | 1 | 42 inch | 0.013 | 62.00 | 54.24 | 1,312.08 | 1,310.90 | 1,325.80 | 1,320.82 | 1,318.58 | 1,317.04 | 6.44 |
| P-3 | MH-2 | MH-3 | 110.00 | 0.007727 | 1 | 48 inch | 0.013 | 124.00 | 126.26 | 1,310.90 | 1,310.05 | 1,320.82 | 1,319.61 | 1,317.04 | 1,316.22 | 9.87 |
| P-2 | MH-3 | MH-4 | 340.00 | 0.007882 | 1 | 48 inch | 0.013 | 124.00 | 127.52 | 1,310.05 | 1,307.37 | 1,319.61 | 1,315.60 | 1,316.22 | 1,313.69 | 9.87 |
| P-1 | MH-4 | O-1 | 300.00 | 0.007900 | 1 | 48 inch | 0.013 | 124.00 | 127.67 | 1,307.37 | 1,305.00 | 1,315.60 | 1,313.34 | 1,313.69 | 1,311.45 | 9.87 |

# Appendix B-4

## Cielo Grande Storm Drain

## Scenario: Base




Title: 83RD AVENUE/PINNACLE PEAK ROAD
p:\...\610drain\610fstorm\87aven 10-7-05.stm
10/10/05 03:09:57 PM


**Jacob's Engineering Inc.**


© Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 USA +1-203-755-1666


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-1 | I-1 | MH-1 | 72.00 | 0.008194 | 2 | 48 inch | 0.013 | 175.00 | 260.05 | 1,332.09 | 1,331.50 | 1,337.91 | 1,337.32 | 1,336.85 | 1,336.58 | 6.96 |
| P-2 | MH-1 | MH-2 | 300.00 | 0.004000 | 2 | 48 inch | 0.013 | 175.00 | 181.69 | 1,331.50 | 1,330.30 | 1,337.32 | 1,339.09 | 1,336.58 | 1,335.47 | 6.96 |
| P-12 | I-2 | MH-2 | 55.30 | 0.008137 | 1 | 30 inch | 0.013 | 28.00 | 37.00 | 1,332.25 | 1,331.80 | 1,336.07 | 1,339.09 | 1,335.73 | 1,335.47 | 5.70 |
| P-3 | MH-2 | MH-3 | 555.00 | 0.002000 | 1 | 72 inch | 0.013 | 194.00 | 189.39 | 1,330.30 | 1,329.19 | 1,339.09 | 1,342.92 | 1,335.47 | 1,334.42 | 7.42 |
| P-13 | I-3 | MH-4 | 129.00 | 0.015504 | 1 | 60 inch | 0.013 | 351.00 | 324.27 | 1,331.27 | 1,329.27 | 1,343.43 | 1,345.32 | 1,336.46 | 1,334.08 | 18.10 |
| P-4 | MH-3 | MH-4 | 460.11 | 0.002000 | 1 | 72 inch | 0.013 | 194.00 | 189.37 | 1,329.19 | 1,328.27 | 1,342.92 | 1,345.32 | 1,334.42 | 1,333.56 | 7.35 |
| P-5 | MH-4 | MH-5 | 439.89 | 0.008002 | 1 | 78 inch | 0.013 | 491.00 | 468.96 | 1,327.77 | 1,324.25 | 1,345.32 | 1,337.85 | 1,333.56 | 1,329.90 | 16.02 |
| P-9 | I-10 | I-5 | 500.00 | 0.002000 | 1 | 66 inch | 0.013 | 72.00 | 150.17 | 1,321.48 | 1,320.48 | 1,329.91 | 1,330.44 | 1,329.96 | 1,329.73 | 3.03 |
| P-11 | I-5 | I-6 | 450.00 | 0.002000 | 1 | 66 inch | 0.013 | 124.00 | 150.17 | 1,320.48 | 1,319.58 | 1,330.44 | 1,331.01 | 1,329.73 | 1,329.12 | 5.22 |
| P-14 | I-6 | I-7 | 372.55 | 0.001986 | 1 | 66 inch | 0.013 | 149.00 | 149.66 | 1,319.58 | 1,318.84 | 1,331.01 | 1,330.46 | 1,329.12 | 1,328.38 | 6.27 |
| P-15 | I-7 | I-8 | 332.97 | 0.002012 | 1 | 66 inch | 0.013 | 171.00 | 150.63 | 1,318.84 | 1,318.17 | 1,330.46 | 1,327.52 | 1,328.38 | 1,327.52 | 7.20 |
| P-16 | I-8 | I-9 | 444.48 | 0.002002 | 1 | 66 inch | 0.013 | 218.00 | 150.26 | 1,318.17 | 1,317.28 | 1,327.52 | 1,328.22 | 1,329.27 | 1,327.39 | 9.18 |
| 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-17 | I-9 | I-11 | 450.00 | 0.002000 | 1 | 66 inch | 0.013 | 232.00 | 150.17 | 1,317.28 | 1,316.38 | 1,328.22 | 1,328.60 | 1,327.39 | 1,325.24 | 9.77 |
| P-7 | MH-6 | MH-7 | 447.60 | 0.008000 | 1 | 78 inch | 0.013 | 491.00 | 468.90 | 1,321.05 | 1,317.47 | 1,332.37 | 1,328.00 | 1,326.84 | 1,323.13 | 16.02 |
| P-8 | I-11 | MH-7 | 441.32 | 0.001994 | 1 | 66 inch | 0.013 | 246.00 | 149.95 | 1,316.38 | 1,315.50 | 1,328.60 | 1,328.00 | 1,325.24 | 1,322.87 | 10.35 |
| P-10 | MH-7 | MH-8 | 137.00 | 0.007226 | 1 | 84 inch | 0.013 | 683.00 | 543.03 | 1,315.50 | 1,314.51 | 1,328.00 | 1,326.50 | 1,322.87 | 1,321.20 | 18.02 |
| P-18 | MH-8 | O-1 | 25.00 | 0.005600 | 1 | 84 inch | 0.013 | 621.00 | 478.03 | 1,314.51 | 1,314.37 | 1,326.50 | 1,323.00 | 1,321.20 | 1,320.71 | 16.95 |

# 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:** | JOF |
| **Subject:** | Grate in Sag Hydraulics | **Date:** | 10/7/05 |
| | 90th Avenue & Pinnacle Peak Road | **Checked:** | |
| | STA 206+60 | **Project No.:** | W7X74300 |

### Input:

| | | | |
|---|---|---|---|
| Q50= | 8.50 | 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 |

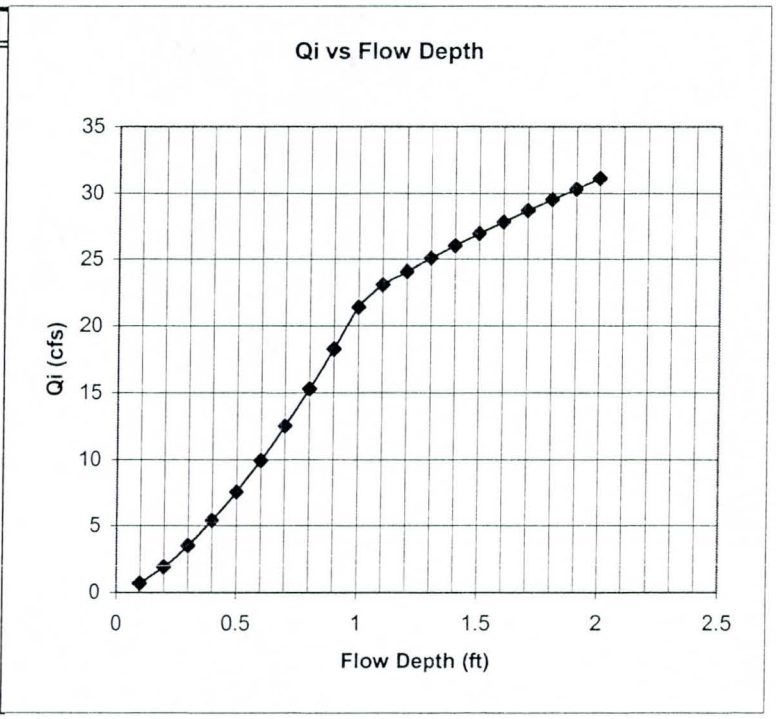
Delta D 0.1 ft

### Output:

Depth for Q = 8.5 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:** | JOF |
| **Subject:** | Grate in Sag Hydraulics | **Date:** | 10/7/05 |
| | 90th Avenue & Pinnacle Peak Road | **Checked:** | |
| | STA 207+00 | **Project No.:** | W7X74300 |

### Input:

| | | | |
|---|---|---|---|
| Q50= | 8.50 | 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 |

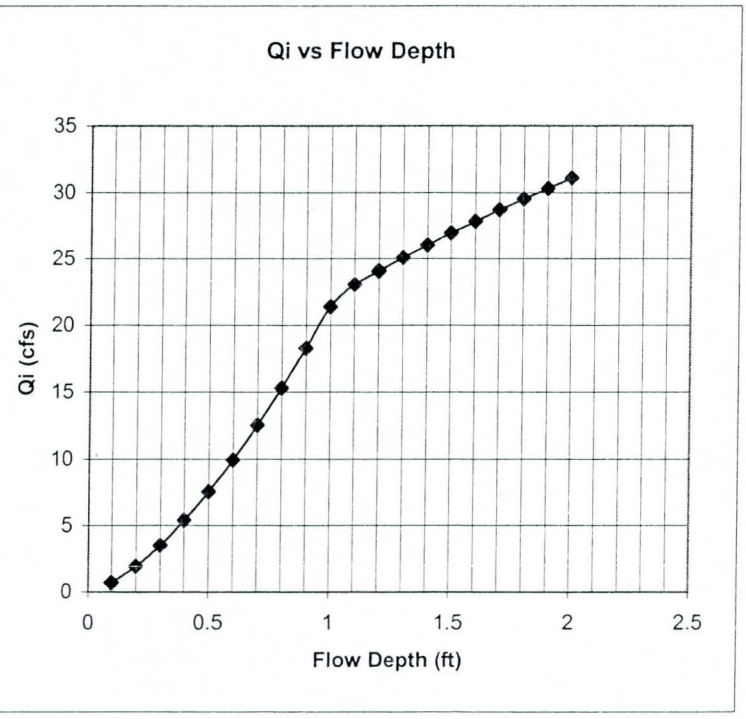
Delta D 0.1 ft

### Output:

Depth for Q = 8.5 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:** | JOF |
| **Subject:** | Grate in Sag Hydraulics | **Date:** | 10/7/05 |
| | 89th Avenue & Pinnacle Peak Road | **Checked:** | |
| | STA 213+00 | **Project No.:** | W7X74300 |

### Input:

| | | | |
|---|---|---|---|
| Q50= | 13.00 | 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 |

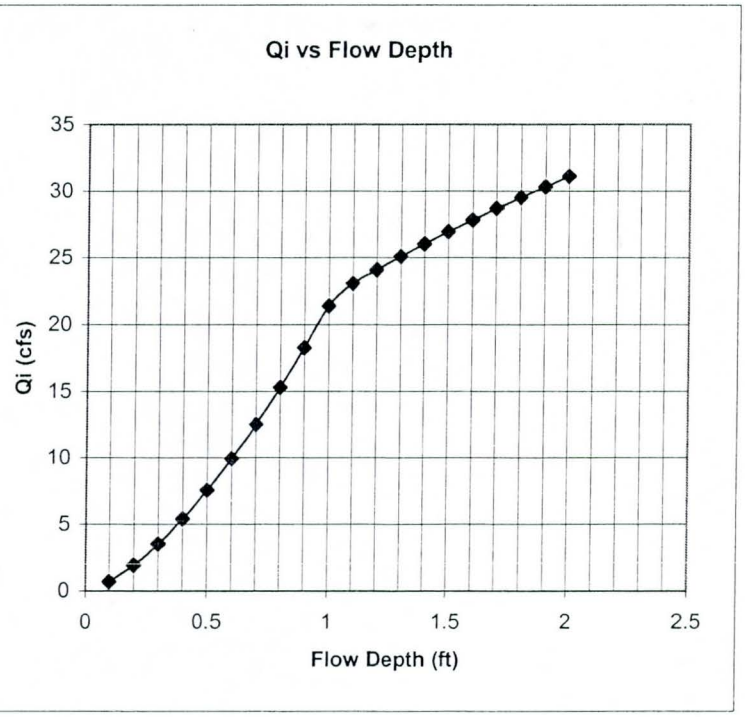
Delta D 0.1 ft

### Output:

Depth for Q = 13 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:** | JOF |
| **Subject:** | Grate in Sag Hydraulics | **Date:** | 10/7/05 |
| | 89th Avenue & Pinnacle Peak Road | **Checked:** | |
| | STA 213+40 | **Project No.:** | W7X74300 |

### Input:

| | | | |
|---|---|---|---|
| Q50= | 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 |

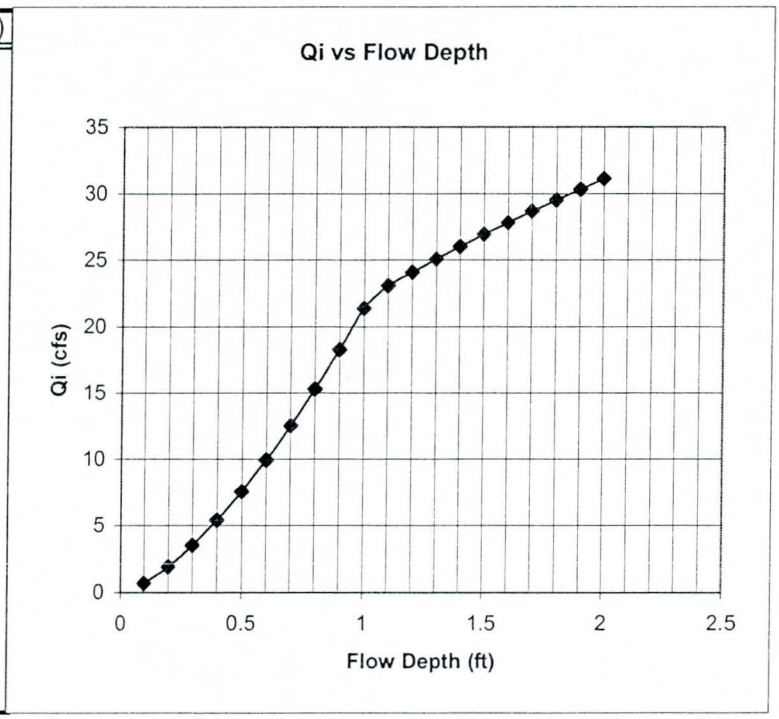
Delta D 0.1 ft

### 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:** | JOF |
| **Subject:** | Grate in Sag Hydraulics | **Date:** | 10/7/05 |
| | 89th Avenue & Pinnacle Peak Road | **Checked:** | |
| | STA 215+00 | **Project No.:** | W7X74300 |

### Input:

| | | | |
|---|---|---|---|
| Q50= | 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 |

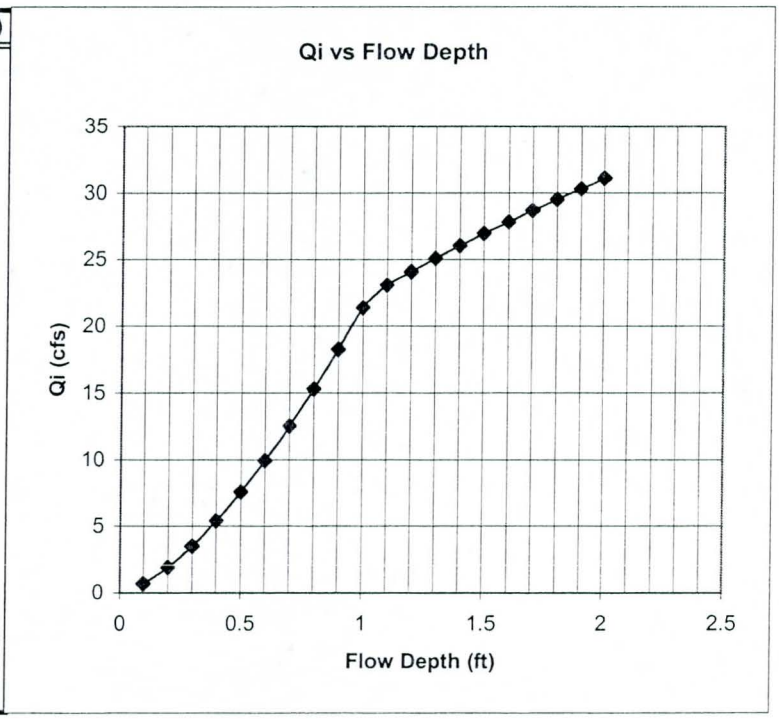
Delta D 0.1 ft

### 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:** | JOF |
| **Subject:** | Grate in Sag Hydraulics | **Date:** | 10/7/05 |
| | 89th Avenue & Pinnacle Peak Road | **Checked:** | |
| | STA 233+40 | **Project No.:** | W7X74300 |

### Input:

| | | | |
|---|---|---|---|
| Q50= | 15.00 | 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 |

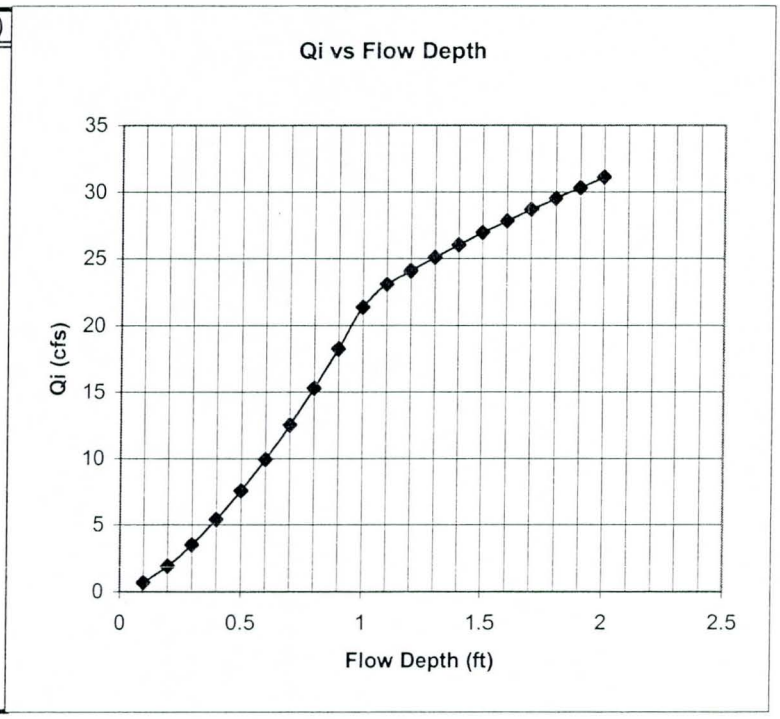
Delta D 0.1 ft

### Output:

Depth for Q = 15 is 0.80 ft 9.60 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:** | JOF |
| **Subject:** | Grate in Sag Hydraulics | **Date:** | 10/5/05 |
| | 87th Avenue | **Checked:** | |
| | STA 300+60 | **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 |

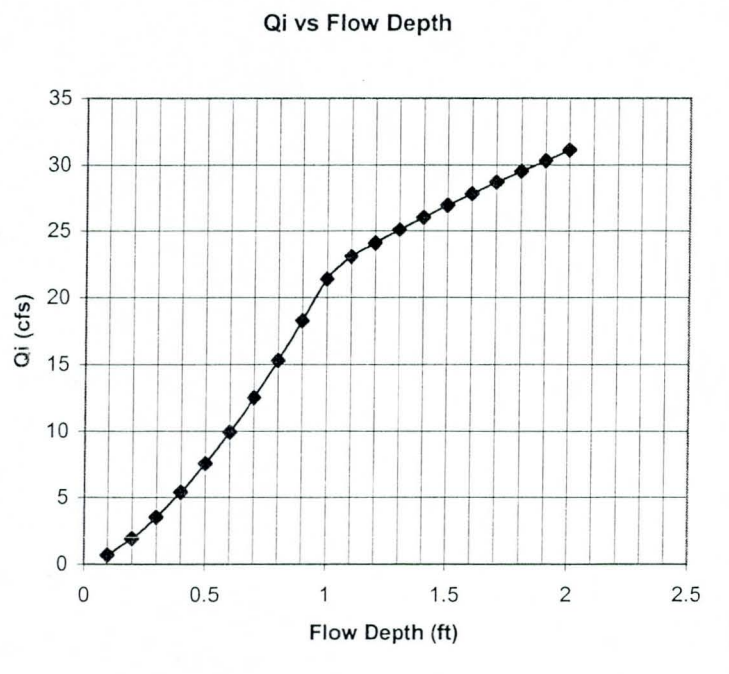
Delta D 0.1 ft

### 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 |
| | 87th Avenue | **Checked:** | |
| | STA 300+80 | **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 |

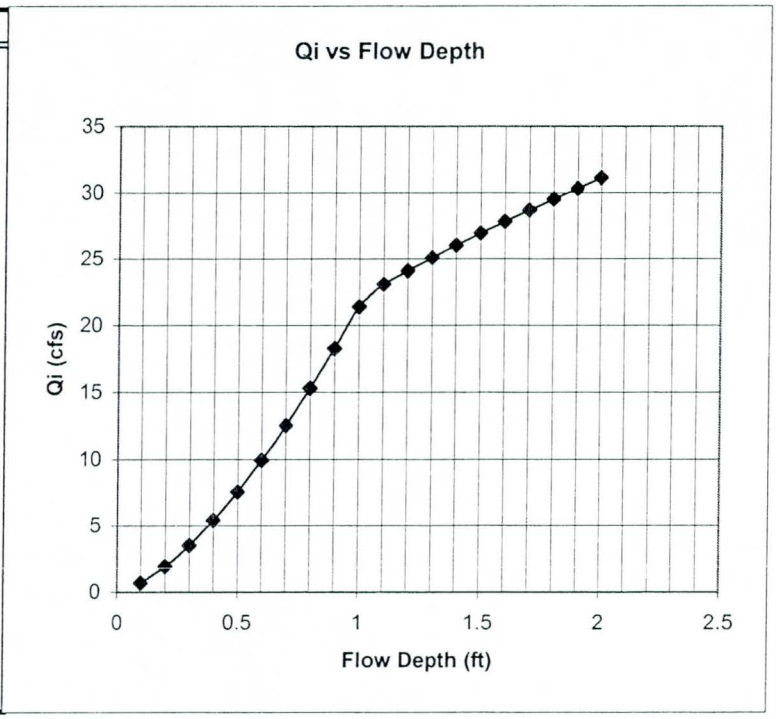
Delta D 0.1 ft

### 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:** | |
| | | **Project No.:** | W7X74300 |

### Input:

| | | | |
|---|---|---|---|
| Q50= | 14.40 | 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 |

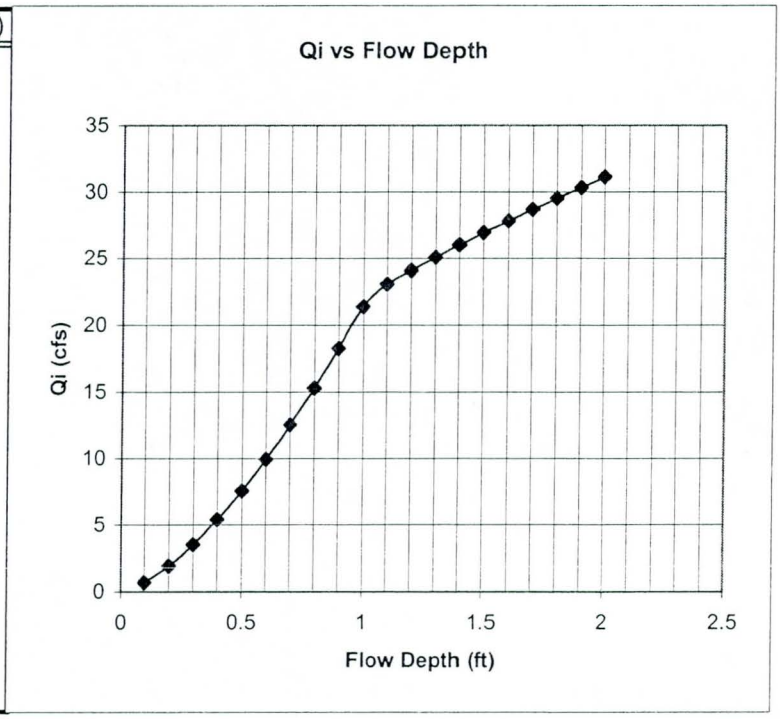
Delta D 0.1 ft

### Output:

Depth for Q = 14.4 is 0.75 ft 9.00 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:** | 10/5/05 |
| | Avenida del Sol | **Checked:** | |
| | | **Project No.:** | W7X74300 |

### Input:

| | | | |
|---|---|---|---|
| Q50= | 8.00 | 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 |

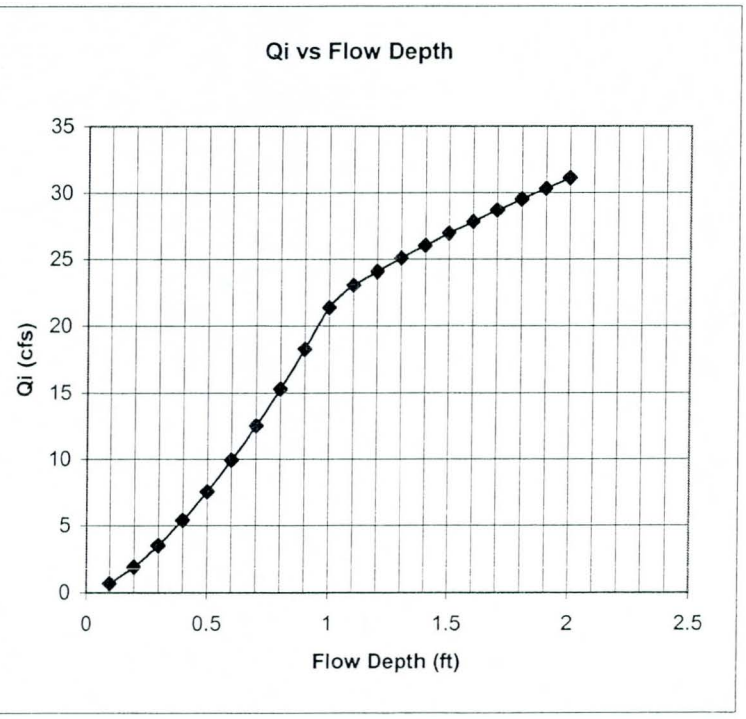
Delta D 0.1 ft

### Output:

Depth for Q = 8 is 0.50 ft 6.00 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 |



# Appendix C-2

## Drop Inlets

# Jacobs Civil Inc.

***Drop Inlet Design***

| | | | |
|---|---|---|---|
| Project: | **83rd Avenue/Pinnacle Peak Road** | By: | **JPF** |
| Subject: | **83rd Avenue & Pinnacle Peak Road** | Date: | **10/6/2005** |
| | **Both Inlets** | 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 : | 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 & Avenida del Sol** | Date: | **10/6/2005** |
| | **STA 142+78.81 RT** | 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 : | 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: | **83rd Avenue & Avenida del Sol** | Date: | **10/6/2005** |
| | **STA 142+78.81 LT** | 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 : | 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: | **Pinnacle Peak Road and 91st Avenue** | Date: | **10/6/2005** |
| | | 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** | Date: | **10/6/2005** |
| | **STA 220+70** | Checked: | |
| | | Jacobs Project No.: | **W7X74300** |

***Remarks:*** Peak flow is 10-year discharge at 89th Avenue per J2, Email 10/5/05.

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

## Calculations:

**Step 1)** Determine peak discharge

| | | |
|---|---|---|
| Subbasin : | N11L3 | |
| Peak Discharge = | 50.0 | cfs |
| Percent to each Inlet = | 50% | |
| Design Q = | 25.0 | 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 = | 1.78 | ft | OK |
| Weir height = | 1.55 | 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 = | 25.0 | cfs |
| HW/D, nomograph = | 1.08 | |

HW = 2.7 ft OK

# Jacobs Civil Inc.

## *Drop Inlet Design*

| | | | |
|---|---|---|---|
| Project: | **83rd Avenue/Pinnacle Peak Road** | By: | **JPF** |
| Subject: | **Pinnacle Peak Road** | Date: | **10/7/2005** |
| | **STA 223+60** | Checked: | |
| | | Jacobs Project No.: | **W7X74300** |

***Remarks:*** Peak flow is 10-year discharge at 89th Avenue per J2, Email 10/5/05.

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

## Calculations:

**Step 1)** Determine peak discharge

| | | |
|---|---|---|
| Subbasin : | N11L3 | |
| Peak Discharge = | 50.0 | cfs |
| Percent to each Inlet = | 50% | |
| Design Q = | 25.0 | 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 = | 1.78 | ft | OK |
| Weir height = | 1.55 | 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 = | 25.0 | cfs |
| HW/D, nomograph = | 1.08 | |

HW = 2.7 ft OK

# Jacobs Civil Inc.

## *Drop Inlet Design*

| | | | |
|---|---|---|---|
| Project: | **83rd Avenue/Pinnacle Peak Road** | By: | **JPF** |
| Subject: | **Calle Lejos STA 326+40** | Date: | **10/6/2005** |
| | **West Retention Basin** | 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 STA 326+40** | Date: | **10/6/2005** |
| | **East Retention Basin** | 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 STA 336+55** | Date: | **10/6/2005** |
| | | 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 STA 340+27** | Date: | **10/6/2005** |
| | | Checked: | |
| | | Jacobs Project No.: | **W7X74300** |

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

Use double pipe with drop inlet from 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: | **10/6/2005** |
| | | 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 : | 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 89th Avenue** | Date: | **10/6/2005** |
| | | Checked: | |
| | | Jacobs Project No.: | **W7X74300** |

***Remarks:*** Peak flow is 10-year discharge at 89th Avenue per J2, Email 10/5/05.

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

## Calculations:

**Step 1)** Determine peak discharge

| | | |
|---|---|---|
| Subbasin : | N11L5A | |
| Peak Discharge = | 84.0 | cfs |
| Percent to each Inlet = | 13% | |
| Design Q = | 11.0 | cfs |

**Step 2)** Select pipe size and drop inlet

| | | | | |
|---|---|---|---|---|
| Pipe Size, diameter = | 24 | in | No. of Pipes = | 1 |
| Weir length, MAAG 501-5 = | 3 | ft | | |
| Weir Coefficient, Cw = | 3.00 | | | |

Q = Cw x W x d^1.5

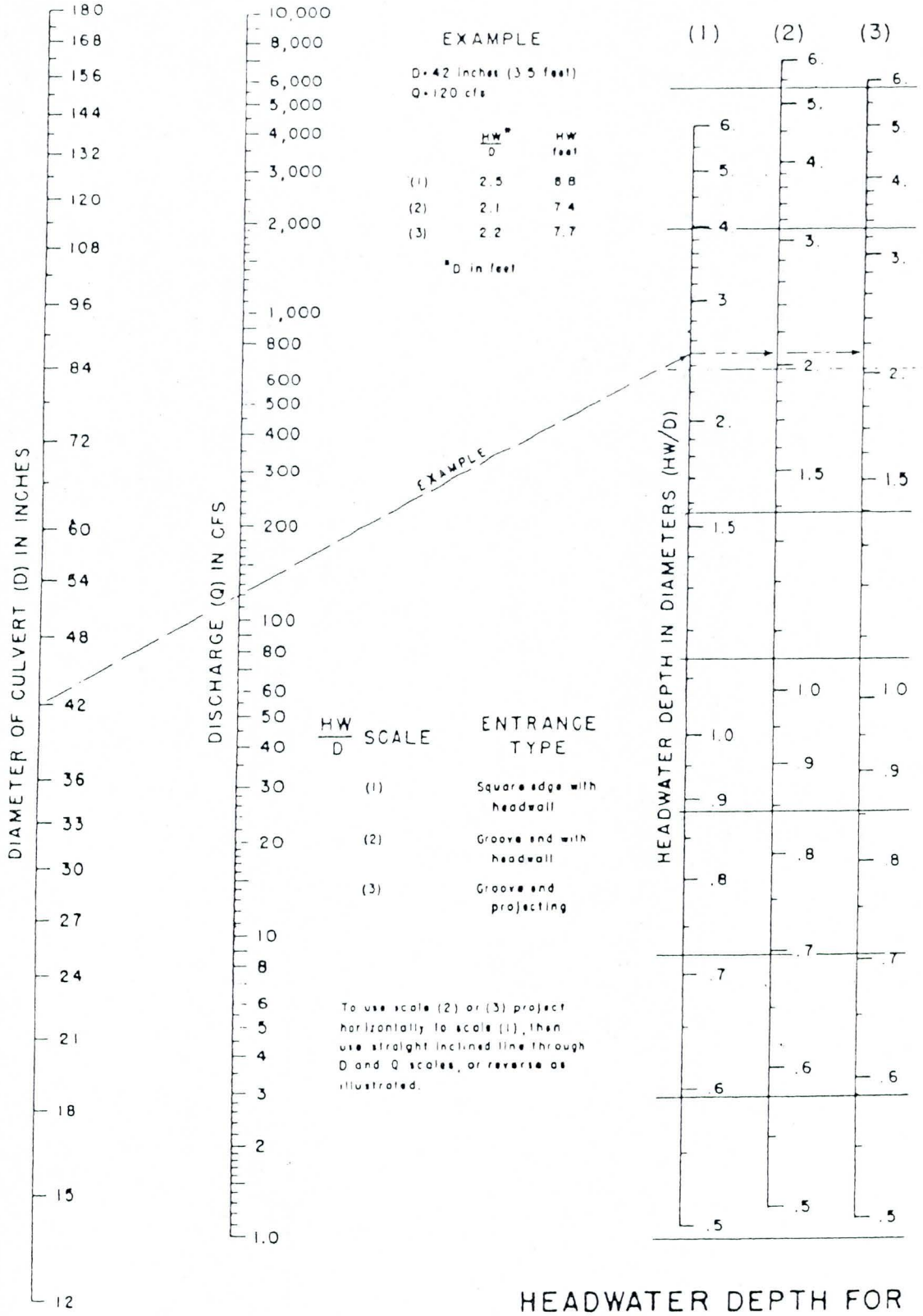
| | | | |
|---|---|---|---|
| Flow Depth, d = | 1.14 | ft | OK |
| Weir height = | 1.69 | ft | Pipe Diameter + 1.33' - d - 0.5' |

**Step 3)** Check Inlet Control for Pipe

Nomograph for Headwater Depth For Concrete Pipe Culverts With Inlet Control

| | | |
|---|---|---|
| Pipe Size, diameter = | 24 | in |
| Design Q = | 11.0 | cfs |
| HW/D, nomograph = | 0.90 | |

HW = 1.8 ft OK




# HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

# Appendix C-3

## Outlet Protection

# Jacobs Civil Inc.

# Riprap Apron Design

| | | | |
|---|---|---|---|
| | | By: | JPF |
| Culvert | Structure | Date: | 10/5/05 |
| Detail No | Location | Checked: | |
| 83rd Avenue | 99+36 | Jacobs Project No.: | W7X74300 |

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

| RESULTS | | | |
|---|---|---|---|
| D50 (in) | T (in) | La | Wa |
| 6 | 12 | 46.0 | 27.0 |

| 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) |
| 43.5 | 2 | 3 | 3 | 6.15 | 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 = 46 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 = 27 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 = 30.67 yd^3 (3*D+Wa)/2*La*T/12/27

# Jacobs Civil Inc.

# Riprap Apron Design

| | | | |
|---|---|---|---|
| | | By: | JPF |
| Culvert | Structure | Date: | 10/5/05 |
| Detail No | Location | Checked: | |
| 83rd Avenue | 134+86 | Jacobs Project No.: | W7X74300 |

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

| RESULTS | | | |
|---|---|---|---|
| D50 (in) | T (in) | La | Wa |
| 6 | 12 | 60.0 | 36.0 |

| 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) |
| 84 | 1 | 4 | 2.86 | 9.99 | 2.86 | 0.00 |

## Riprap Apron Basin Design

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

TW = 2.86 ft
D/2 = 2 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 = 60 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 = 36 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 = 53.33 yd^3 (3*D+Wa)/2*La*T/12/27

# Jacobs Civil Inc.

# Riprap Apron Design

| | | | |
|---|---|---|---|
| | | By: | JPF |
| Culvert | Structure | Date: | 10/5/05 |
| Detail No | Location | Checked: | |
| 83rd Avenue | 245+65 | Jacobs Project No.: | W7X74300 |

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

| RESULTS | | | |
|---|---|---|---|
| D50 (in) | T (in) | La | Wa |
| 6 | 12 | 107.0 | 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) |
| 360 | 1 | 7 | 5 | 12.24 | 4.7 | 0.00 |

## Riprap Apron Basin Design

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

TW = 4.7 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 = 107 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 = 168.43 yd^3 (3*D+Wa)/2*La*T/12/27

# Jacobs Civil Inc.

# Riprap Apron Design

| | | | |
|---|---|---|---|
| | | By: | JPF |
| Culvert | Structure | Date: | 10/5/05 |
| Detail No | Location | Checked: | |
| 83rd Avenue | 311+55 | Jacobs Project No.: | W7X74300 |

**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 |
| Culvert Detail No | Structure Location | Date: | 10/5/05 |
| | | Checked: | |
| 83rd Avenue | 311+55 | Jacobs Project No.: | W7X74300 |

**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.

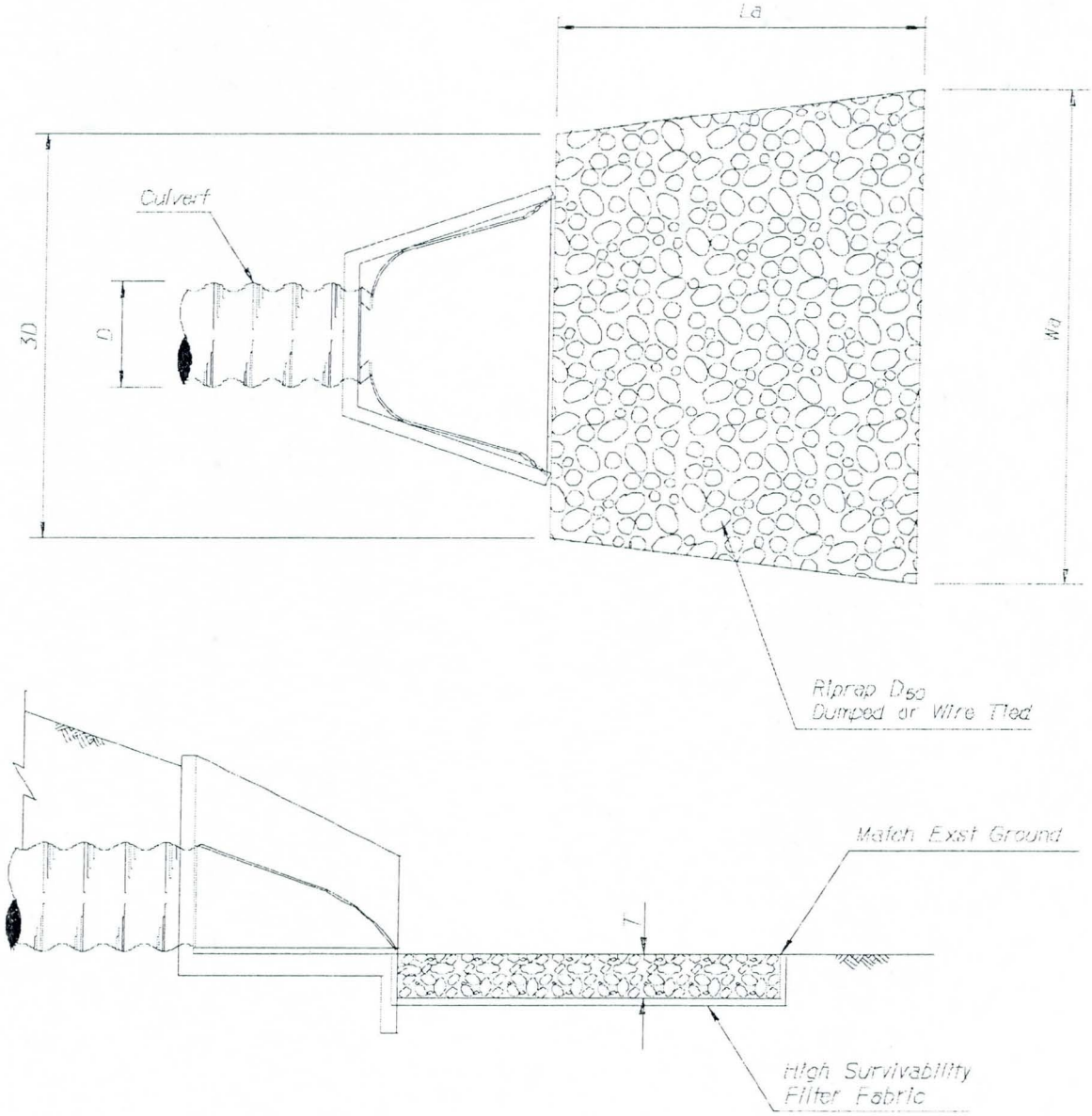
# Riprap Apron Design

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

**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

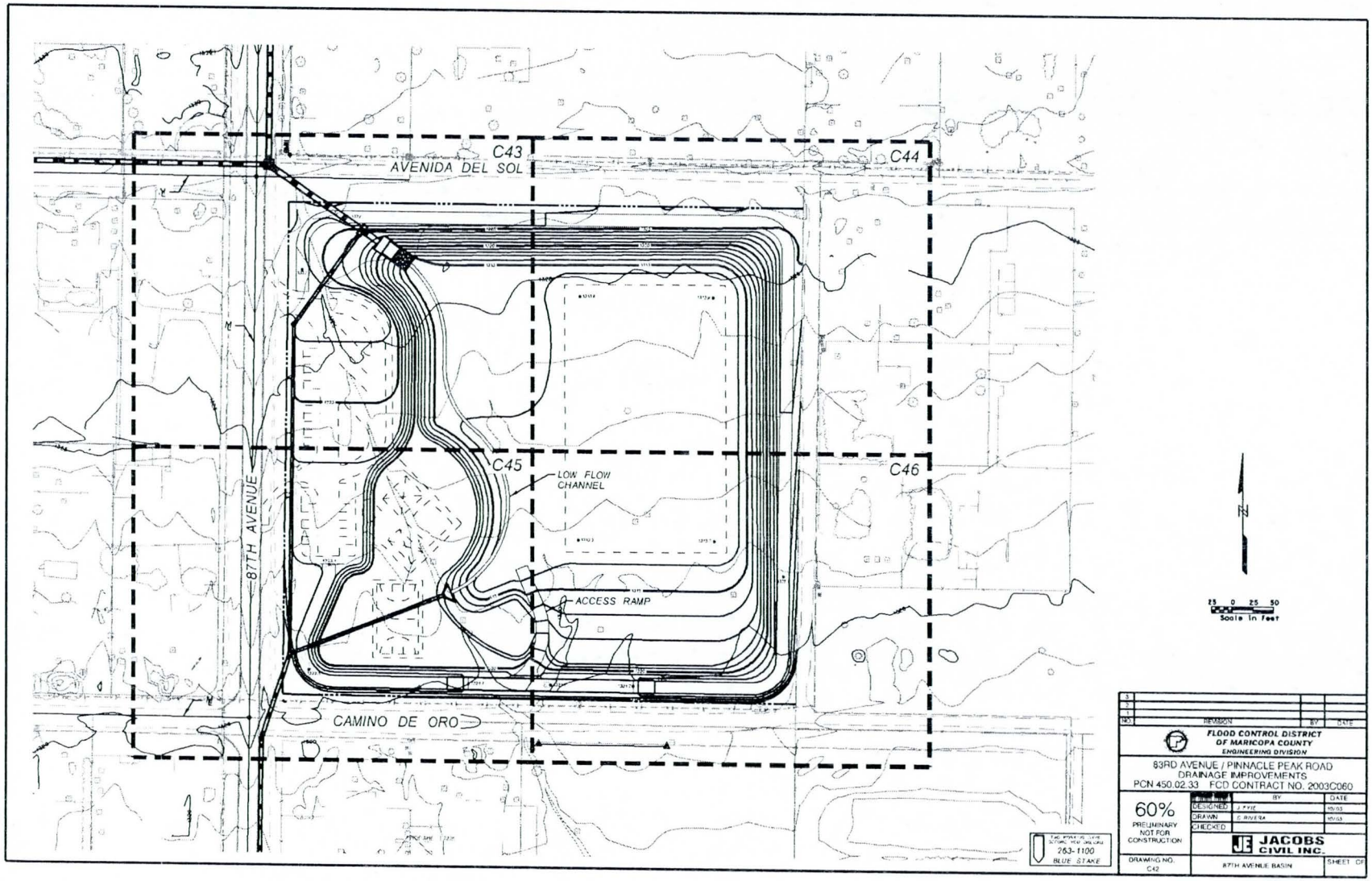

C43
AVENIDA DEL SOL
C44
C45
LOW FLOW CHANNEL
C46
87TH AVENUE
ACCESS RAMP
CAMINO DE ORO
N
25 0 25 50
Scale in Feet
263-1100
BLUE STAKE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION
83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060
60%
PRELIMINARY NOT FOR CONSTRUCTION
DESIGNED
DRAWN
CHECKED
JACOBS CIVIL INC.
87TH AVENUE BASIN
DRAWING NO. C42
SHEET OF

Figure 1-18

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) |
|---|---|---|---|---|---|---|---|---|---|
| 1313 | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1314 | 101,808 | 101,808 | 50,904 | 1.17 | 0.00 | 0.23 | 0.00 | 12.11 | 12.11 |
| 1315 | 139,424 | 139,424 | 171,520 | 3.94 | 1.23 | 1.23 | 27.85 | 27.85 | 55.70 |
| 1316 | 148,986 | 148,986 | 315,725 | 7.25 | 2.23 | 2.23 | 37.48 | 37.48 | 74.96 |
| 1317 | 158,886 | 158,886 | 469,661 | 10.78 | 3.23 | 3.23 | 45.10 | 45.10 | 90.19 |
| 1318 | 194,483 | 194,483 | 646,346 | 14.84 | 4.23 | 4.23 | 51.60 | 51.60 | 103.20 |
| 1319 | 203,000 | 203,000 | 845,087 | 19.40 | 5.23 | 5.23 | 57.37 | 57.37 | 114.74 |
| 1320 | 243,066 | 243,066 | 1,068,120 | 24.52 | 6.23 | 6.23 | 62.61 | 62.61 | 125.23 |
| 1321 | 252,719 | 252,719 | 1,316,013 | 30.21 | 7.23 | 7.23 | 67.45 | 67.45 | 134.90 |

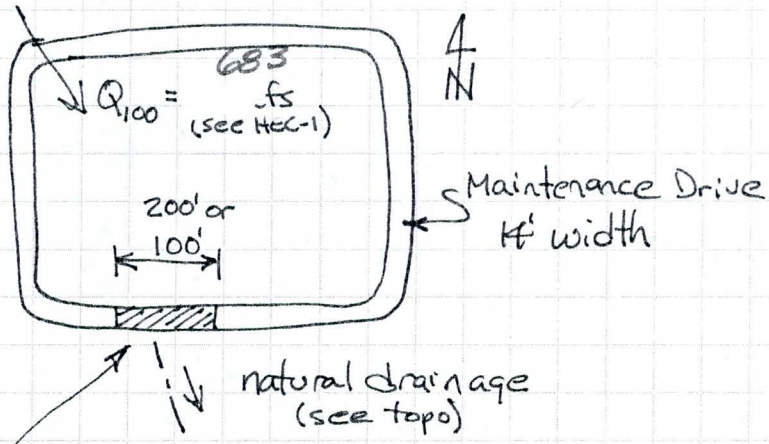
Q = Cd x Ao x (2gh)^0.5
Cd = 0.62 2 Orifices - 1 at Elev 1312.50 and 1 at Elev 1312.50
Orifice Diameter each @ (in) = 30.4
Orifice Area each (sq ft) = Ao = 5.04
h = elevation - center of orifice
center of orifices = 1313.77 and 1313.77

Revised 9/27/05

**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

$Q = 683$ cfs

$L = 100$ ft

$C = 2.6$ broad crested

$H_1$ = flow depth (ft)

$712 = 2.6 \times 100 \times H_1^{3/2}$

$H_1^{3/2} =$ $H_1 = 1.90$ ft

Trial #2

$Q = 683$ cfs

$L = 200$ ft

$C = 2.6$

$H_2$ = flow depth

$712 = 2.6 \times 200 \times H_2^{3/2}$

$H_2^{3/2} = 1.313$ $H_2 = 1.20$ ft

* Use $H_2 = 1.20$ ft $L = 200'$

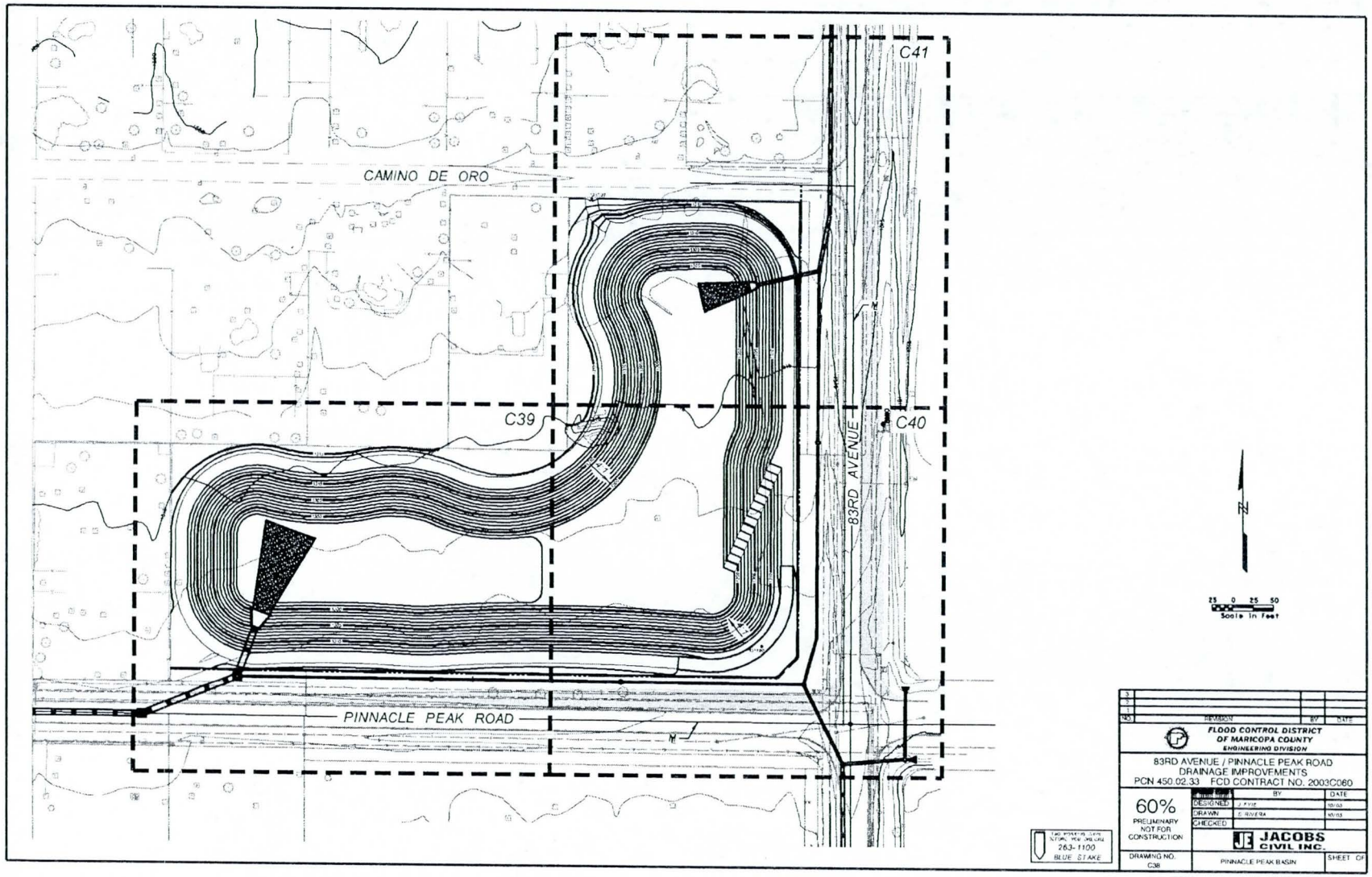

C41
CAMINO DE ORO
C39
C40
83RD AVENUE
PINNACLE PEAK ROAD
N
25 0 25 50
Scale in Feet
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION
83RD AVENUE / PINNACLE PEAK ROAD
DRAINAGE IMPROVEMENTS
PCN 450.02.33 FCD CONTRACT NO. 2003C060
60%
PRELIMINARY
NOT FOR
CONSTRUCTION
DESIGNED
DRAWN
CHECKED
JACOBS
CIVIL INC.
263-1100
BLUE STAKE
DRAWING NO.
C38
PINNACLE PEAK BASIN
SHEET OF

Figure 1-33

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) |
|---|---|---|---|---|---|---|---|---|---|
| 1298 | 35,074 | 35,074 | 17,537 | 0.40 | 0.00 | 0.85 | 0.00 | 4.55 | 4.55 |
| 1299 | 95,948 | 95,948 | 83,048 | 1.91 | 0.00 | 1.85 | 0.00 | 6.72 | 6.72 |
| 1300 | 104,030 | 104,030 | 183,037 | 4.20 | 0.00 | 2.85 | 0.00 | 8.35 | 8.35 |
| 1301 | 112,212 | 112,212 | 291,158 | 6.68 | 0.00 | 3.85 | 0.00 | 9.70 | 9.70 |
| 1302 | 120,495 | 120,495 | 407,512 | 9.36 | 0.00 | 4.85 | 0.00 | 10.89 | 10.89 |
| 1303 | 128,878 | 128,878 | 532,198 | 12.22 | 0.00 | 5.85 | 0.00 | 11.96 | 11.96 |
| 1304 | 137,362 | 137,362 | 665,318 | 15.27 | 2.77 | 6.85 | 8.23 | 12.94 | 21.17 |
| 1305 | 145,946 | 145,946 | 806,972 | 18.53 | 3.77 | 7.85 | 9.60 | 13.85 | 23.45 |
| 1306 | 154,631 | 154,631 | 957,261 | 21.98 | 4.77 | 8.85 | 10.80 | 14.71 | 25.51 |
| 1307 | 163,417 | 163,417 | 1,116,285 | 25.63 | 5.77 | 9.85 | 11.88 | 15.52 | 27.40 |
| 1308 | 172,303 | 172,303 | 1,284,145 | 29.48 | 6.77 | 10.85 | 12.87 | 16.29 | 29.15 |
| 1309 | 181,289 | 181,289 | 1,460,941 | 33.54 | 7.77 | 11.85 | 13.78 | 17.02 | 30.81 |
| 1310 | 190,376 | 190,376 | 1,646,773 | 37.80 | 8.77 | 12.85 | 14.64 | 17.73 | 32.37 |
| 1311 | 199,564 | 199,564 | 1,841,743 | 42.28 | 9.77 | 13.85 | 15.46 | 18.40 | 33.86 |
| 1312 | 208,852 | 208,852 | 2,045,951 | 46.97 | 10.77 | 14.85 | 16.23 | 19.06 | 35.29 |
| 1313 | 218,236 | 218,236 | 2,259,495 | 51.87 | 11.77 | 15.85 | 16.97 | 19.69 | 36.65 |

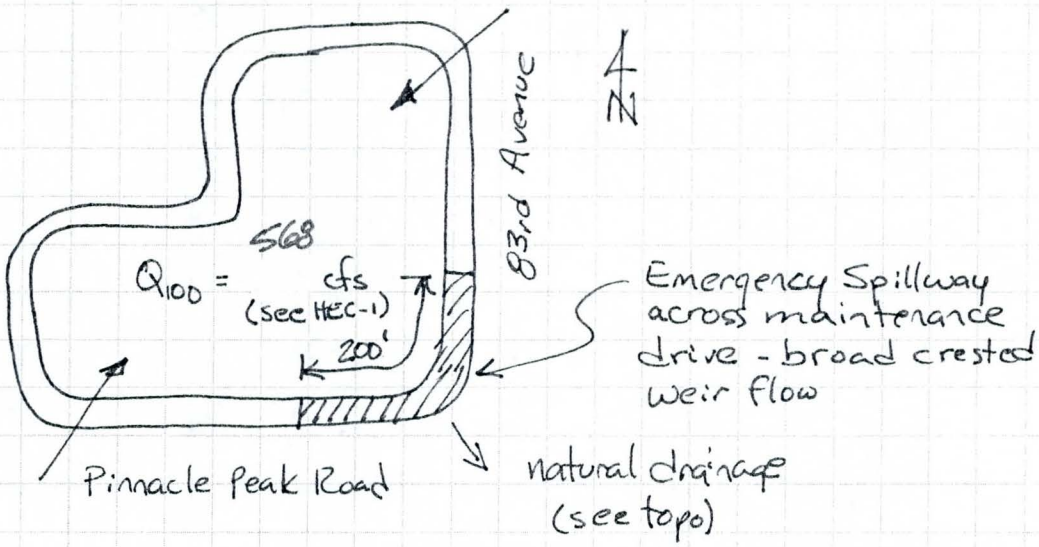
Q = Cd x Ao x (2gh)^0.5
Cd = 0.62 2 Orifices - 1 at Elev 1300.67 and 1 at Elev 1296.59
Orifice Diameter each @ (in) = 13.5
Orifice Area each (sq ft) = Ao = 0.99
h = elevation - center of orifice
center of orifices = 1301.23 and 1297.15

Revised 9/28/05

**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




$Q = CLH^{3/2}$

$Q = 568$ cfs

$L = 200$ ft

$C = 2.6$

$H$ = flow depth (ft)

$568 = 2.6 \times 200 \times H^{3/2}$

$H^{3/2} = 1.09$ $\quad H = 1.06$ ft