Back-Up Data

MARYVALE AREA DRAINAGE MASTER STUDY
FLOODPLAIN MITIGATION STUDY

FCD #93-29

Prepared for:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
2801 West Durango
Phoenix, AZ 85009
(602) 506-1501

Prepared by:

WOOD, PATEL & ASSOCIATES, INC.
1550 East Missouri Avenue, Suite 203
Phoenix, AZ 85014
(602) 234-1344

November 12, 1997
WP #94154.00

WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

PROJECT Maryvale ADMS

PROJECT NO. 94154 SHEET NO. 1 OF

CALCULATED BY DTP DATE 4 FEB 98 CHECKED BY DATE

BACKUP DATA FOR SELECTED ALTERNATIVE

SECTION 8.2.1 - GRAND AVE at 79th AVE
OPTION 1 - 10 YEAR

DATA PROVIDED:

Existing Condition Hydrology:

HEC-1 KK Card ID: C2631N

PEAK INFLOW: 312 cfs
RUNOFF VOLUME: 43 ac-ft

Type of MITIGATION: 10 - YEAR

DETENTION STORAGE: (yes) / ~~No~~

BASIN TYPE: ON-LINE

Comments:

Drain time: $T \leq \frac{43 \text{ Ac-ft}}{43 \text{ cfs}}$

$T \leq 12.4$ hrs

VOLUME: 43 ac-ft
OUTFALL: Gravity
PEAK STAGE: 1138.5 ft
Surrounding Ground EL: 1139 ft on low side
AVG PONDED DEPTH: 5 ft

STORM DRAIN: (yes) / ~~No~~ (Bleed off)

comments: Tie into existing 36 inch SD in Peoria Avenue (Capacity = 43 cfs).

Need to utilize junction box concept to enclose existing 8" sanitary sewer (see plan/profile drawing in ADMS Report

CHANNEL CONSIDERATIONS: ~~Yes~~ / (No)

Comments:

GRAND AVE @ 79th AVE

```
: C2631N
CM SUB-BASIN COMBINE (C26-31N)
CO      1
:       2  15.223

CRES26N
:  PONDING AREA RESERVOIR ROUTE
C. PONDING AREA NORTHEAST OF GRAND AVENUE/RR EMBANKMENT
CM SUB-BASIN 26-31
:       1    ELEV   1136.
:       0    2.81   35.11   72.11   86.13   96.24  106.94  124.13
SE 1136.   1138.   1140.   1141.  1141.3  1141.5  1141.7   1142.
CO      0     0.1     0.2     0.3     0.4    100.    160.    970.
```

10-yr Q @ RES26N = 0 cfs, Thus no outflow of storage Route

From Inflow Hydrograph (C2631N)

Q_{10} = 312 cfs

V_{10} = 43 Ac-ft

Wood/Patel and Associates Inc.

MARYVALE AREA DRAINAGE MASTER STUDY

Flood Control District of Maricopa County 20-Aug-97

FLOOD MITIGATION OPTIONS **Contract FCD 93-29**
LEVEL II ANALYSIS, OPTION 1, 10-yr **W/P # 94154.00**

STUDY AREA: 79th Avenue and Peoria Avenue

South Detention Basin

Average Bottom Width =	390 ft
Average Bottom Length =	1000 ft
Side Slope =	4 :1 (h:v)
Average Basin Bottom =	1134 ft Elev
High Water =	1139 ft Elev
Average Natural Ground =	1142 ft Elev
Basin Type =	1 1 = Rectangular, 2 = Triangular

Depth to Bottom (Feet)	Water Surface Elevation	Surface Area (Acres)	Storage Volume		Earth Work Volume	
			Incrimental (Ac-ft)	Cumulative (Ac-ft)	Incrimental (CY)	Cumulative (CY)
0	1134	9.0	0.0	0.0	0	0
1	1135	9.2	9.2	9.2	14,859	14,859
2	1136	9.5	9.5	18.7	15,278	30,136
3	1137	9.7	9.7	28.4	15,701	45,838
4	1138	10.0	10.0	38.4	16,130	61,967
5	1139	10.3	10.3	48.7	16,563	78,530
6	1140	10.5	10.5	--	17,001	95,531
7	1141	10.8	10.8	--	17,444	112,975
8	1142	11.1	11.1	--	17,891	130,866
9	1143	11.4	11.4	--	18,343	--
10	1144	11.7	11.7	--	18,800	--
11	1145	11.9	11.9	--	19,262	--
12	1146	12.2	12.2	--	19,728	--
13	1147	12.5	12.5	--	20,199	--
14	1148	12.8	12.8	--	20,675	--
15	1149	13.1	13.1	--	21,156	--
16	1150	13.4	13.4	--	21,641	--
17	1151	13.7	13.7	--	22,131	--
18	1152	14.0	14.0	--	22,626	--

Land Acquisition: Book 142
MAP 13
Parcel 6k

Area ≈ 12.9 Acres

CIRCULAR CHANNEL ANALYSIS
NORMAL DEPTH COMPUTATION

February 4, 1998
Maryvale ADMS - Grand Avenue @ 79th Avenue
Option 1, 10-year
Existing 36" SD Capacity

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PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second)	42.0
Channel Bottom Slope (feet per foot)	0.0035
Manning's Roughness Coefficient (n-value)	0.0130
Channel Diameter (feet)	3.00

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet)	2.68
Flow Velocity (feet per second)	6.30
Froude Number (Flow is Sub-Critical)	0.583
Velocity Head (feet)	0.62
Energy Head (feet)	3.30
Cross-Sectional Area of Flow (square feet)	6.67
Top Width of Flow (feet)	1.84

==========

CIRCULAR CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.5 (c) 1986
Dodson & Associates, Inc., 5629 FM 1960 W., #314, Houston, TX 77069
(713) 440-3787. A complete program manual is available.

WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

PROJECT MARYVALE ADMS

PROJECT NO. 94154 SHEET NO. 1 OF 1

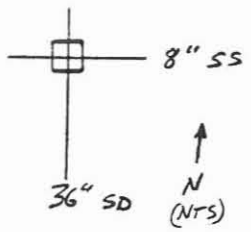
CALCULATED BY DTP DATE 20 Aug 97 CHECKED BY _____ DATE _____

79TH AVE & PEORIA AVE

LEVEL II

JUNCTION BOX - Concrete Quanity

OPTION 1, 10-YR:



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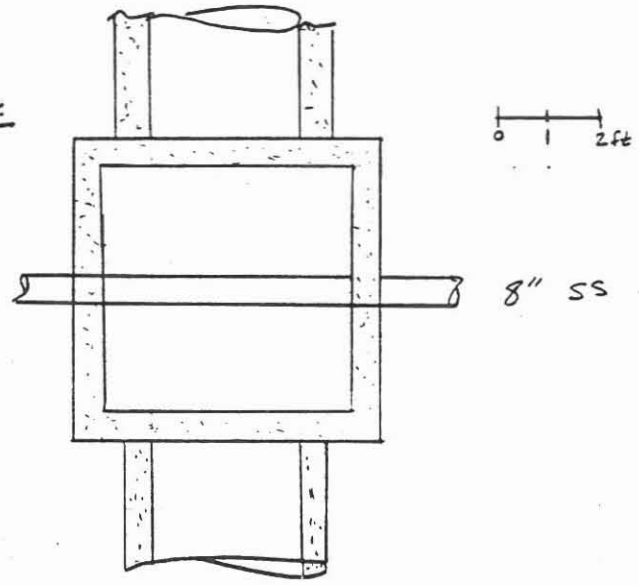


USE 5'x5' JUNCTION BOX:

Perimeter = 20 ft

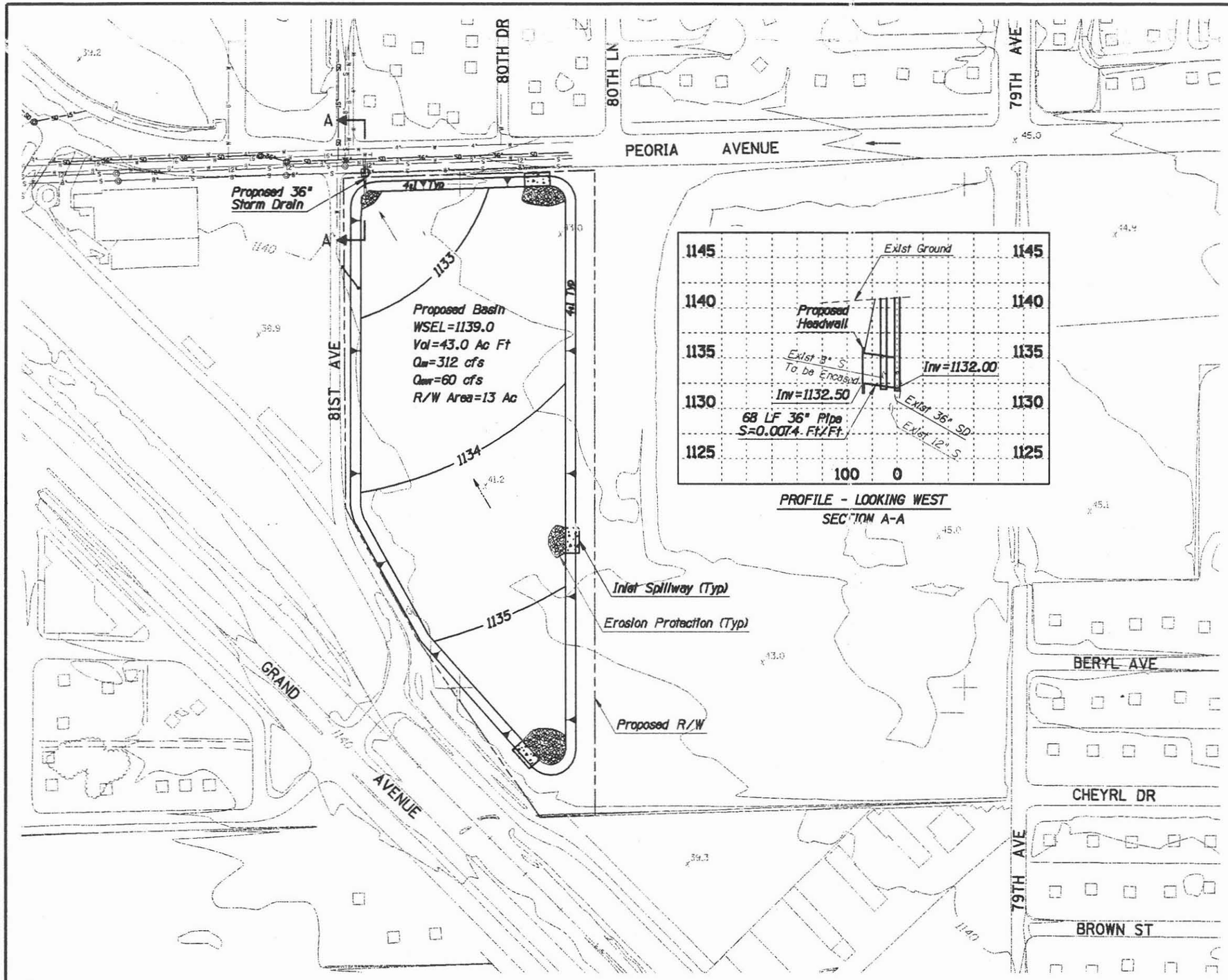
Thickness = 8 in

Height = 8 ft

Concrete Volume: for Sides = 20ft(8ft) 8/12 = 4 cy

Top & Bottom: $V = 2[5' \times 5' \times \frac{8}{12}] = 1.2$ cy

$\Sigma V = 5.2$ cy



NOTE:
THESE PLANS ARE PRELIMINARY AND ARE VIDED FOR PLANNING PURPOSES ONLY.
THE LOCATIONS OF ALL STRUCTURES, UT AND RIGHT-OF-WAY ARE APPROXIMATE
AND ARE BASED UPON RECORD DOCUMEN ERIAL TOPOGRAPHY WAS PRODUCED AT A
SCALE OF 1INCH=200 FEET WITH A 2 FO NTOUR INTERVAL. MAPPING WAS PREPARED
BY KENNEY AERIAL MAPPING AND IS BAS GROUND CONTROL SURVEY DATA PROVIDED
BY KAMINSKI-HUBBARD ENGINEERING INC. OJECT ENGINEERING CONSULTANTS, LTD.

LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE

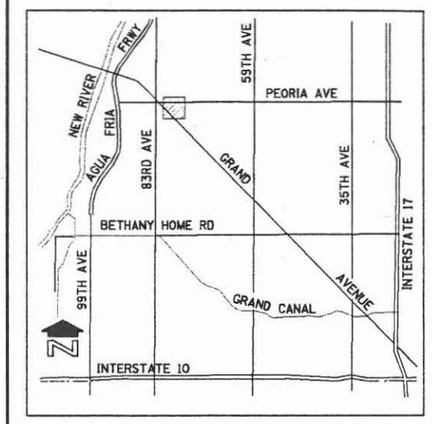
NOTE: Depiction of Inlet Spillways is Conceptual. Size, Number & Location of Required Spillways to be Determined With Final Design.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

MARYVALE AREA DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION LEVEL III

GRAND AVENUE AT 79TH AVENUE

MITIGATION OPTION 1, 10-YEAR

N

100 0 100 200

SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN | FIGURE 9 | SHEET 1 OF 44

TRACS NO.

WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

PROJECT Maryvale Adms

PROJECT NO. 94154 SHEET NO. 1 OF

CALCULATED BY DTP DATE 4 FEB 98 CHECKED BY DATE

BACKUP DATA FOR SELECTED ALTERNATIVE

SECTION 8.2.2 - GRAND AVE @ 75th AVE

OPTION 1, 10-year

DATA PROVIDED:

Existing Condition Hydrology:

HEC-1 KK Card ID: C26315

PEAK INFLOW: 595 cfs

RUNOFF VOLUME: 197 ac-ft

Ponded: 67 ac-ft

TYPE OF MITIGATION: 10 - YEAR

DETENTION STORAGE: (Yes) / ~~No~~

comments:

BASIN TYPE: On-Line

VOLUME: 197 ac-ft

OUTFALL: Gravity

PEAK STAGE: 1130 ft

Surrounding Ground EL: 1131 ft @ Low side

AVG PONDED DEPTH: 18 ft

Drain Time: $T \leq \frac{V}{Q} = \frac{197 \text{ ac ft}}{50 \text{ cfs}}$

$T \leq 48$ hrs

STORM DRAIN: (Yes) / ~~No~~ (Bleed off)

comments: Equalizer pipe sized for prorated inflow peak with respect to downstream storage basin.

Outfall to tie into existing 96 inch Stormdrain in Olive Avenue, thus outflow is limited be bleed off pipe, 42 inch RCP @ S = 0.0025 ft/ft, $Q_{capacity}$ = 50 cfs.

CHANNEL CONSIDERATIONS: ~~Yes~~ / (No)

Comments:

```
KKC2631S
KM SUB-BASIN COMBINE (C26-31S)
KO      1
HC      3  15.223
*
KKRES26S
KM PONDING AREA RESERVOIR ROUTE
KM SUB-BASIN 26-31E
KM PONDING AREA NORTHEAST OF GRAND AVENUE/RR EMBANKMENT
KM OUTFLOW REPRESENTS BOTH FLOW WEST (OVER THE RR EMBANKEMENT) AND
KM FLOW SOUTH OVER OLIVE AVENUE
RS      1    ELEV   1132.
SV      0    3.40   27.60   56.80  V 99.80   129.13   243.28
SE 1132.    1134.   1136.   1137.  EL 1138.   1138.5    1140.
SQ      0     0.1     0.2     0.3     2170.    4810.   51070.
                                  ↑
                                  520
```

10-year Q @ RES26S = 520 cfs

Thus, for existing conditions - Ponded 10-yr Volume = 67 ac-ft

Stage = 1137.2 ft

Outflow = 520 cfs

From Inflow Hydrograph

10-yr Q @ C26 31S = 595 cfs

V = 197 ac-ft

Wood/Patel and Associates Inc.

MARYVALE AREA DRAINAGE MASTER STUDY

Flood Control District of Maricopa County 01-Sep-97

FLOOD MITIGATION OPTIONS
LEVEL II ANALYSIS, OPTION 1, 10-yr

Contract FCD 93-29
W/P # 94154.00

STUDY AREA: Grand Avenue at 75th Avenue

South Detention Basin

Average Bottom Width =	500 ft		
Average Bottom Length =	690 ft		
Side Slope =	4 :1 (h:v)	Total Storage V:	197
Average Basin Bottom =	1113.5 ft Elev	South	North
High Water =	1130 ft Elev	82.3	114.2
Average Natural Ground =	1133 ft Elev		
Basin Type =	2 1 = Rectangular, 2 = Triangular		

Depth to Bottom (Feet)	Water Surface Elevation	Surface Area (Acres)	Storage Volume Incrimental (Ac-ft)	Storage Volume Cumulative (Ac-ft)	Earth Work Volume Incrimental (CY)	Earth Work Volume Cumulative (CY)
0.5	1114	4.0	2.0	2.0	3,239	3,239
1.5	1115	4.1	4.1	6.1	6,656	9,895
2.5	1116	4.2	4.2	10.4	6,837	16,732
3.5	1117	4.4	4.4	14.7	7,020	23,752
4.5	1118	4.5	4.5	19.2	7,206	30,958
5.5	1119	4.6	4.6	23.8	7,394	38,353
6.5	1120	4.7	4.7	28.5	7,585	45,938
7.5	1121	4.8	4.8	33.3	7,778	53,715
8.5	1122	4.9	4.9	38.2	7,973	61,688
9.5	1123	5.1	5.1	43.3	8,171	69,859
10.5	1124	5.2	5.2	48.5	8,371	78,230
11.5	1125	5.3	5.3	53.8	8,573	86,803
12.5	1126	5.4	5.4	59.2	8,778	95,581
13.5	1127	5.6	5.6	64.8	8,985	104,565
14.5	1128	5.7	5.7	70.5	9,194	113,760
15.5	1129	5.8	5.8	76.3	9,406	123,166
16.5	1130	6.0	6.0	82.3	9,620	132,787
17.5	1131	6.1	6.1	--	9,837	142,624
18.5	1132	6.2	6.2	--	10,056	152,680
19.5	1133	6.4	6.4	--	10,277	162,957
20.5	1134	6.5	6.5	--	10,501	--
21.5	1135	6.6	6.6	--	10,727	--
22.5	1136	6.8	6.8	--	10,956	--
23.5	1137	6.9	6.9	--	11,186	--
24.5	1138	7.1	7.1	--	11,420	--
25.5	1139	7.2	7.2	--	11,655	--
26.5	1140	7.4	7.4	--	11,893	--
27.5	1141	7.5	7.5	--	12,133	--
28.5	1142	7.7	7.7	--	12,376	--
29.5	1143	7.8	7.8	--	12,621	--
30.5	1144	8.0	8.0	--	12,868	--
31.5	1145	8.1	8.1	--	13,118	--
32.5	1146	8.3	8.3	--	13,370	--

Wood/Patel and Associates, Inc.

MARYVALE AREA DRAINAGE MASTER STUDY

Flood Control District of Maricopa County 01-Sep-97

FLOOD MITIGATION OPTIONS **Contract FCD 93-29**
LEVEL II ANALYSIS, OPTION 1, 10-yr **W/P # 94154.00**

STUDY AREA: Grand Avenue at 75th Avenue

North Detention Basin

Average Bottom Width =	800 ft
Average Bottom Length =	800 ft
Side Slope =	4 :1 (h:v)
Average Basin Bottom =	1116.5 ft Elev
High Water =	1130 ft Elev
Average Natural Ground =	1138 ft Elev
Basin Type =	2 1 = Rectangular, 2 = Triangular

Depth to Bottom (Feet)	Water Surface Elevation	Surface Area (Acres)	Storage Volume		Earth Work Volume	
			Incrimental (Ac-ft)	Cumulative (Ac-ft)	Incrimental (CY)	Cumulative (CY)
0.5	1117	7.4	3.7	3.7	5,985	5,985
1.5	1118	7.6	7.6	11.3	12,210	18,195
2.5	1119	7.7	7.7	19.0	12,452	30,647
3.5	1120	7.9	7.9	26.9	12,696	43,343
4.5	1121	8.0	8.0	34.9	12,943	56,286
5.5	1122	8.2	8.2	43.1	13,191	69,477
6.5	1123	8.3	8.3	51.4	13,443	82,920
7.5	1124	8.5	8.5	59.9	13,696	96,616
8.5	1125	8.6	8.6	68.5	13,952	110,568
9.5	1126	8.8	8.8	77.3	14,211	124,779
10.5	1127	9.0	9.0	86.3	14,471	139,251
11.5	1128	9.1	9.1	95.4	14,735	153,985
12.5	1129	9.3	9.3	104.7	15,000	168,985
13.5	1130	9.5	9.5	114.2	15,268	184,253
14.5	1131	9.6	9.6	--	15,538	199,791
15.5	1132	9.8	9.8	--	15,811	215,602
16.5	1133	10.0	10.0	--	16,086	231,687
17.5	1134	10.1	10.1	--	16,363	248,050
18.5	1135	10.3	10.3	--	16,643	264,693
19.5	1136	10.5	10.5	--	16,925	281,618
20.5	1137	10.7	10.7	--	17,209	298,827

WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

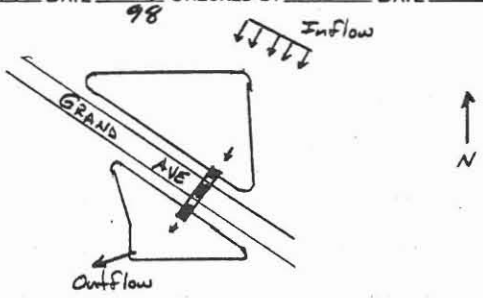
PROJECT Maryville Adms

PROJECT NO. 94154 SHEET NO. 1 OF 1

CALCULATED BY DTP DATE 5 FEB 98 CHECKED BY _____ DATE _____

GRAND AVE @ 75TH AVE

EQUALIZER PIPE SIZING
for Option 1, 10-year



From HEC-1: 10-YR 6-hr
$Q_p = 595$ cfs @ 5.33 hrs

Assumption: Size Equalizer pipe to convey the prorated Inflow peak flowrate, with respect to the downstream basin storage volume.

$$Q_{pipe} = Q_{IN} \frac{V_{D/S}}{V_{TOTAL}}$$

$$Q_{pipe} = 595 \text{ cfs} \left(\frac{82.3}{197}\right)$$

$$Q_{pipe} = 250 \text{ cfs}$$

Utilizing Surcharge Capacity - Max Depth at U/S Basin = 1130 - 1115
= 15 ft

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

February 5, 1998
Maryvale ADMS - Grand Avenue @ 75th Avenue
Option 1, 10-year
Equalizer Pipe

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	5.00
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.0130
Entrance Loss Coefficient of Culvert Opening	0.50
Culvert Length (feet)	345.0
Culvert Slope (feet per foot)	0.0019

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
250.0	0.00	9.80	10.99	5.00	4.42	4.42	13.61
250.0	5.00	9.80	11.28	5.00	4.42	5.00	12.73
250.0	10.00	9.80	16.28	5.00	4.42	5.00	12.73

==========

PIPE CULVERT ANALYSIS COMPUTER PROGRAM Version 1.7 Copyright (c)1986
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(713) 440-3787. All Rights Reserved.

Upstream Basin - avg depth @ WSEL = 1130 is 15 ft
This pipe should be looked at closer if D = 60" is selected.

CIRCULAR CHANNEL ANALYSIS
NORMAL DEPTH COMPUTATION

February 5, 1998
Maryvale ADMS - Grand Avenue @ 75th Avenue
Option 1, 10-year
Bleed off pipe capacity

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second)	50.0
Channel Bottom Slope (feet per foot)	0.0025
Manning's Roughness Coefficient (n-value)	0.0130
Channel Diameter (feet)	3.50

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet)	2.85
Flow Velocity (feet per second)	5.97
Froude Number (Flow is Sub-Critical)	0.600
Velocity Head (feet)	0.55
Energy Head (feet)	3.40
Cross-Sectional Area of Flow (square feet)	8.38
Top Width of Flow (feet)	2.73

==========

CIRCULAR CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.5 (c) 1986
Dodson & Associates, Inc., 5629 FM 1960 W., #314, Houston, TX 77069
(713) 440-3787. A complete program manual is available.

WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

PROJECT Maryvale Adms

PROJECT NO. 94154 SHEET NO. 1 OF 1

CALCULATED BY DTP DATE 30 Sep 97 CHECKED BY _____ DATE _____

GRAND AVE @ 79TH AVE & MOUNTAIN VIEW

TIME TO DRAIN

Runoff Volume = 197 Ac-ft

Q_{out} = 50 cfs

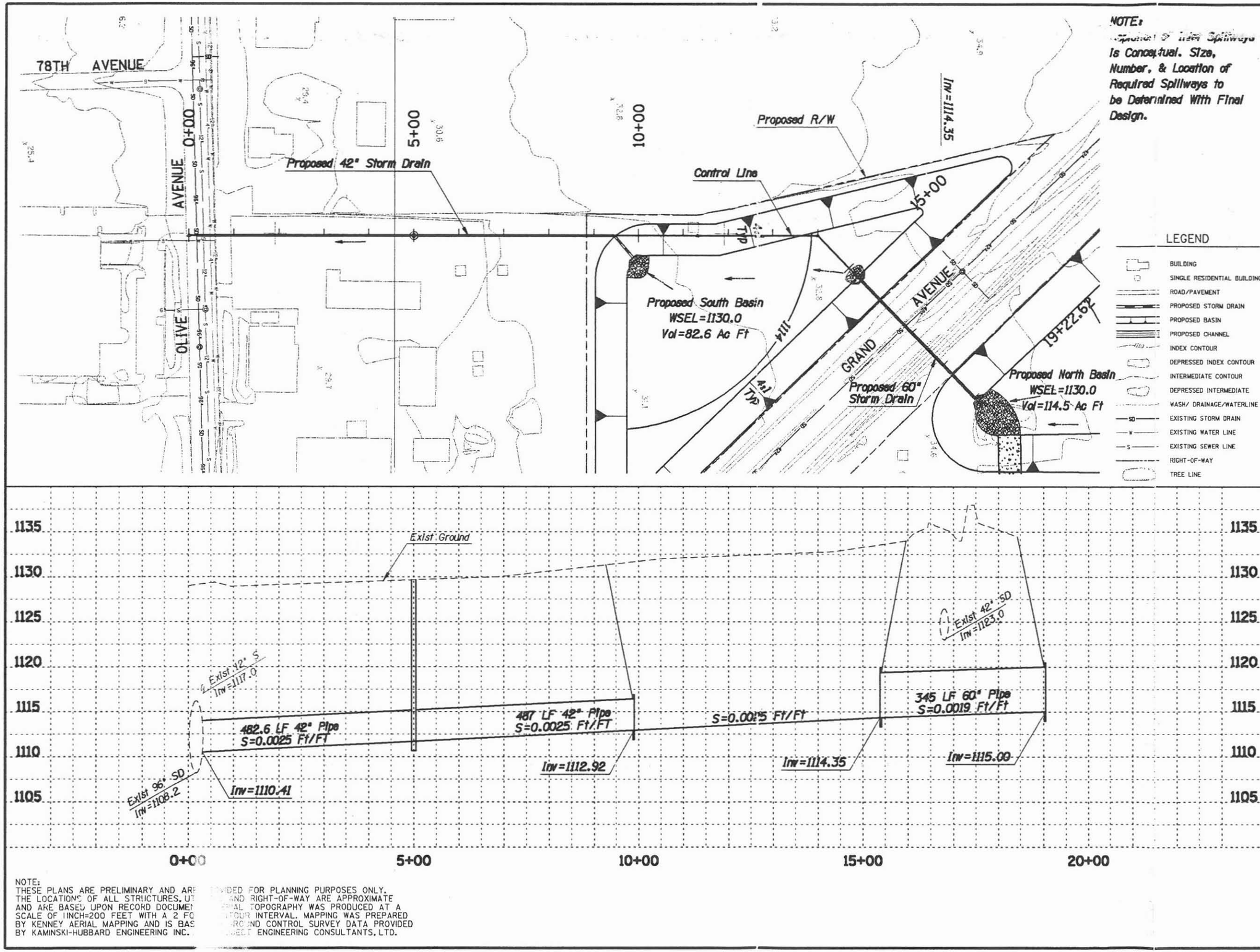
42 in RCP
S = 0.0025 ft/ft } @ Normal Depth
No Surcharge

Thus if Q = 50 cfs

Time to Drain: $T \leq \frac{V}{Q} = \frac{197 \text{ Ac-ft}}{50 \text{ cfs}} \left(\frac{43560 \text{ ft}^3/\text{Ac}}{3600 \text{ sec/hr}}\right)$

$T \leq 48$ hrs

Basin will Drain in less than 48 hrs



NOTE:
Spacing of Weir Spillways Is Conceptual. Size, Number, & Location of Required Spillways to be Determined With Final Design.

LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE

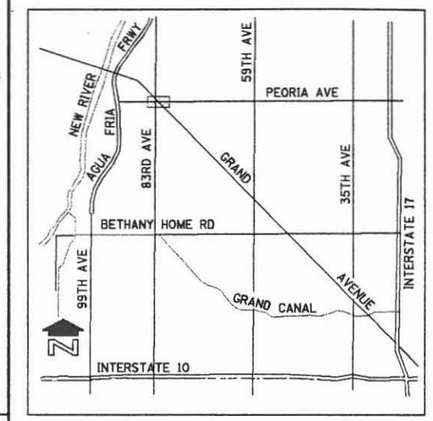
NOTE:
THESE PLANS ARE PRELIMINARY AND ARE PROVIDED FOR PLANNING PURPOSES ONLY. THE LOCATIONS OF ALL STRUCTURES, UTILITIES AND RIGHT-OF-WAY ARE APPROXIMATE AND ARE BASED UPON RECORD DOCUMENTS. AERIAL TOPOGRAPHY WAS PRODUCED AT A SCALE OF 1INCH=200 FEET WITH A 2 FOOT CONTOUR INTERVAL. MAPPING WAS PREPARED BY KENNEY AERIAL MAPPING AND IS BASED ON GROUND CONTROL SURVEY DATA PROVIDED BY KAMINSKI-HUBBARD ENGINEERING INC. PROJECT ENGINEERING CONSULTANTS, LTD.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

MARYVALE AREA DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION LEVEL III

GRAND AVENUE AT 75TH AVENUE

MITIGATION OPTION 1, 10-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

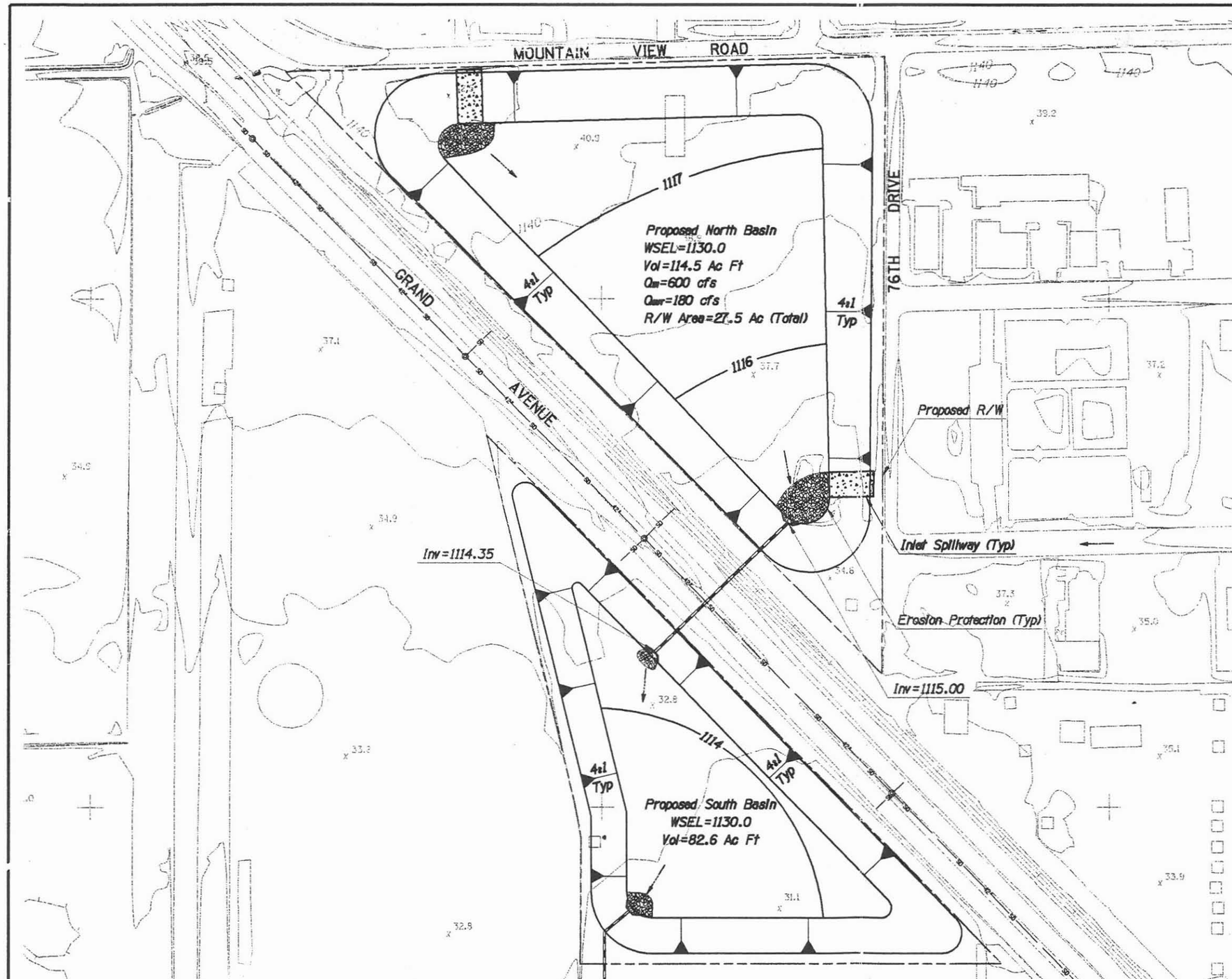
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 0+00 TO 19+30

FIGURE 9 | SHEET 2 OF 44

TRACS NO.



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE

NOTE:
THESE PLANS ARE PRELIMINARY AND ARE ED FOR PLANNING PURPOSES ONLY.
THE LOCATIONS OF ALL STRUCTURES, UT ND RIGHTS-OF-WAY ARE APPROXIMATE
AND ARE BASED UPON RECORD DOCUMEN AL TOPOGRAPHY WAS PRODUCED AT A
SCALE OF 1INCH=200 FEET WITH A 2 FO UR AERIAL MAPPING WAS PREPARED
BY KENNEY AERIAL MAPPING AND IS BAS SURVEY DATA PROVIDED
BY KAMINSKI-HUBBARD ENGINEERING INC. G CONSULTANTS, LTD.

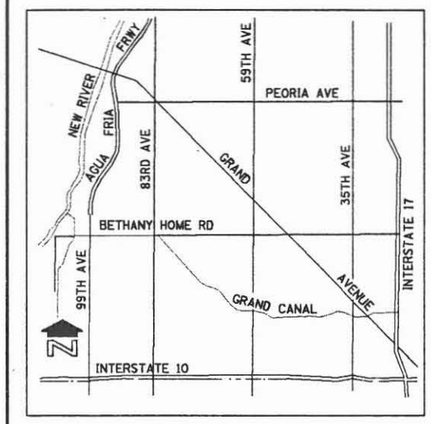
NOTE:
Depiction of Inlet Spillways is Conceptual. Size, Number, & Location of Required Spillways to be Determined With Final Design.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 75TH AVENUE

MITIGATION OPTION 1, 10-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN | FIGURE 9 | SHEET 3 OF 44

TRACS NO.

WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

PROJECT Maryvale ADMS

PROJECT NO. 94154 SHEET NO. 1 OF

CALCULATED BY DTP DATE 5 FEB 98 CHECKED BY DATE

BACKUP DATA FOR SELECTED ALTERNATIVE

GRAND AVE @ 73rd AVE

OPTION 1, 10-year

DATA PROVIDED:

Existing Condition Hydrology:

HEC-1 KK Card ID: C3631E

PEAK INFLOW: 1045 cfs

RUNOFF VOLUME: 227 ac-ft

PONDED VOL: 50 ac-ft

Type of MITIGATION: 10-YEAR

DETENTION STORAGE: (Yes) / ~~No~~

Comments:

By-Pass Q = 392 cfs

BASIN TYPE: SURGE

VOLUME: 68 ac-ft

OUTFALL: Gravity

PEAK STAGE: 1134 ft

Surrounding Ground EL: 1136 ft

AVG PONDED DEPTH: 14.5 ft

Time to Drain: $T \cdot Q = \frac{V}{Q} = \frac{68 \text{ ac-ft}}{96 \text{ cfs}}$

$T \leq 1$ hr

STORM DRAIN: (Yes) ~~No~~ (BLEED off)

Comments:

Tie into existing 78 inch storm drain in Olive Avenue. (RCP, s = 0.0068 ft/ft, thus Q_{full} = 465 cfs)

Bleed off pipe: 42" RCP, s = 0.0080 ft/ft → Q_{full} = 96 cfs

CHANNEL CONSIDERATIONS: ~~Yes~~ / (No)

Comments:

```
KKC3631E
KM SUB-BASIN COMBINE
KO      1
HC      5     20.6
*
KK RES36
KM PONDING AREA RESERVOIR ROUTE
KM PONDING AREA NORTHEAST OF GRAND AVENUE/RR EMBANKMENT
KM SUB-BASIN 36-31E
RS      1     ELEV    1132.
SV      0     3.10    19.20    35.25  ✓ 57.20   130.00   191.30
SE 1132.    1134.    1136.    1137.  EL 1138.    1140.    1141.
SQ      0      0.1      0.2      0.3  ↑ 1470.    9050.   16540.
*                                     968
```

10-YEAR Q_p (RES 36) = 968 cfs @ 6.58 hrs

10-YR Ponded Volume = 50 Ac-ft

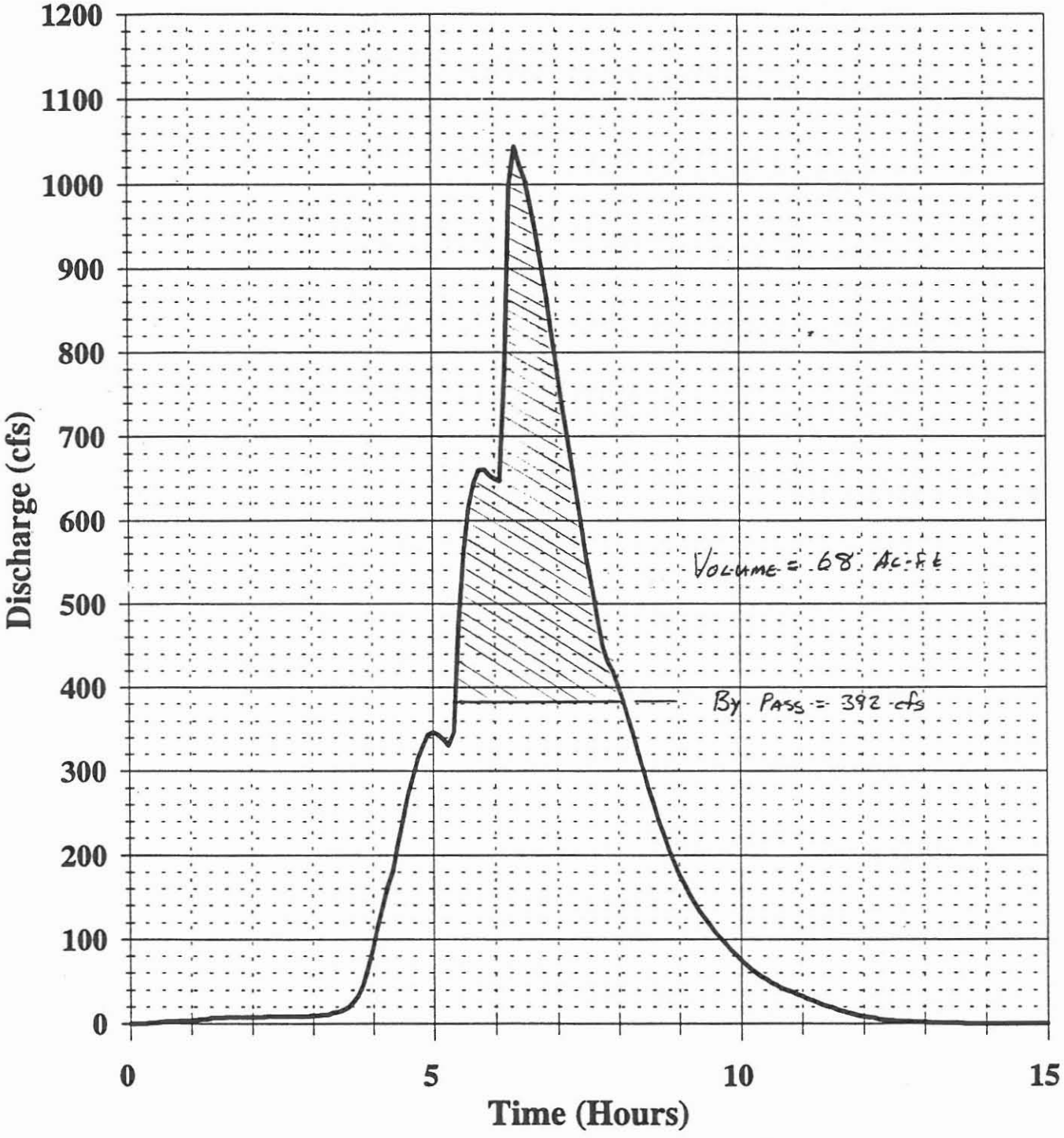
STAGE = 1137.7 ft

FROM INFLOW HYDROGRAPH:

10-YR Q_p (C3631E) = 1045 cfs @ 6.33 hrs

VOLUME: 227 Ac-Ft

Grand Ave @ 73rd Avenue
10-year Inflow Hydrograph @ C3631E



Wood/Patel and Associates Inc.

MARYVALE AREA DRAINAGE MASTER STUDY

Flood Control District of Maricopa County 01-Sep-97

FLOOD MITIGATION OPTIONS **Contract FCD 93-29**
LEVEL II ANALYSIS, OPTION 1, 10-yr **W/P # 94154.00**

STUDY AREA: Grand Avenue at 73rd Avenue

Detention Basin

Average Bottom Width =	580 ft
Average Bottom Length =	550 ft
Side Slope =	4 :1 (h:v)
Average Basin Bottom =	1119 ft Elev
High Water =	1134 ft Elev
Average Natural Ground =	1136 ft Elev
Basin Type =	2 1 = Rectangular, 2 = Triangular

Depth to Bottom (Feet)	Water Surface Elevation	Surface Area (Acres)	Storage Volume		Earth Work Volume	
			Incrimental (Ac-ft)	Cumulative (Ac-ft)	Incrimental (CY)	Cumulative (CY)
0	1119	3.7	0.0	0.0	0	0
1	1120	3.8	3.8	3.8	6,076	6,076
2	1121	3.9	3.9	7.6	6,247	12,323
3	1122	4.0	4.0	11.6	6,420	18,743
4	1123	4.1	4.1	15.7	6,596	25,339
5	1124	4.2	4.2	19.9	6,774	32,113
6	1125	4.3	4.3	24.2	6,955	39,068
7	1126	4.4	4.4	28.6	7,137	46,205
8	1127	4.5	4.5	33.2	7,323	53,528
9	1128	4.7	4.7	37.8	7,510	61,038
10	1129	4.8	4.8	42.6	7,700	68,738
11	1130	4.9	4.9	47.5	7,892	76,630
12	1131	5.0	5.0	52.5	8,087	84,717
13	1132	5.1	5.1	57.6	8,284	93,001
14	1133	5.3	5.3	62.9	8,483	101,484
15	1134	5.4	5.4	68.3	8,685	110,170
16	1135	5.5	5.5	--	8,889	119,059
17	1136	5.6	5.6	--	9,096	128,155
18	1137	5.8	5.8	--	9,305	--

CIRCULAR CHANNEL ANALYSIS
NORMAL DEPTH COMPUTATION

February 5, 1998
Maryvale ADMS - Grand Avenue @ 73rd Avenue
Option 1, 10-year
Existing 78in SD in Olive Avenue

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second)	465.0
Channel Bottom Slope (feet per foot)	0.0068
Manning's Roughness Coefficient (n-value)	0.0130
Channel Diameter (feet)	6.50

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet)	5.89
Flow Velocity (feet per second)	14.71
Froude Number (Flow is Sub-Critical)	0.897
Velocity Head (feet)	3.36
Energy Head (feet)	9.25
Cross-Sectional Area of Flow (square feet)	31.61
Top Width of Flow (feet)	3.79

==========

CIRCULAR CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.5 (c) 1986
Dodson & Associates, Inc., 5629 FM 1960 W., #314, Houston, TX 77069
(713) 440-3787. A complete program manual is available.

CIRCULAR CHANNEL ANALYSIS
NORMAL DEPTH COMPUTATION

February 5, 1998
Maryvale ADMS - Grand Avenue @ 73rd Avenue
Option 1, 10-year
Bleed off pipe from proposed basin

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second)	96.0
Channel Bottom Slope (feet per foot)	0.0080
Manning's Roughness Coefficient (n-value)	0.0130
Channel Diameter (feet)	3.50

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet)	3.15
Flow Velocity (feet per second)	10.52
Froude Number (Flow is Sub-Critical)	0.889
Velocity Head (feet)	1.72
Energy Head (feet)	4.87
Cross-Sectional Area of Flow (square feet)	9.12
Top Width of Flow (feet)	2.10

==========

CIRCULAR CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.5 (c) 1986
Dodson & Associates, Inc., 5629 FM 1960 W., #314, Houston, TX 77069
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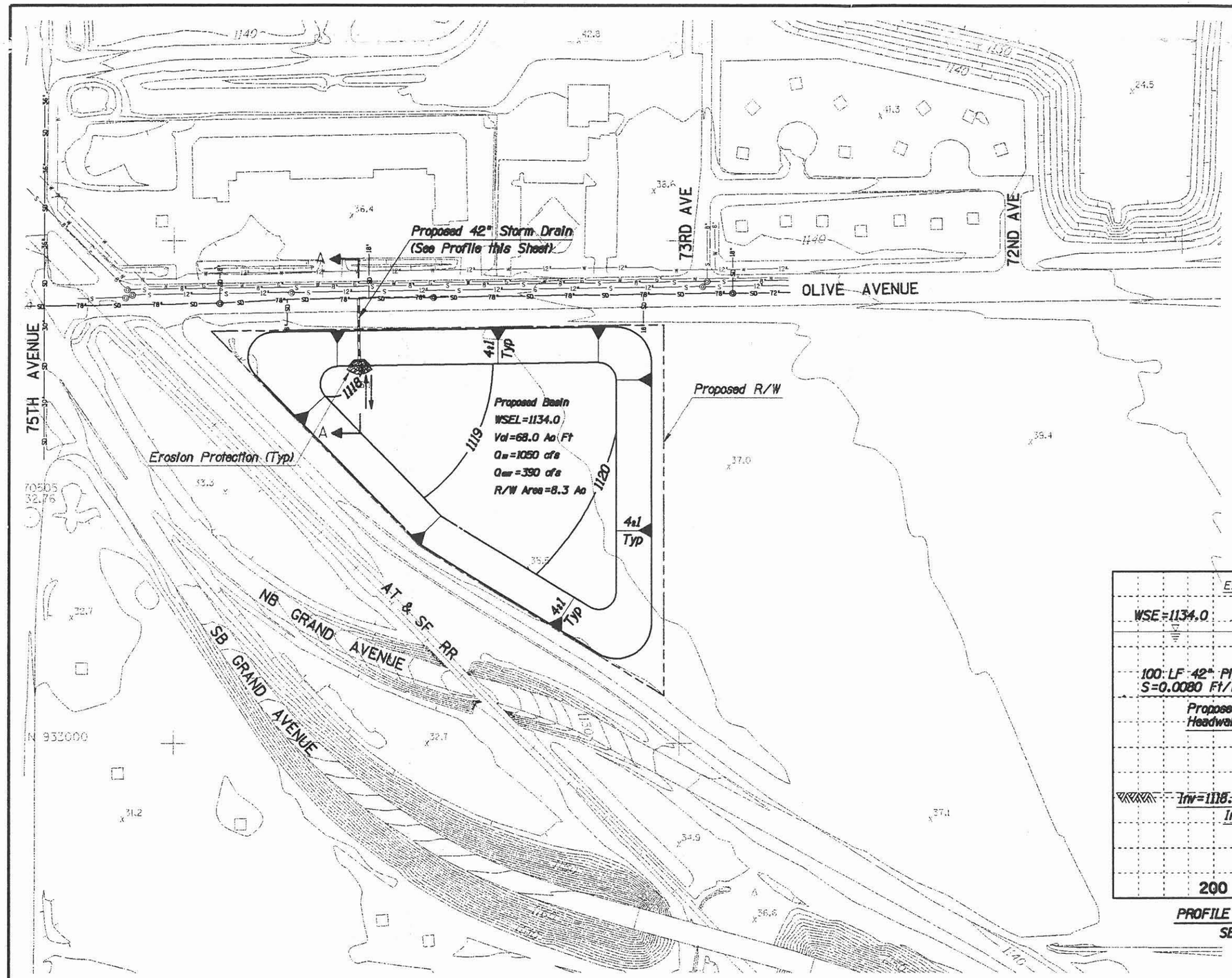

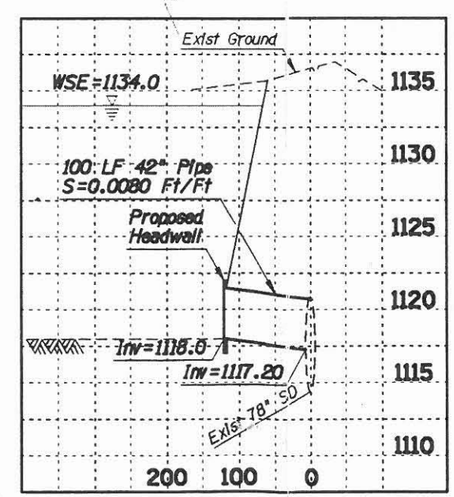

PROFILE - LOOKING WEST
SECTION A-A

LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- EXISTING STORM DRAIN
- EXISTING WATER LINE
- EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE

NOTE:
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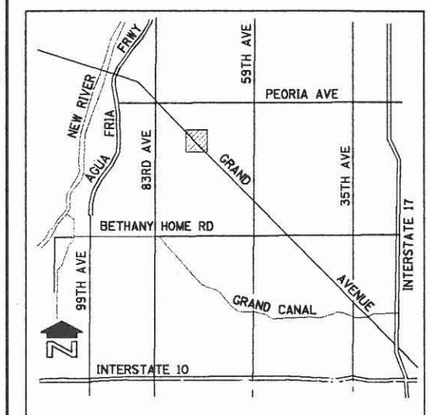
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

MARYVALE AREA DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION LEVEL III

GRAND AVENUE AT 73RD AVENUE

MITIGATION OPTION 1, 10-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN | FIGURE 9 | SHEET 4 OF 44

TRACS NO.

WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

PROJECT Maryvale ADMS

PROJECT NO. 94154 SHEET NO. 1 OF

CALCULATED BY DATE CHECKED BY DATE

Backup Data For Selected Alternative

Grand Avenue @ 67th Ave

Option 1, 100-year

Data Provided:

Existing Condition Hydrology: 100-YEAR

HEC-1 KK Card ID: C622EA

Peak Inflow: 2888 cfs

Runoff Volume: 570 ac-ft

Ponded Vol: 495 ac-ft

Type of Mitigation: 100-YEAR

Detention Storage: (Yes) / ~~No~~

Comments:

By Pass = 110 cfs

Time to Drain = 2.6 Days

Basin Type: Surge

Volume: 495 ac-ft

Outfall: Gravity + Pump

Peak Stage: 1140 ft

Surrounding Ground El: 1144.5 ft

Avg Ponded Depth: 19 ft

Storm Drain: ~~Yes~~ / (No)

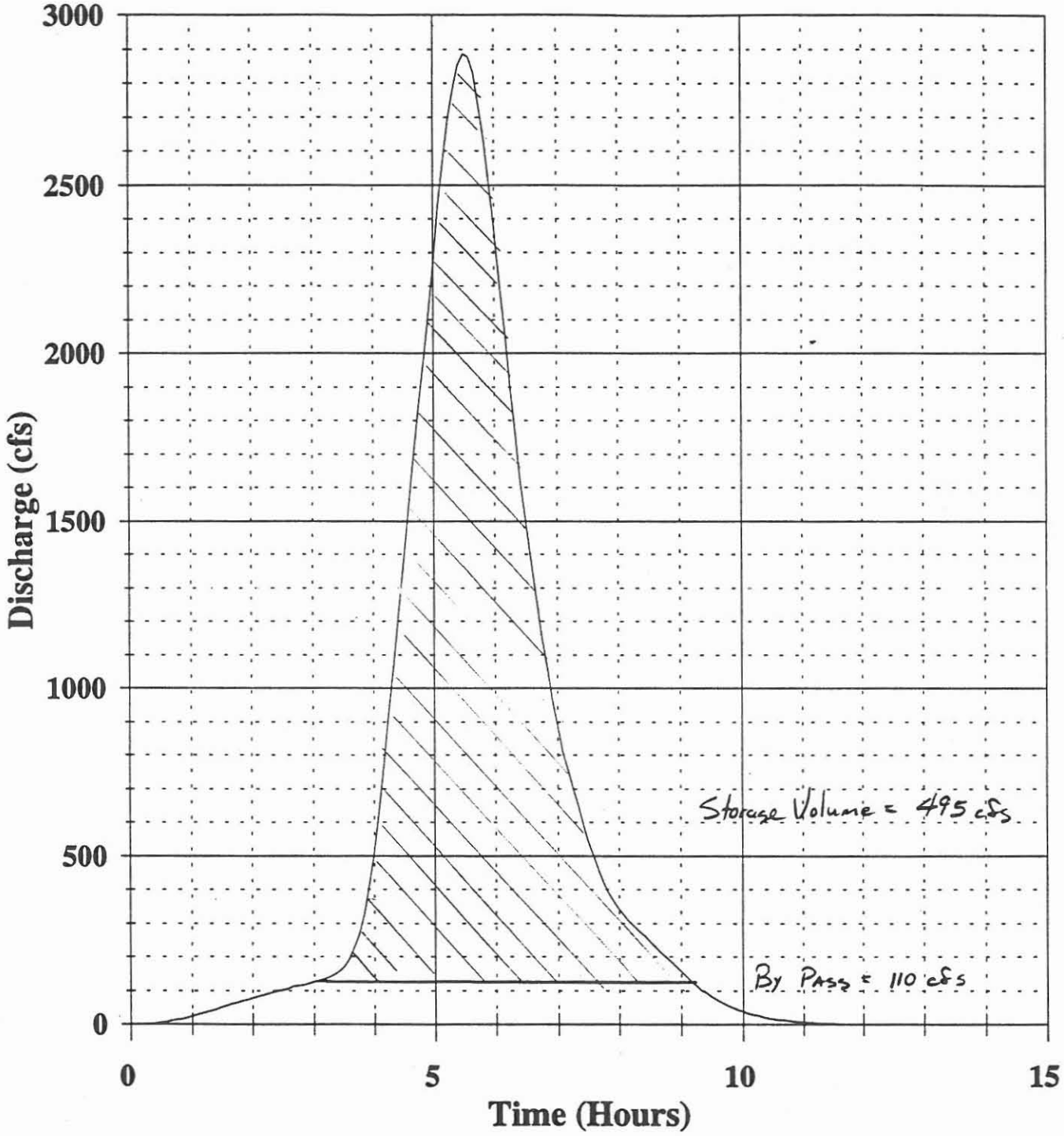
Comments:

Outfall to existing Northern/Orangewood Stormdrain

Channel Considerations: ~~Yes~~ / (No)

Comments:

Grand Ave @ 67th Ave & Northern
100-year Inflow @ C622EA



Wood, Patel & Associates Inc.

MARYVALE AREA DRAINAGE MASTER STUDY

Flood Control District of Maricopa County 23-Jul-97

FLOOD MITIGATION OPTIONS **Contract FCD 93-29**
LEVEL II ANALYSIS, OPTION 1, 100-yr **W/P # 94154.00**

STUDY AREA: Grand Avenue @ 67th Avenue
Note: Expand basin for capacity required for 100-yr detention volume

This is total for 100-yr Basin

South Detention Basin

Average Bottom Width =	970 ft
Average Bottom Length =	1020 ft
Side Slope =	4 :1 (h:v)
Average Basin Bottom =	1121 ft Elev
High Water =	1141 ft Elev
Average Natural Ground =	1145 ft Elev
Basin Type =	1 1 = Rectangular, 2 = Triangular

Depth to Bottom (Feet)	Water Surface Elevation	Surface Area (Acres)	Storage Volume Incrimental (Ac-ft)	Storage Volume Cumulative (Ac-ft)	Earth Work Volume Incrimental (CY)	Earth Work Volume Cumulative (CY)
0	1121	22.7	0.0	0.0	0	0
1	1122	23.1	23.1	23.1	37,236	37,236
2	1123	23.5	23.5	46.5	37,833	75,070
3	1124	23.8	23.8	70.4	38,435	113,504
4	1125	24.2	24.2	94.6	39,041	152,545
5	1126	24.6	24.6	119.1	39,652	192,197
6	1127	25.0	25.0	144.1	40,268	232,465
7	1128	25.3	25.3	169.4	40,888	273,353
8	1129	25.7	25.7	195.2	41,513	314,866
9	1130	26.1	26.1	221.3	42,143	357,009
10	1131	26.5	26.5	247.8	42,778	399,787
11	1132	26.9	26.9	274.7	43,417	443,204
12	1133	27.3	27.3	302.0	44,061	487,265
13	1134	27.7	27.7	329.7	44,710	531,975
14	1135	28.1	28.1	357.9	45,364	577,339
15	1136	28.5	28.5	386.4	46,022	623,361
16	1137	28.9	28.9	415.3	46,685	670,047
17	1138	29.4	29.4	444.7	47,353	717,400
18	1139	29.8	29.8	474.4	48,026	765,426
19	1140	30.2	30.2	504.6	48,703	814,129
20	1141	30.6	30.6	535.2	49,385	863,514
21	1142	31.0	31.0	--	50,072	913,586
22	1143	31.5	31.5	--	50,764	964,350
23	1144	31.9	31.9	--	51,460	1,015,809
24	1145	32.3	32.3	--	52,161	1,067,970
25	1146	32.8	32.8	--	52,867	--
26	1147	33.2	33.2	--	53,577	--
27	1148	33.7	33.7	--	54,292	--
28	1149	34.1	34.1	--	55,012	--
29	1150	34.5	34.5	--	55,737	--
30	1151	35.0	35.0	--	56,467	--
31	1152	35.5	35.5	--	57,201	--
32	1153	35.9	35.9	--	57,940	--

Incrimental Earthwork will be 100-yr Basin
— 10-yr Basin

File = Q:\Mvladmp\Level II\Grand Ave\67th-Grand Ave\Ret-vol.xls
Print Date 05-02-98

WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

PROJECT Maryvale Adms

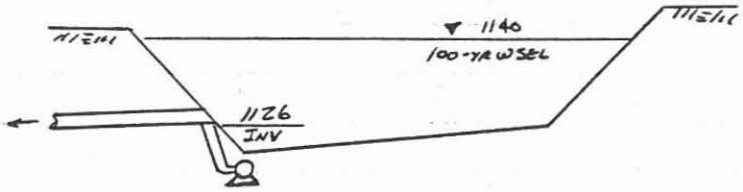
GRAND AVENUE AT 67th AVE

PROJECT NO. 94154 SHEET NO. 1 OF 1

CALCULATED BY DTP DATE 5 FEB 98 CHECKED BY _____ DATE _____

OPTION 1, 100-YEAR

TIME TO DRAIN ESTIMATE:



GRAVITY DRAIN: 60 inch RCP, $Q_{AVG} \approx 110$ cfs

From EL 1140 to EL 1128, $\Delta V = 335.2$ ac-ft

Time: $T = \frac{V}{Q} = \frac{335.2 \text{ ac-ft}}{110 \text{ cfs}}$

$T_{gravity} = 36.9$ hrs

PUMP TIME: 36 000 gpm = 80 cfs

@ EL = 1128, $V = 169.4$ ac-ft

$T_{pump} = \frac{169.4 \text{ ac-ft}}{80 \text{ cfs}}$

$T_{pump} = 25.6$ hrs

Total Time = 62.5 hrs = 2.6 days

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

July 23, 1997
MARYVALE ADMS
67TH AND NORTHERN AVENUES DETENTION BASIN OUTFLOW
RATING CURVE BASED ON THE N/O PRELIMINARY PLAN

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	5.00
FHWA Chart Number (1,2 or 3).....	1
Scale Number on Chart (Type of Culvert Entrance).....	1
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	5000.0
Culvert Slope (feet per foot).....	0.0080

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
20.0	5.00	1.68	-34.68	0.99	1.23	0.99	7.25
40.0	5.00	2.45	-33.73	1.40	1.76	1.40	8.85
60.0	5.00	3.10	-32.14	1.73	2.18	1.73	9.93
80.0	5.00	3.69	-29.92	2.02	2.53	2.02	10.79
100.0	5.00	4.27	-27.07	2.29	2.85	2.29	11.42
120.0	5.00	4.83	-23.58	2.55	3.13	2.55	11.94
140.0	5.00	5.40	-19.45	2.80	3.39	2.80	12.36
160.0	5.00	6.11	-14.69	3.04	3.63	3.04	12.78
180.0	5.00	6.69	-9.29	3.29	3.84	3.29	13.13
200.0	5.00	7.48	-3.26	3.57	4.04	3.57	13.35
110.0	5.00	4.55	-25.40	2.42	2.99	2.42	11.68
50.0	5.00	2.78	-33.02	1.58	1.98	1.58	9.42

==========

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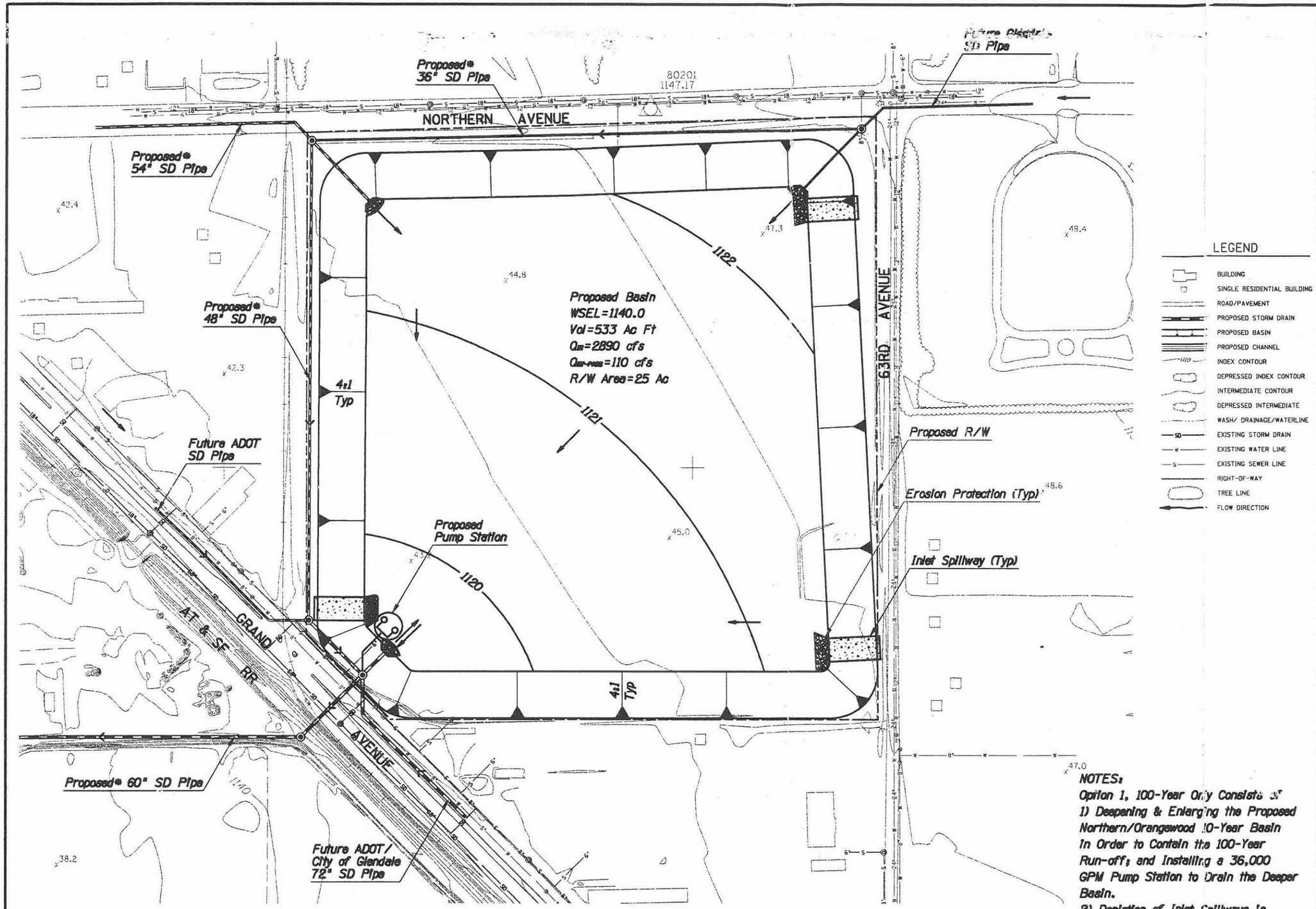

NOTES:
Option 1, 100-Year Only Consists Of
1) Deepening & Enlarging the Proposed Northern/Orangewood 10-Year Basin In Order to Contain the 100-Year Run-off; and Installing a 36,000 GPM Pump Station to Drain the Deeper Basin.
2) Depiction of Inlet Spillways Is Conceptual Size, Number & Location of Required Spillways to be Determined with Final Design

NOTE:
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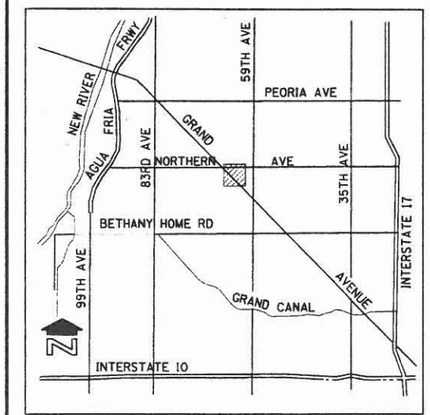
* Northern/Orangewood Project

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

MARYVALE AREA DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 67TH AVENUE

MITIGATION OPTION 1, 100-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN | FIGURE 9 | SHEET 5 OF 44

TRACS NO.

WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

PROJECT: MARYVALE ADMS

PROJECT NO. 94154 SHEET NO. 1 OF

CALCULATED BY DTP DATE 5 FEB 98 CHECKED BY DATE

BACKUP DATA FOR SELECTED ALTERNATIVE

GRAND AVENUE @ 51ST AVE

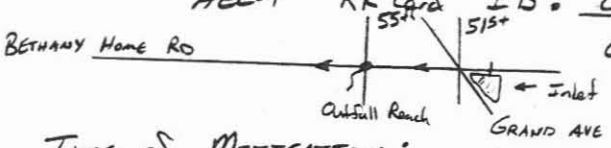
OPTIONS 6 & 8, 10-YEAR

DATA PROVIDED:

Existing Condition Hydrology: 10-YEAR

HEC-1 KK Card ID: CBH51B @ Inlet PEAK INFLOW: 505 cfs

C822W @ Outfall RUNOFF VOLUME: 138 ac-ft



TYPE OF MITIGATION:

DETENTION STORAGE: (Yes) / NO BASIN TYPE: SURGE

comments:

By-Pass Q = 120 cfs

VOLUME: 80 ac-ft

OUTFALL: Gravity

PEAK STAGE: 1144 ft

Surrounding Ground EL: 1147 ft

Time to Drain: $T \leq \frac{V}{Q} = \frac{80 \text{ ac-ft}}{120 \text{ cfs} - 20\%}$

$T \leq 10.1$ hrs

STORM DRAIN: (Yes) ~~No~~

comments:

See HGL Calculations and Plan / Profile set in ADMS Report for more details.

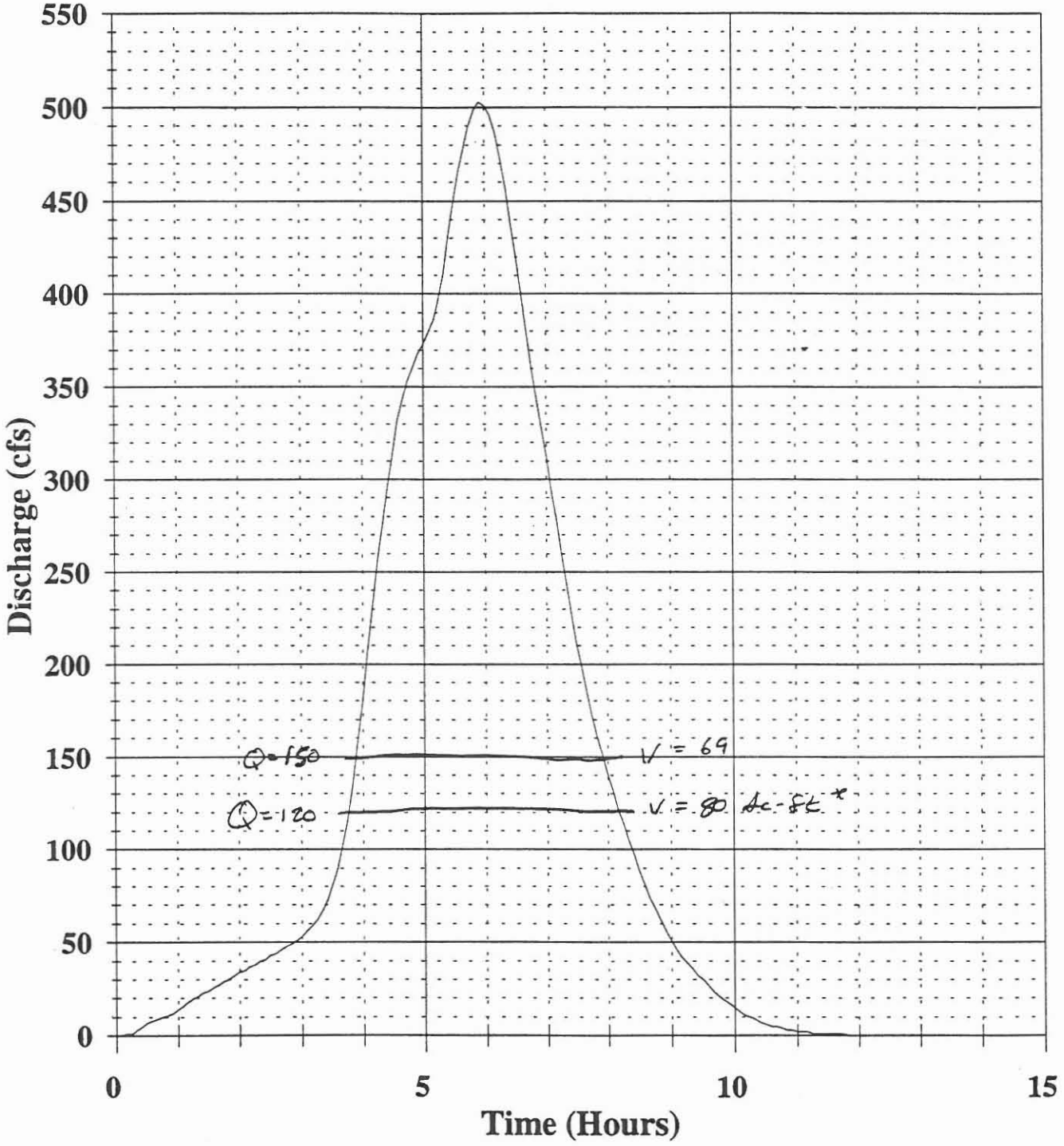
CHANNEL CONSIDERATIONS: ~~Yes~~ / (No)

Comments:

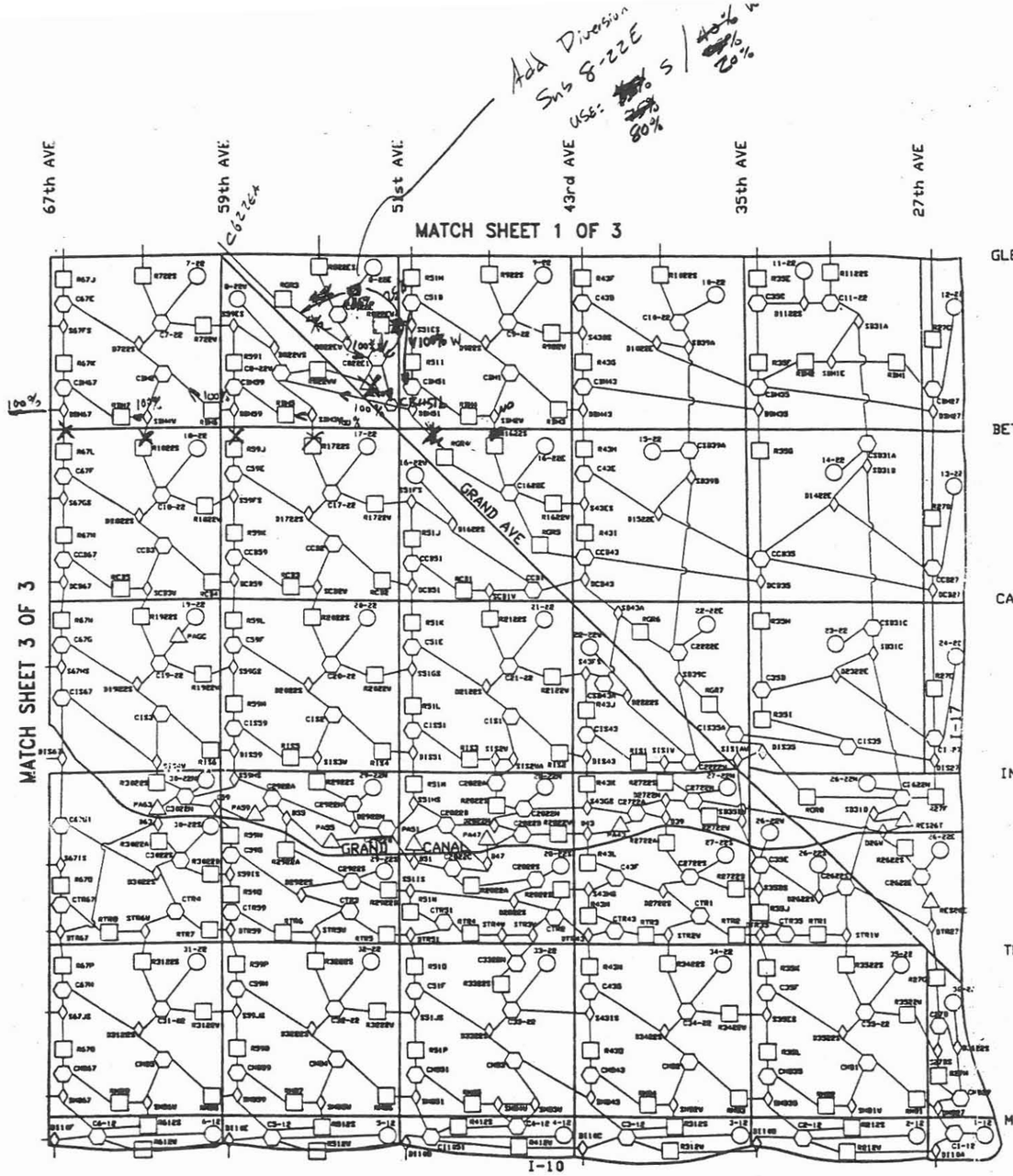
MARYVALE ADMS

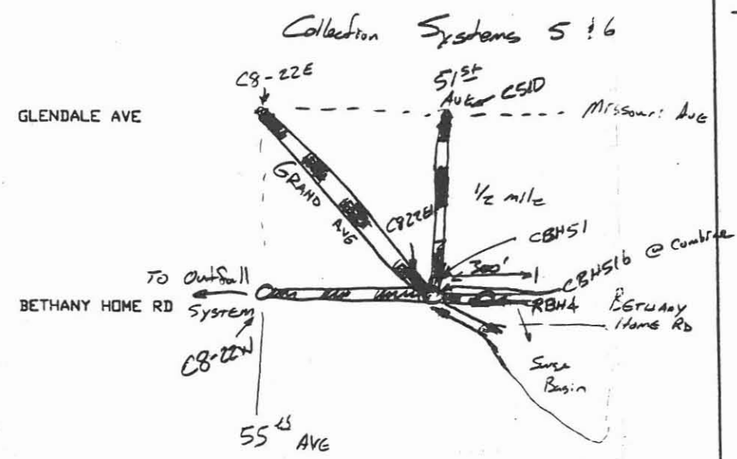
Grand Ave @ 51st Ave - Option 6, 10-yr

INFLOW HYDROGRAPH



—— 51st & Grand Ave





HEC-1 ID	10-YEAR Peak Flow cfs	0026 Qp	0022
RBH4	111	111 *	
CSID	297	297 *	
CBHS1	405	405 *	
CBHS1B	- - - -	503 *	
C8-22E	269	448	
C8-22EI	220* inflow	266 *	
CBHS1 b	503	510 *	
C8-22W	340	340 *	
		585 w/o Surge Basin	

* Use for Design

Note: Splits Coded in File

OPTION 6 ⇒ H:\MULADMP\.HECIGA\BHSD0026.ihl

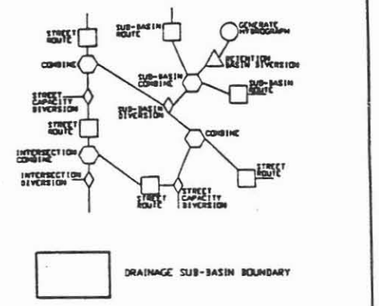
15 Sept 97

OPTION 5 ⇒ H:\MULADMP\HECIGA\BHSD0022.ihl

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

MARYVALE
AREA DRAINAGE MASTER STUDY
FCD CONTRACT # 93-29

LEGEND



Note: Option 5 = (Option 6) - (Surge Basin)

HYDROLOGY

INDEX MAP

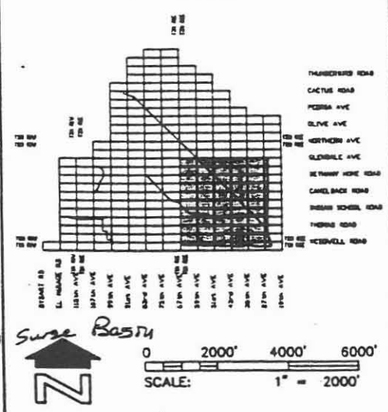


EXHIBIT 1
HEC-1 SCHEMATIC

CH2M HILL | WOOD / PATEL

	BY	DATE
DESIGN	-	-
DESIGN CHK.	-	-
PLANS	-	-
PLANS CHK.	DWD	OCT 96
SUBMITTED BY		DATE: OCT 96

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE
APPROVED BY: DATE
CHIEF ENGINEER AND GENERAL MANAGER

SHEET 2 OF 3

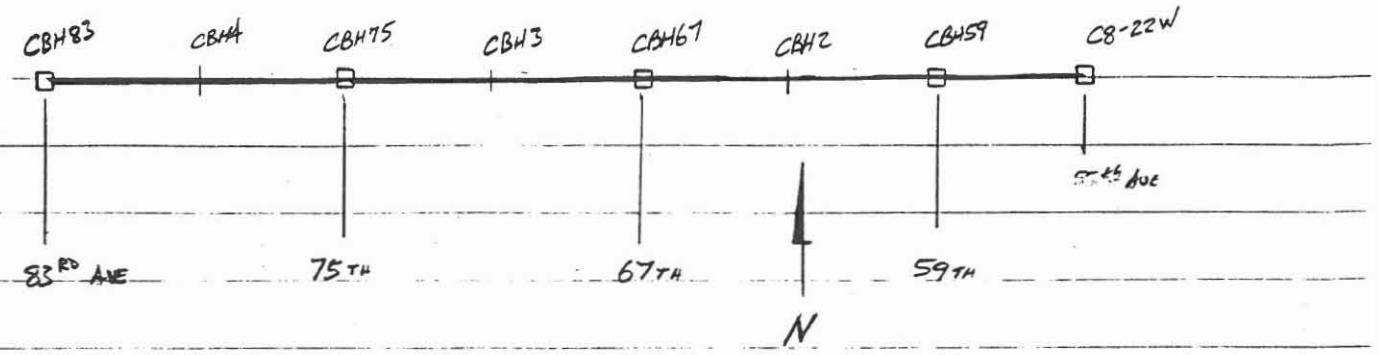
19 Sept 97

MARWALE ADMS

BETHANY HOME ROAD SD

Options 8 and 9

Summary of Q_p



N-S STREET	HEC-1 ID	10-YEAR Peak Flow, in cfs for each MODEL BHSD0026*	BHSD002c	BHSD003
55 TH AVE	C8-22W	340	585	340
59 TH AVE	CBH 59	372	588	372
63rd AVE	CBH 2	463	588	463
67 TH AVE	CBH 67	515	654	515
71st AVE	CBH 3	643	769	643
75 TH AVE	CBH 75	714	857	714
79th AVE	CBH 4	805	946	805
83 RD AVE	CBH83	837	980	837

This option not optimized

More storage is available, Thus flows can be reduced. For simplicity this collection system outlet 340 cfs to match opt

	Collection System		HEC-1 File
Selected Option *	OPTION 6	(w/ Surge Basin)	BHSD0026
	OPTION 5	(w/o Surge Basin)	BHSD002c
	OPTION 4	(w/ 2 Surge Basins)	BHSD003

Wood/Patel and Associates Inc.

MARYVALE AREA DRAINAGE MASTER STUDY

Flood Control District of Maricopa County 14-Aug-97

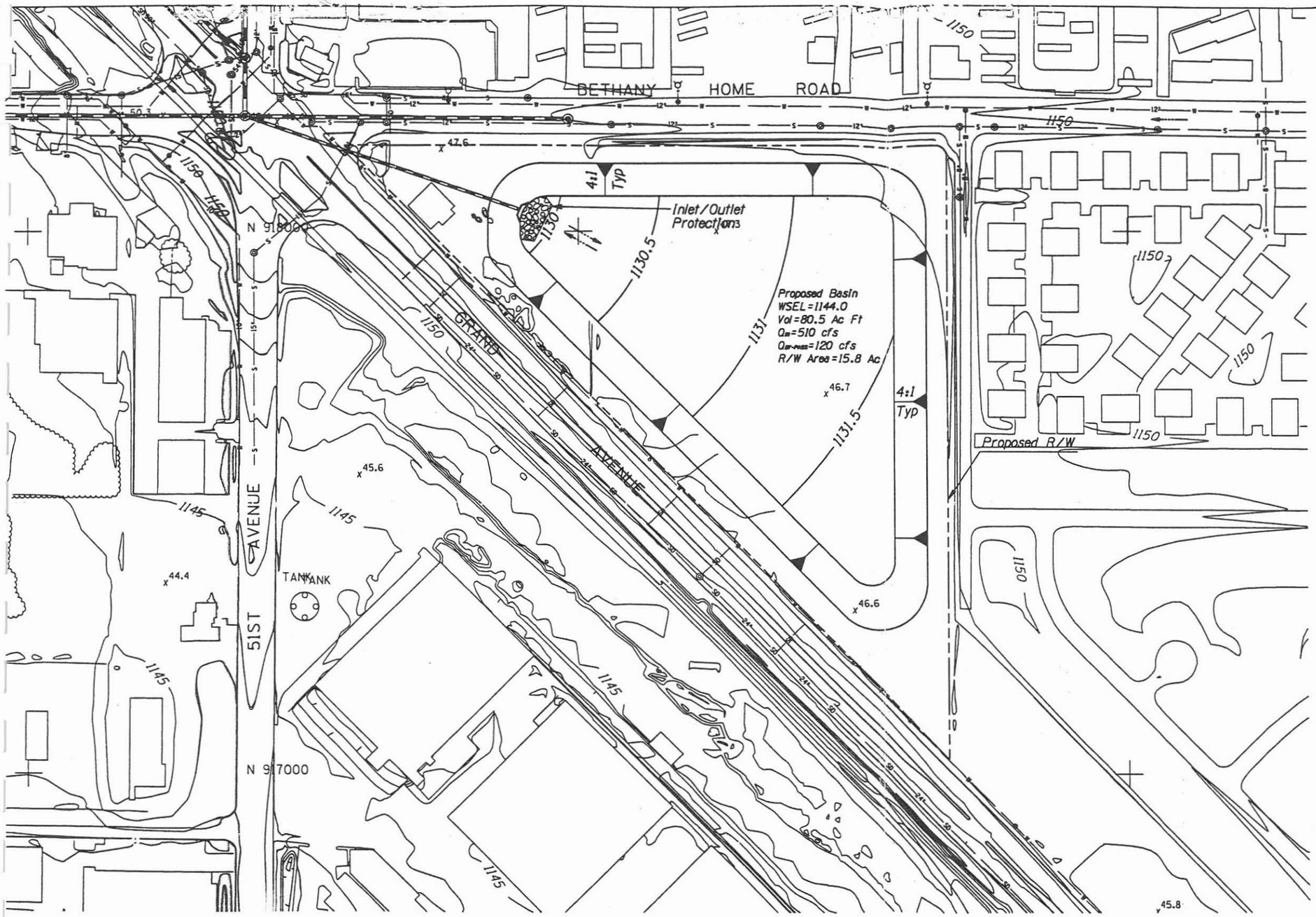
FLOOD MITIGATION OPTIONS **Contract FCD 93-29**
LEVEL II ANALYSIS, OPTION 6, 10-yr **W/P # 94154.00**

STUDY AREA: 51st & Grand Ave - Storm drain w/ basin.

South Detention Basin

Average Bottom Width =	670 ft
Average Bottom Length =	690 ft
Side Slope =	4 :1 (h:v)
Average Basin Bottom =	1131 ft Elev
High Water =	1144 ft Elev
Average Natural Ground =	1146 ft Elev
Basin Type =	2 1 = Rectangular, 2 = Triangular

Depth to Bottom (Feet)	Water Surface Elevation	Surface Area (Acres)	Storage Volume Incrimental (Ac-ft)	Storage Volume Cumulative (Ac-ft)	Earth Work Volume Incrimental (CY)	Earth Work Volume Cumulative (CY)
0	1131	5.3	0.0	0.0	0	0
1	1132	5.4	5.4	5.4	8,764	8,764
2	1133	5.6	5.6	11.0	8,969	17,733
3	1134	5.7	5.7	16.7	9,176	26,909
4	1135	5.8	5.8	22.5	9,386	36,295
5	1136	5.9	5.9	28.4	9,598	45,893
6	1137	6.1	6.1	34.5	9,813	55,706
7	1138	6.2	6.2	40.7	10,030	65,735
8	1139	6.4	6.4	47.1	10,249	75,984
9	1140	6.5	6.5	53.6	10,470	86,454
10	1141	6.6	6.6	60.2	10,694	97,149
11	1142	6.8	6.8	67.0	10,921	108,070
12	1143	6.9	6.9	73.9	11,150	119,219
13	1144	7.1	7.1	81.0	11,381	130,600
14	1145	7.2	7.2	--	11,614	142,214
15	1146	7.3	7.3	--	11,850	154,064
16	1147	7.5	7.5	--	12,088	--
17	1148	7.6	7.6	--	12,329	--
18	1149	7.8	7.8	--	12,572	--



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE

FROM CAD

A_{TOP} = 10.40 Ac

A_{BOTTOM} = 6.78 Ac

EL_{TOP} ≈ 1145

EL_{BOTTOM} ≈ 1130.5

AVG END METHOD

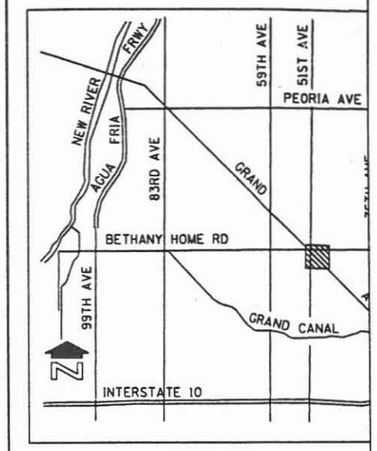
$V = \frac{10.4 + 6.78}{2}(45 - 30.5)$

V ≈ 125 Ac-ft

NOTE:
THESE PLANS ARE PRELIMINARY AND ARE PR[illegible]D FOR PLANNING PURPOSES ONLY.
'HE LOCATIONS OF ALL STRUCTURES, UTILITI[illegible]D RIGHT-OF-WAY ARE APPROXIMATE
ND ARE BASED UPON RECORD DOCUMENTS. [illegible] TOPOGRAPHY WAS PRODUCED AT A
SCALE OF 1INCH=200 FEET WITH A 2 FOOT [illegible]UR INTERVAL. MAPPING WAS PREPARED
BY KENNEY AERIAL MAPPING AND IS BASED [illegible]OUND CONTROL SURVEY DATA PROVIDED
BY KAMINSKI-HUBBARD ENGINEERING INC. AND [illegible]T ENGINEERING CONSULTANTS, LTD.

CONTRACT NO. FCD 93-2

FLOOD MITIGATION OPTI[illegible]



VICINITY MAP

OPTION EVALUATIO[illegible]
LEVEL III

GRAND AVENUE AT 51ST AVENUE

MITIGATION OPTION 6, 10-YE[illegible]

100 0 100
SCALE IN FEET
CONTOUR INTERVAL = 2

NO.	REVISION
3	
2	
1	

FLOOD CONTROL DISTRIC[illegible]
OF MARICOPA COUNTY
ENGINEERING DIVISION

		BY
CONCEPT PLAN	DESIGNED	D. PHELPS, S. ZOU[illegible]
	DRAWN	S. RASMUSSEN, A. L[illegible]
	CHECKED	J. MOODY, A. PATE[illegible]

WOOD, PATEL & ASSOCI[illegible]
1550 EAST MISSOURI, SU[illegible]
PHOENIX, ARIZONA (602)

DRAINAGE SYSTEM PLAN

FIG [illegible]

960730/grand&51st/basin05.dgn [illegible]09, 1998 15:58:38

WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

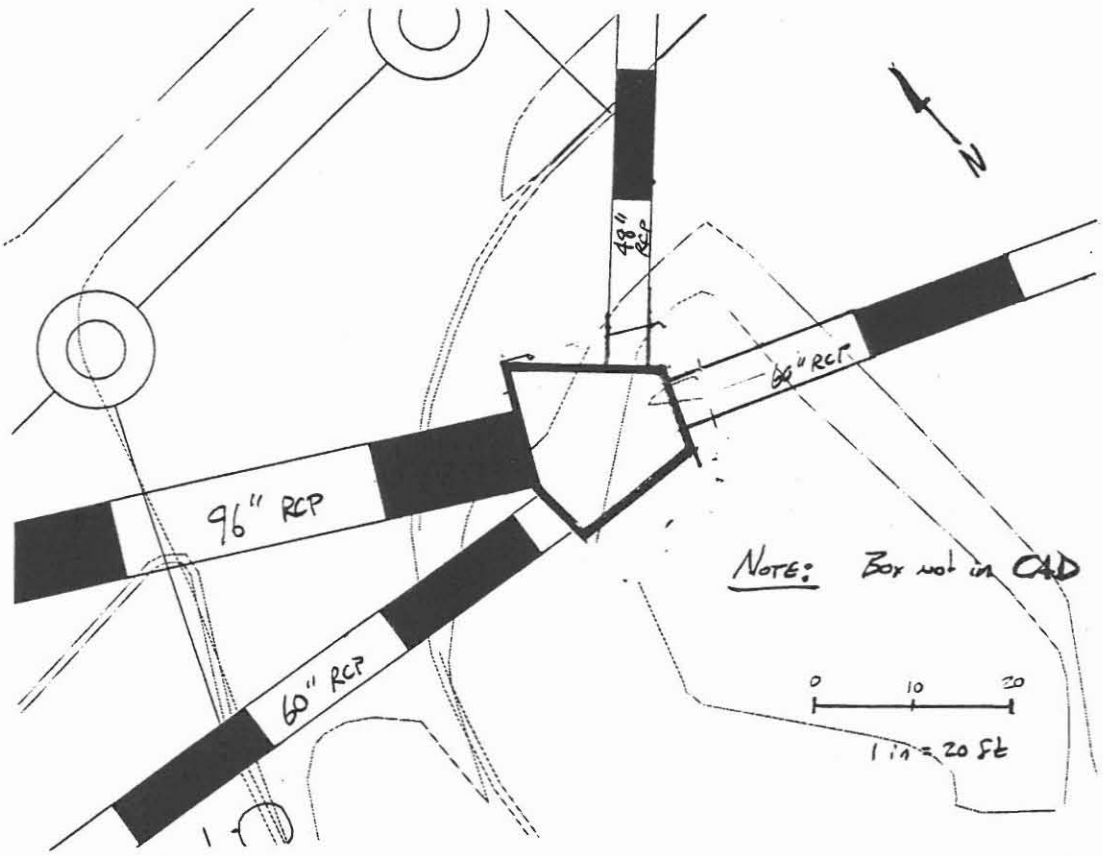
PROJECT MARYVALE ADMS

PROJECT NO. 94154 SHEET NO. 1 OF 1

CALCULATED BY DTP DATE 18 AUG 97 CHECKED BY _____ DATE _____

GRAND AVE @ 51 ST AVE
LEVEL II
COST ESTIMATE

Storm Drain Junction Box near intersection of Grand Ave, 51 ST Ave and Bethany Hw



Assume: 8 in thick walls
15 ft Deep (Vertical walls)

Measured Perimeter : 61 ft $\xrightarrow{(61 \times 15)}$ 915 sq. ft.
Top & Bottom Area: 2 x 207 ft²/side $\longrightarrow$ 414 sq. ft

Σ 1329 sq. ft

Total Volume of Concrete = $1392\ ft^2 \left(\frac{8\ in}{12}\right) = 33\ CY$

Project: Maryvale ADMP GRAND AVE @51st AVE, OPTIONS 6 & 8, 10-year
File: Q:\MVLADMP\LEVEL II\Grand Ave\51st - Grand Ave\HGL.wb2
Print Date: 05-Feb-98 Input Data Revision: 23-Sep.-97
Engineer: SAZ
Description: Computation of EGL and HGL for storm drain system
Reference: Drainage Design Manual for Maricopa County, Arizona
Volume II, Hydraulics, January, 1996
Formulas Revised: August 22, 1997

Notes:

1. This spreadsheet is developed to compute storm drain hydraulic grade line based on the above mentioned reference.
   All Equations used and minor loss coefficients shall be referred to this reference.
2. The blue areas are user input blocks, the grey areas are computed values, and the dark grey areas are check cells.
3. The recommended flow type for storm drain systems by the reference is pressure flow. Therefore, open channel flow computation is only an approximation here.
   The hydraulic grade line at the outfall is assumed to be the invert elevation plus the pipe diameter. If the tailwater elevation is different from this value, the user should change this number manually.
4. The station is located at the immediate downstream of a change point.
5. If the number of rows of the spreadsheet is not enough for a project, the user can copy (do not insert any rows in the middle of the spreadsheet) more rows to the bottom of the spreadsheet and copy the formulas by rows to the new area.
6. Column F are the suggested pipe diameters computed by the spreadsheet with increment of 6 inches. User can select different values than the suggested.
7. Manning's n values in Column H can be selected from Table 4.1.
8. Column M are the summation of Kt values for each section, and the individual Kt values are from Tables 4.2 to 4.4 based on the transition types: a) gradual enlargement,
   b) sudden enlargement, c) contraction, the D2/D1 ratio in Column R, the velocity in Column S, and other related information on these tables.
9. Column N are the summation of Kb values including some manhole losses for each section, and the individual bend Kb values are from Figure 4.7.
10. Columns O, P, and Q are input data for computation of junction losses: Q3 is the lateral flow, D3 is the pipe diameter of the lateral flow,
    and theta is the angle between the main flow pipe and the lateral flow pipe.
11. Column AD are minor losses other than the types considered in the spreadsheet. The user should calculate these values and input them directly.
12. If users find any error or have any suggestion, please contact Wood, Patel & Associates.

BETHANY HOME ROAD STORM DRAIN - 51st Ave. to 83rd Ave.

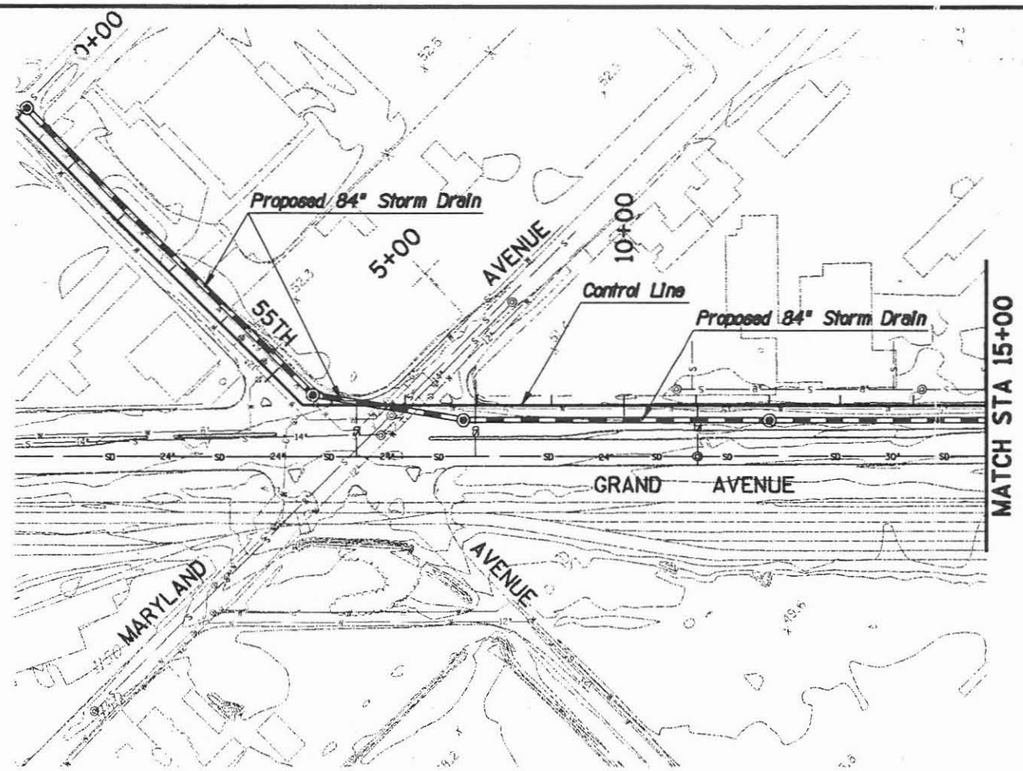
Storm Sewer Line Station Location	Pipe #	Station	Pipe Diameter Sheet Suggested (in)	Pipe Diameter User Selected (in)	n	Natural Ground Elevation (ft)	Invert Elev. (ft)	Pipe Slope	Design Q (cfs)	Transitn Loss Coeff. Sum(Kt)	Bend Loss Coeff. Sum(Kb)	Junction Losses Q3 (cfs)	Junction Losses D3 (in)	Junction Losses Theta (deg.)	D2/D1	Vel. (ft/s)	Full Area (sq ft)	Station Interval (ft)	Pipe Length (ft)	V^2/(2g) (ft)	K	Sf (ft/ft)	Losses hf (ft)	Losses ht (ft)	Losses hb (ft)	Losses hj (ft)	Losses Others (ft)	Total Losses (ft)	Hydraulic Grade Line Elevation (ft)	Energy Grade Line Elevation (ft)	Pressure Flow Check	"Overflow" Check	Comments	Depth to Hydraulic Grade Line (ft)	Depth to Invert (ft)
Outfall @83 Ave		6+50	120	108	0.012	1085.50	1070.50	0.00250	838.0	1.00	0.20	0.00	0	0	1.00	5.00	63.62			0.39				2.31	0.54	0.00	0.00	0.00	1079.50	1079.89	OK	OK			
79th Ave.		32+60	120	108	0.012	1095.00	1077.03	0.00250	838.0	0.00	0.15	0.00	0	0	1.00	13.17	63.62	2610.00	2610.0	2.69	0.0042	0.0038	10.01	0.00	0.37	0.00	0.00	12.85	1090.05	1092.74	OK	OK		5.0	18.0
75th Ave.		52+40	120	108	0.012	1102.20	1081.98	0.00250	805.0	0.00	0.15	0.00	0	0	1.00	12.65	63.62	1980.00	1980.0	2.49	0.0042	0.0035	7.01	0.00	0.29	0.00	0.00	7.38	1097.63	1100.12	OK	OK		4.6	20.2
72nd Dr.		72+20	114	108	0.012	1110.50	1086.93	0.00250	714.0	0.00	0.10	0.00	0	0	1.00	11.22	63.62	1980.00	1980.0	1.96	0.0042	0.0028	5.51	0.00	0.20	0.00	0.00	5.81	1103.97	1105.93	OK	OK		6.5	23.6
71st Ave.		78+80	114	108	0.012	1112.50	1088.58	0.00250	714.0	0.00	0.15	0.00	0	0	1.00	11.22	63.62	660.00	660.0	1.96	0.0042	0.0028	1.84	0.00	0.24	0.00	0.00	2.03	1106.00	1107.96	OK	OK		6.5	23.9
67th Ave.		105+20	102	108	0.012	1122.50	1097.82	0.00350	643.0	0.09	0.20	0.00	0	0	1.13	10.11	63.62	2640.00	2640.0	1.59	0.0042	0.0023	5.96	0.00	0.33	0.00	0.00	6.20	1112.57	1114.16	OK	OK		9.9	24.7
63rd Ave.		130+10	96	96	0.012	1128.70	1106.53	0.00350	515.0	0.00	0.20	0.00	0	0	1.00	10.25	50.27	2490.00	2490.0	1.63	0.0042	0.0027	6.76	0.00	0.26	0.00	0.00	7.09	1119.62	1121.25	OK	OK		9.1	22.2
59th Ave.		156+50	90	96	0.012	1137.20	1115.77	0.00350	464.0	0.09	0.15	0.00	0	0	1.14	9.23	50.27	2640.00	2640.0	1.32	0.0042	0.0022	5.82	0.01	0.22	0.00	0.00	6.08	1126.00	1127.33	OK	OK		11.2	21.4
56th Ave.		176+30	84	84	0.012	1142.30	1122.70	0.00350	373.0	0.00	0.20	0.00	0	0	1.00	9.69	38.48	1980.00	1980.0	1.46	0.0042	0.0029	5.75	0.00	0.29	0.00	0.00	5.98	1131.85	1133.31	OK	OK		10.5	19.6
Near 56th Ave.		178+00	96	84	0.012	1142.50	1123.04	0.00200	373.0	0.00	0.25	0.00	0	0	1.00	9.69	38.48	170.00	170.0	1.46	0.0042	0.0029	0.49	0.00	0.30	0.00	0.00	0.79	1132.63	1134.09	OK	OK		9.9	19.5
55th Ave.		183+50	90	84	0.012	1143.20	1124.14	0.00200	340.0	0.00	0.10	0.00	0	0	1.00	8.83	38.48	550.00	550.0	1.21	0.0042	0.0024	1.33	0.00	0.12	0.00	0.00	1.63	1134.51	1135.72	OK	OK		8.7	19.1
Near 53rd Dr.		196+70	90	84	0.012	1145.00	1126.78	0.00200	340.0	0.23	0.05	0.00	0	0	1.40	8.83	38.48	1320.00	1320.0	1.21	0.0042	0.0024	3.18	0.15	0.03	0.00	0.00	3.30	1137.81	1139.02	OK	OK		7.2	18.2
51st Ave.		210+20	60	60	0.012	1149.50	1129.48	0.00200	120.0	0.20	1.00	0.00	0	0	1.00	6.11	19.63	1350.00	1350.0	0.58	0.0042	0.0018	2.44	0.02	0.49	0.00	0.00	2.61	1141.06	1141.64	OK	OK		8.4	20.0
Near Surge Basin		216+00	60	60	0.012	1148.00	1130.64	0.00200	110.0	0.50	0.05	0.00	0	0		5.60	19.63	580.00	580.0	0.49	0.0042	0.0015	0.88			0.00	0.00	1.39	1142.54	1143.03	OK	OK		5.5	17.4

BETHANY HOME ROAD STORM DRAIN - Grand Ave. (Surge Basin to 55th Ave.)

Storm Sewer Line Station Location	Pipe #	Station	Pipe Diameter Sheet Suggested (in)	Pipe Diameter User Selected (in)	n	Natural Ground Elevation (ft)	Invert Elev. (ft)	Pipe Slope	Design Q (cfs)	Transitn Loss Coeff. Sum(Kt)	Bend Loss Coeff. Sum(Kb)	Junction Losses Q3 (cfs)	Junction Losses D3 (in)	Junction Losses Theta (deg.)	D2/D1	Vel. (ft/s)	Full Area (sq ft)	Station Interval (ft)	Pipe Length (ft)	V^2/(2g) (ft)	K	Sf (ft/ft)	Losses hf (ft)	Losses ht (ft)	Losses hb (ft)	Losses hj (ft)	Losses Others (ft)	Total Losses (ft)	Hydraulic Grade Line Elevation (ft)	Energy Grade Line Elevation (ft)	Pressure Flow Check	"Overflow" Check	Comments	Depth to Hydraulic Grade Line (ft)	Depth to Invert (ft)
Surge Basin		48+70	108	108	0.012	1145.00	1129.00	0.00093	390.0	1.00	0.00	0.00	0	0	1.00	1.00	63.62			0.02				0.57	0.00	0.00	0.00	0.00	1144.00	1144.02	OK	OK			
Surge Junction		44+20	108	108	0.012	1149.50	1129.50	0.00093	390.0	0.00	1.00	0.00	0	0	1.00	6.13	63.62	450.00	540.0	0.58	0.0042	0.0008	0.45	0.00	0.61	0.00	0.00	1.02	1144.45	1145.03	OK	OK		5.1	20.0
Combine Junction		43+20	84	108	0.012	1149.20	1130.00	0.00455	400.0	0.16	0.75	0.00	0	0	1.29	6.29	63.62	100.00	110.0	0.61	0.0042	0.0009	0.10	0.02	0.56	0.00	0.00	0.71	1145.13	1145.74	OK	OK		4.1	19.2
E. 53rd Ave.		25+75	84	84	0.012	1149.80	1133.49	0.00200	266.0	0.00	0.20	0.00	0	0	1.00	6.91	38.48	1745.00	1745.0	0.74	0.0042	0.0015	2.58	0.00	0.15	0.00	0.00	3.15	1148.15	1148.89	OK	OK		1.6	16.3
53rd Ave.		24+75	84	84	0.012	1150.00	1133.71	0.00200	266.0	0.00	0.15	0.00	0	0	1.00	6.91	38.48	100.00	110.0	0.74	0.0042	0.0015	0.16	0.00	0.09	0.00	0.00	0.31	1148.46	1149.21	OK	OK		1.5	16.3
E. 55th Ave.		7+70	78	84	0.012	1152.20	1137.12	0.00200	240.0	0.00	0.25	0.00	0	0	1.00	6.24	38.48	1705.00	1705.0	0.60	0.0042	0.0012	2.05	0.00	0.13	0.00	0.00	2.14	1150.74	1151.34	OK	OK		1.5	15.1
55th Ave.		5+60	78	84	0.012	1152.30	1137.54	0.00200	220.0	0.00	0.15	0.00	0	0	1.00	5.72	38.48	210.00	210.0	0.51	0.0042	0.0010	0.21	0.00	0.06	0.00	0.00	0.34	1151.18	1151.68	OK	OK		1.1	14.8
55th Ave. Inlet		0+00	72	84	0.012	1152.40	1138.66	0.00200	200.0	0.00	0.00	0.00	0	0		5.20	38.48	560.00	560.0	0.42	0.0042	0.0008	0.47			0.00	0.00	0.53	1151.79	1152.21	OK	OK		0.6	13.7

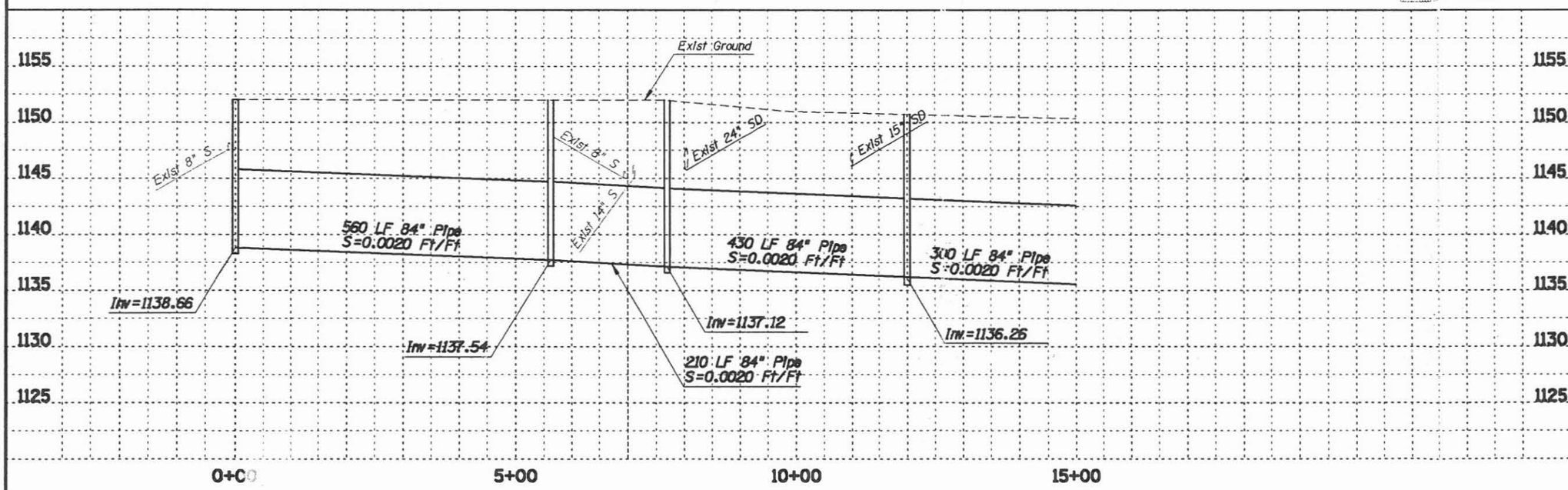
BETHANY HOME ROAD STORM DRAIN - 51st Ave. (Bethany Home Road to Maryland Ave.)

Storm Sewer Line Station Location	Pipe #	Station	Pipe Diameter Sheet Suggested (in)	Pipe Diameter User Selected (in)	n	Natural Ground Elevation (ft)	Invert Elev. (ft)	Pipe Slope	Design Q (cfs)	Transitn Loss Coeff. Sum(Kt)	Bend Loss Coeff. Sum(Kb)	Junction Losses Q3 (cfs)	Junction Losses D3 (in)	Junction Losses Theta (deg.)	D2/D1	Vel. (ft/s)	Full Area (sq ft)	Station Interval (ft)	Pipe Length (ft)	V^2/(2g) (ft)	K	Sf (ft/ft)	Losses hf (ft)	Losses ht (ft)	Losses hb (ft)	Losses hj (ft)	Losses Others (ft)	Total Losses (ft)	Hydraulic Grade Line Elevation (ft)	Energy Grade Line Elevation (ft)	Pressure Flow Check	"Overflow" Check	Comments	Depth to Hydraulic Grade Line (ft)	Depth to Invert (ft)
Combine Junction		25+80	84	84	0.012	1149.20	1130.00	0.00250	294.0	0.00	0.75	0.00	0	0	1.00	6.30	38.48			0.62				0.00	0.68	0.00	0.00	0.00	1145.13	1145.75	OK	OK			
Cavalier Dr.		19+00	84	84	0.012	1149.50	1131.70	0.00250	294.0	0.00	0.05	0.00	0	0	1.00	7.64	38.48	680.00	680.0	0.91	0.0042	0.0018	1.23	0.00	0.04	0.00	0.00	1.91	1146.75	1147.65	OK	OK		2.8	17.8
Marlette Ave.		7+10	78	84	0.012	1151.50	1134.67	0.00250	280.0	0.00	0.10	0.00	0	0	1.17	7.28	38.48	1190.00	1190.0	0.82	0.0042	0.0016	1.95	0.00	0.13	0.00	0.00	1.99	1148.82	1149.64	OK	OK		2.7	16.8
Maryland Ave.		0+40	78	72	0.012	1155.00	1136.35	0.00250	260.0	0.00	0.05	0.00	0	0		9.20	28.27	670.00	670.0	1.31	0.0042	0.0032	2.15			0.00	0.00	2.28	1150.61	1151.92	OK	OK		4.4	18.7



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE



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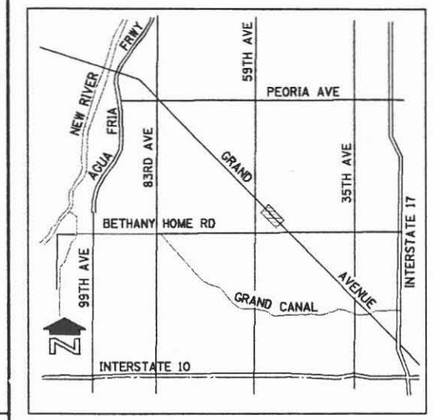
SCALE OF 1INCH=200 FEET WITH A 2 FOOT INTERVAL. MAPPING WAS PREPARED
BY KENNEY AERIAL MAPPING AND IS BASED ON CONTROL SURVEY DATA PROVIDED
BY KAMINSKI-HUBBARD ENGINEERING INC. ENGINEERING CONSULTANTS, LTD.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 51ST AVENUE

MITIGATION OPTION 6, 10-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

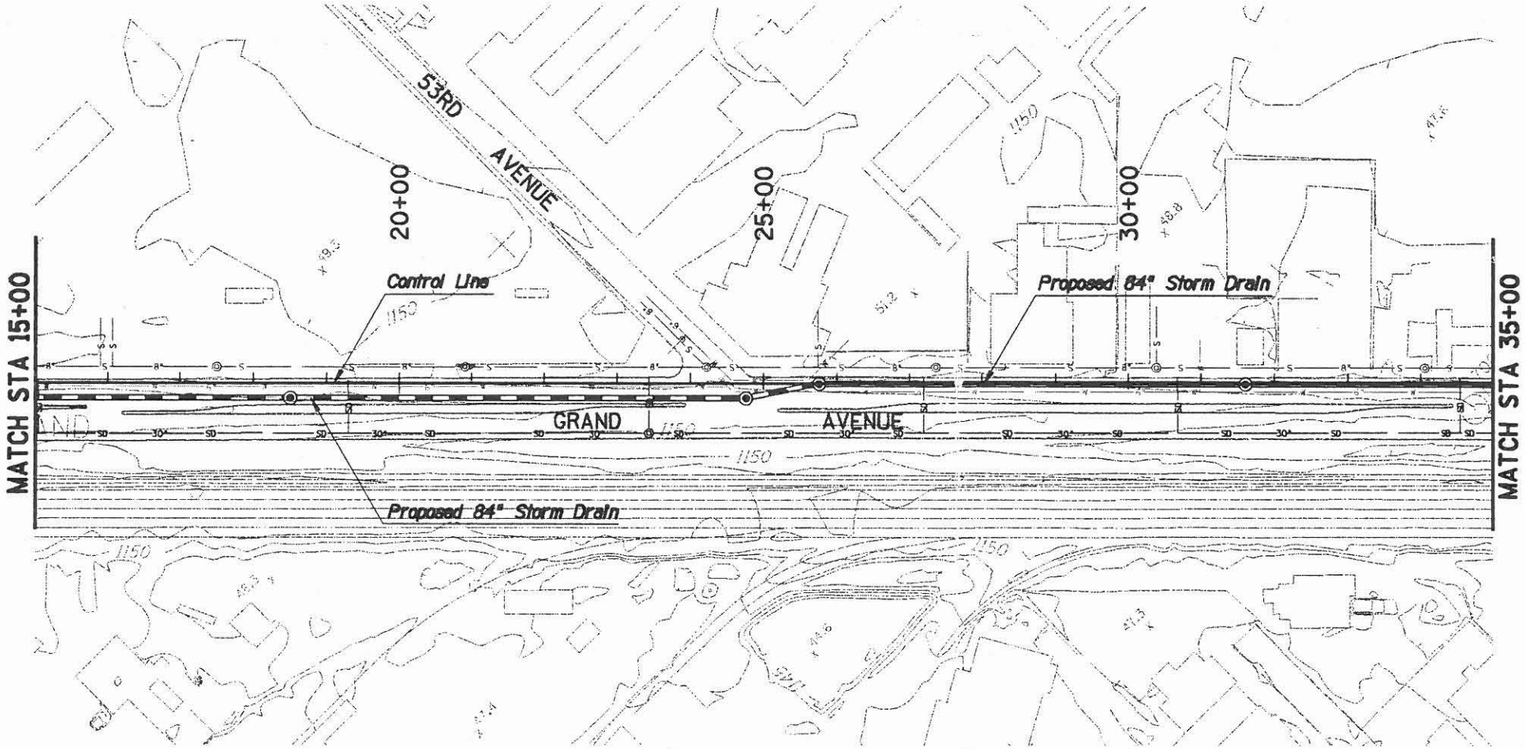
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 0+00 TO 15+00

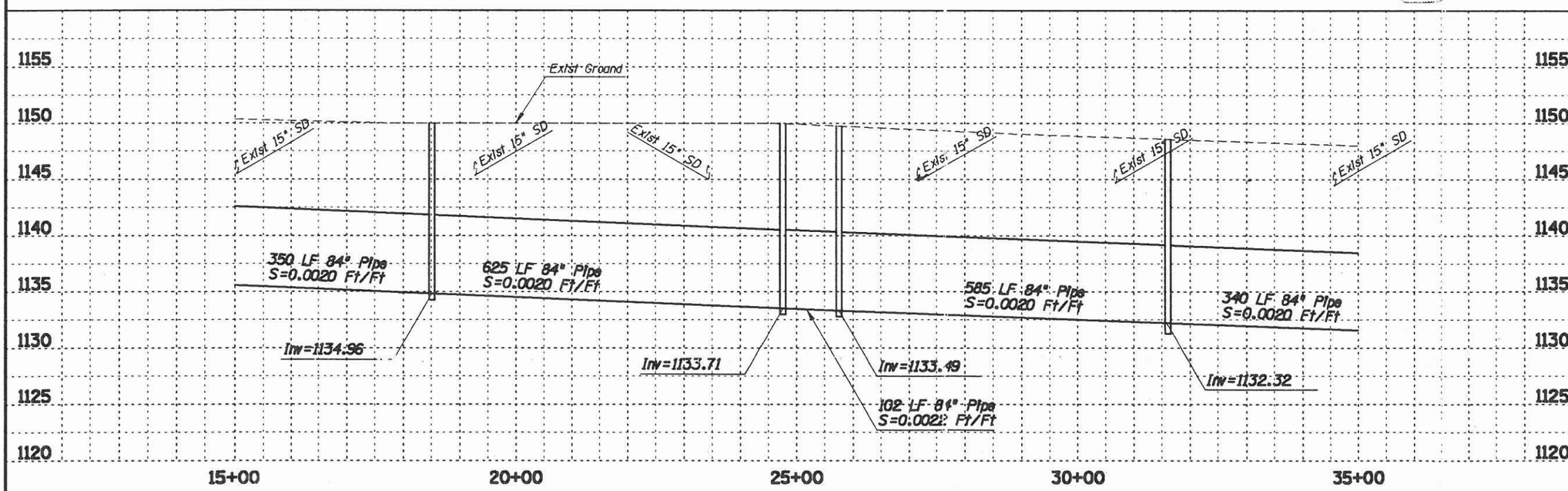
FIGURE 9 | SHEET 6 OF 44

TRACS NO.



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- EXISTING STORM DRAIN
- EXISTING WATER LINE
- EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE



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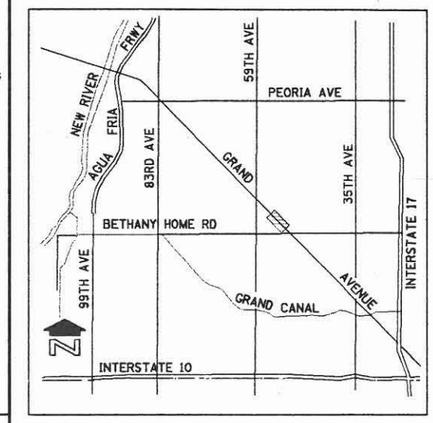
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 51ST AVENUE

MITIGATION OPTION 6, 10-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

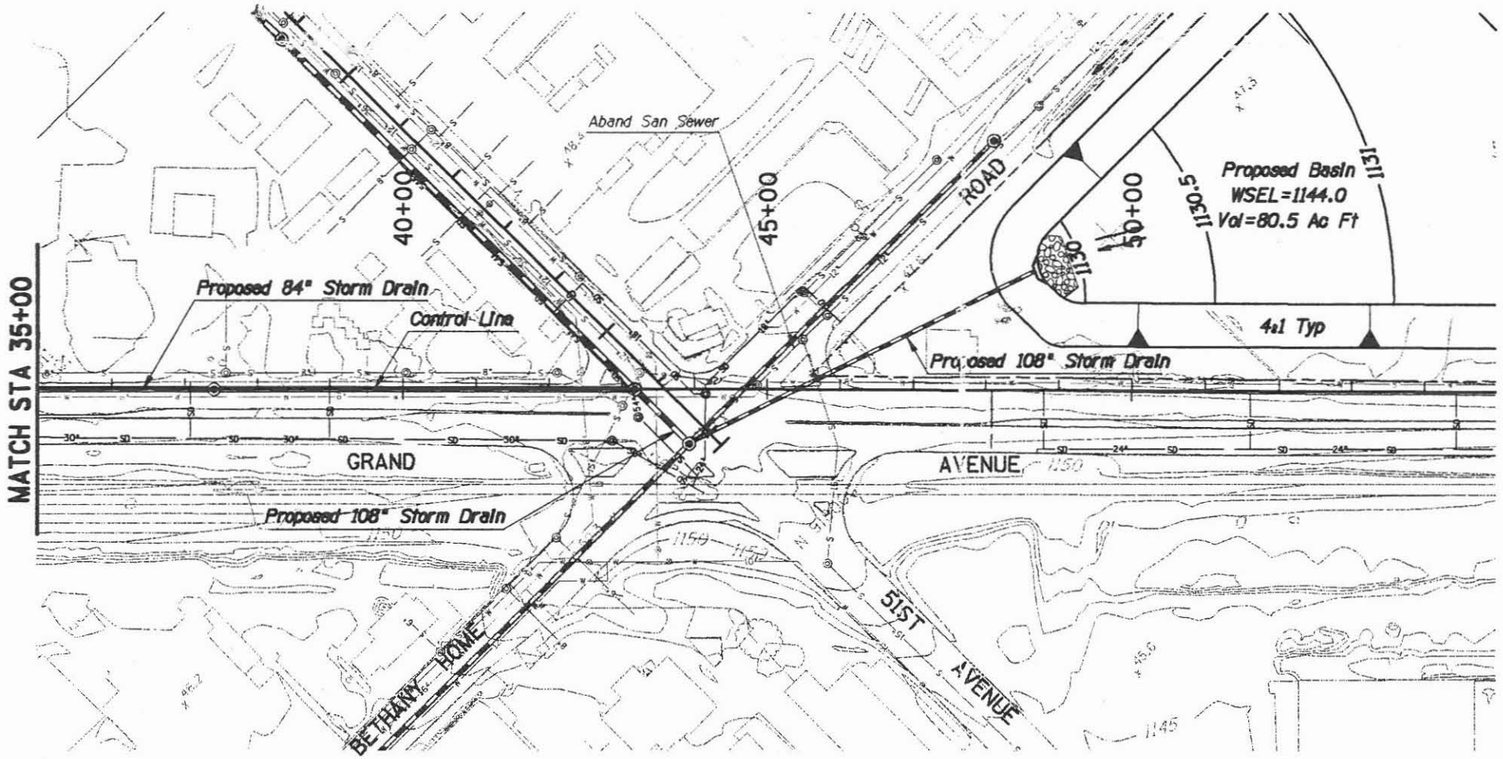
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 15+00 TO 35+00

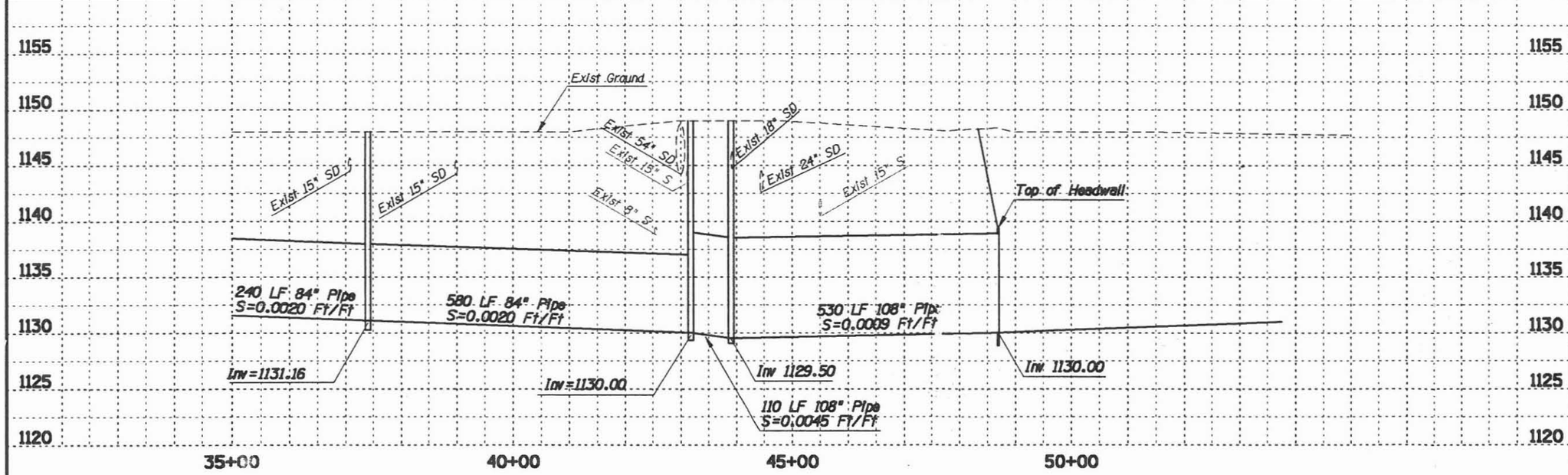
FIGURE 9 | SHEET 7 OF 44

TRACS NO.



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE



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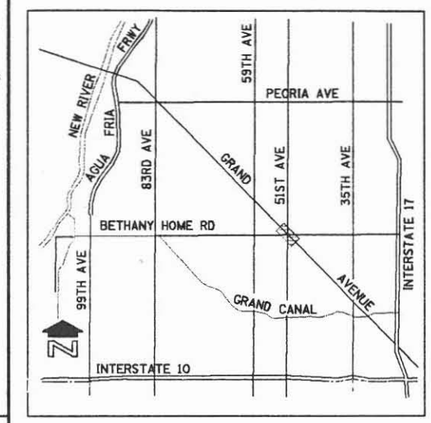
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 51ST AVENUE

MITIGATION OPTION 6, 10-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

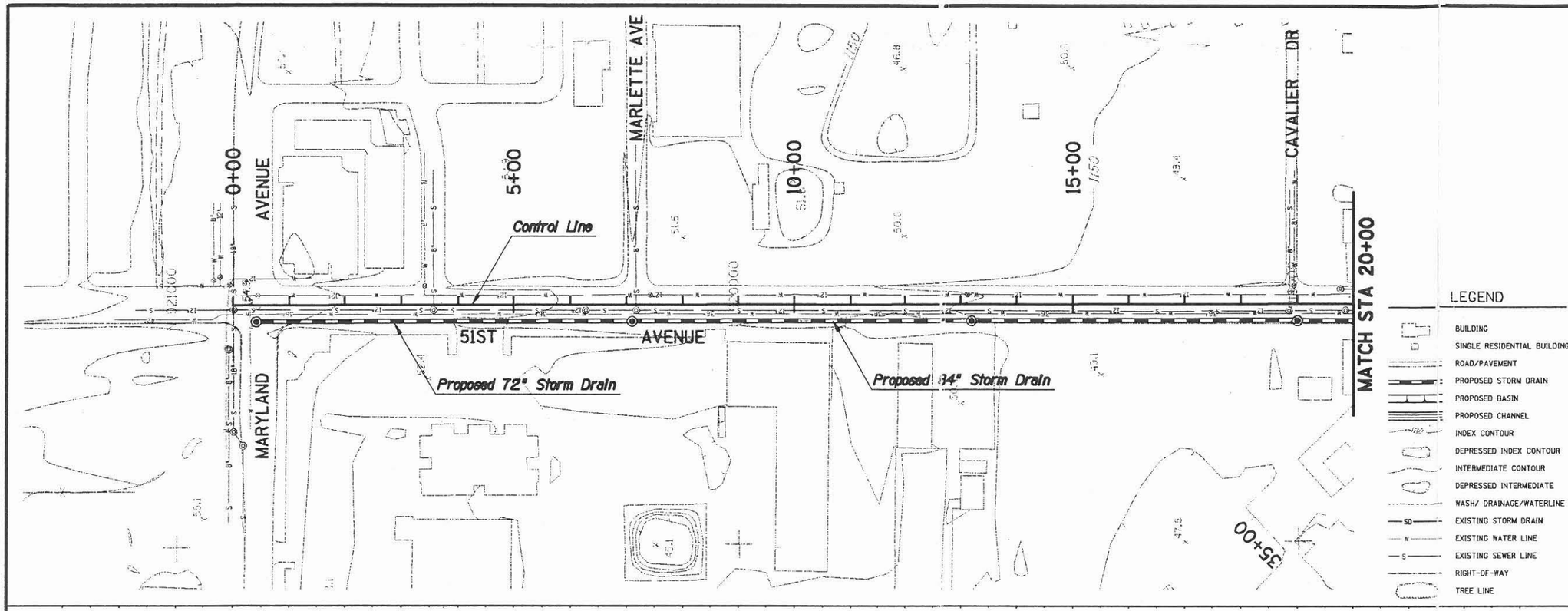
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

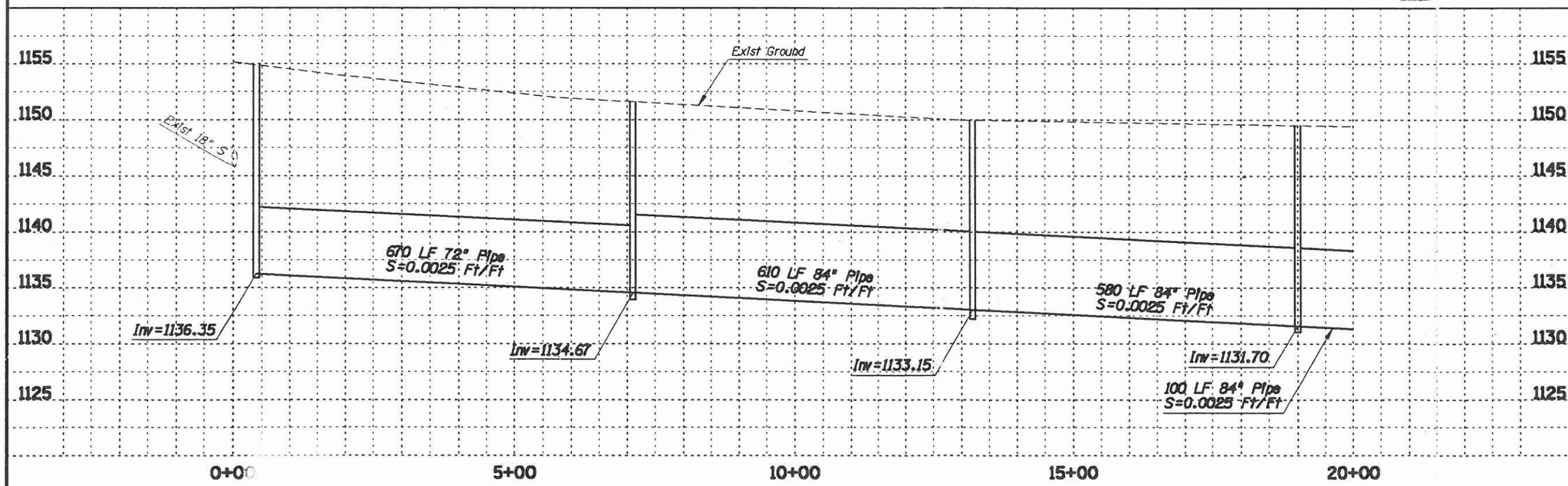
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 35+00 TO 48+70

FIGURE 9 SHEET 8 OF 44

TRACS NO.





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THE LOCATIONS OF ALL STRUCTURES, UT
AND ARE BASED UPON RECORD DOCUMEN
SCALE OF 1INCH=200 FEET WITH A 2 FOO
BY KENNEY AERIAL MAPPING AND IS BAS
BY KAMINSKI-HUBBARD ENGINEERING INC.

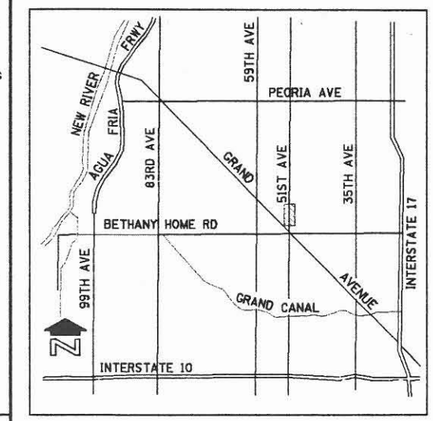
NNING PU SES ONLY.
-WAY PPROXIMATE
DUCED AT A
WAS PREPARED
DATA PROVIDED
TANTS, LTD.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 51ST AVENUE

MITIGATION OPTION 6, 10-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

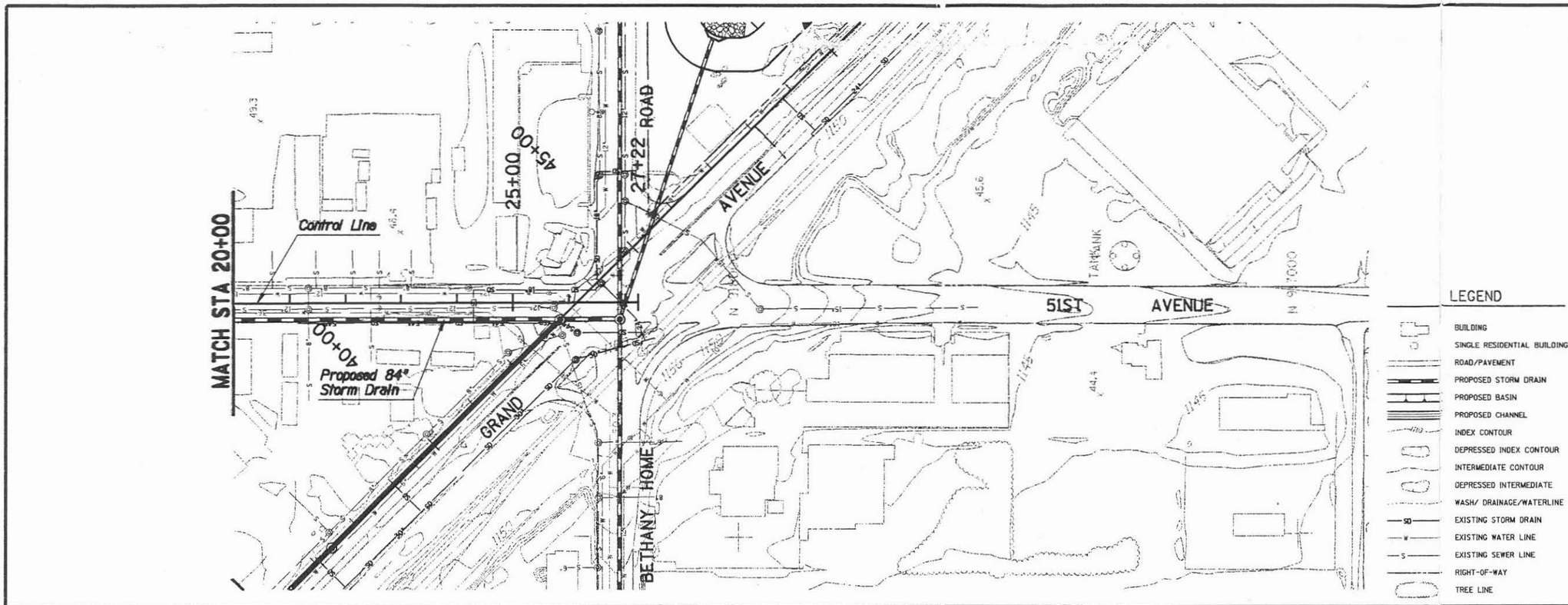
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

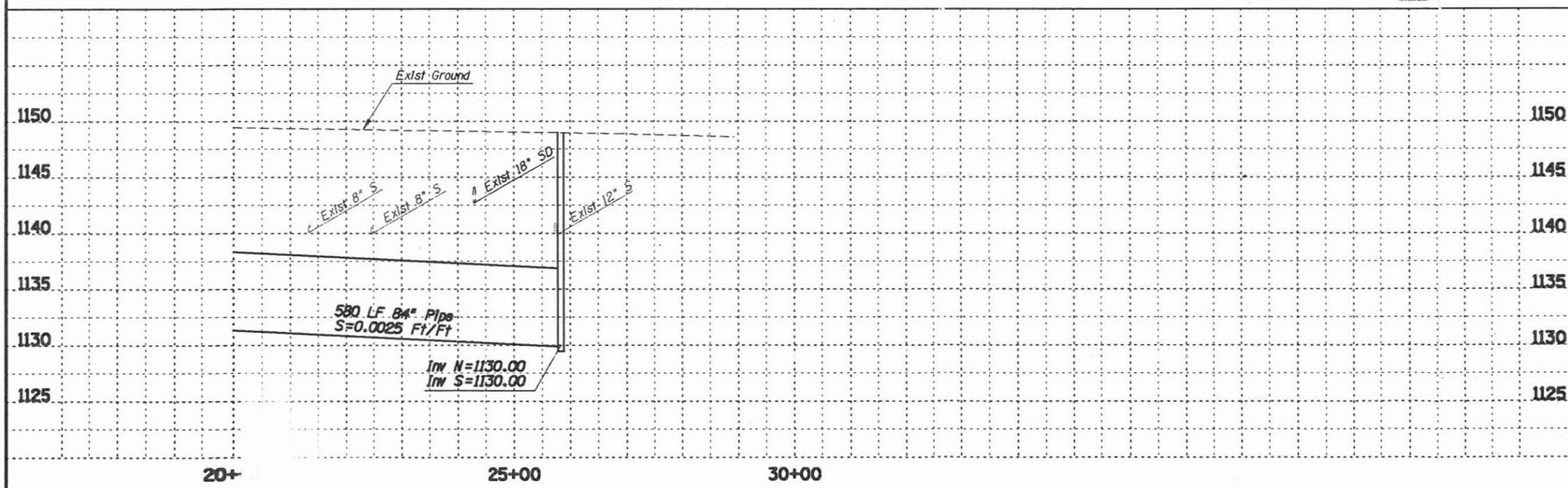
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 0+00 TO 20+00

FIGURE 9 | SHEET 9 OF 44

TRACS NO.





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AND ARE BASED UPON RECORD DOCUMEN
SCALE OF 1INCH=200 FEET WITH A 2 FC
BY KENNEY AERIAL MAPPING AND IS BAS
BY KAMINSKI-HUBBARD ENGINEERING INC.

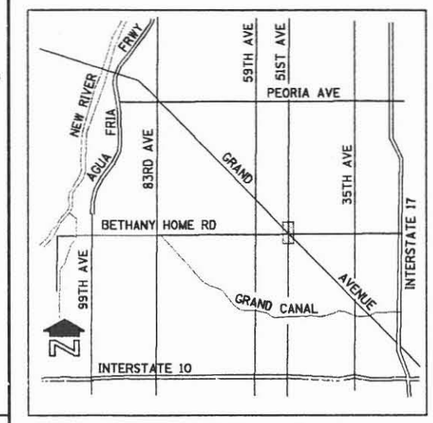
PURPOSES ONLY.
ARE APPROXIMATE
AS PRODUCED AT A
APPR AS PREPARED
DATA PROVIDED
TANTS, LTD.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 51ST AVENUE

MITIGATION OPTION 6, 10-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL - 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
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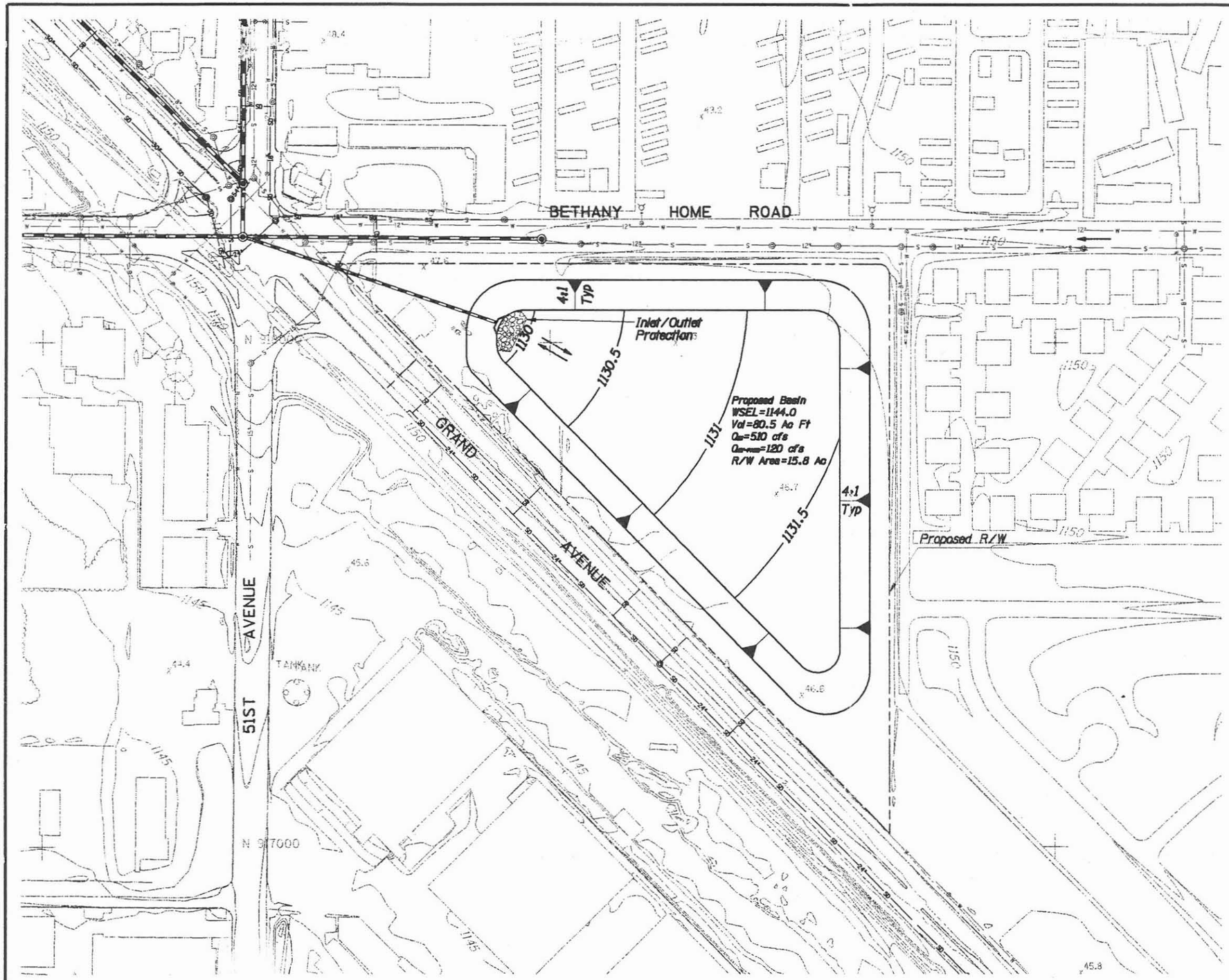
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN STA 20+00 TO 26+89.5	FIGURE	SHEET OF
	9	10 44

TRACS NO.



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE

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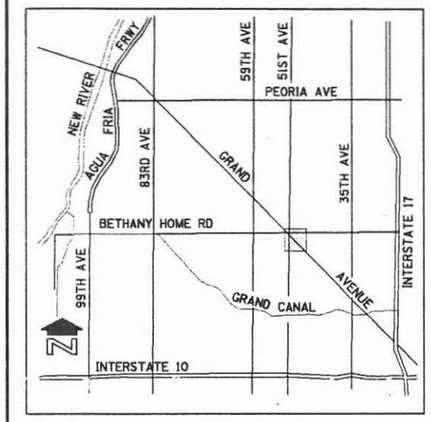
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 51ST AVENUE

MITIGATION OPTION 6, 10-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

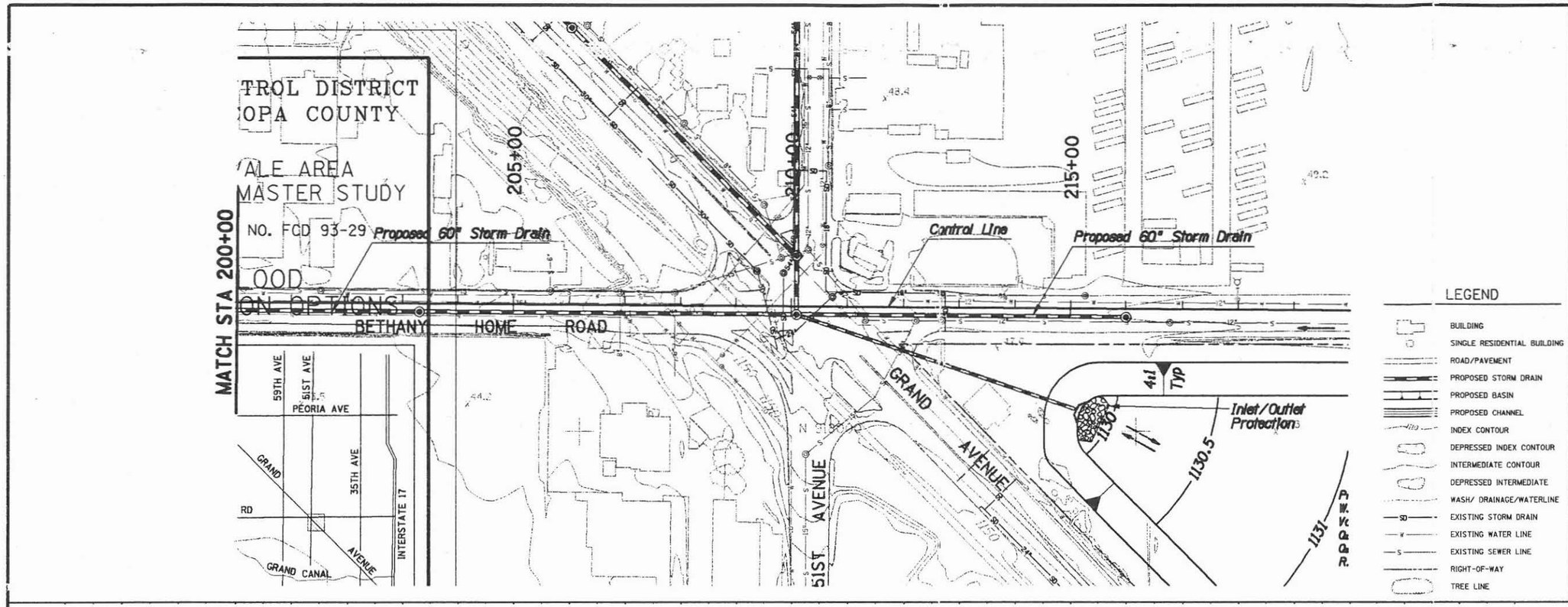
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

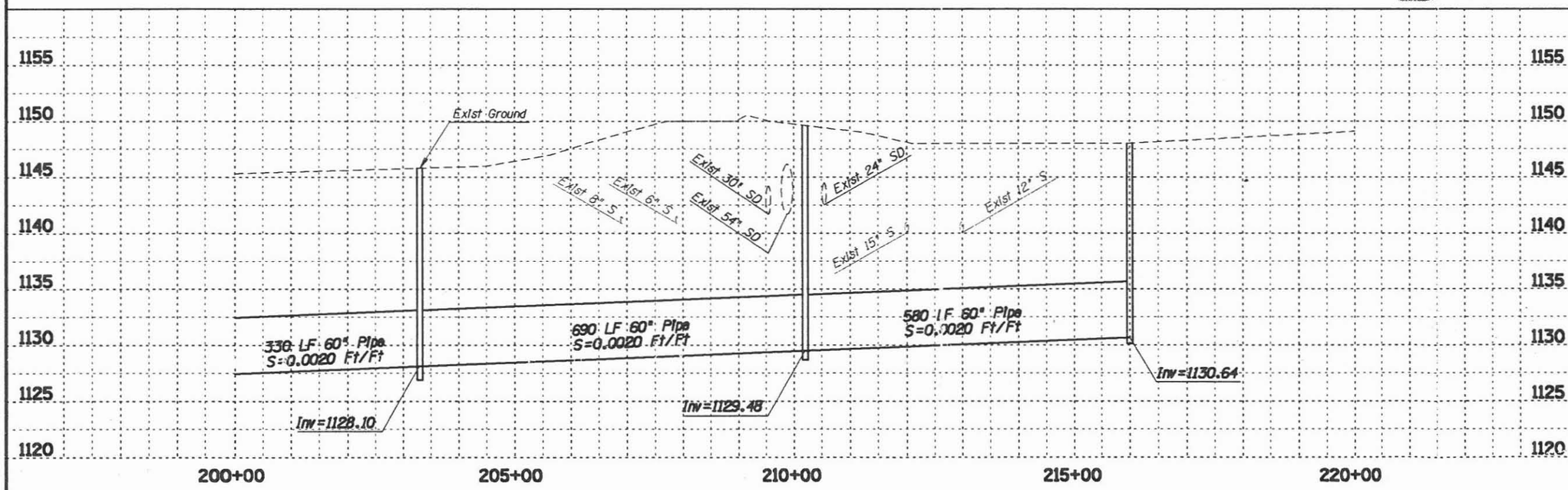
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN | FIGURE 9 | SHEET 11 OF 44

TRACS NO.





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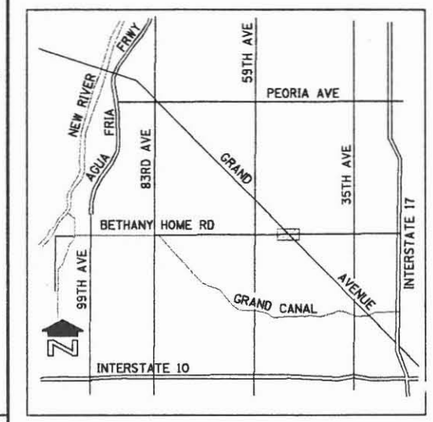
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

MARYVALE AREA DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 51ST AVENUE

MITIGATION OPTION 6, 10-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
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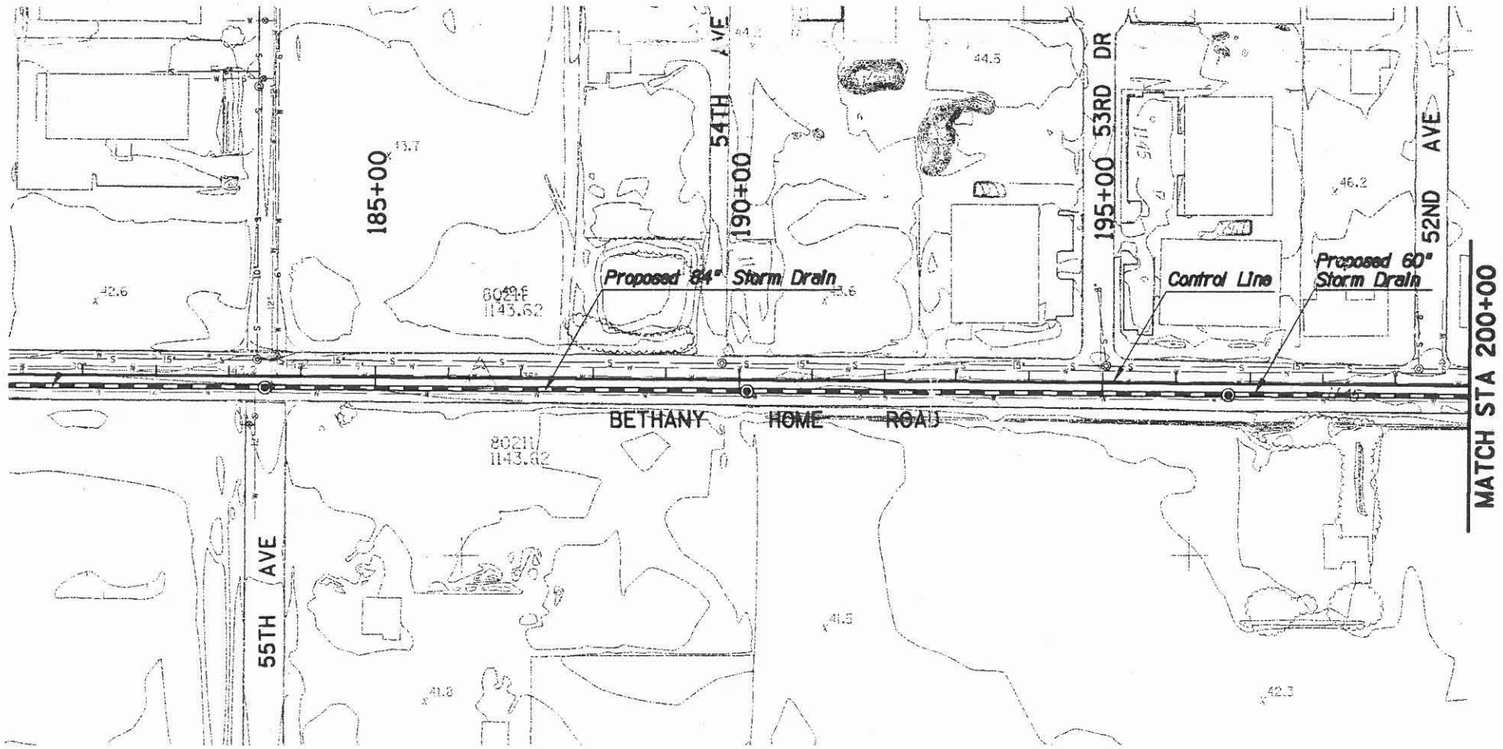
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 200+00 TO 216+00

FIGURE 9 | SHEET 12 OF 44

TRACS NO.



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
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- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
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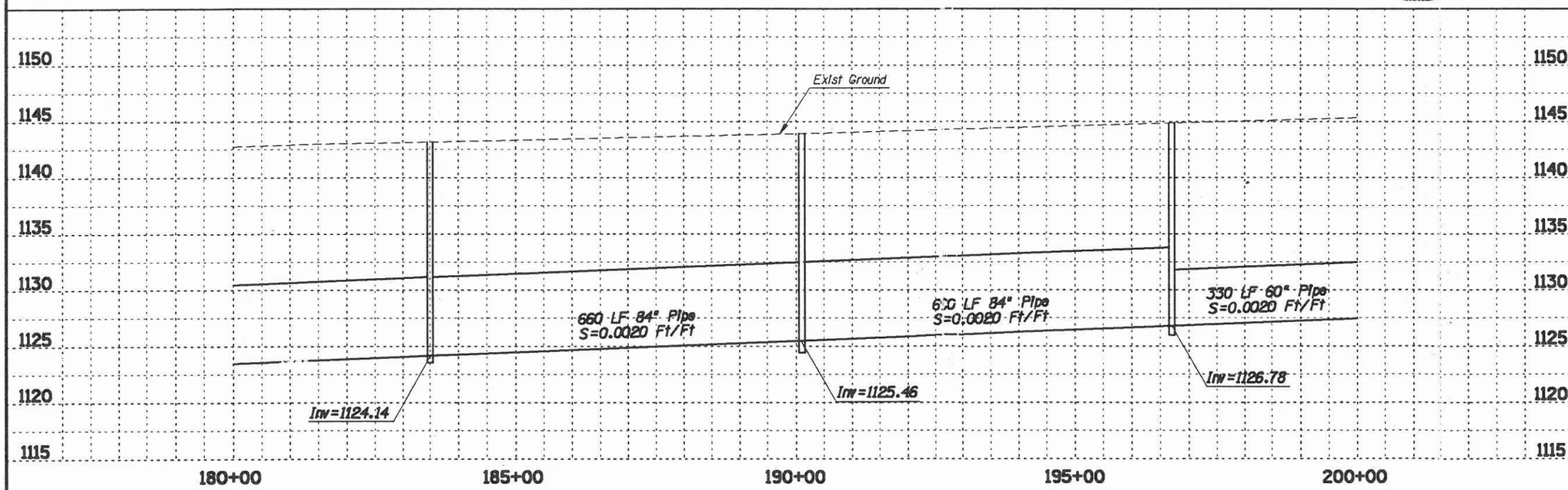
- TREE LINE



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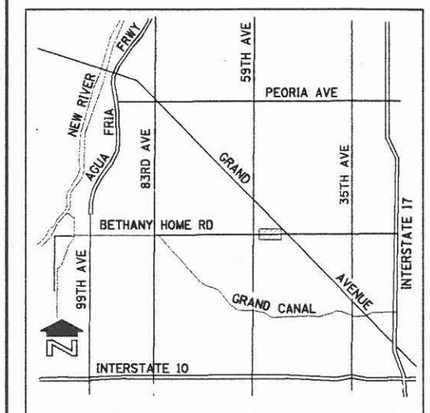
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 51ST AVENUE

MITIGATION OPTION 6, 10-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

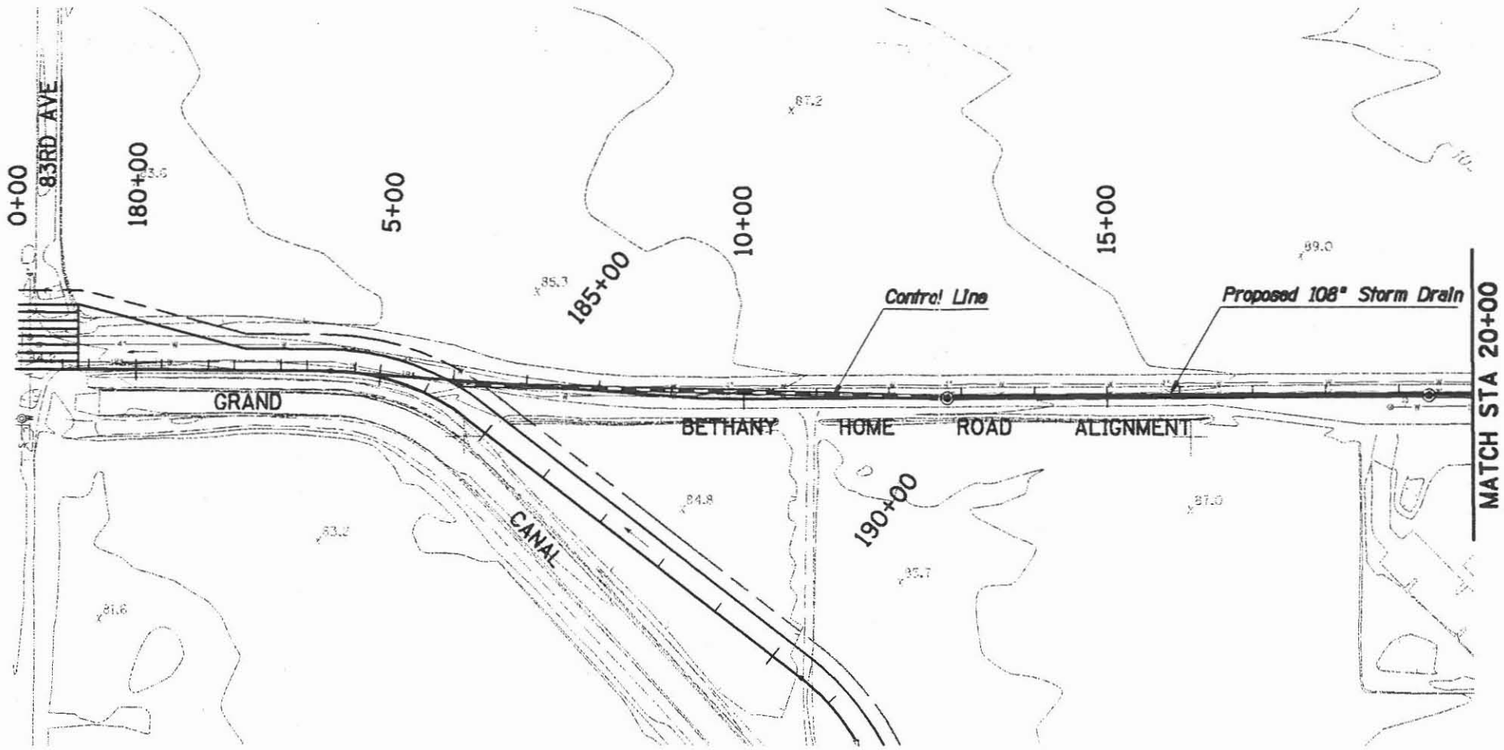
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 180+00 TO 200+00

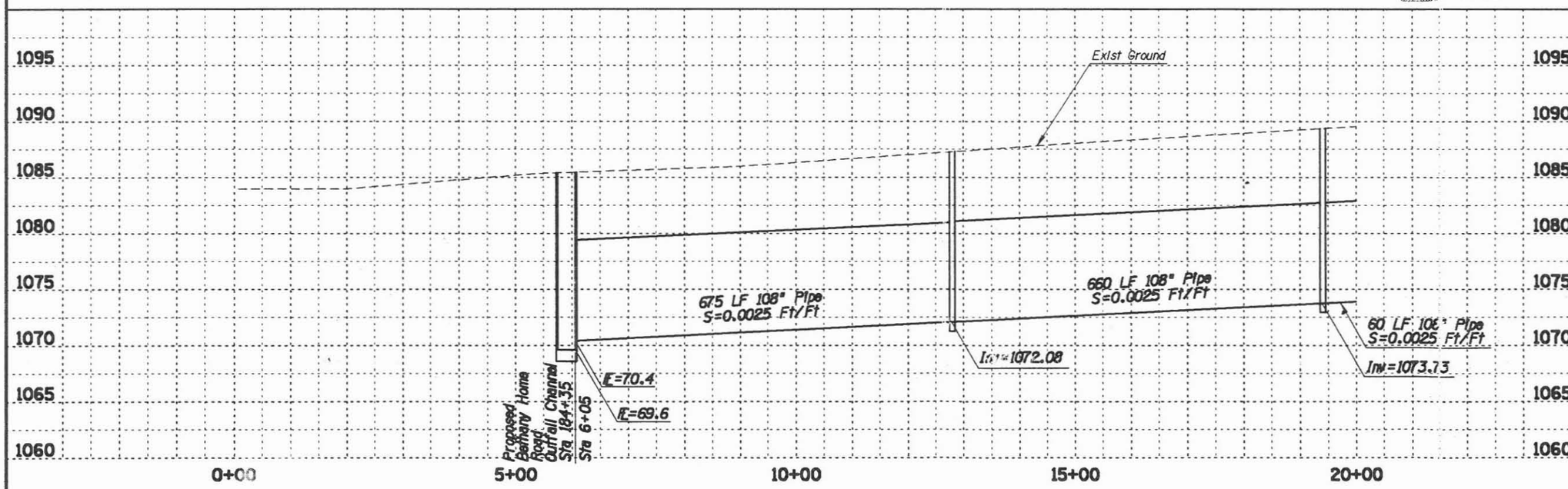
FIGURE 9 | SHEET 13 OF 44

TRACS NO.



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE



NOTE:
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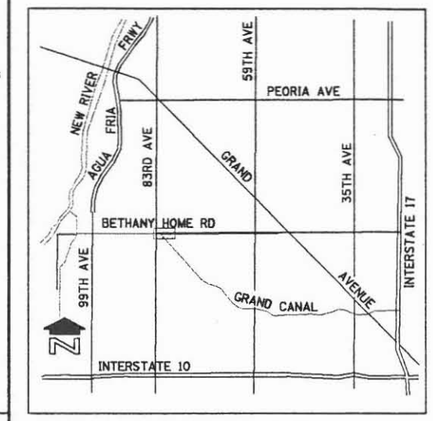
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 51ST AVENUE

MITIGATION OPTION 8, 10-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

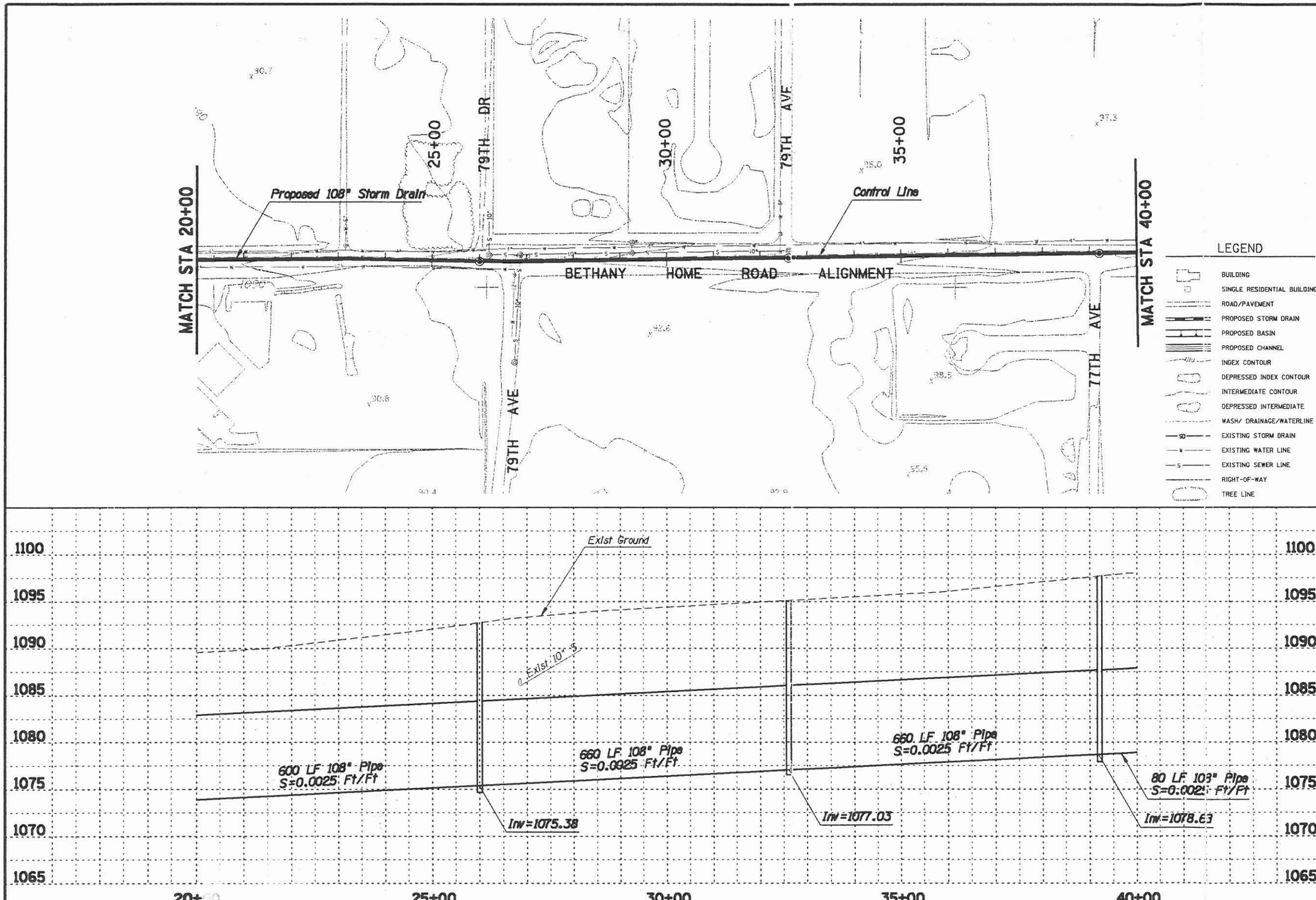
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 6+50 TO 20+00

FIGURE 9 | SHEET 14 OF 44

TRACS NO.



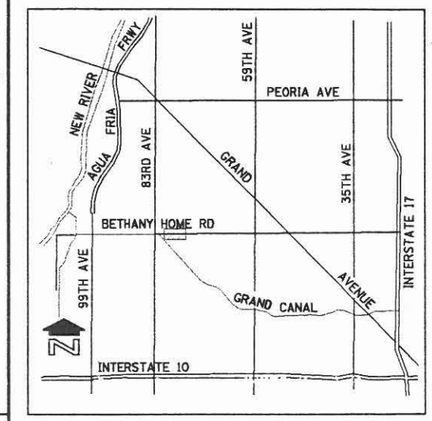
NOTE:
THESE PLANS ARE PRELIMINARY AND AR[illegible]NG PURPOSES ONLY.
THE LOCATIONS OF ALL STRUCTURES, UT[illegible]AY ARE APPROXIMATE
AND ARE BASED UPON RECORD DOCUMEN[illegible]Y WAS PRODUCED AT A
SCALE OF 1INCH=200 FEET WITH A 2 FO[illegible] MAPPING WAS PREPARED
BY KENNEY AERIAL MAPPING AND IS BAS[illegible]L SURVEY DATA PROVIDED
BY KAMINSKI-HUBBARD ENGINEERING INC.[illegible]NG CONSULTANTS, LTD.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 51ST AVENUE

MITIGATION OPTION 8, 10-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

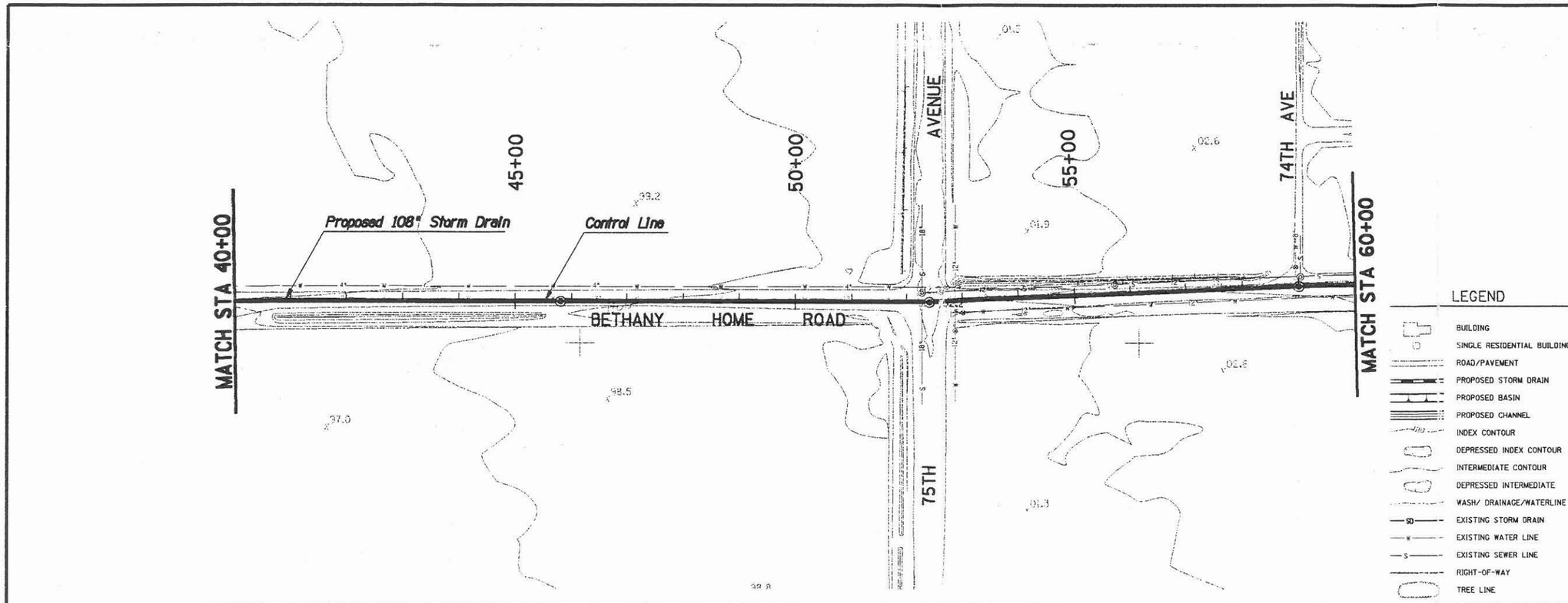
		BY	DATE
CONCEPT PLAN	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

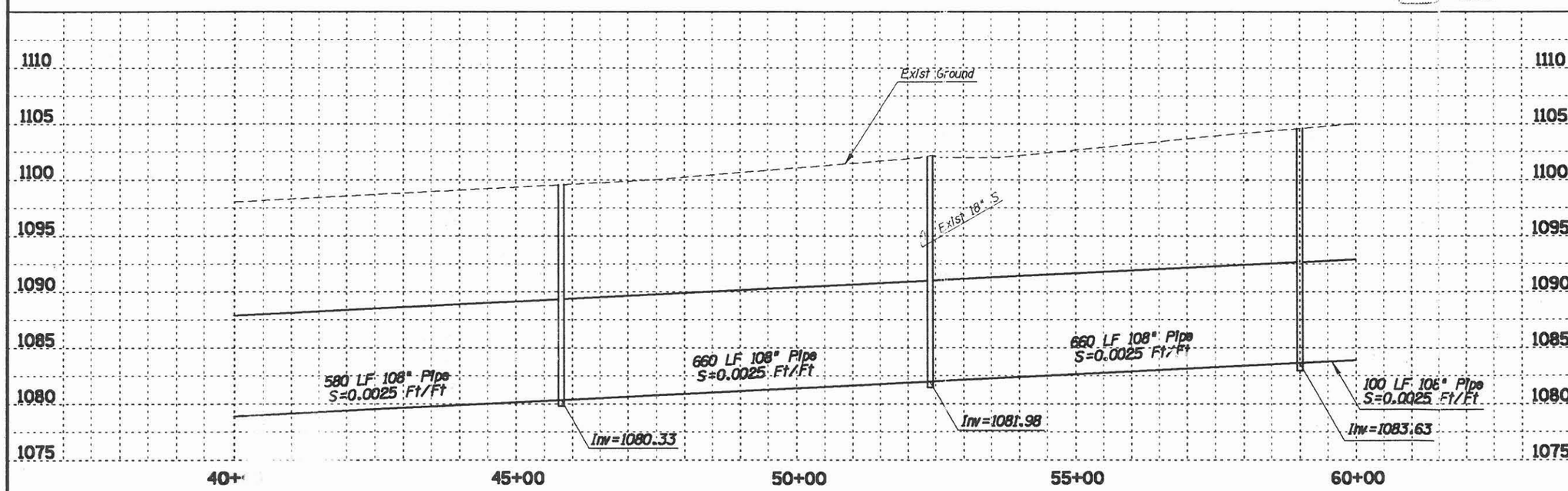
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 20+00 TO 40+00

FIGURE 9 | SHEET 15 OF 44

TRACS NO.





NOTE:
THESE PLANS ARE PRELIMINARY AND ARE
THE LOCATIONS OF ALL STRUCTURES, UT
AND ARE BASED UPON RECORD DOCUMEN
SCALE OF 1INCH=200 FEET WITH A 2 FO
BY KENNEY AERIAL MAPPING AND IS BAS
BY KAMINSKI-HUBBARD ENGINEERING INC.

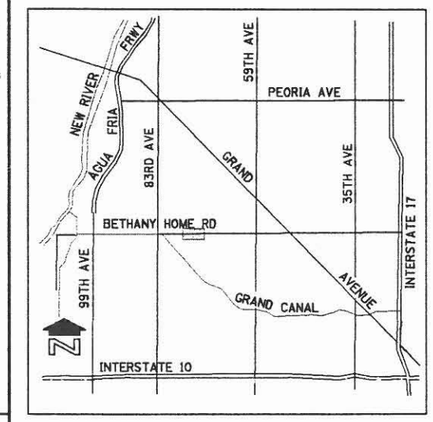
ANNING PURPOSES ONLY.
OF-WAY ARE APPROXIMATE
APPY WAS PRODUCED AT A
MAPPING WAS PREPARED
SURVEY DATA PROVIDED
CONSULTANTS, LTD.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 51ST AVENUE

MITIGATION OPTION 8, 10-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

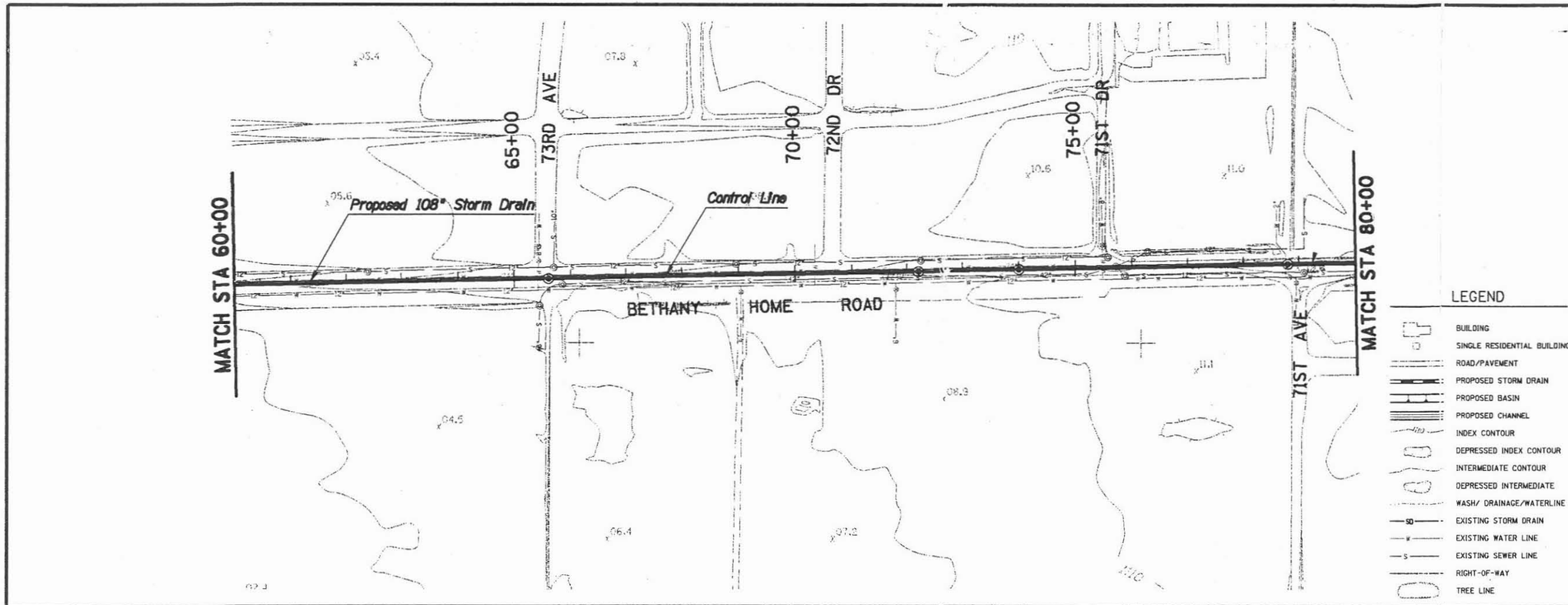
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

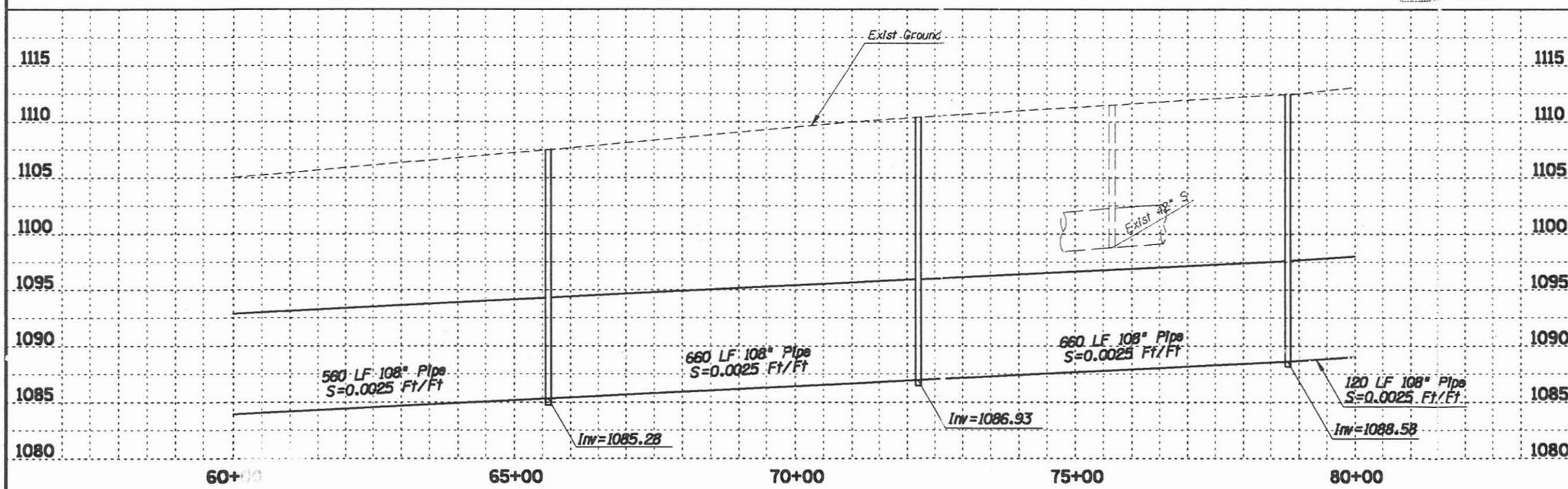
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 40+00 TO 60+00

FIGURE 9 | SHEET 16 OF 44

TRACS NO.





NOTE:
THESE PLANS ARE PRELIMINARY AND ARE
THE LOCATIONS OF ALL STRUCTURES, UT
AND ARE BASED UPON RECORD DOCUMEN
SCALE OF 1INCH=200 FEET WITH A 2 FO
BY KENNEY AERIAL MAPPING AND IS BAS
BY KAMINSKI-HUBBARD ENGINEERING INC.

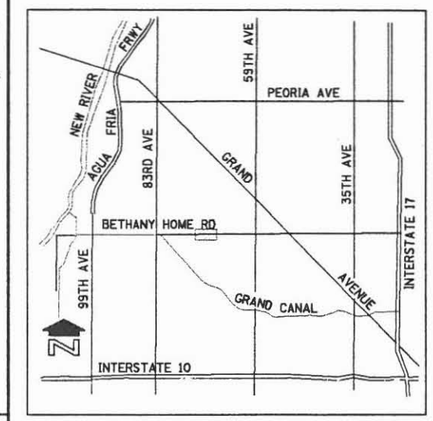
ANNING PURPOSES ONLY.
-WAY ARE APPROXIMATE
PHY WAS PRODUCED AT A
MAPPING WAS PREPARED
SURVEY DATA PROVIDED
CONSUL TS, LTD.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 51ST AVENUE

MITIGATION OPTION 8, 10-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

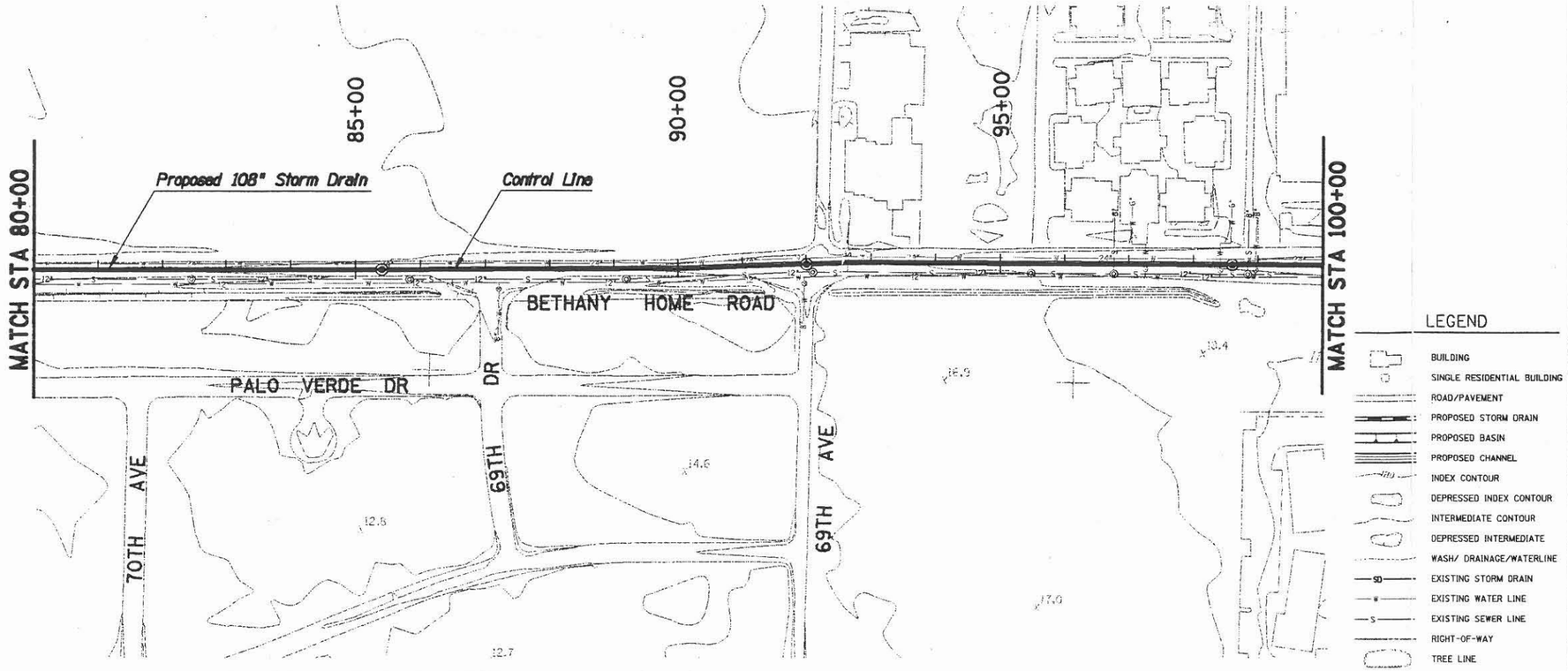
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

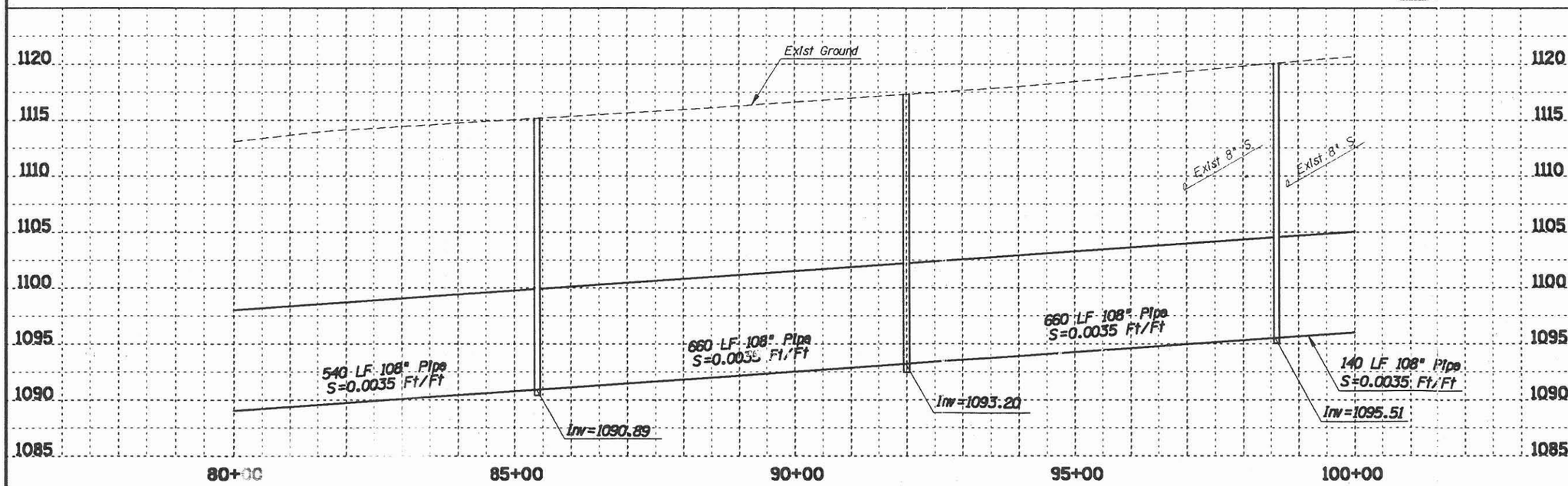
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 60+00 TO 80+00

FIGURE 9 | SHEET 17 OF 44

TRACS NO.





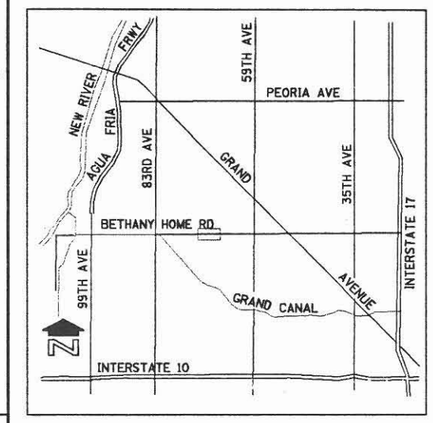
NOTE:
THESE PLANS ARE PRELIMINARY AND ARE [illegible] OR PLANN[illegible] NLY.
THE LOCATIONS OF ALL STRUCTURES, UT[illegible] GHT-OF[illegible] MATE
AND ARE BASED UPON RECORD DOCUMEN[illegible] OGRAP[illegible] AT A
SCALE OF 1INCH=200 FEET WITH A 2 FO[illegible] TERVA[illegible] PARED
BY KENNEY AERIAL MAPPING AND IS BAS[illegible] PROVIDED
BY KAMINSKI-HUBBARD ENGINEERING INC. [illegible] D.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 51ST AVENUE

MITIGATION OPTIONS 8, 10-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

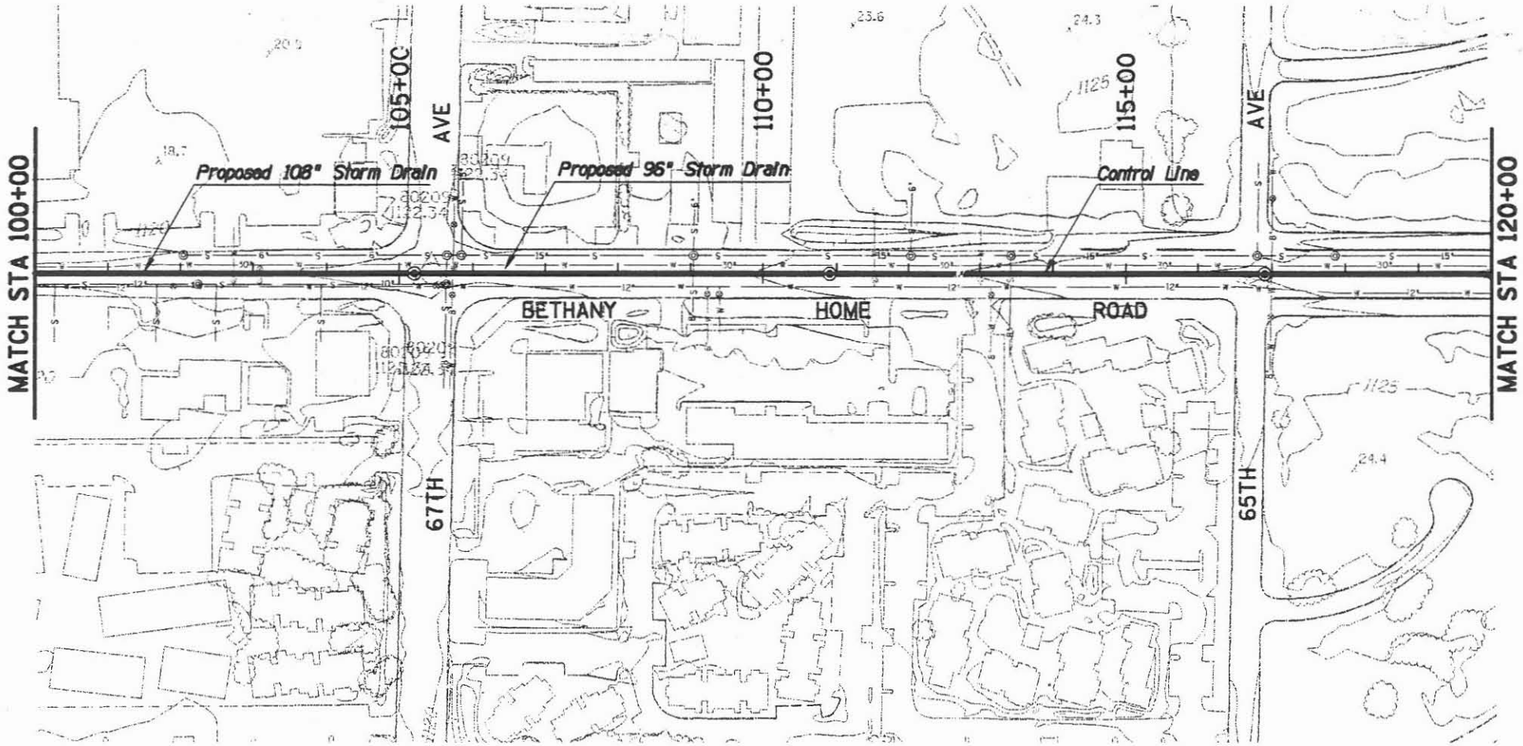
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

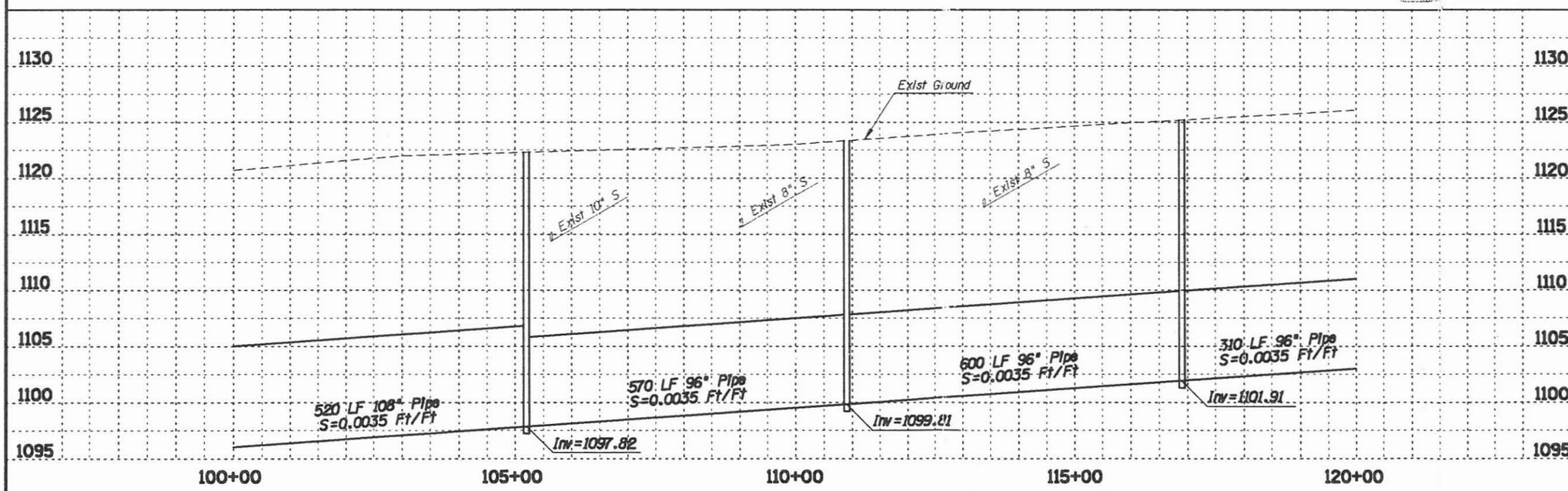
DRAINAGE SYSTEM PLAN STA 80+00 TO 100+00	FIGURE	SHEET OF
	9	18 44

TRACS NO.



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE



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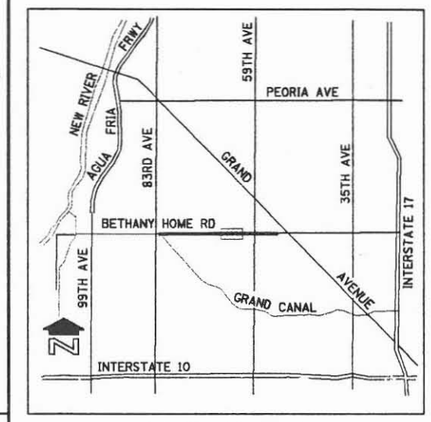
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 51ST AVENUE

MITIGATION OPTION 8, 10-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

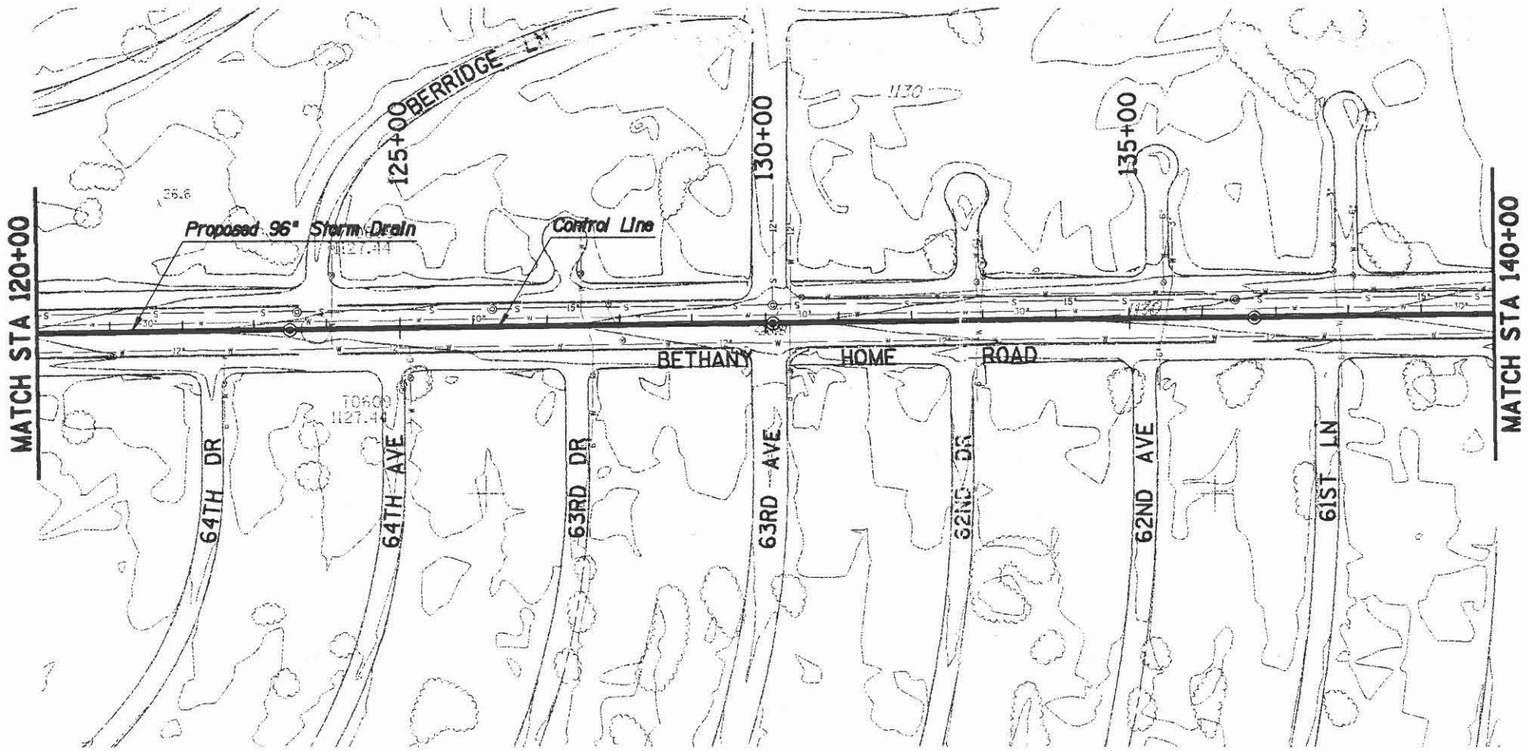
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 100+00 TO 120+00

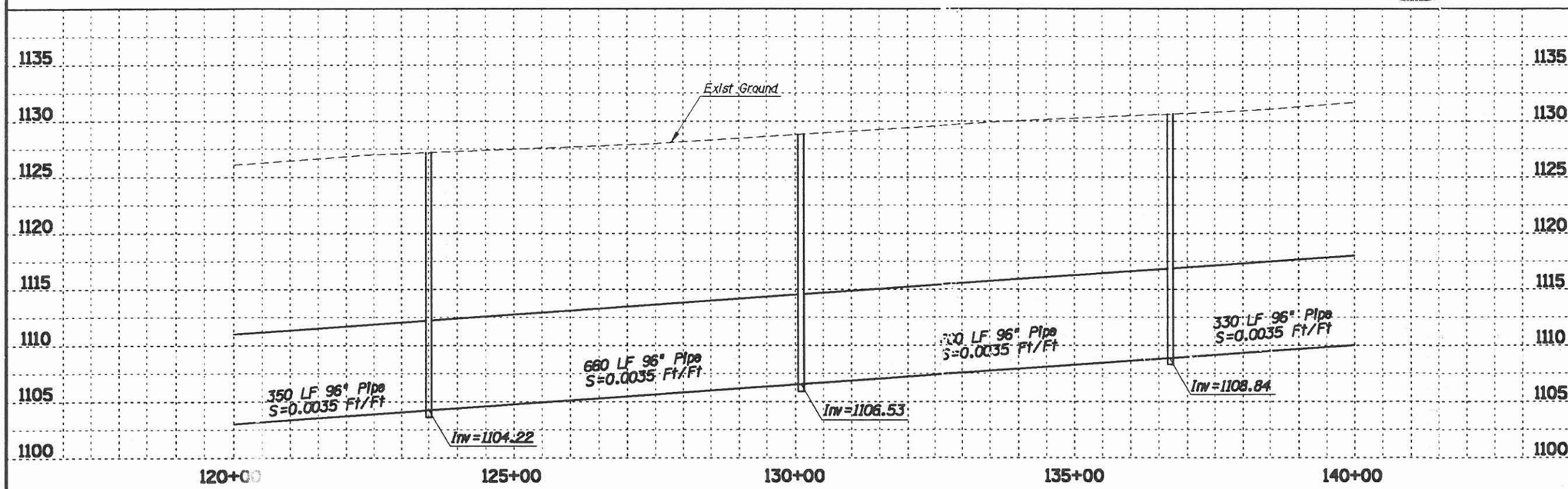
FIGURE 9 | SHEET 19 OF 44

TRACS NO.



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE



NOTE:
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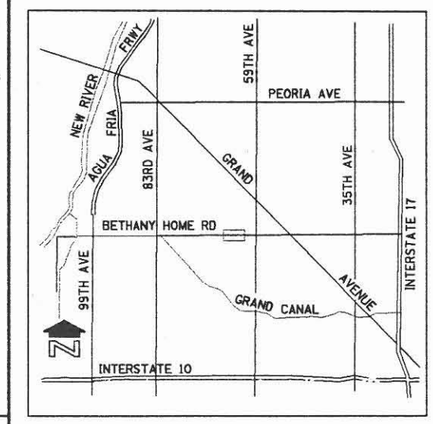
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 51ST AVENUE

MITIGATION OPTIONS 8, 10-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

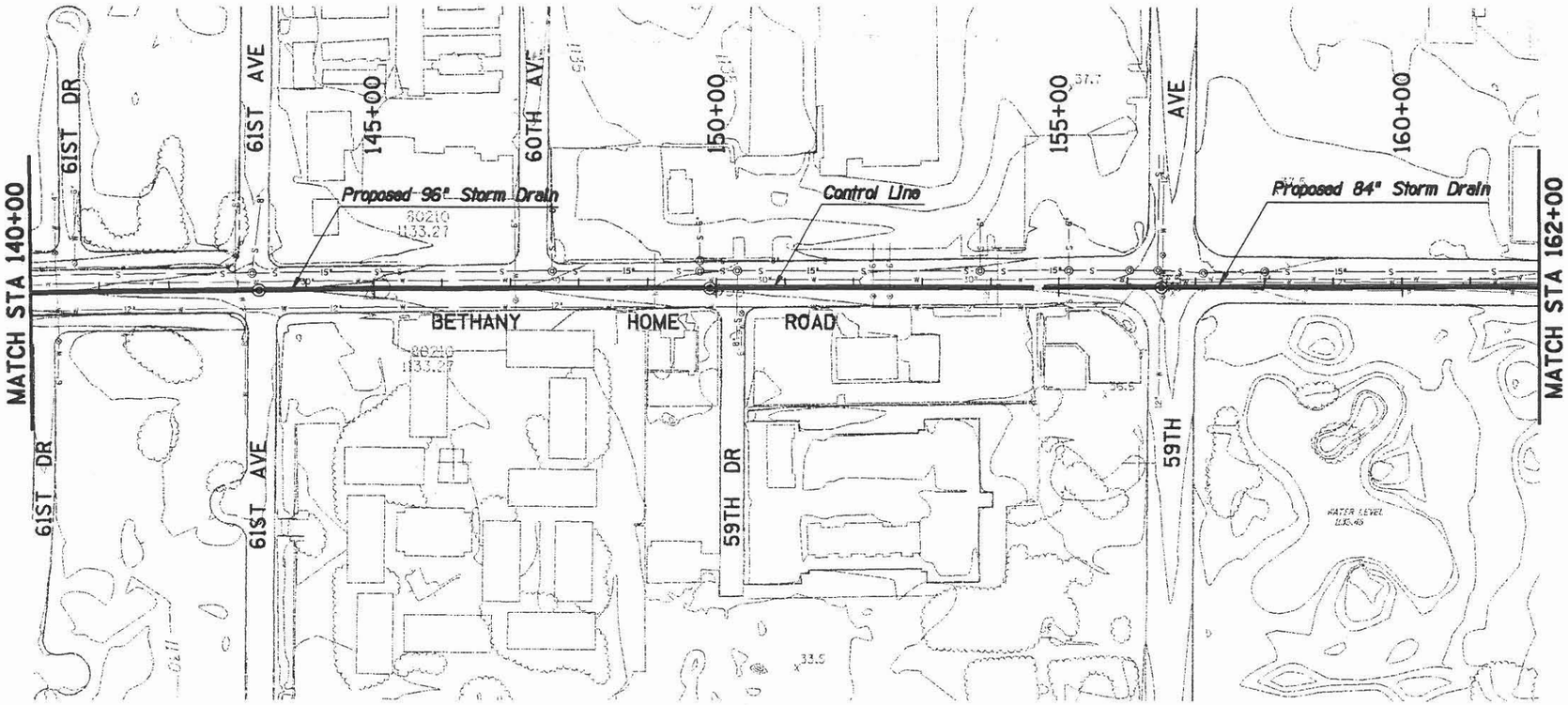
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 120+00 TO 140+00

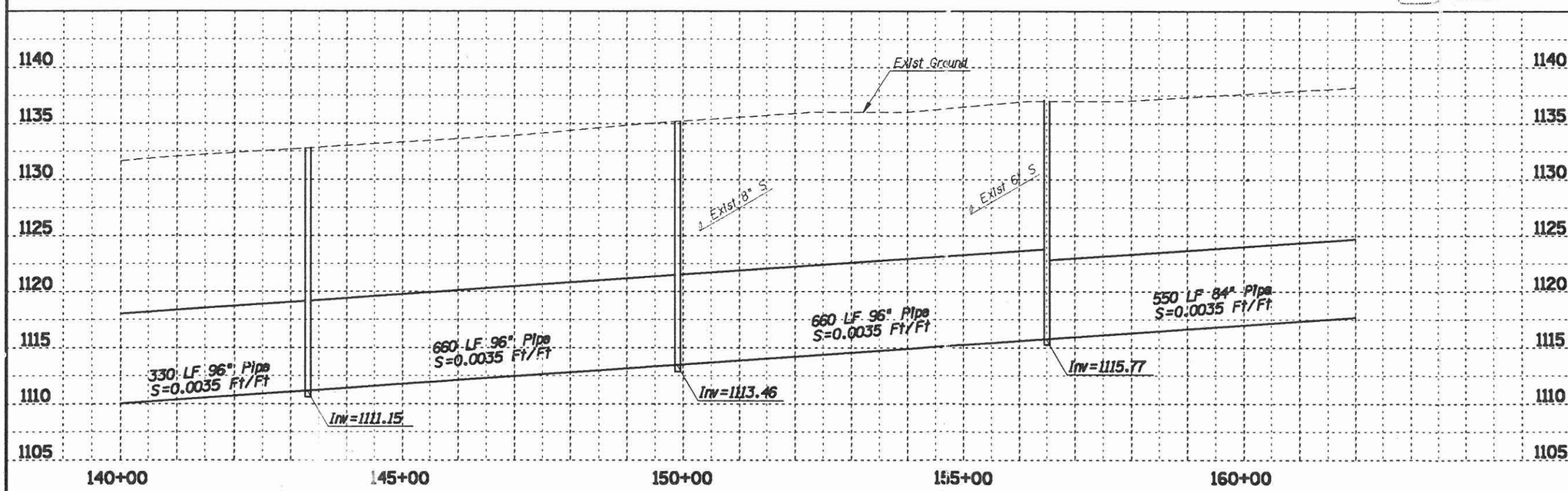
FIGURE 9 | SHEET 20 OF 44

TRACS NO.



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE



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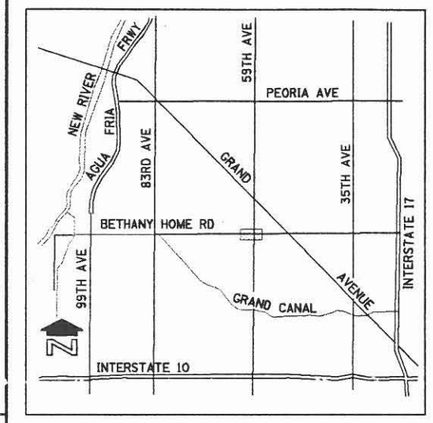
THE LOCATIONS OF ALL STRUCTURES, UT[illegible]TIES A[illegible] [illegible]WAY ARE APPROXIMATE
AND ARE BASED UPON RECORD DOCUMEN[illegible] AERI[illegible] [illegible] WAS PRODUCED AT A
SCALE OF 1INCH=200 FEET WITH A 2 FO[illegible] CONT[illegible] [illegible] MAPPING WAS PREPARED
BY KENNEY AERIAL MAPPING AND IS BASE[illegible] ON [illegible] [illegible] SURVEY DATA PROVIDED
BY KAMINSKI-HUBBARD ENGINEERING INC. [illegible] [illegible] CONSULTANTS, LTD.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

MARYVALE AREA DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION LEVEL III

GRAND AVENUE AT 51ST AVENUE

MITIGATION OPTION 8, 10-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

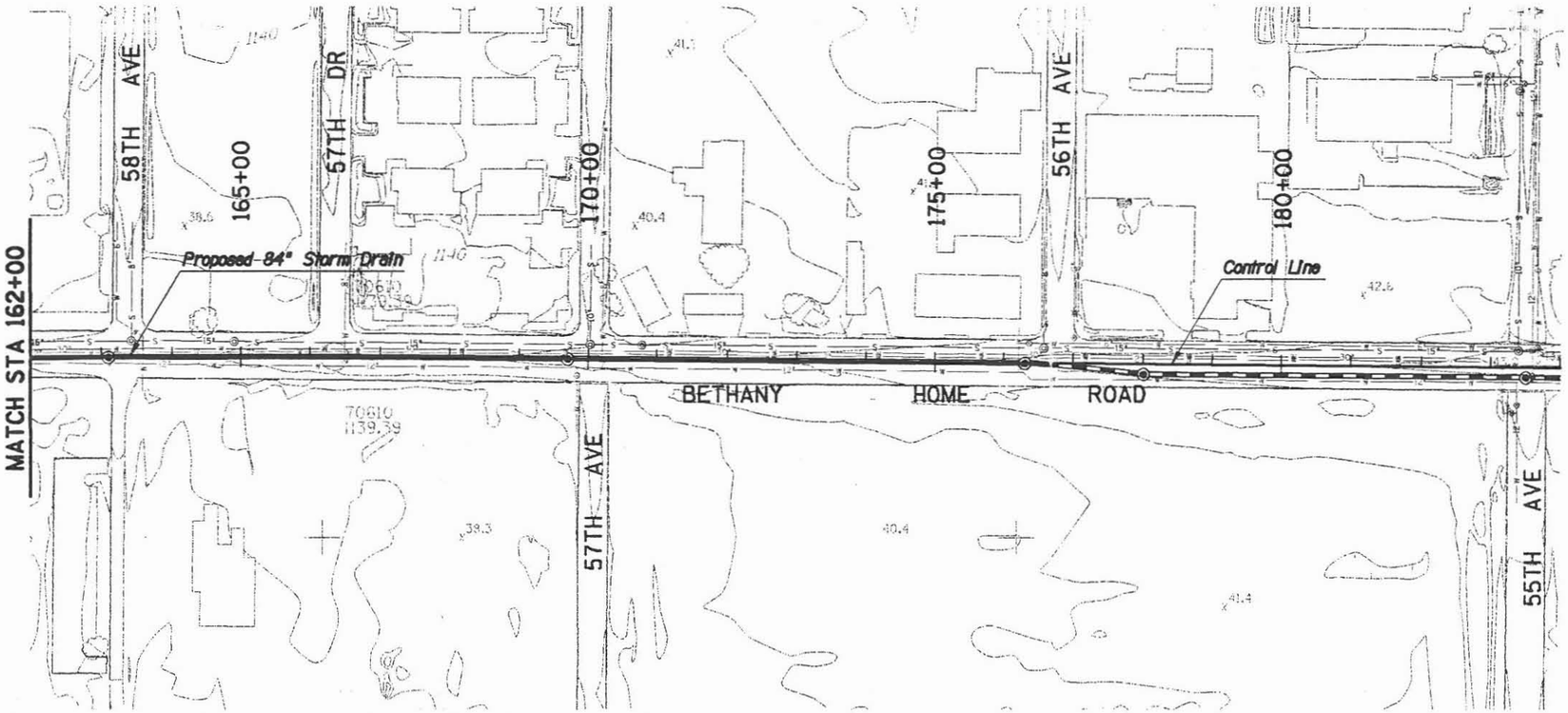
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 140+00 TO 162+00

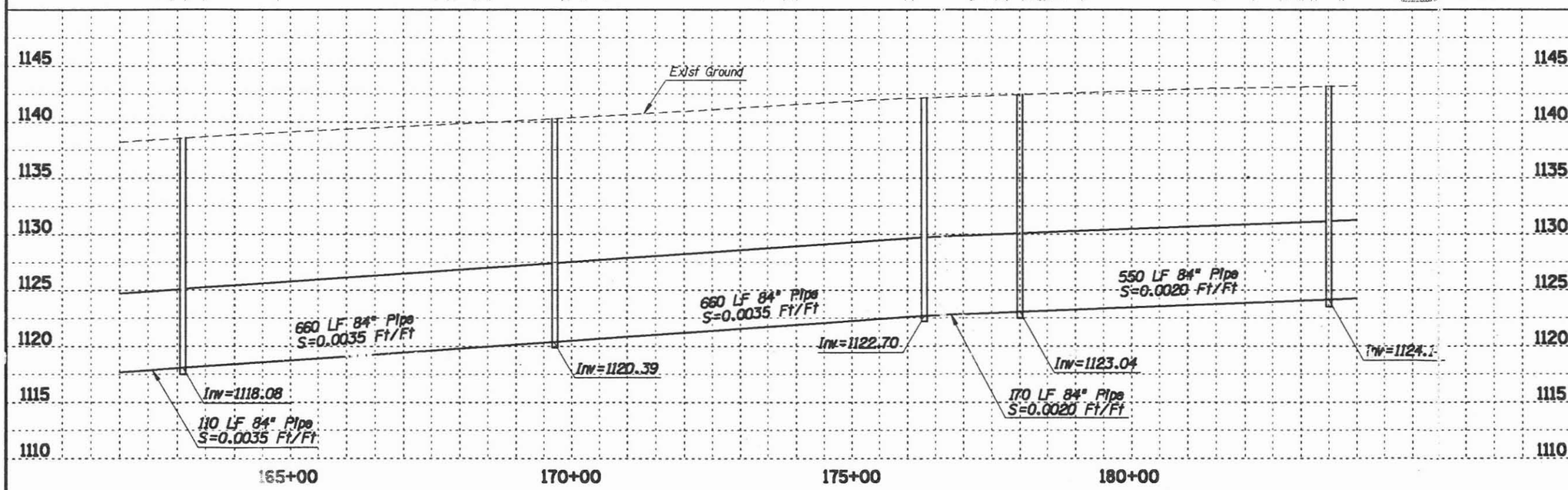
FIGURE	SHEET	OF
9	21	44

TRACS NO.



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE



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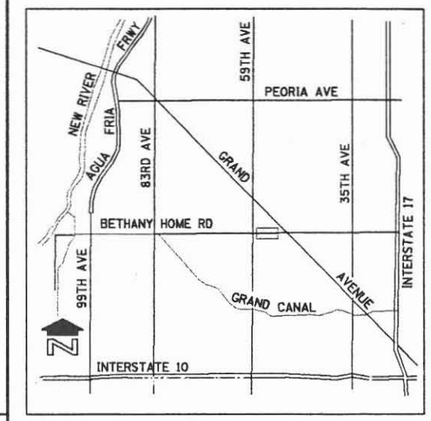
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 51ST AVENUE

MITIGATION OPTION 8, 10-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 160+00 TO 183+50

FIGURE 9 | SHEET 22 OF 44

TRACS NO.

WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

PROJECT Maryvale ADMS

PROJECT NO. 94154 SHEET NO. 1 OF

CALCULATED BY DATE CHECKED BY DATE

BACKUP DATA FOR SELECTED ALTERNATIVE

GRAND AVENUE @ 43rd AVE

OPTION 4, 10-YEAR

DATA PROVIDED:

Existing Condition Hydrology: 10-YEAR

HEC-1 KK Card ID: CCB43

PEAK INFLOW: 708 cfs

RUNOFF VOLUME: 188 ac-ft

TYPE OF MITIGATION:

DETENTION STORAGE: (yes) / ~~no~~

BASIN TYPE: SURGE

Comments:

By-Pass Q = 355 cfs

Time to Drain: $T = \frac{V}{Q} = \frac{50 \text{ ac-ft}}{265 \text{ cfs}}$

T = 2.3 hours

VOLUME: 49.5 ac-ft

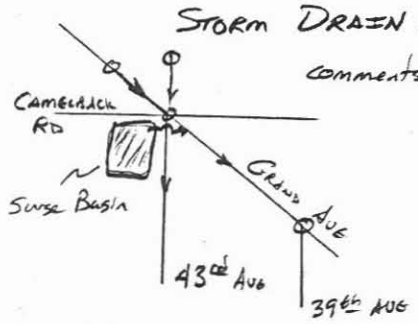
OUTFALL: Gravity

PEAK STAGE: 1134.5 ft

Surrounding Ground EL: 1134 ft at Low end

AVG PONDING DEPTH: 12 ft

STORM DRAIN: (yes) / ~~no~~



Comments:

New Collection SD 3500 ft NW of intersection in Grand Ave.

New Collection SD 2500 ft N of intersection in 43rd AVE.

New outfall SD in Grand Ave connecting Existing 43rd AVE and Existing 39th Ave Stormdrains.

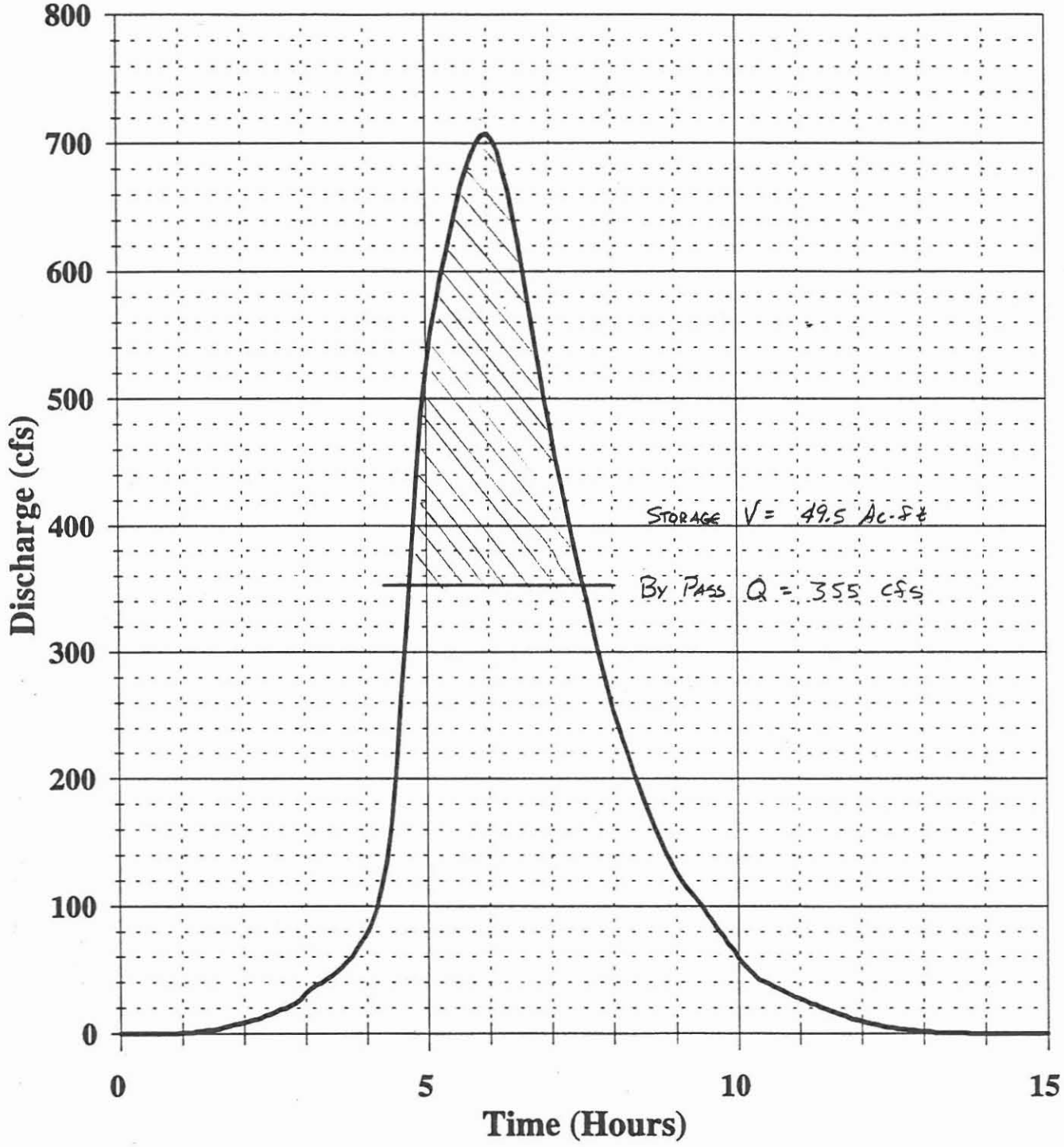
- HGL calculations are included herein and in ADMS Report.
- See ADMS Report for Plan/Profile drawings

CHANNEL CONSIDERATIONS: ~~yes~~ / (no)

Comments:

{ From HGL Sheet - Bleed off is through Grand Ave to 39th AVE SD
thus Q(39th) = 265 cfs

Grand Ave @ 43rd Avenue
10-year Inflow Hydrograph @ CCB43



Wood/Patel and Associates Inc.

MARYVALE AREA DRAINAGE MASTER STUDY

Flood Control District of Maricopa County 05-Feb-98

FLOOD MITIGATION OPTIONS
LEVEL III ANALYSIS, OPTION 4, 10-yr

Contract FCD 93-29
W/P # 94154.00

STUDY AREA: Grand Avenue at 43rd Avenue and Camelback Road

South Detention Basin

Average Bottom Width =	300 ft
Average Bottom Length =	460 ft
Side Slope =	4 :1 (h:v)
Average Basin Bottom =	1122.5 ft Elev
High Water =	1134.5 ft Elev
Average Natural Ground =	1135.5 ft Elev
Basin Type =	1 1 = Rectangular, 2 = Triangular

Depth to Bottom (Feet)	Water Surface Elevation	Surface Area (Acres)	Storage Volume		Earth Work Volume	
			Incrimental (Ac-ft)	Cumulative (Ac-ft)	Incrimental (CY)	Cumulative (CY)
0	1122.5	3.2	0.0	0.0	0	0
1	1123.5	3.3	3.3	3.3	5,339	5,339
2	1124.5	3.5	3.5	6.8	5,571	10,910
3	1125.5	3.6	3.6	10.4	5,808	16,718
4	1126.5	3.7	3.7	14.1	6,050	22,767
5	1127.5	3.9	3.9	18.0	6,296	29,064
6	1128.5	4.1	4.1	22.1	6,548	35,611
7	1129.5	4.2	4.2	26.3	6,804	42,415
8	1130.5	4.4	4.4	30.7	7,064	49,479
9	1131.5	4.5	4.5	35.2	7,330	56,809
10	1132.5	4.7	4.7	39.9	7,600	64,409
11	1133.5	4.9	4.9	44.8	7,875	72,284
12	1134.5	5.1	5.1	49.9	8,155	80,439
12.5	1135	5.1	2.6	--	4,148	84,587
13.5	1136	5.3	5.3	--	8,583	--
14.5	1137	5.5	5.5	--	8,875	--
15.5	1138	5.7	5.7	--	9,171	--
16.5	1139	5.9	5.9	--	9,472	--
17.5	1140	6.1	6.1	--	9,778	--

Wood, Patel & Associates, Inc.

TABLE C.2
STORM DRAIN HYDRAULIC GRADE LINE COMPUTATION WORKSHEET

Project: Maryvale ADMS Grand Ave. at 43rd Ave., Option 4, 10-year.
File: Q:\MVLADMP\LEVEL II\Grand Ave\43rd - Camelback\HGL\HGL.wb2
Print Date: 05-Feb-98
Engineer: SAZ Input Data Revision: 14-Oct-97
Description: Computation of EGL and HGL for storm drain system
Reference: Drainage Design Manual for Maricopa County, Arizona
Volume II, Hydraulics, January, 1996
Formulas Revised: August 22, 1997

Notes:

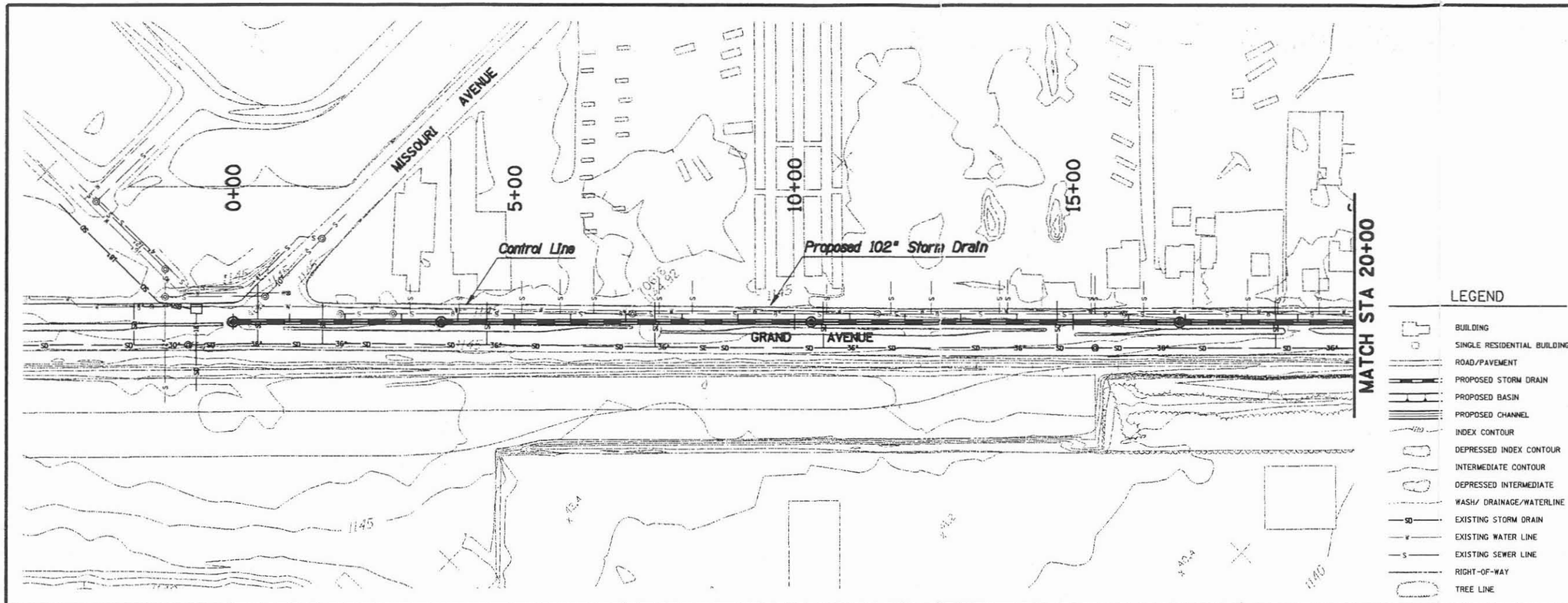
1. This spreadsheet is developed to compute storm drain hydraulic grade line based on the above mentioned reference.
   All Equations used and minor loss coefficients shall be referred to this reference.
2. The blue areas are user input blocks, the grey areas are computed values, and the dark grey areas are check cells.
3. The recommended flow type for storm drain systems by the reference is pressure flow. Therefore, open channel flow computation is only an approximation here.
   The hydraulic grade line at the outfall is assumed to be the invert elevation plus the pipe diameter. If the tailwater elevation is different from this value, the user should change this number manually.
4. The station is located at the immediate downstream of a change point.
5. If the number of rows of the spreadsheet is not enough for a project, the user can copy (do not insert any rows in the middle of the spreadsheet) more rows to the bottom of the spreadsheet and copy the formulas by rows to the new area.
6. Column F are the suggested pipe diameters computed by the spreadsheet with increment of 6 inches. User can select different values than the suggested.
7. Manning's n values in Column H can be selected from Table 4.1.
8. Column M are the summation of Kt values for each section, and the individual Kt values are from Tables 4.2 to 4.4 based on the transition types: a) gradual enlargement,
   b) sudden enlargement, c) contraction, the D2/D1 ratio in Column R, the velocity in Column S, and other related information on these tables.
9. Column N are the summation of Kb values including some manhole losses for each section, and the individual bend Kb values are from Figure 4.7.
10. Columns O, P, and Q are input data for computation of junction losses: Q3 is the lateral flow, D3 is the pipe diameter of the lateral flow,
    and theta is the angle between the main flow pipe and the lateral flow pipe.
11. Column AD are minor losses other than the types considered in the spreadsheet. The user should calculate these values and input them directly.
12. If users find any error or have any suggestion, please contact Wood, Patel & Associates.

43RD AVENUE STORM DRAIN - Indian School Road to Missouri Avenue

Storm Sewer Line Station Location	Pipe #	Station	Pipe Diameter Sheet Suggested (in)	Pipe Diameter User Selected (in)	n	Natural Ground Elevation (ft)	Invert Elev. (ft)	Pipe Slope	Design Q (cfs)	Transitn Loss Coeff. Sum(Kt)	Bend Loss Coeff. Sum(Kb)	Junction Losses Q3 (cfs)	Junction Losses D3 (in)	Junction Losses Theta (deg.)	D2/D1	Vel. (ft/s)	Full Area (sq ft)	Station Interval (ft)	Pipe Length (ft)	V^2/(2g) (ft)	K	Sf (ft/ft)	Losses hf (ft)	Losses ht (ft)	Losses hb (ft)	Losses hj (ft)	Losses Others (ft)	Total Losses (ft)	Hydraulic Grade Line Elevation (ft)	Energy Grade Line Elevation (ft)	Pressure Flow Check	"Overflow" Check	Comments	Depth to Hydraulic Grade Line (ft)	Depth to Invert (ft)
Indian School Rd.		80+95	48	60	0.012	1115.00	1096.10	0.00337	90.0	0.00	0.20	0.00	0	0	1.00	5.00	19.63			0.39				0.00	0.07	0.00	0.00	0.00	1114.50	1114.89	OK	OK			
Campbell Ave.	Exist	54+55	48	60	0.012	1127.00	1105.00	0.00337	90.0	0.00	0.20	0.00	0	0	1.00	4.58	19.63	2640.00	2640.0	0.33	0.0042	0.0010	2.68	0.00	0.07	0.00	0.00	2.75	1117.31	1117.64	OK	OK		9.7	22.0
To Existing Pipe	Exist	28+80	48	60	0.012	1139.50	1115.04	0.00390	90.0	0.30	0.50	0.00	0	0	0.77	4.58	19.63	2575.00	2575.0	0.33	0.0042	0.0010	2.62	0.44	0.89	0.00	0.00	2.68	1119.99	1120.32	OK	OK		19.5	24.5
Surge Junction		28+40	96	78	0.012	1139.80	1115.10	0.00150	355.0	0.50	1.20	0.00	0	0	1.30	10.70	33.18	40.00	40.0	1.78	0.0042	0.0039	0.16	0.08	1.93	0.00	0.00	1.48	1121.60	1121.80	Open	OK	Reduce D	18.2	24.7
Camelback Rd.		28+10	66	60	0.012	1140.00	1115.25	0.00500	200.0	0.50	0.20	0.00	0	0	1.00	10.19	19.63	30.00	30.0	1.61	0.0042	0.0050	0.15	0.00	0.32	0.00	0.00	2.17	1122.36	1123.97	OK	OK		17.6	24.8
Missouri Ave.		0+00	66	60	0.012	1149.00	1126.50	0.00400	200.0	0.00	0.20	0.00	0	0		10.19	19.63	2810.00	2810.0	1.61	0.0042	0.0050	14.11			0.00	0.00	14.43	1136.79	1138.40	OK	OK		12.2	22.5

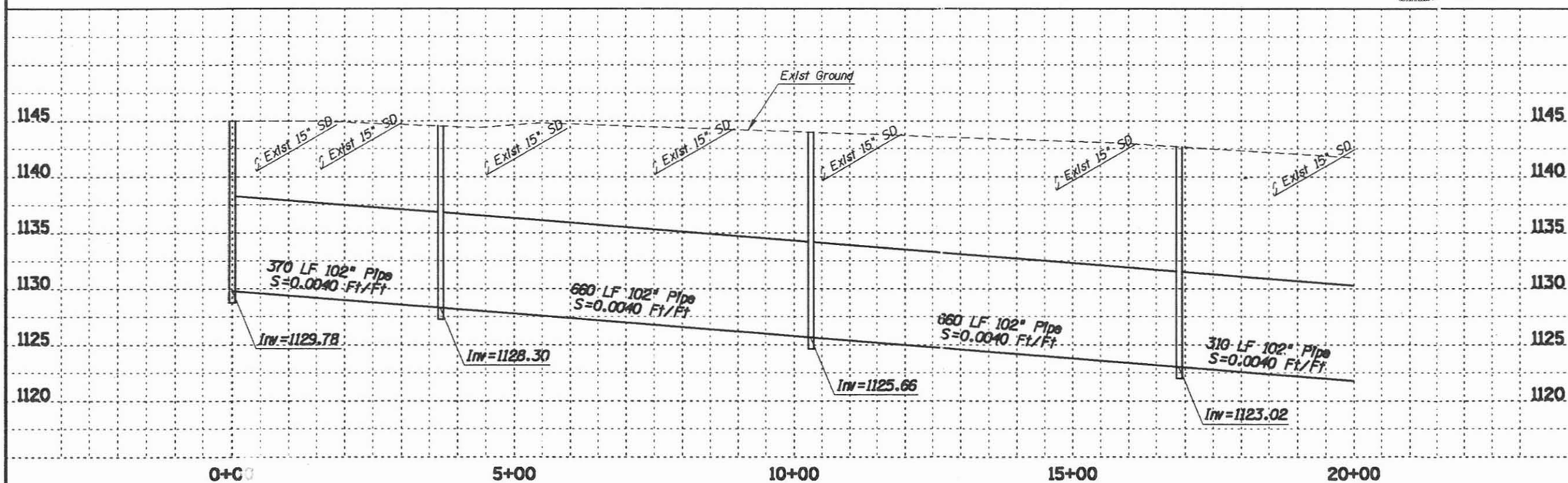
GRAND AVENUE STORM DRAIN - 39th Avenue to Missouri Avenue

Storm Sewer Line Station Location	Pipe #	Station	Pipe Diameter Sheet Suggested (in)	Pipe Diameter User Selected (in)	n	Natural Ground Elevation (ft)	Invert Elev. (ft)	Pipe Slope	Design Q (cfs)	Transitn Loss Coeff. Sum(Kt)	Bend Loss Coeff. Sum(Kb)	Junction Losses Q3 (cfs)	Junction Losses D3 (in)	Junction Losses Theta (deg.)	D2/D1	Vel. (ft/s)	Full Area (sq ft)	Station Interval (ft)	Pipe Length (ft)	V^2/(2g) (ft)	K	Sf (ft/ft)	Losses hf (ft)	Losses ht (ft)	Losses hb (ft)	Losses hj (ft)	Losses Others (ft)	Total Losses (ft)	Hydraulic Grade Line Elevation (ft)	Energy Grade Line Elevation (ft)	Pressure Flow Check	"Overflow" Check	Comments	Depth to Hydraulic Grade Line (ft)	Depth to Invert (ft)
39th Ave.		74+00	84	78	0.012	1128.00	1109.50	0.00150	265.0	0.00	0.20	0.00	0	0	1.00	8.00	33.18			0.99				0.00	0.20	0.00	0.00	0.00	1126.00	1126.99	OK	OK			
Exist-Pipe Junctn		37+10	84	78	0.012	1140.00	1115.04	0.00150	265.0	0.00	0.50	0.00	0	0	1.00	7.99	33.18	3690.00	3690.0	0.99	0.0042	0.0022	8.03	0.00	0.89	0.00	0.00	8.22	1134.23	1135.22	OK	OK		5.8	25.0
Surge Junction		36+70	96	78	0.012	1140.00	1115.10	0.00150	355.0	0.16	1.00	0.00	0	0	0.76	10.70	33.18	40.00	40.0	1.78	0.0042	0.0039	0.16	0.05	1.46	0.00	0.00	1.04	1134.49	1136.26	OK	OK		5.5	24.9
Manhole		16+90	96	102	0.012	1142.50	1123.02	0.00400	550.0	0.00	0.75	0.00	0	0	1.00	9.69	56.75	1980.00	1980.0	1.46	0.0042	0.0022	4.44	0.00	0.58	0.00	0.00	5.95	1140.75	1142.21	OK	OK		1.7	19.5
Missouri Ave.		0+00	84	102	0.012	1145.00	1129.78	0.00400	400.0	0.00	0.30	0.00	0	0		7.05	56.75	1690.00	1690.0	0.77	0.0042	0.0012	2.00			0.00	0.00	2.58	1144.02	1144.79	OK	OK		1.0	15.2



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE



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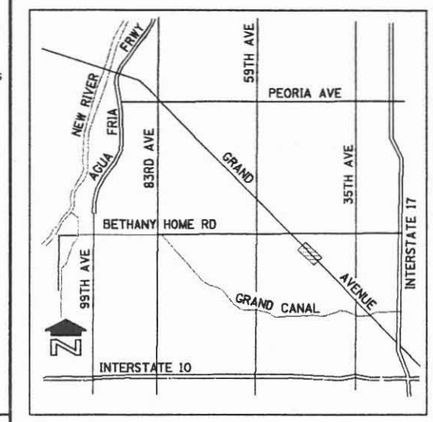
BY KENNEY AERIAL MAPPING AND IS BAS[illegible] CONTROL DATA PROVIDED
BY KAMINSKI-HUBBARD ENGINEERING INC. [illegible] ENGINEERS [illegible] TANTS, LTD.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 43RD AVENUE

MITIGATION OPTION 4, 10-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

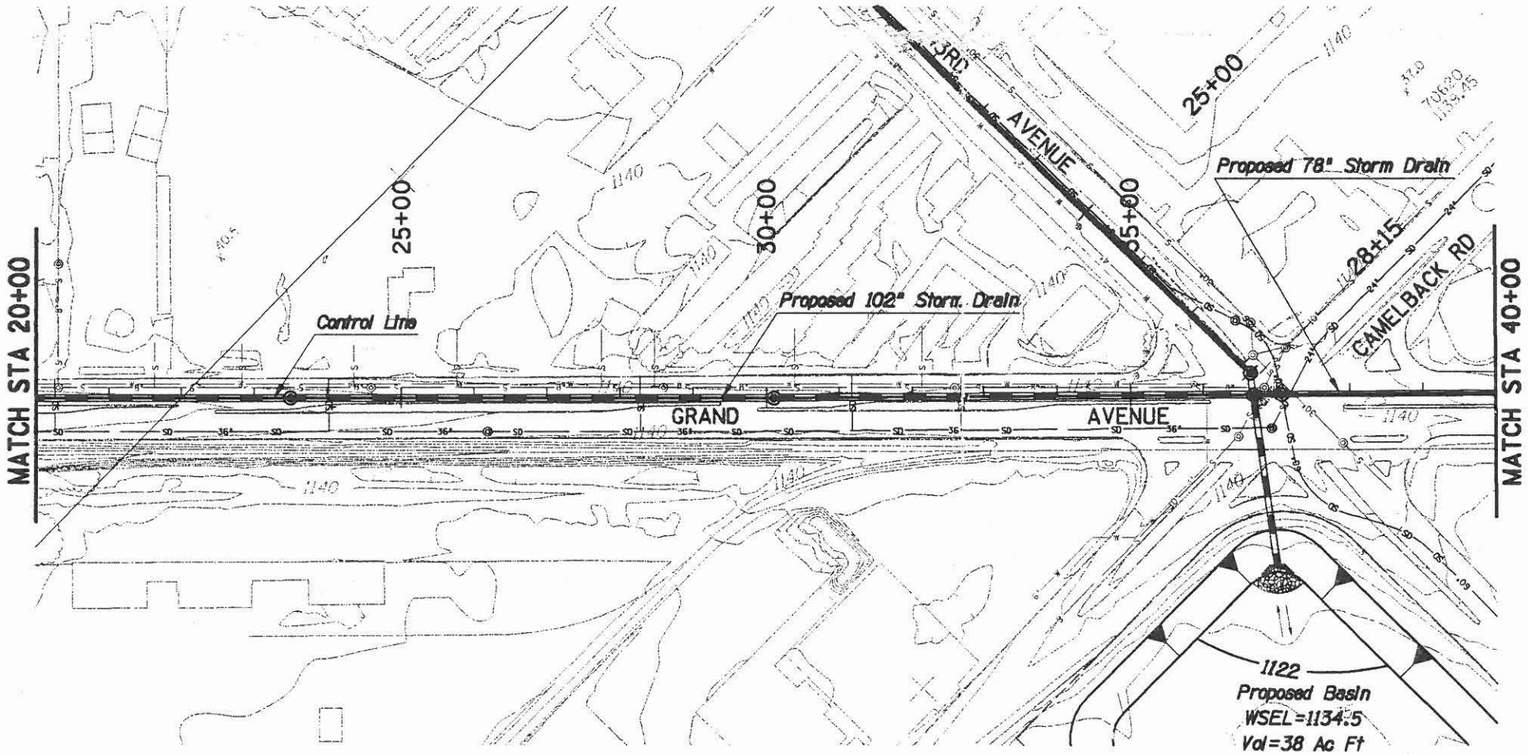
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 0+00 TO 20+00

FIGURE 9 | SHEET 23 OF 44

TRACS NO.



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
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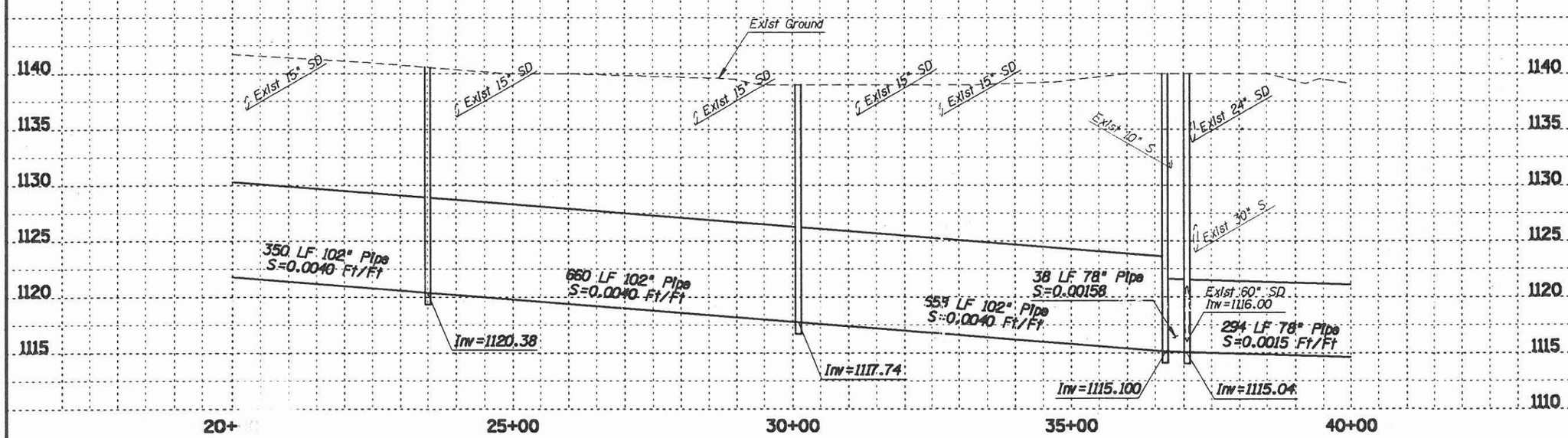

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BY KENNEY AERIAL MAPPING AND IS BA
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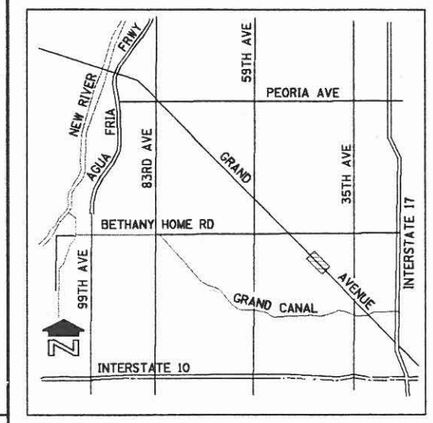
GHT-OF-WAY ARE APPROXIMATE
POGRAPHY WAS PRODUCED AT A
TERVAL. MAPPING WAS PREPARED
CONTROL SURVEY DATA PROVIDED
NGINEERING CONSULTANTS, LTD.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 43RD AVENUE

MITIGATION OPTION 4, 10-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

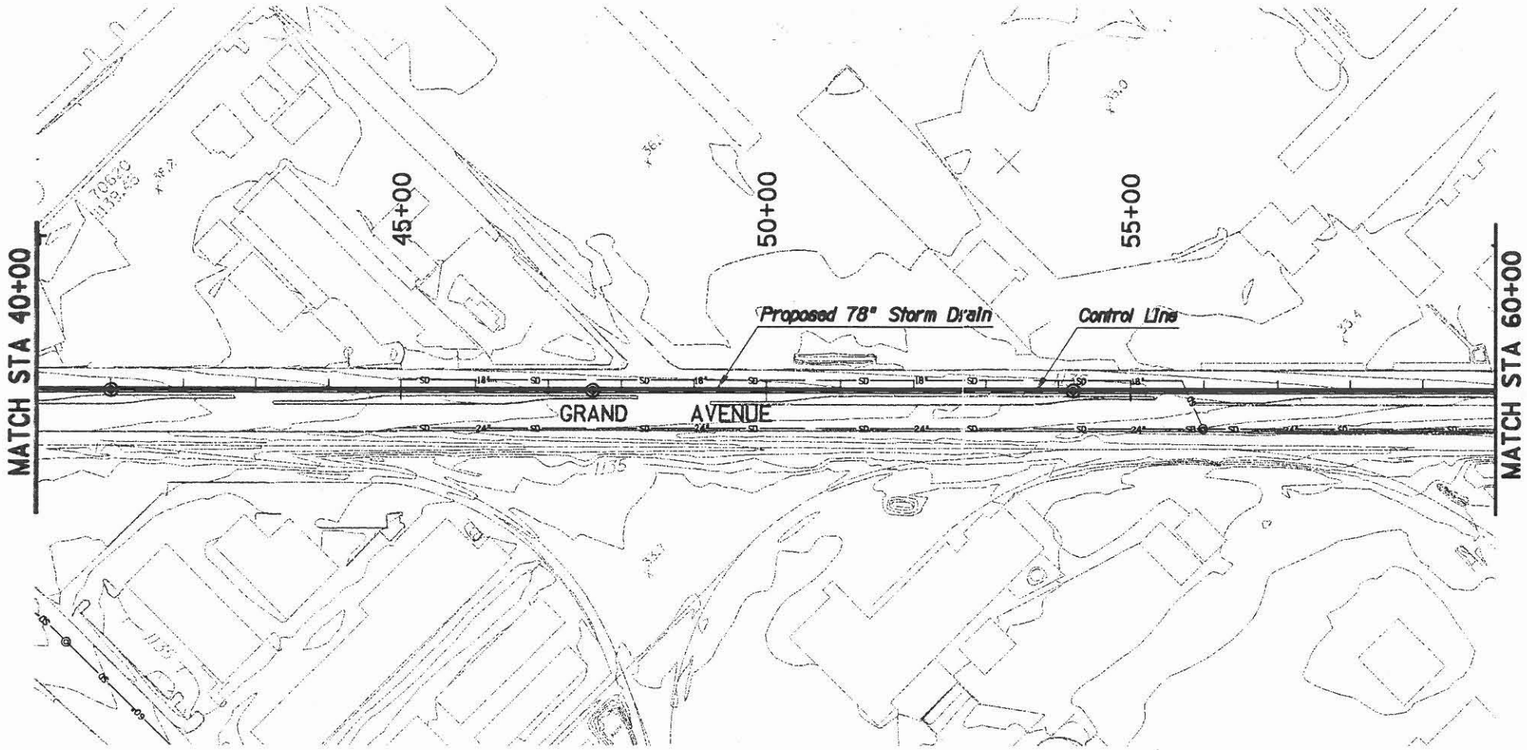
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 20+00 TO 40+00

FIGURE 9 | SHEET 24 OF 44

TRACS NO.



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
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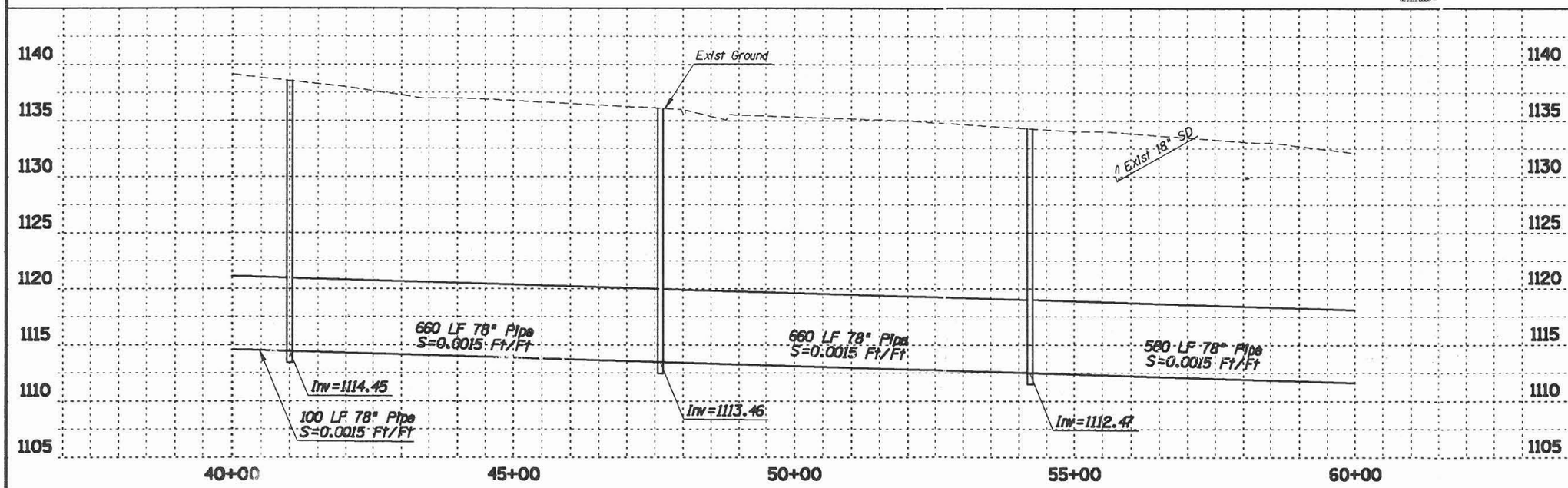

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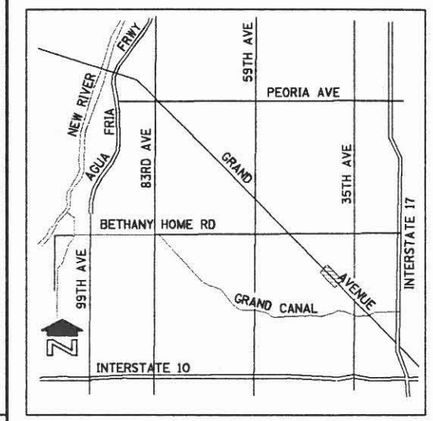
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 43RD AVENUE

MITIGATION OPTION 4, 10-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL : 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
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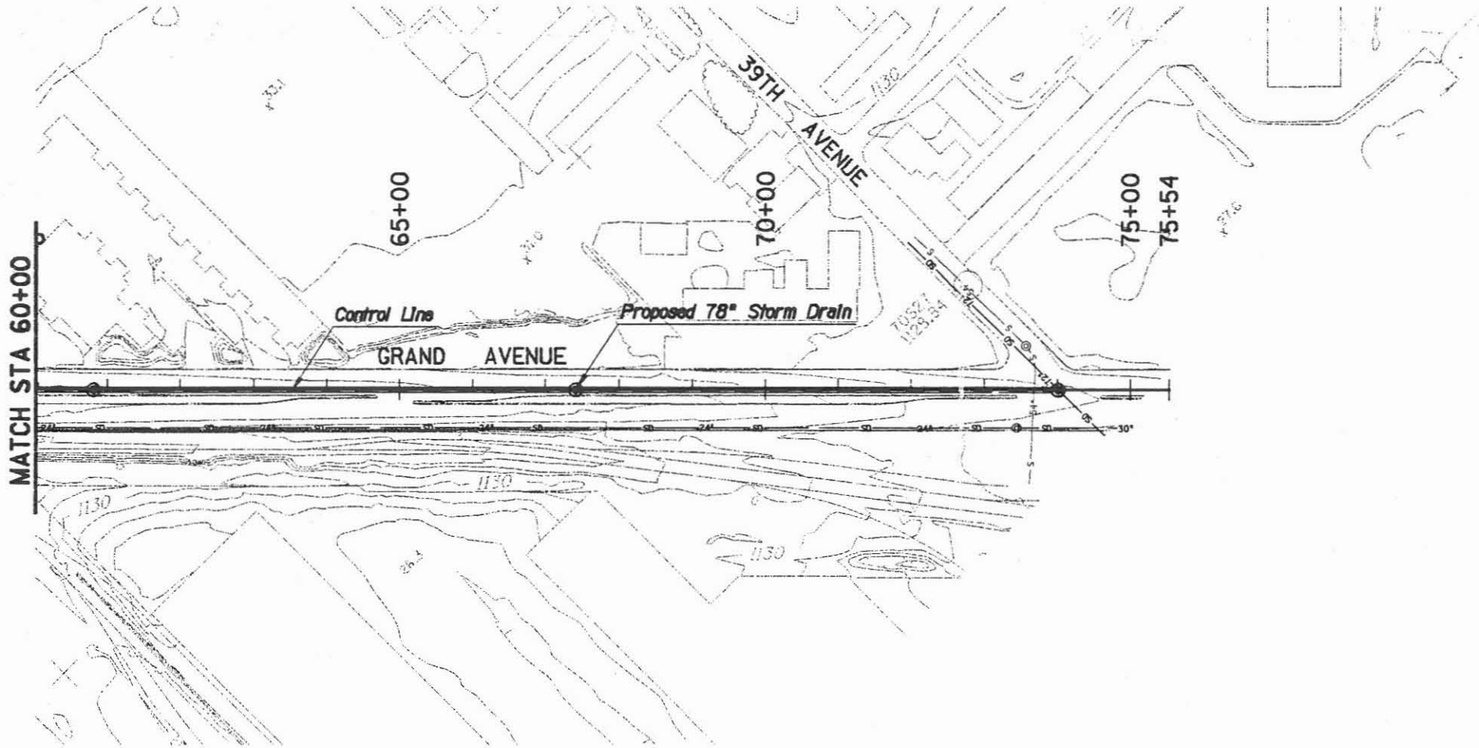
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 40+00 TO 60+00

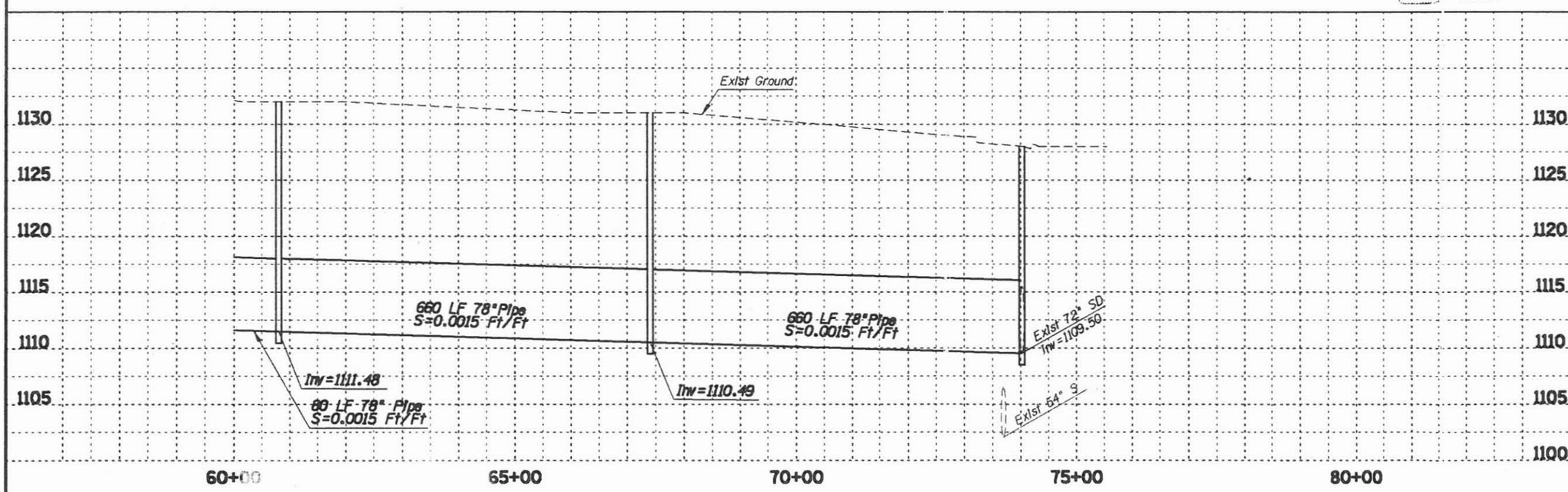
FIGURE 9 | SHEET 25 OF 44

TRACS NO.



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE



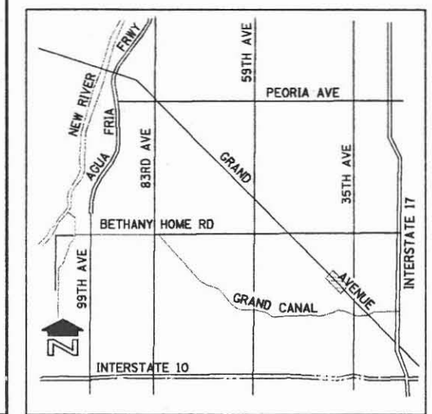
NOTE:
THESE PLANS ARE PRELIMINARY AND ARE
THE LOCATIONS OF ALL STRUCTURES, UT
AND ARE BASED UPON RECORD DOCUMEN
SCALE OF 1INCH=200 FEET WITH A 2 FC
BY KENNEY AERIAL MAPPING AND IS BAS
BY KAMINSKI-HUBBARD ENGINEERING INC.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 43RD AVENUE

MITIGATION OPTION 4, 10-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

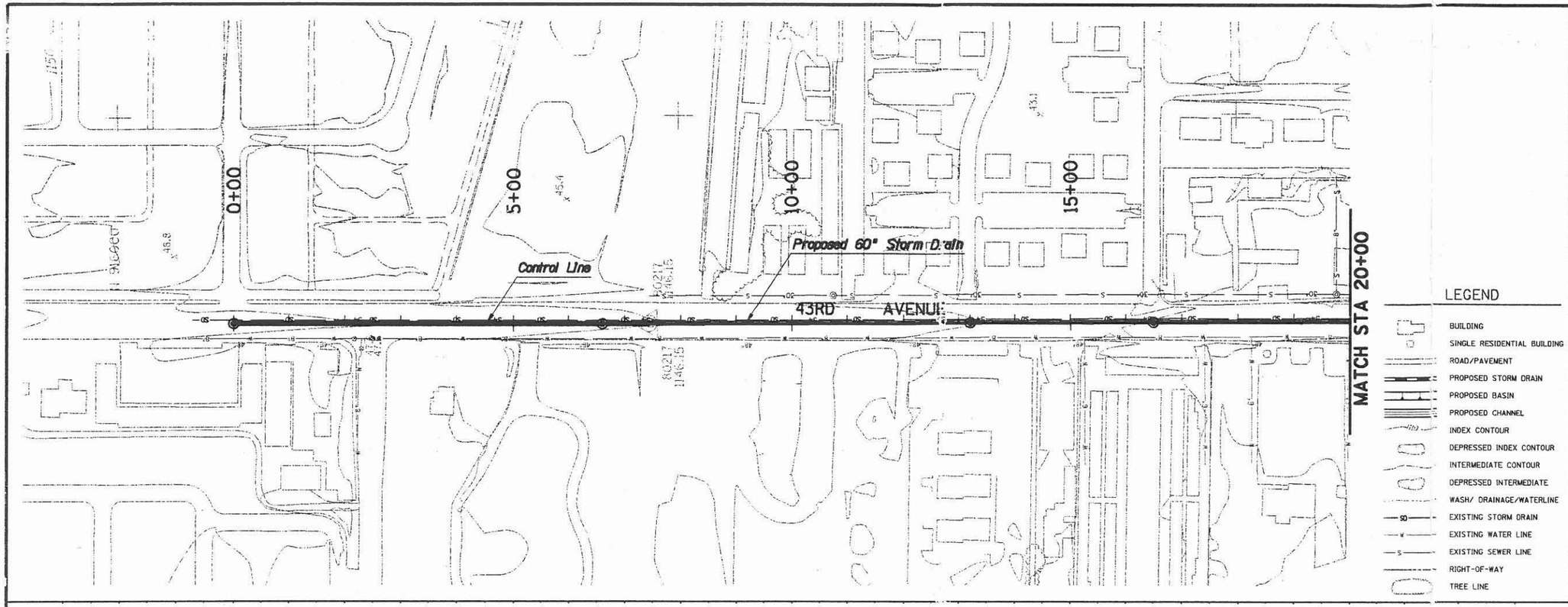
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

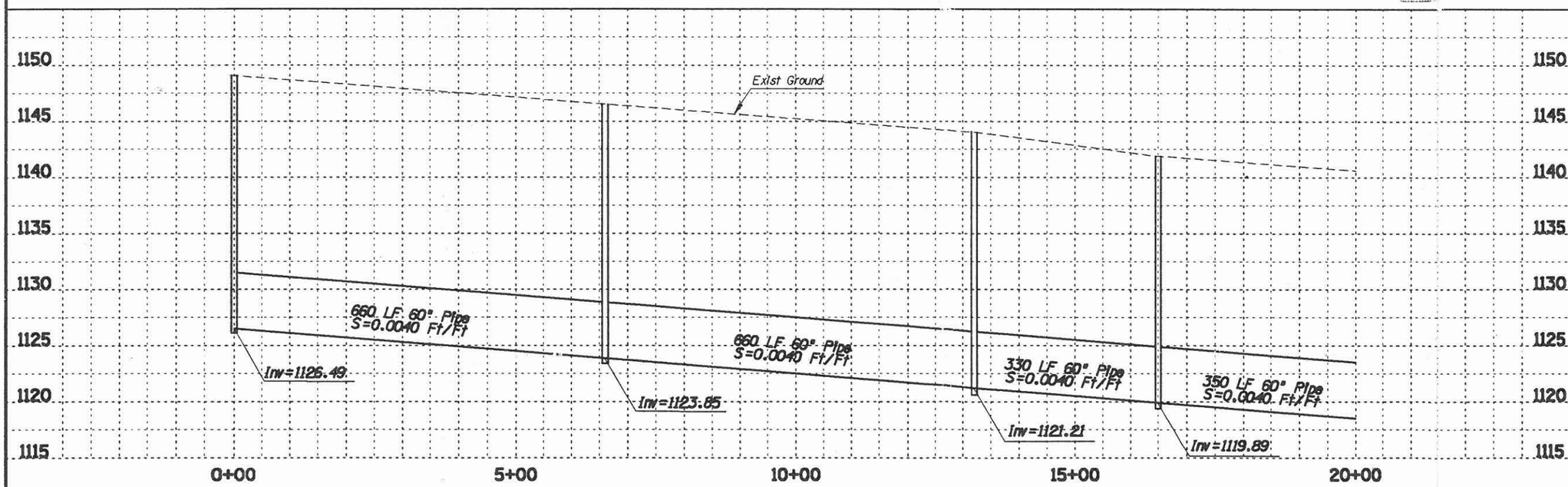
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 60+00 TO 75+00

FIGURE 9 | SHEET 26 OF 44

TRACS NO.





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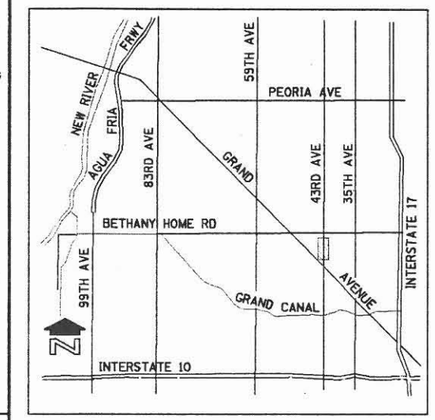
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

MARYVALE AREA DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION LEVEL III

GRAND AVENUE AT 43RD AVENUE

MITIGATION OPTION 4, 10-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

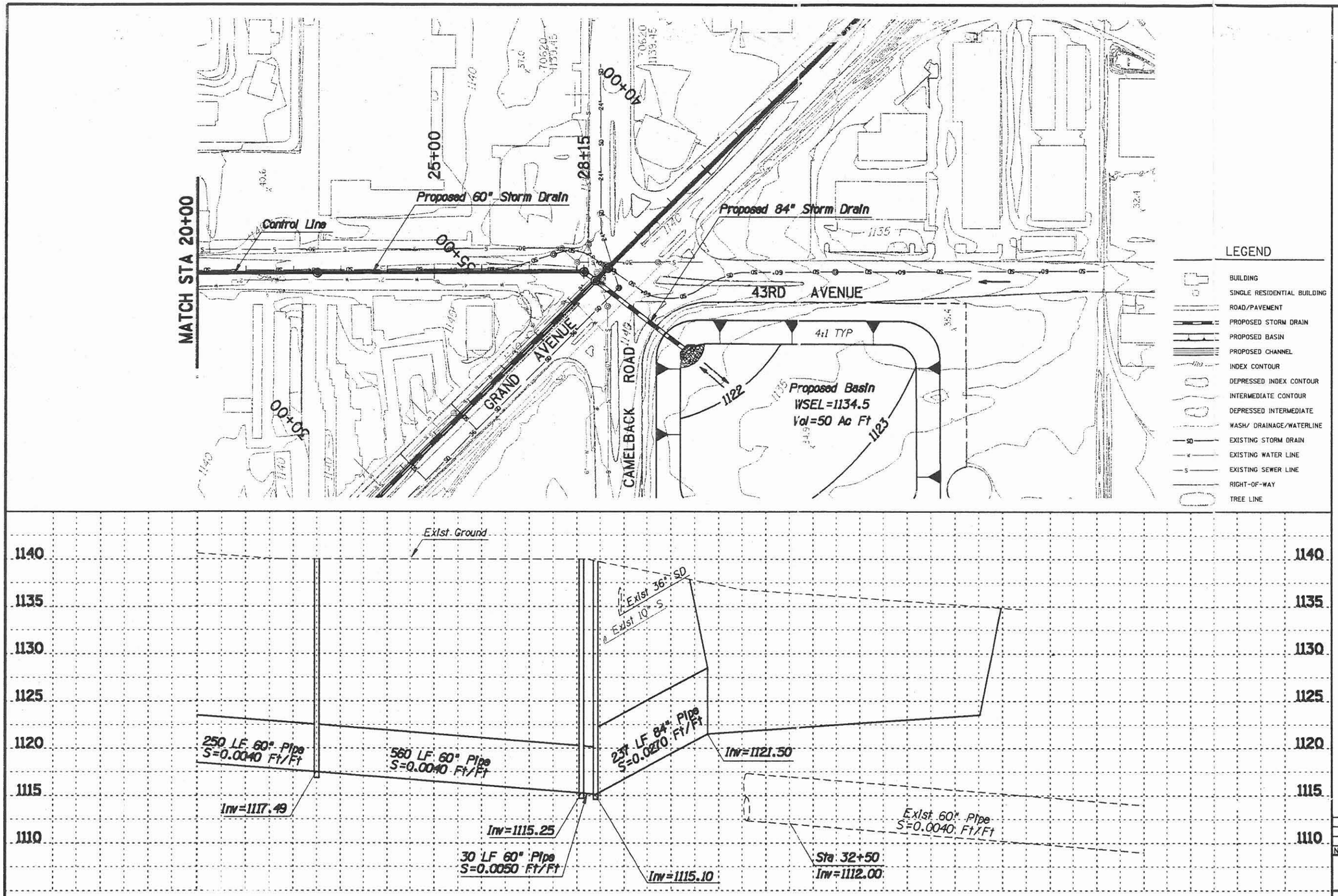
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 0+00 TO 20+00

FIGURE 9 | SHEET 27 OF 44

TRACS NO.



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THE LOCATIONS OF ALL STRUCTURES, UT[illegible] OF-WAY ARE APPROXIMATE
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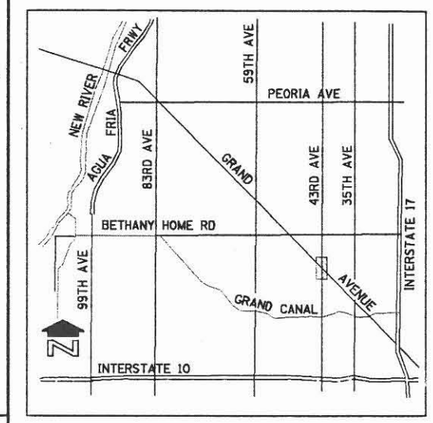
SCALE OF 1INCH=200 FEET WITH A 2 FO[illegible] MAPPING WAS PREPARED
BY KENNEY AERIAL MAPPING AND IS BAS[illegible] SURVEY DATA PROVIDED
BY KAMINSKI-HUBBARD ENGINEERING INC. [illegible] CONSULTANTS, LTD.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 43RD AVENUE

MITIGATION OPTION 4, 10-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
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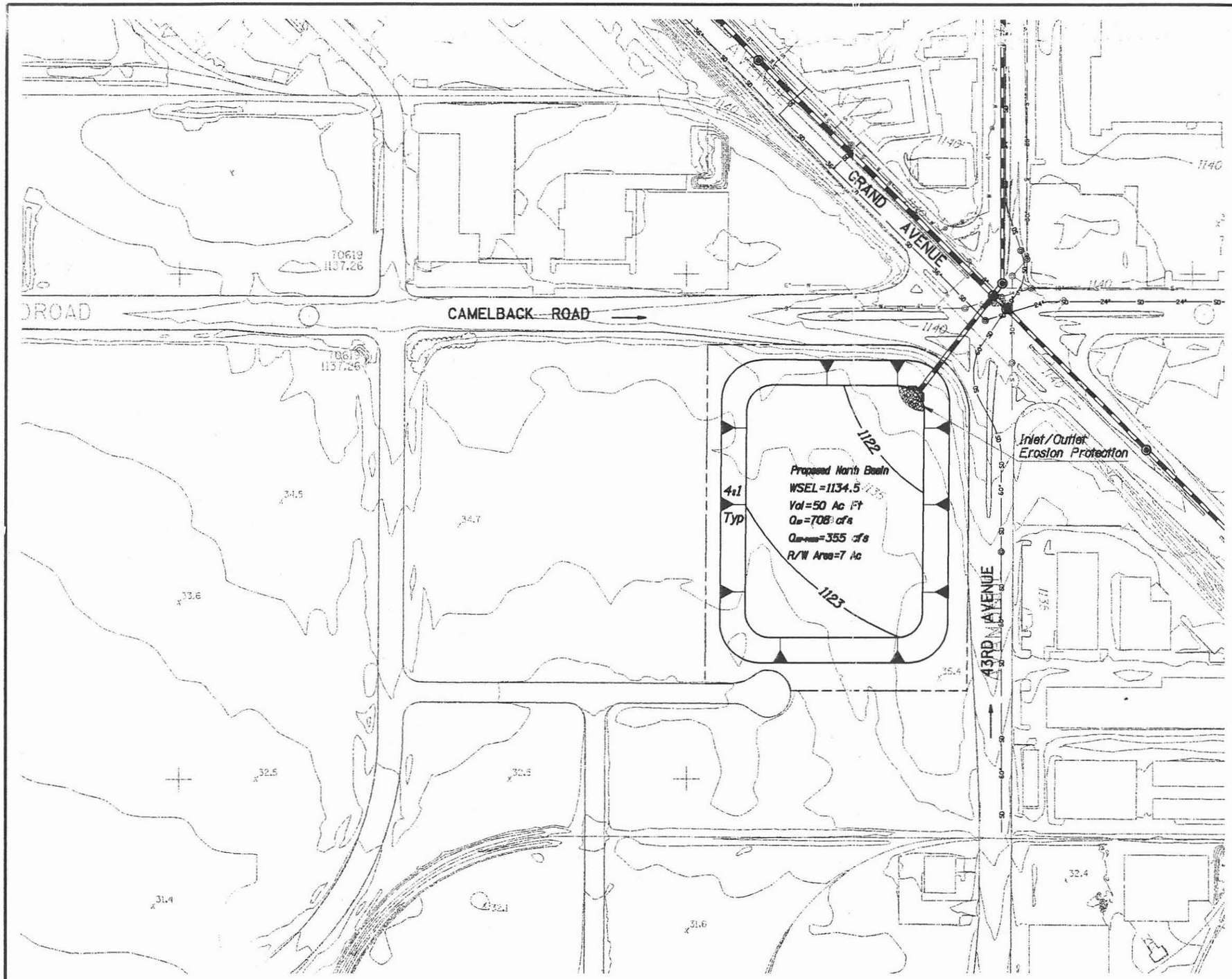
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 20+00 TO 40+00

FIGURE 9 | SHEET 28 OF 44

TRACS NO.



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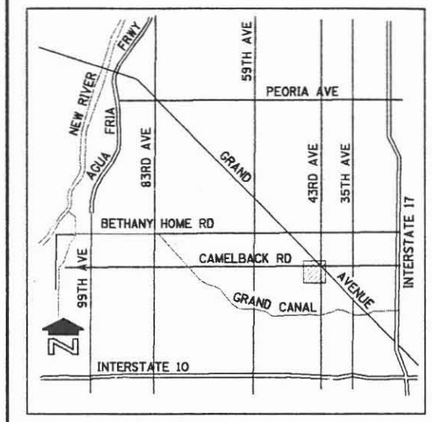
BY KENNEY AERIAL MAPPING AND IS BASED ON SURVEY DATA PROVIDED
BY KAMINSKI-HUBBARD ENGINEERING INC. AND ... CONSULTANTS, LTD.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND AVENUE AT 43RD AVENUE

MITIGATION OPTION 4, 10-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
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WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN | FIGURE 9 | SHEET 29 OF 44

TRACS NO.

WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

PROJECT Maryvale ADMS

PROJECT NO. 94154 SHEET NO. 1 OF

CALCULATED BY DATE CHECKED BY DATE

BACKUP DATA FOR SELECTED ALTERNATIVE

GRAND AVENUE @ I-17

Option 1, 5 year

DATA PROVIDED:

Existing Condition Hydrology: 5-YEAR

HEC-1 KK Card ID: C2622E

PEAK INFLOW: 953 cfs

RUNOFF VOLUME: 184 ac-ft

TYPE OF MITIGATION:

DETENTION STORAGE: (Yes) / NO

BASIN TYPE: ON-LINE

VOLUME: 192 ac-ft

OUTFALL: Pump & Gravity

PEAK STAGE: 1095 ft

Surrounding Ground EL: 1094 ft at low side

comments: Triangular commercial tract (Car Dealership) bounded by Grand Ave, Thomas Rd & I-17 is TOO COSTLEY for Detention Site, thus a pump station was used.

Time To Drain: T = 33.7 hrs = 1.4 days

STORM DRAIN: (Yes) / ~~NO~~ Bleed off pipe to connect to existing 60 inch SD in 27th Avenue

comments:

CHANNEL CONSIDERATIONS: ~~YES~~ / (NO)

Comments:

Wood/Patel and Associates, Inc.

MARYVALE AREA DRAINAGE MASTER STUDY

Flood Control District of Maricopa County 12-Aug-97

FLOOD MITIGATION OPTIONS **Contract FCD 93-29**
LEVEL II ANALYSIS - OPTION 2, 10-yr **W/P # 94154.00**

TITLE: Detention Basins at I-17 and Thomas Road

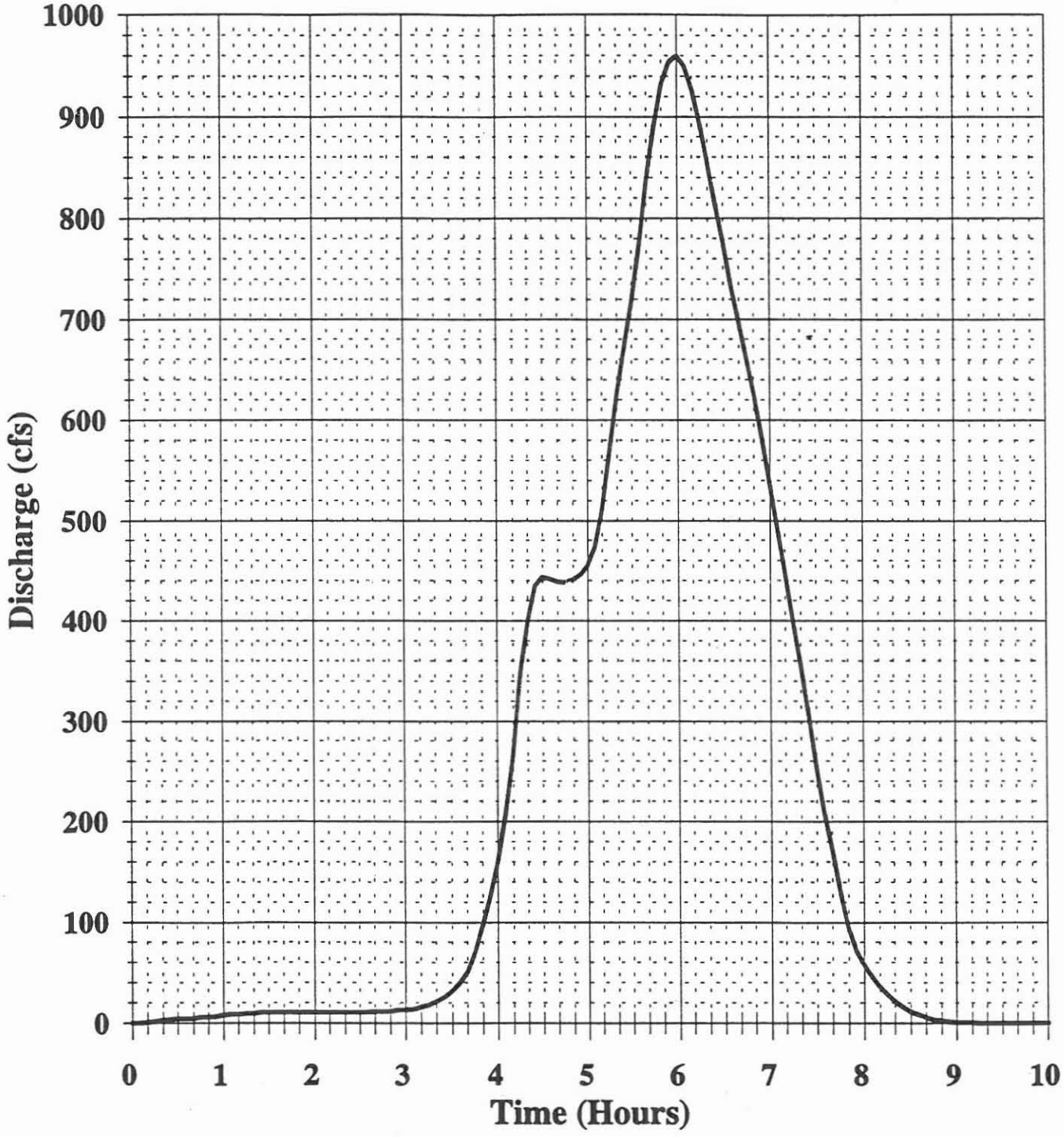
This Basin also Works for 5-yr Storm.

North Detention Basin

Average Bottom Width =	200 ft
Average Bottom Length =	640 ft
Side Slope =	4 :1 (h:v)
Average Basin Bottom =	1063 ft Elev
High Water =	1095 ft Elev
Average Natural Ground =	1096.8 ft Elev
Basin Type =	1 1 = Rectangular, 2 = Triangular

Depth to Bottom (Feet)	Water Surface Elevation	Surface Area (Acres)	Storage Volume Incrimental (Ac-ft)	Storage Volume Cumulative (Ac-ft)	Earth Work Volume Incrimental (CY)	Earth Work Volume Cumulative (CY)
0	1063	2.9	0.0	0.0	0	0
1	1064	3.1	3.1	3.1	4,992	4,992
2	1065	3.3	3.3	6.3	5,248	10,240
3	1066	3.4	3.4	9.8	5,509	15,749
4	1067	3.6	3.6	13.3	5,774	21,523
5	1068	3.7	3.7	17.1	6,044	27,567
6	1069	3.9	3.9	21.0	6,319	33,887
7	1070	4.1	4.1	25.1	6,599	40,486
8	1071	4.3	4.3	29.4	6,884	47,369
9	1072	4.4	4.4	33.8	7,173	54,542
10	1073	4.6	4.6	38.4	7,467	62,009
11	1074	4.8	4.8	43.2	7,765	69,774
12	1075	5.0	5.0	48.2	8,069	77,843
13	1076	5.2	5.2	53.4	8,377	86,220
14	1077	5.4	5.4	58.8	8,690	94,910
15	1078	5.6	5.6	64.4	9,007	103,917
16	1079	5.8	5.8	70.2	9,330	113,247
17	1080	6.0	6.0	76.2	9,657	122,904
18	1081	6.2	6.2	82.4	9,989	132,892
19	1082	6.4	6.4	88.8	10,325	143,218
20	1083	6.6	6.6	95.4	10,667	153,884
21	1084	6.8	6.8	102.2	11,013	164,897
22	1085	7.0	7.0	109.3	11,364	176,261
23	1086	7.3	7.3	116.5	11,719	187,980
24	1087	7.5	7.5	124.0	12,079	200,059
25	1088	7.7	7.7	131.7	12,444	212,504
26	1089	7.9	7.9	139.7	12,814	225,318
27	1090	8.2	8.2	147.8	13,189	238,507
28	1091	8.4	8.4	156.2	13,568	252,075
29	1092	8.6	8.6	164.9	13,952	266,027
30	1093	8.9	8.9	173.8	14,341	280,367
31	1094	9.1	9.1	182.9	14,734	295,102
32	1095	9.4	9.4	192.3	15,132	310,234
33	1096	9.6	9.6	--	15,535	325,769
33.8	1096.8	9.8	7.9	--	12,689	338,458
34	1097	9.9	2.0	--	3,189	--

Grand Ave @ I-17
5-year Inflow Hydrograph @ C2622E



WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

PROJECT Maryvale Adms

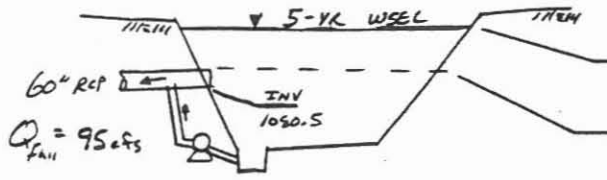
PROJECT NO. 9454 SHEET NO. 1 OF 1

CALCULATED BY DTP DATE 6 Feb 99 CHECKED BY _____ DATE _____

GRAND AVE @ I-17

Pump Station

5-YEAR PARAMETERS (for Single Basin, North of Thomas Rd)



5-YR WSEL = 1094 V = 182.9 ac-ft

GRAVITY DRAIN: D + INV = 1085.5 V = 105.8 ac-ft

Volume Drained By Gravity = 77.1 ac ft

$$\text{Time (Gravity)} = \frac{V}{Q} = \frac{77.1 \text{ ac ft}}{95 \text{ cfs}}$$

$$T_G = 9.8 \text{ hrs}$$

Pump: V_{pump} = 105.8 ac-ft

Use 3-60 hp (1430) pumps → Q = 24000 gpm = 53.5 cfs

$$T_{pump} = \frac{V}{Q} = \frac{105.8 \text{ ac ft}}{53.5 \text{ cfs}}$$

$$T_{pump} = 23.9 \text{ hrs}$$

Time to Drain: $T = T_G + T_P$

$$T = 9.8 + 23.9 = 33.7 \text{ hrs}$$

$$T = 1.4 \text{ days}$$

WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

PROJECT Maryvale ADMS

PROJECT NO. 94154 SHEET NO. 2 OF 4

CALCULATED BY DTP DATE 15 Aug 97 CHECKED BY _____ DATE _____

Grand Ave @ I-17

Pump Station

For Two Basin System

5-YR PARAMETERS:

Runoff Volume = 185 Ac-ft

Gravity Volume = 101 Ac-ft @ EL=1086

Pump Volume = 84 Ac-ft @ 18-4 ft of Head

Gravity Q = 95 cfs ⟹ Gravity Time = 101 Ac-ft / 95 cfs = 12.9 hrs

C-3501 Pump(s)	Impeller	5-YR Pump(s) Rate	Pump Volume Time to Drain	+ 12.9 ⟹	Total Basin Drain Time	
2-60 Hp	1430	16000 gpm	28.5 hrs		1.73 days	ok

100-YR PARAMETERS:

Runoff Volume = 610 Ac-ft

Gravity Volume = 406 Ac-ft @ EL=1086

Pump Volume = 204 Ac-ft @ 27-4 ft of Head

Gravity Q = 95 cfs ⟹ Gravity Time = 406 Ac-ft / 195 cfs = 51.7 hrs (2.2 days)

C-3501 Pump(s)	Impeller	100-YR Pump(s) Rate	Pump Volume Time to Drain	+ 51.7 ⟹	Total Basin Drain Time
* 3-60 Hp	1430	24,000 gpm	46.2 hrs (1.9 days)		4.1 days
4-60 Hp	1430	32,000 gpm	34.6 hrs (1.4 days)		3.5 days

Use 3-60 Hp Pumping Time = 1.9 Days

Increase Gravity Drain Time ∴ Total time < 4 days

WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

PROJECT MARYVALE ADMS

PROJECT NO. 94154 SHEET NO. 1 OF 4

CALCULATED BY DTP DATE 15 AUG 97 CHECKED BY _____ DATE _____

GRAND AVENUE @ I-17

Pump STATION

NOTE: 1 ft^3 = 7.4805 gal

10-YR PARAMETERS:

Runoff Volume = 280 Ac-ft

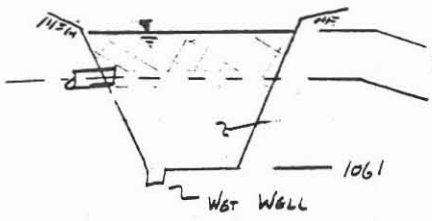
Time to Drain = 36 hrs

$\therefore Q = \frac{V}{T} = 94.1$ cfs

use Q = 95 cfs = 42,640 gpm

Superceded by Selected Alternative is 5-YEAR

60" RCP Gravity Drain Invert = 1080.5



10-YR WSEL = 1095

GRAVITY DRAIN INVERT + D = 1085.5

USE 1086

V = 281 Ac-ft @ 1095

V = 170 Ac-ft @ 1086

(111 Ac-ft drained by Gravity)

Pump: MAX CAPACITY = 95 cfs = 42,640 gpm

OPERATING HEAD = 25 to 4 ft Head

Pumping Volume = 170 Ac-ft = 55,395,000 gal

Gravity: 111 Ac-ft / 95 cfs = 14.13 hrs

ASSUMING PUMPING HEAD = 15 ft

C-3501 Pump(s)	IMPELLER	10-YR Pump(s) Rate	Pump Volume Time To Drain	Basin – Total Drain Time
1-80 Hp	1430	14,300 gpm	64.56 hrs	3.3 days
1-60 Hp	1430	8,000 gpm	115.4 hrs	5.4 days
2-60 Hp	1430	16,000 gpm	57.7 hrs	3 days ✓
2-80 Hp	1430	28,600 gpm	32.3 hrs	1.9 days ✓
3-60 Hp	1430	24,000 gpm	38.5 hrs	2.2 days ✓

10-YR option ∴ Total Drain time = 2.2 day is reasonable

USE 3-60 hp C-3501 w/ 1430 Impeller pumps.

Cost: $78 000 Each (60 Hp)

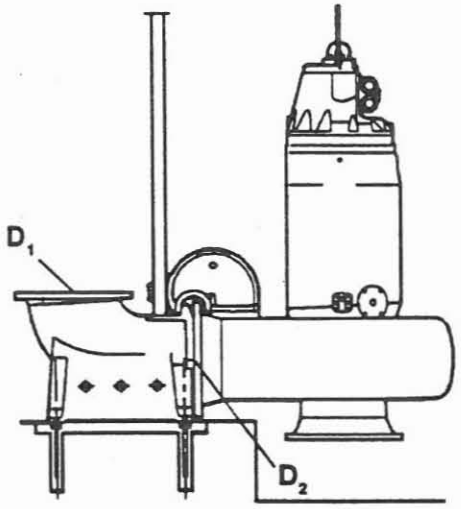
C-3501

Impeller/Motor/Nominal Sizes

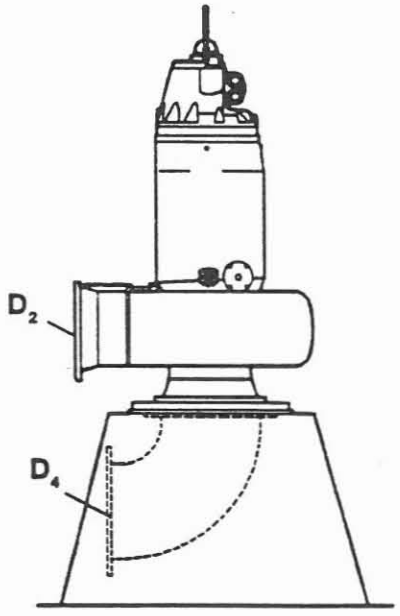
PUMP MODEL	IMPELLER CODE	HP RATING CP & CT	VAC	RPM	D1	D2	D3	D4
3501 3Ø	1030 LT	160, 185, 250, 325	460, 575	710	20"	20"	--	30"
	1230 LT	90	230, 460, 575	595				
		120, 150, 215	460, 575					
	1430 LT	60 ~~50~~, 80	230, 460, 575	505				
		100, 130	460, 575					

LT = High Volume

NOTE: Pump available in CS by custom order only.

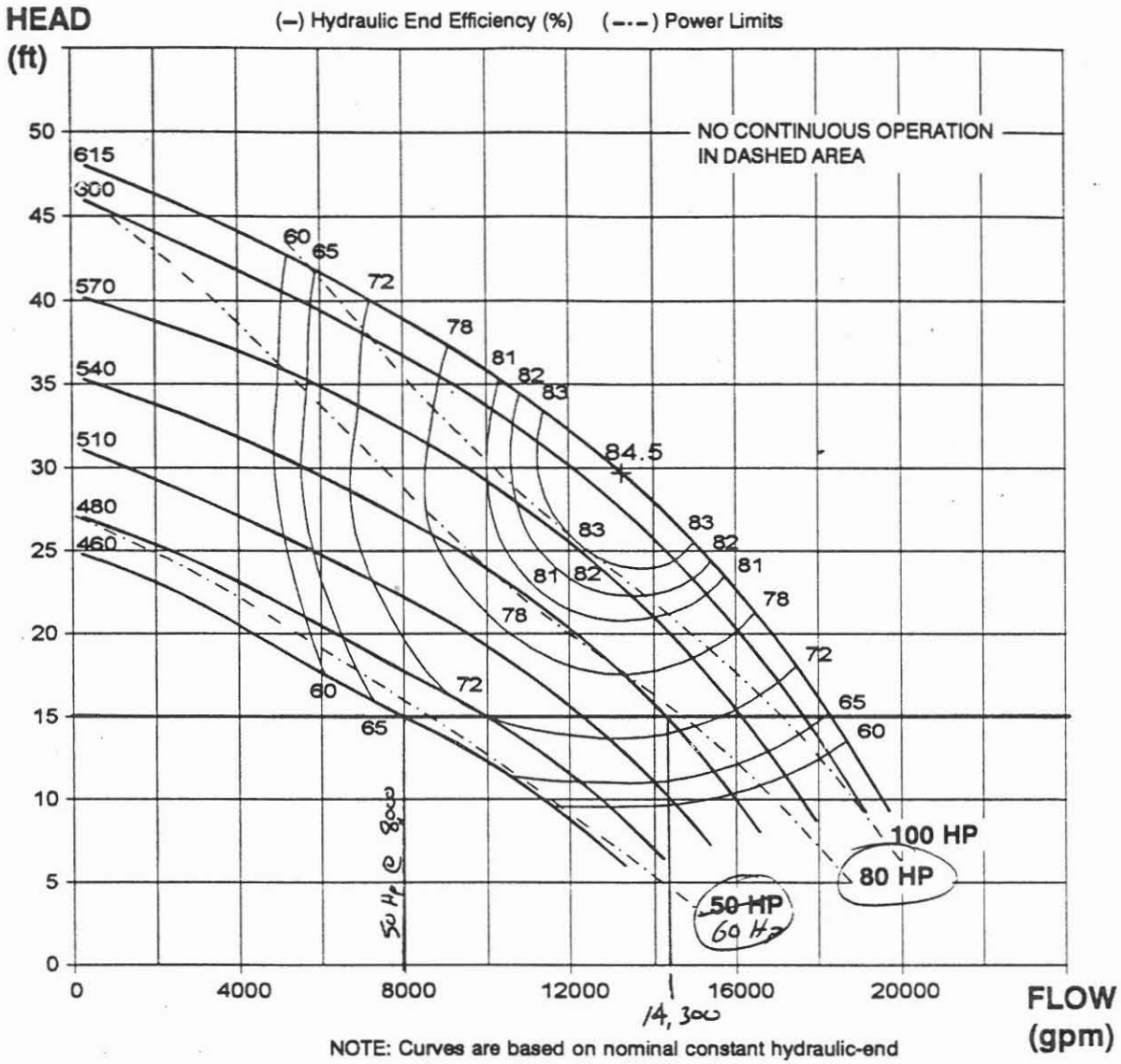


CP

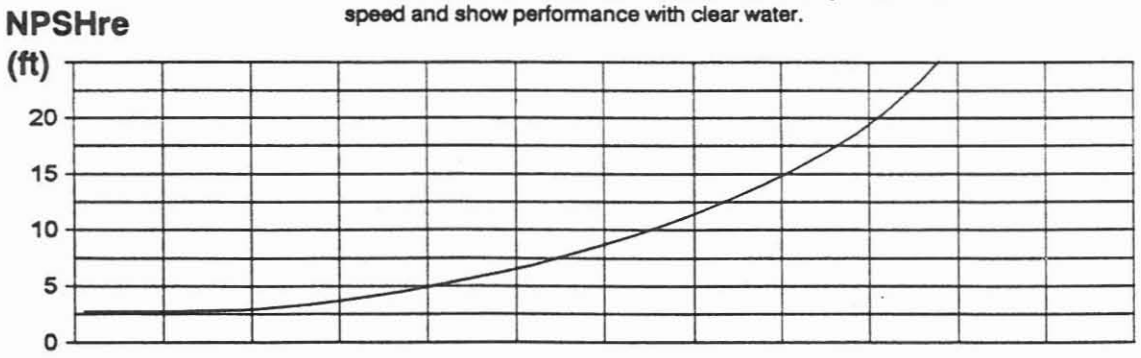


CT

C-3501
1430 Impeller



NOTE: Curves are based on nominal constant hydraulic-end speed and show performance with clear water.



NOTE: Per Bill T. via phone w/ Mark Lux @ JCH (Flygt Sales) 50 Hp is now 60 Hp.

WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

PROJECT Maryvale ADMS

PROJECT NO. 94154 SHEET NO. _____ OF _____

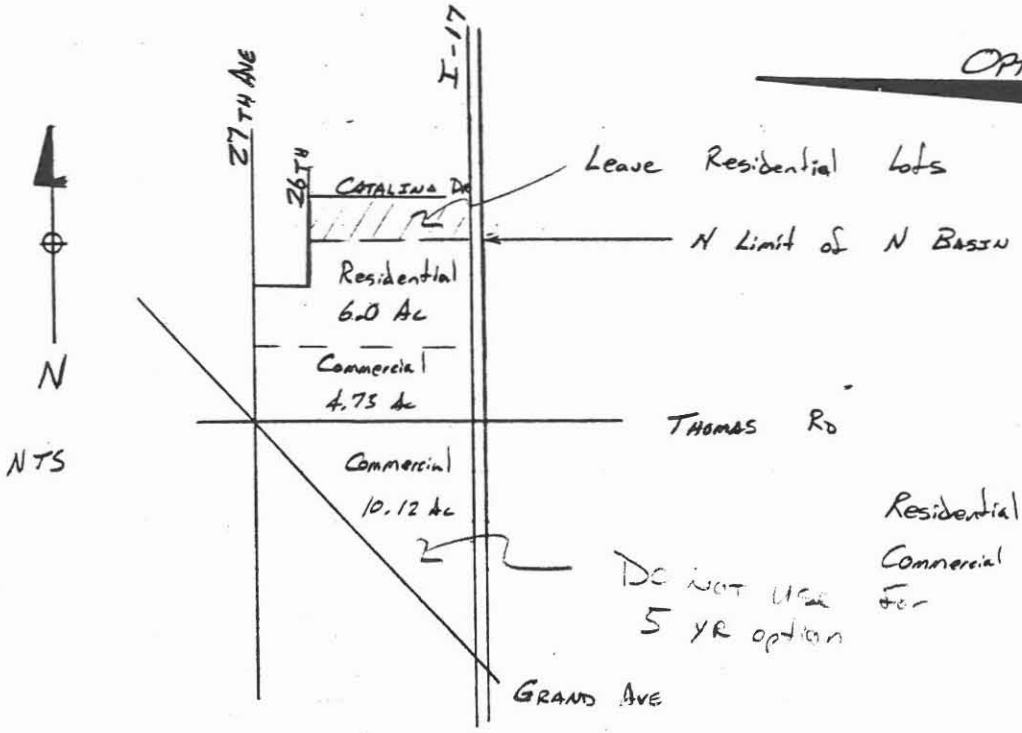
CALCULATED BY DTP DATE 19 Aug 97 CHECKED BY _____ DATE _____

GRAND AVE at I-17 and THOMAS

LEVEL II

LAND Acquisition Summary

OPTION 2, 10-YEAR



Residential A = 6.0 Acres

Commercial A = 14.9 Acres

NOTE: Option 2, 100-year = 2, 10-yr + (Residential A to north of 10-yr option)

Residential A = 6.0 + 11.2 = 17.2 Ac

Commercial A = 14.9 Ac

All 3 options (2, 10-yr ; 2, 100-yr ; 1, 5-yr) require a pumping facility

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 14, 1997
MARYVALE ADMS - Level II
Grand Ave @ I-17
Outlet Pipe - connecting to existing 60" SD

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	5.00
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.0130
Entrance Loss Coefficient of Culvert Opening	0.50
Culvert Length (feet)	105.0
Culvert Slope (feet per foot)	0.0019

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
95.0	5.00	4.12	5.48	3.51	2.77	5.00	4.84

==========

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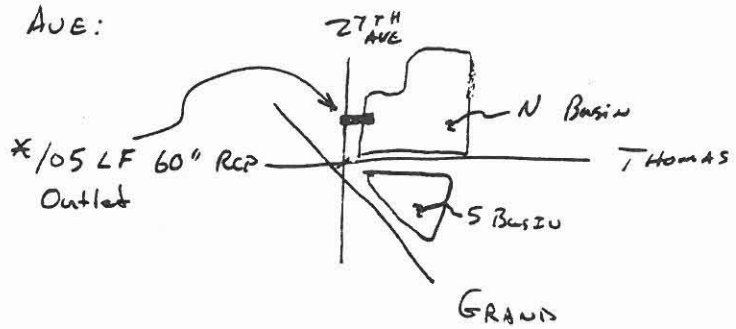
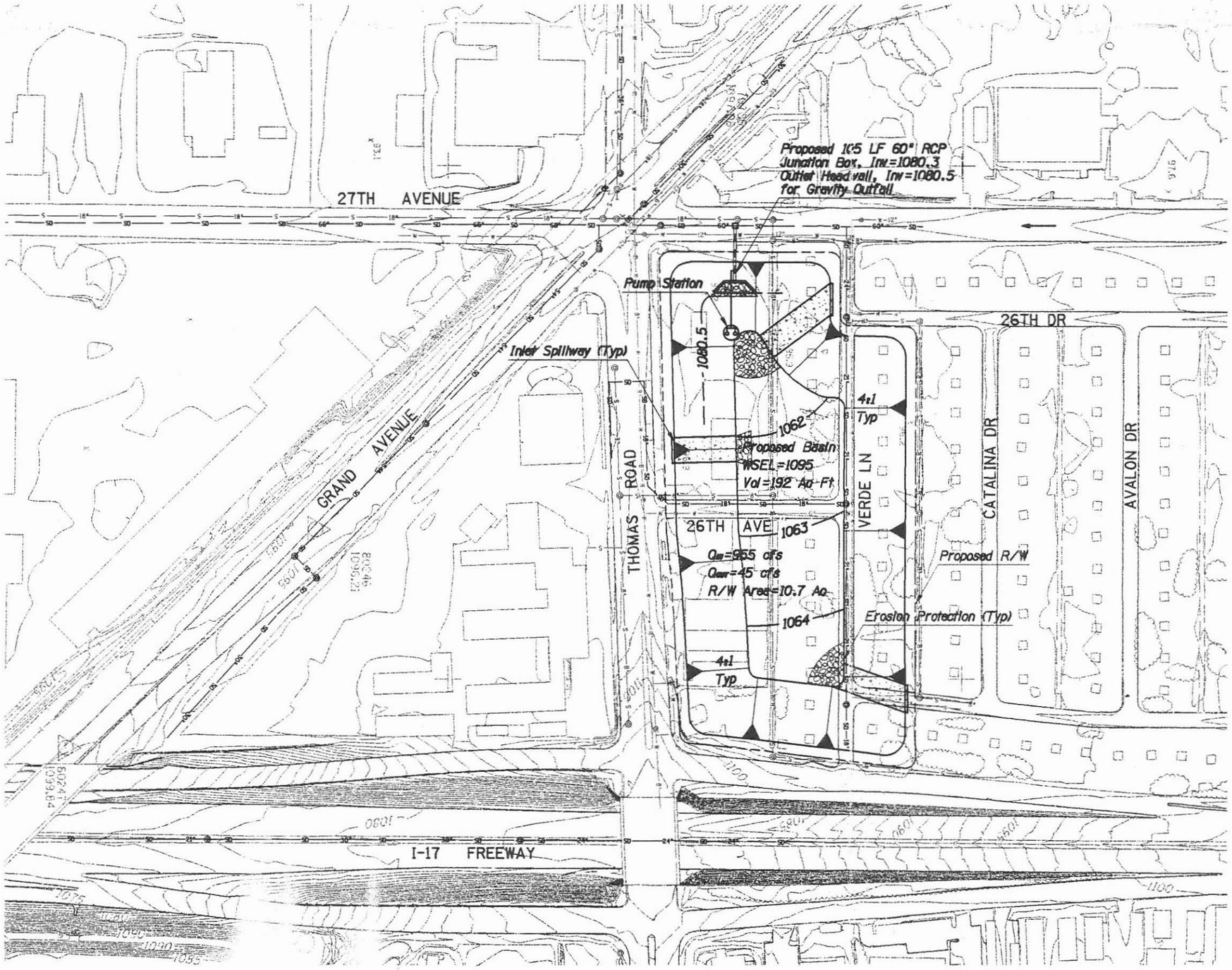
* USE 60" RCP for Outlet Connecting to 27th Ave

North of Grand Ave:





NOTE:
THESE PLANS ARE PRELIMINARY AND ARE ... ONLY.
THE LOCATIONS OF ALL STRUCTURES, UT... APPROXIMATE
AND ARE BASED UPON RECORD DOCUMEN... ...CED AT A
SCALE OF 1INCH=200 FEET WITH A 2 FO... ...PREPARED
BY KENNEY AERIAL MAPPING AND IS BAS... ...PROVIDED
BY KAMINSKI-HUBBARD ENGINEERING INC. ...TO.

LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE

NOTE:
Depiction of Inlet Spillways is Conceptual. Size, Number & Location of Required Spillways to be determined with final design.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS

VICINITY MAP

OPTION EVALUATION LEVEL III

GRAND AVENUE AT INTERSTATE 17

MITIGATION OPTION 1, 5-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN | FIGURE 9 | SHEET 30 OF 44

TRACS NO.

WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

PROJECT MARYVALE ADMS

PROJECT NO. 94154 SHEET NO. 1 OF 1

CALCULATED BY DTP DATE 6 FEB 98 CHECKED BY _____ DATE _____

BACKUP DATA FOR SELECTED ALTERNATIVE

GRAND CANAL STUDY AREA
67th AVENUE TO AGUA FRIA FREEWAY

OPTION 4, 100-year

DATA PROVIDED:

Existing Condition Hydrology: 100-YEAR

HEC-1 KK Card ID: Varies
See Diagram → { PEAK INFLOW: _____ cfs
RUNOFF VOLUME: _____ ac-ft

TYPE OF MITIGATION:

DETENTION STORAGE: (Yes) / ~~No~~ BASIN TYPE: ON-LINE

Comments:

VOLUME: 85 ac-ft

Inflow @ Basin: Q_{IN} = 1280 cfs, V_{IN} = 1280 acft OUTFALL: Gravity (2-6'x3' Box)

Outflow @ Basin: Q_{OUT} = 540 cfs, V_{OUT} = 329 PEAK STAGE: 1094.1 ft

Surrounding Ground EL: 1095 ft @ Bottom End

Need to relocate Sanitary Sewer lines in proposed basin area.

STORM DRAIN: ~~Yes~~ / (No)

Comments:

CHANNEL CONSIDERATIONS: (Yes) / ~~No~~

Comments:

Concrete lined rectangular channel; refer to ADMS report for Plan/profile drawings and HEC-RAS analysis.

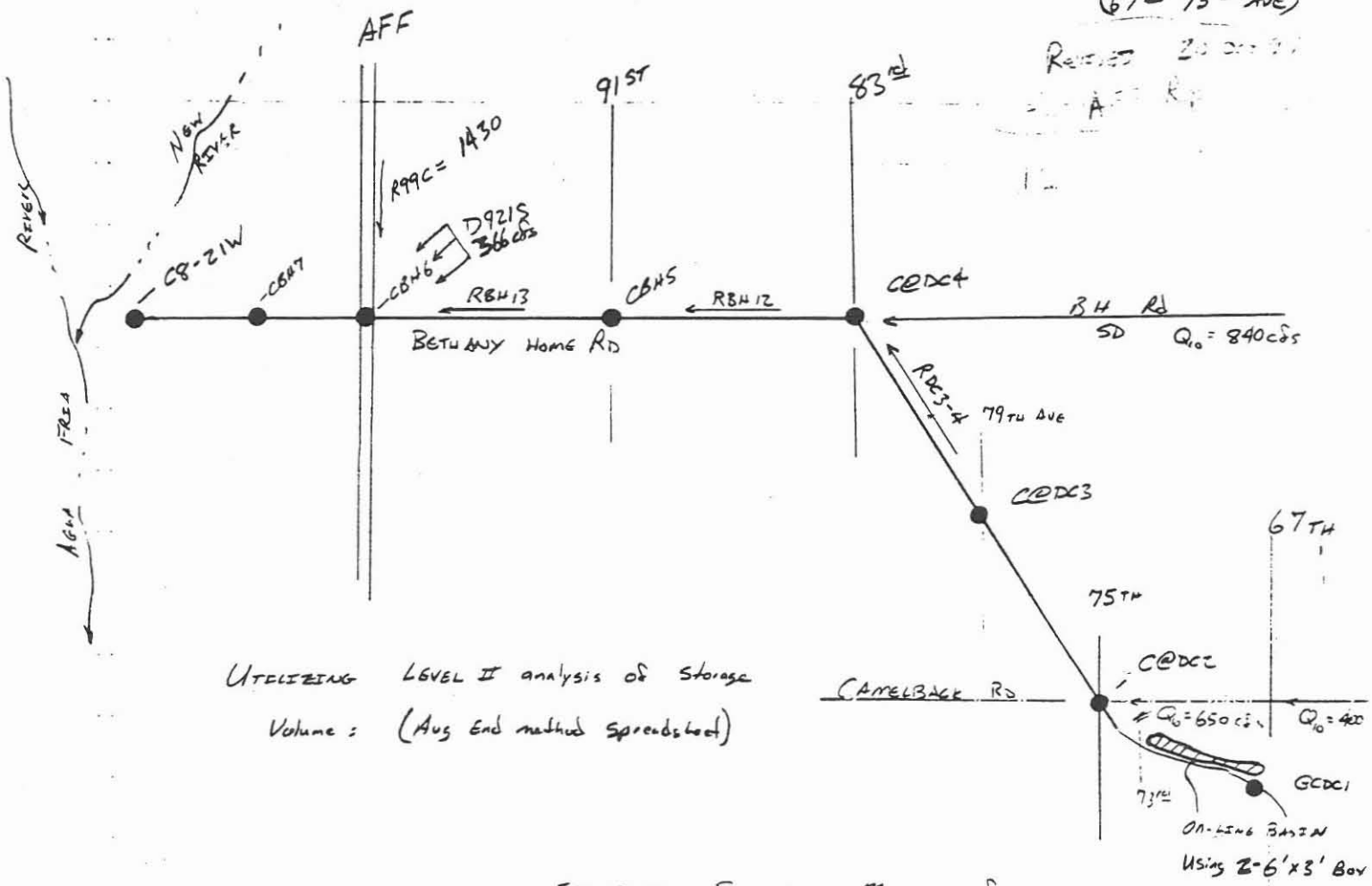
GCDC Flows for FCDMC

25 Sept 97

LEVEL III

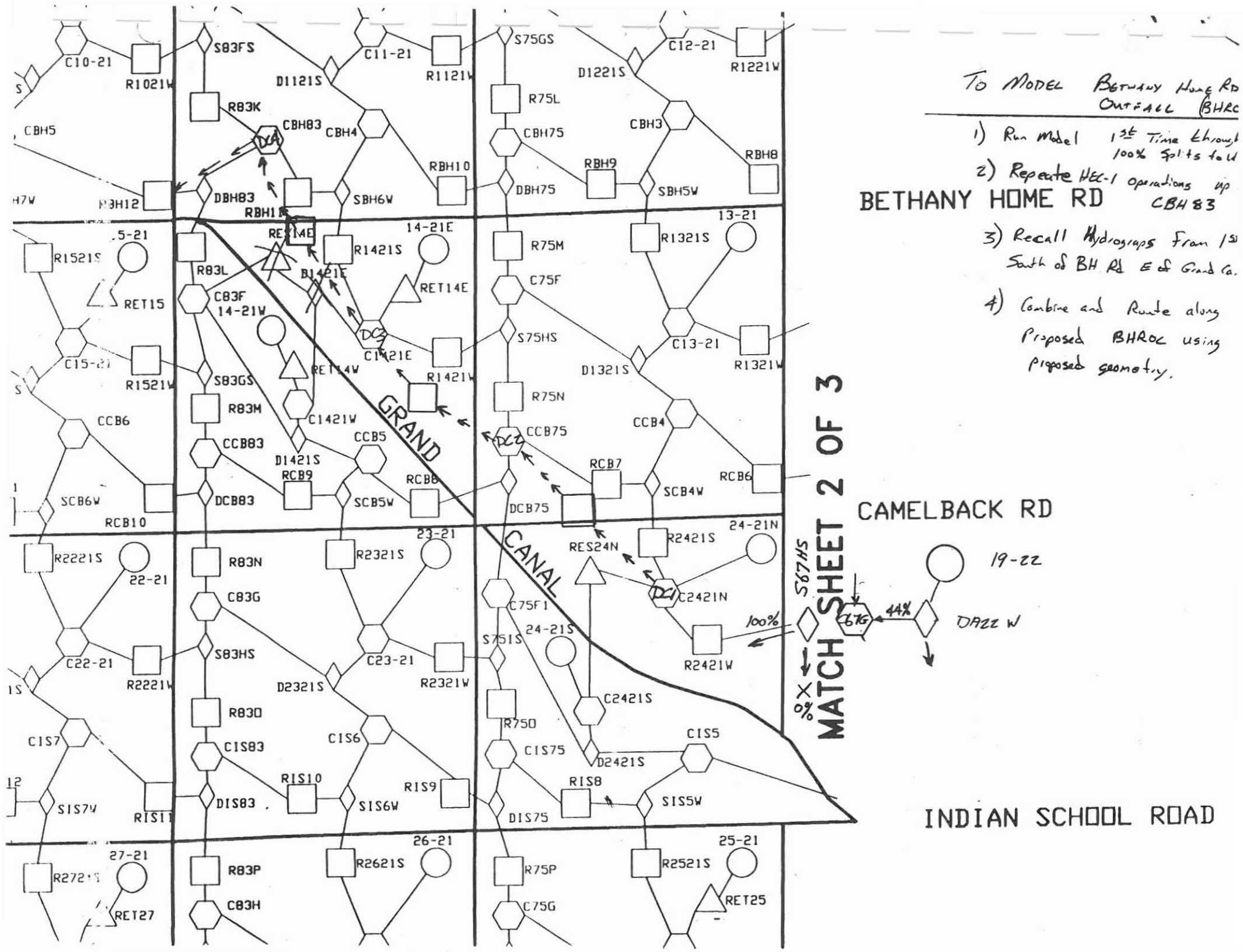
OPTION 4, 100-YR

w/ ON-LINE BASIN (67th 73rd Ave)



UTILIZING LEVEL II analysis of storage Volume: (Avg End method spreadsheet)

HEC-1 ID	HEC-RAS STA	FLOWRATES FOR EACH MODEL, cfs 100-YR 24hr GC00ZE		100-YR-24hr GC00C_ (Without Basin)
@67th GCDC1	N/A	1280 (Inflow)		1280
@73rd GCDC0	270+00 ~~261+05~~	540		N/A
@75th C@DC2	258+00	800		1621
@79th C@DC3	222+00	1545	1530	2294
RDC3-4		~~1540~~		--
@83 Rd C@DC4	184+00	2260	2330	2800
@91st CBH5	127+00	2880	2874	3530
Just U/s of AFF		366 + 2874	3240	366 + 3522
D9215 + RBH13	90+00	3240	3905	3890
@confluence @ AFF & RH			4405	
@99th CBH6	95+00	[illegible]		5231
@103rd CBH7	53+00	4670		5260
@107th C8-21W	45+00	4700		5280


To Model Bethany Home Rd Outfall (BHRO
1) Run Model 1st Time through 100% Splits to W
2) Repeate HEC-1 operations up CBH83
3) Recall Hydrographs from 1st South of BH Rd E of Grand Ca.
4) Combine and Route along Proposed BHROC using Proposed geometry.
BETHANY HOME RD
CAMELBACK RD
INDIAN SCHOOL ROAD
GRAND CANAL
MATCH SHEET 2 OF 3
S67HS
100%
44%
0%
DA22 W
19-22
C10-21
R1021W
S83FS
C11-21
R1121W
S75GS
C12-21
R1221W
D1121S
D1221S
R83K
CBH83
CBH4
R75L
CBH75
CBH3
RBH8
CBH5
RBH10
RBH9
DBH83
SBH6W
DBH75
SBH5W
RBH12
RBH11
RE14E
R1421S
14-21E
R75M
R1321S
13-21
R1521S
15-21
R83L
B1421E
RET14E
C75F
RET15
C83F
14-21W
C1421E
S75HS
C13-21
R1321W
C15-21
R1521W
S83GS
RET14W
R1421W
D1321S
R83M
R75N
C1421W
CCB6
CCB83
CCB5
CCB75
CCB4
D1421S
RCB9
RCB8
RCB7
RCB6
SCB6W
DCB83
SCB5W
DCB75
SCB4W
RCB10
R2221S
22-21
R83N
R2321S
23-21
RES24N
R2421S
24-21N
C83G
C75F1
C2421N
S67HS
C22-21
R2221W
S83HS
C23-21
R2321W
S75IS
24-21S
R2421W
D2321S
C2421S
R83O
R75O
C1S7
C1S83
C1S6
C1S75
D2421S
C1S5
RIS10
RIS9
RIS8
SIS7W
RIS11
DIS83
SIS6W
DIS75
SIS5W
27-21
26-21
25-21
R83P
R2621S
R75P
R2521S
RET27
C83H
C75G
RET25

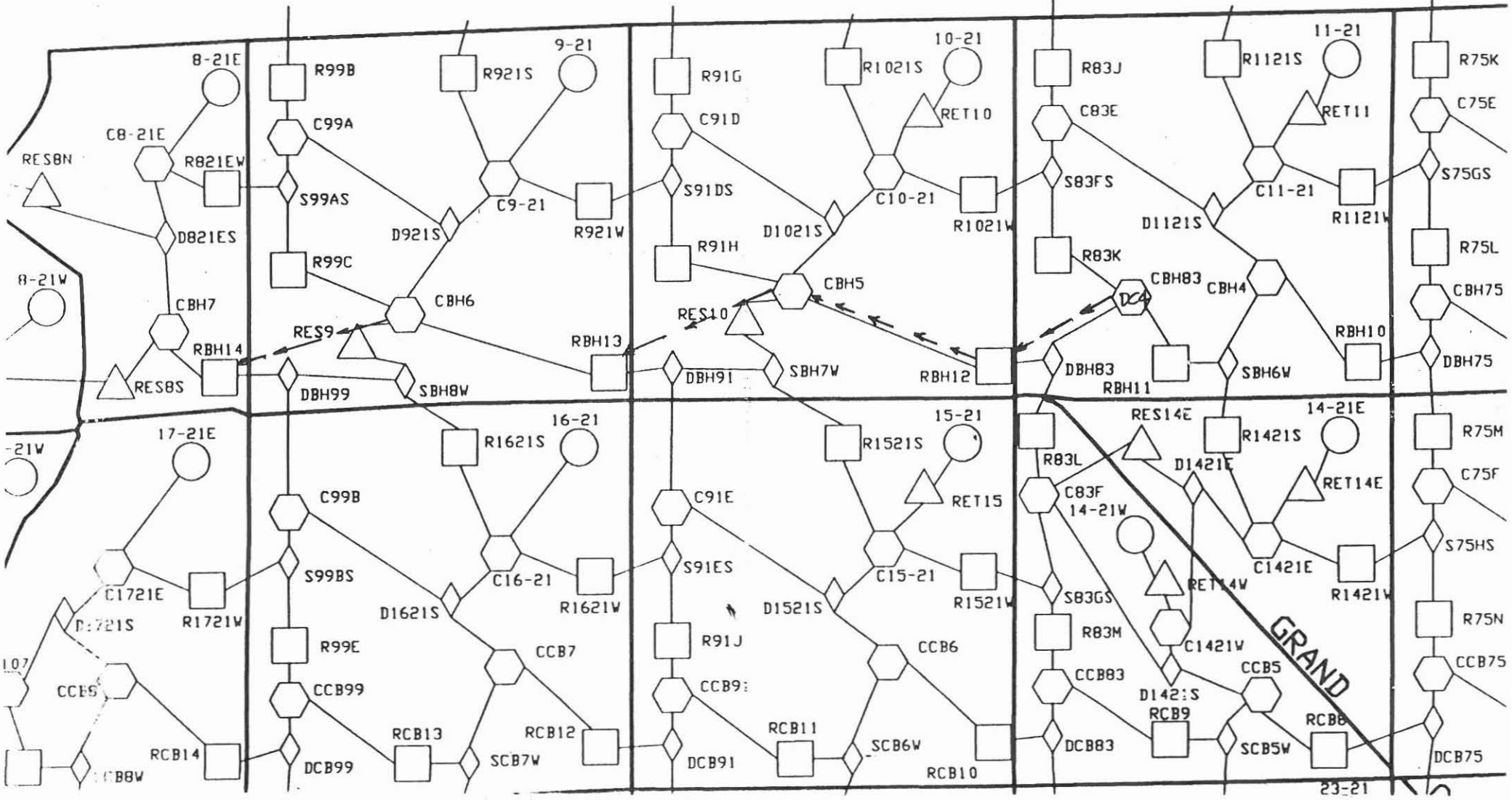
99th AVE

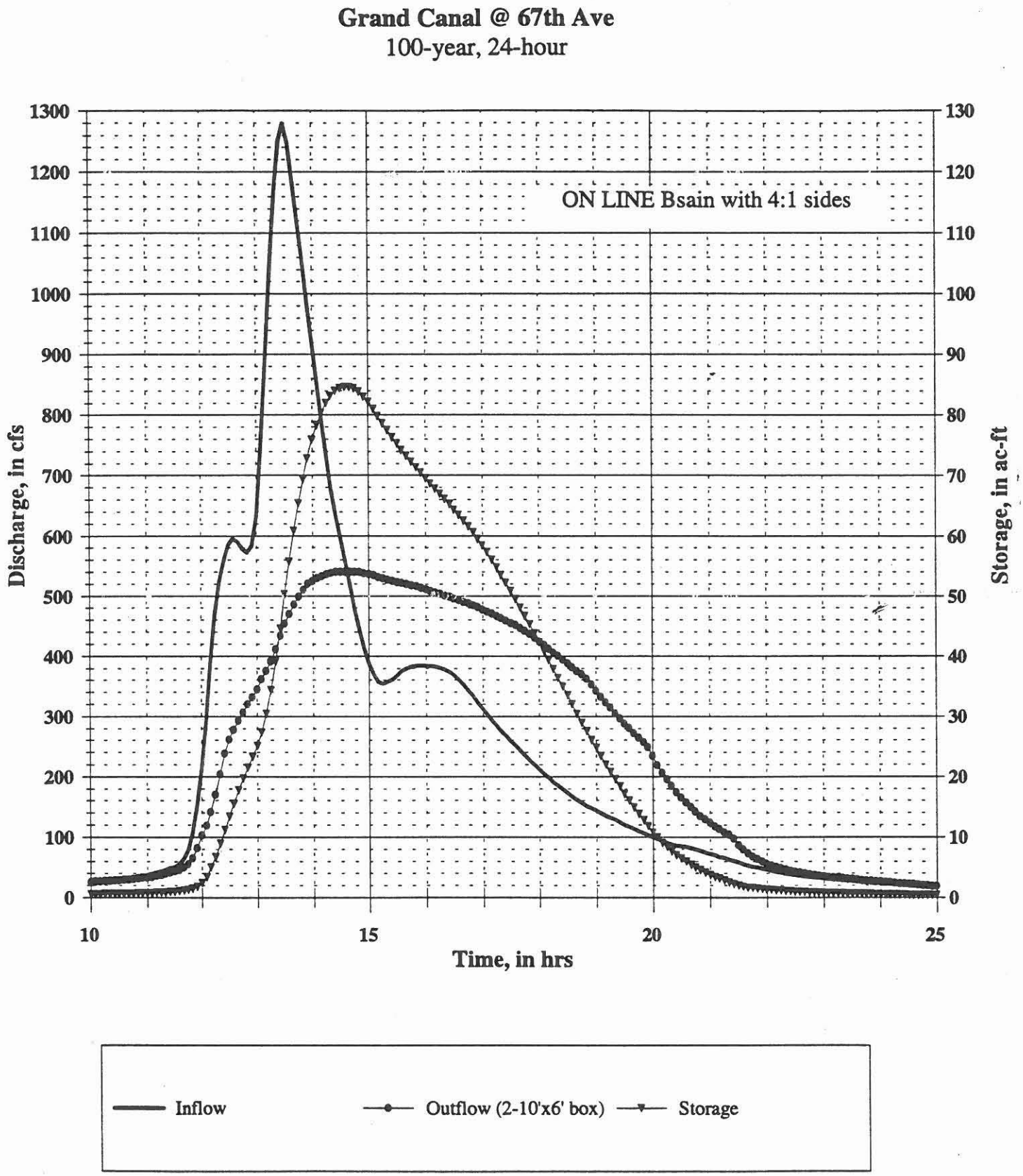
91st AVE

83rd AVE

75th AVE

MATCH SHEET 1 OF 3




Grand Canal @ 67th Ave
100-year, 24-hour
ON LINE Bsain with 4:1 sides
Discharge, in cfs
Storage, in ac-ft
Time, in hrs
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
130
120
110
100
90
80
70
60
50
40
30
20
10
0
10
15
20
25
Inflow
Outflow (2-10'x6' box)
Storage

Wood/Patel and Associates Inc.

MARYVALE AREA DRAINAGE MASTER STUDY

Flood Control District of Maricopa County 24-Aug-97

FLOOD MITIGATION OPTIONS **Contract FCD 93-29**
LEVEL II ANALYSIS, OPTION 4, 100-yr **W/P # 94154.00**

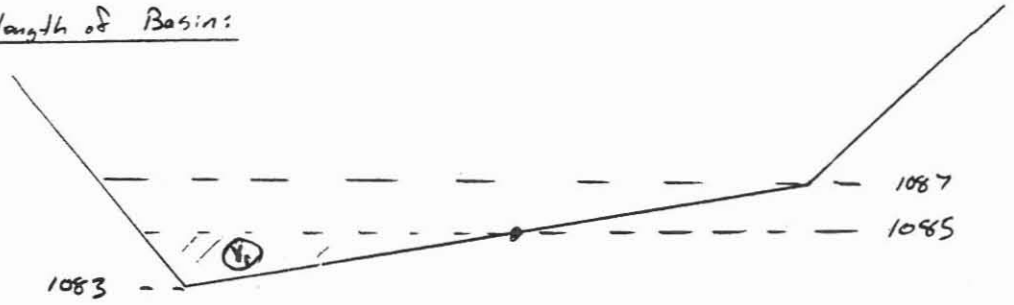
STUDY AREA: Grand Canal, 67th Avenue to 87th Avenue

South Detention Basin

Average Bottom Width =	42 ft
Average Bottom Length =	4900 ft
Side Slope =	4 :1 (h:v)
Average Basin Bottom =	1085 ft Elev
High Water =	1094 ft Elev
Average Natural Ground =	1096 ft Elev
Basin Type =	1 1 = Rectangular, 2 = Triangular

Depth to Bottom (Feet)	Water Surface Elevation	Surface Area (Acres)	Storage Volume Incrimental (Ac-ft)	Storage Volume Cumulative (Ac-ft)	Earth Work Volume Incrimental (CY)	Earth Work Volume Cumulative (CY)
0	1085	4.7	0.0	~~0.0~~ 2.4	0	0
1	1086	5.6	5.6	~~5.6~~ Don't use	9,046	9,046
2	1087	6.5	6.5	12.1	10,517	19,563
3	1088	7.4	7.4	19.6	11,993	31,556
4	1089	8.4	8.4	27.9	13,474	45,030
5	1090	9.3	9.3	37.2	14,960	59,990
6	1091	10.2	10.2	47.4	16,450	76,440
7	1092	11.1	11.1	58.5	17,945	94,385
8	1093	12.1	12.1	70.6	19,445	113,830
9	1094	13.0	13.0	83.5	20,949	134,779
10	1095	13.9	13.9	-- 97.4	22,459	157,237
11	1096	14.9	14.9	--	23,973	181,210
12	1097	15.8	15.8	--	25,491	--
13	1098	16.7	16.7	--	27,015	--
14	1099	17.7	17.7	--	28,543	--
15	1100	18.6	18.6	--	30,076	--
16	1101	19.6	19.6	--	31,614	--
17	1102	20.6	20.6	--	33,156	--
18	1103	21.5	21.5	--	34,703	--

Section along length of Basin:



Bottom A = 4.7 Ac

Thus $V_1 = \left(\frac{4.7\ Ac}{2}\right) 1\ ft = 2.4\ Ac\text{-}ft$ @ EL 1085

WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

PROJECT Maryvale Adms

PROJECT NO. 94154 SHEET NO. 1 OF 1

CALCULATED BY DTP DATE 25 Sept 97 CHECKED BY _____ DATE _____

Grand Canal

On-Line Basin north of Grand Canal from 67th - 73rd Avenues.

Proposed Basin Hydrologic characteristics

→	SV	0	2.4	12	28	47	71	97
→	SE	1083	1085	1087	1089	1091	1093	1095
	SQ	0	153	378	549	666	774	846

Using 3-6'x3' Box: Outflow = 719 cfs @ 1092 ft Too much, Try 2-6'x3' Box

---

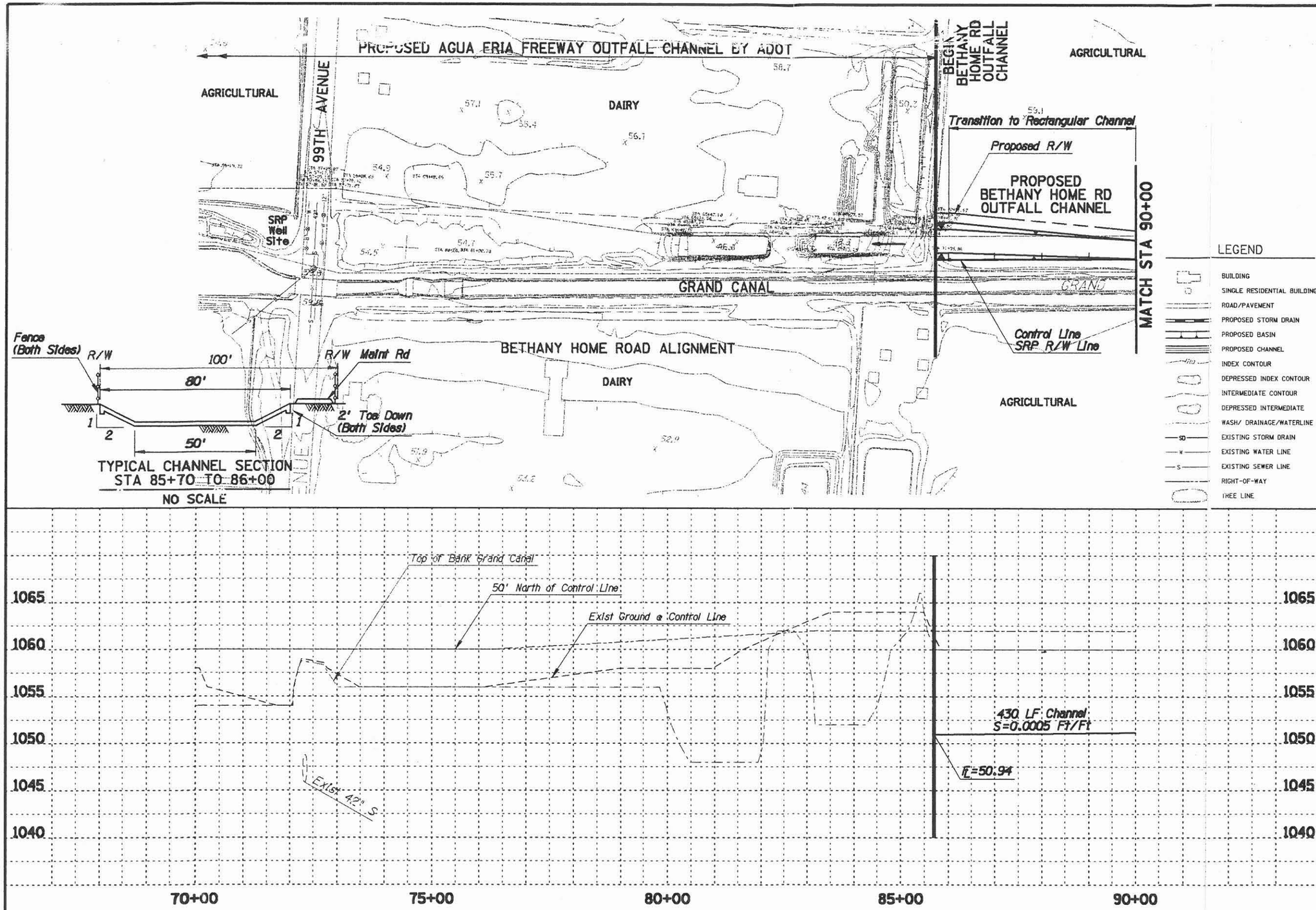
Using 2-6'x3' Box Culvert

→	SQ =	0	102	252	366	444	516	564

Outflow = 541 cfs @ 1094 ft

Note: → use these HEC-1 cards to model Proposed Basin.

HEC-1 File = H:\MVLADMP\HEC1GC\GC0ØZE.ihl



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- THEE LINE

NOTE:
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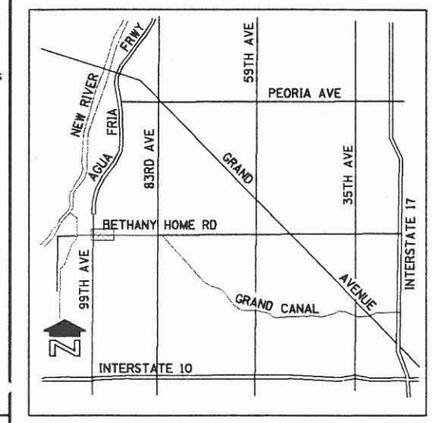
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

MARYVALE AREA DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION LEVEL III

GRAND CANAL 67TH AVENUE TO AGUA FRIA FREEWAY

MITIGATION OPTION 4, 100-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL - 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

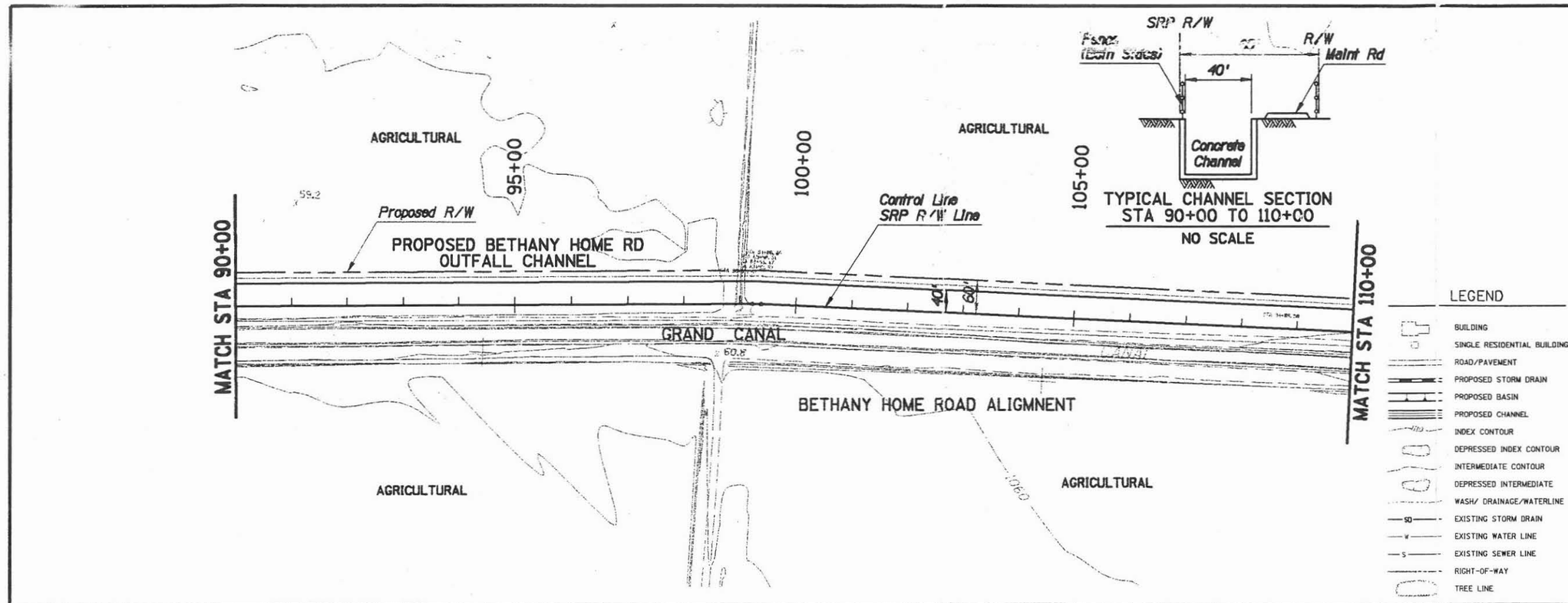
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

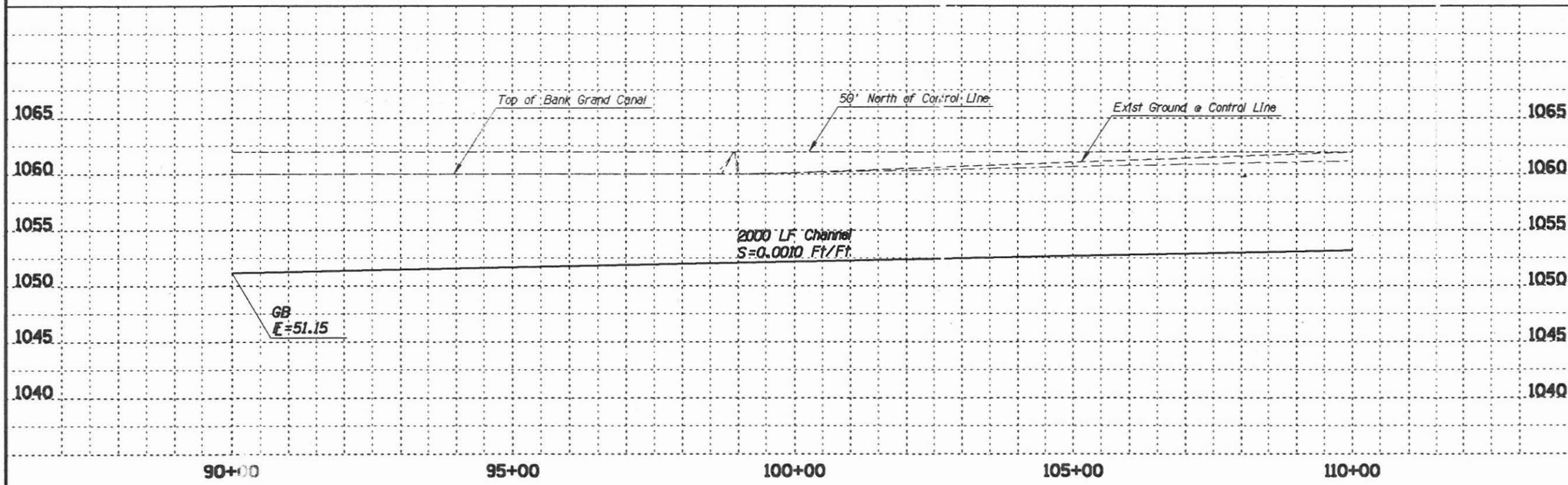
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 85+70 TO 90+00

FIGURE 9 | SHEET 31 OF 44

TRACS NO.





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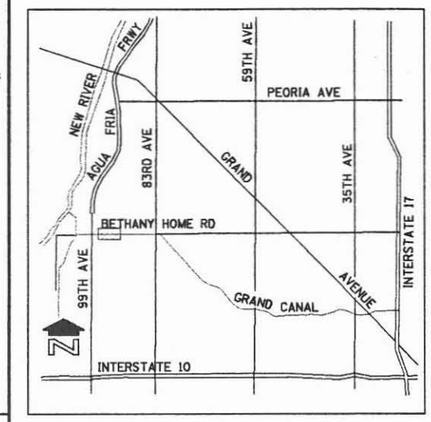
SCALE OF 1INCH=200 FEET WITH A 2 FO[illegible] NTERVAL. [illegible]APPING WAS PREPARED
BY KENNEY AERIAL MAPPING AND IS BAS[illegible] CONTRO[illegible] URVEY DATA PROVIDED
BY KAMINSKI-HUBBARD ENGINEERING INC. [illegible] ENGINEER[illegible] CONSULTANTS, LTD.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND CANAL 67TH AVENUE TO AGUA FRIA FREEWAY

MITIGATION OPTION 4, 100-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
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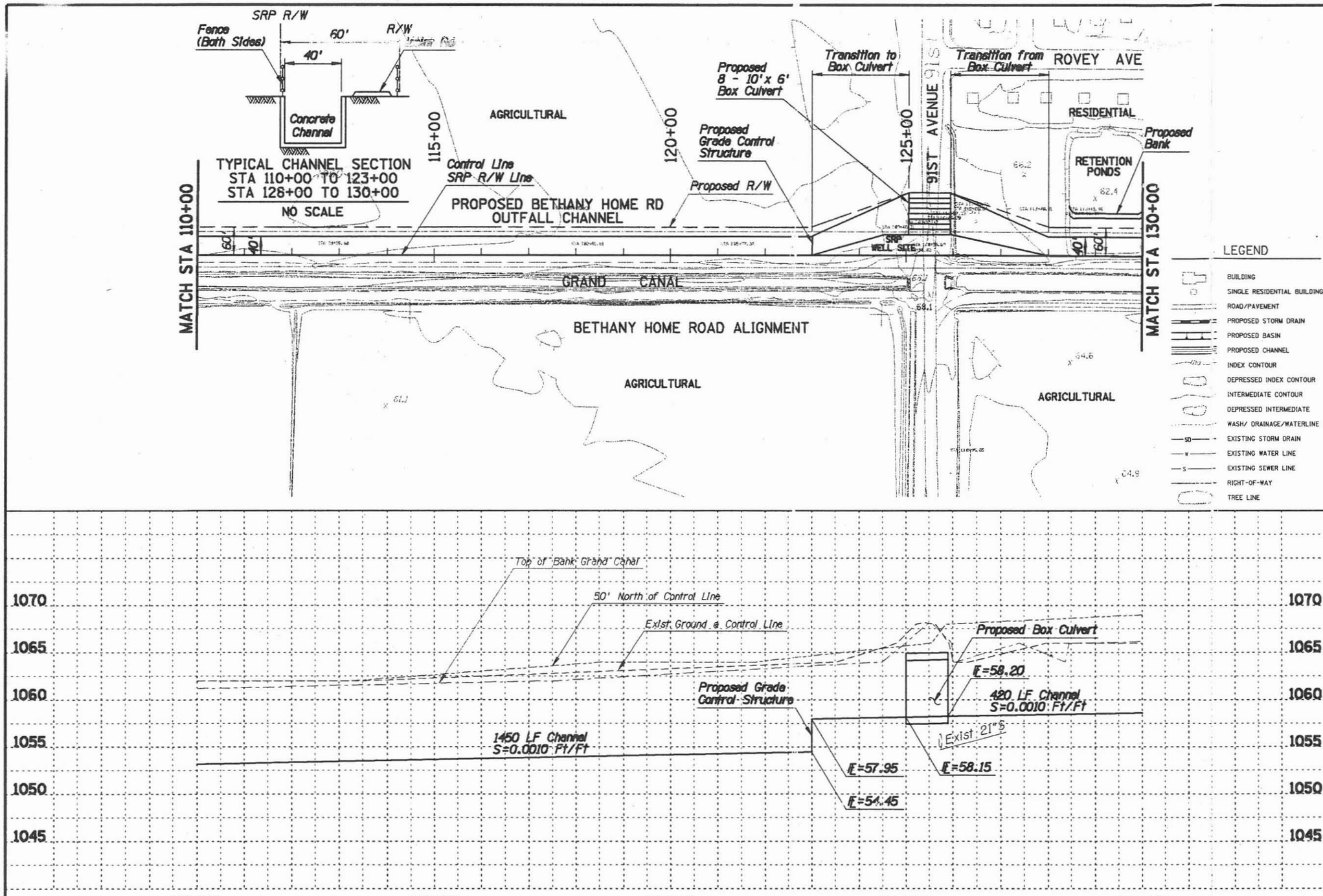
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN STA 90+00 TO 110+00	FIGURE	SHEET OF
	9	32 44

TRACS NO.



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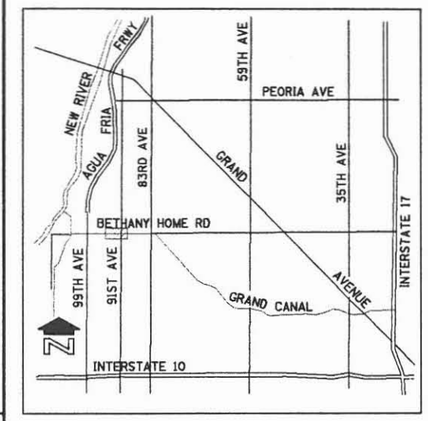
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND CANAL 67TH AVENUE TO AGUA FRIA FREEWAY

MITIGATION OPTION 4, 100-YEAR

N

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
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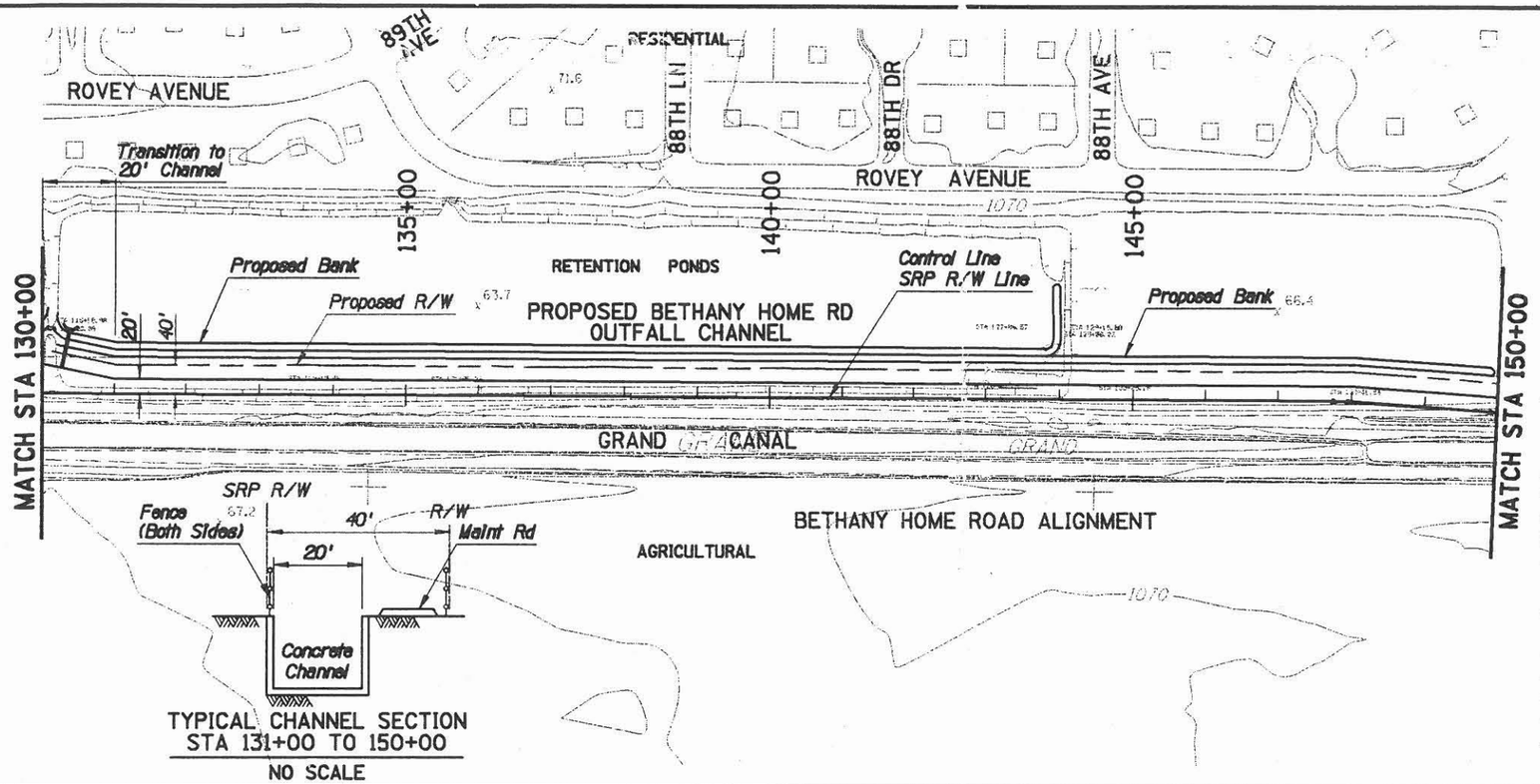
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

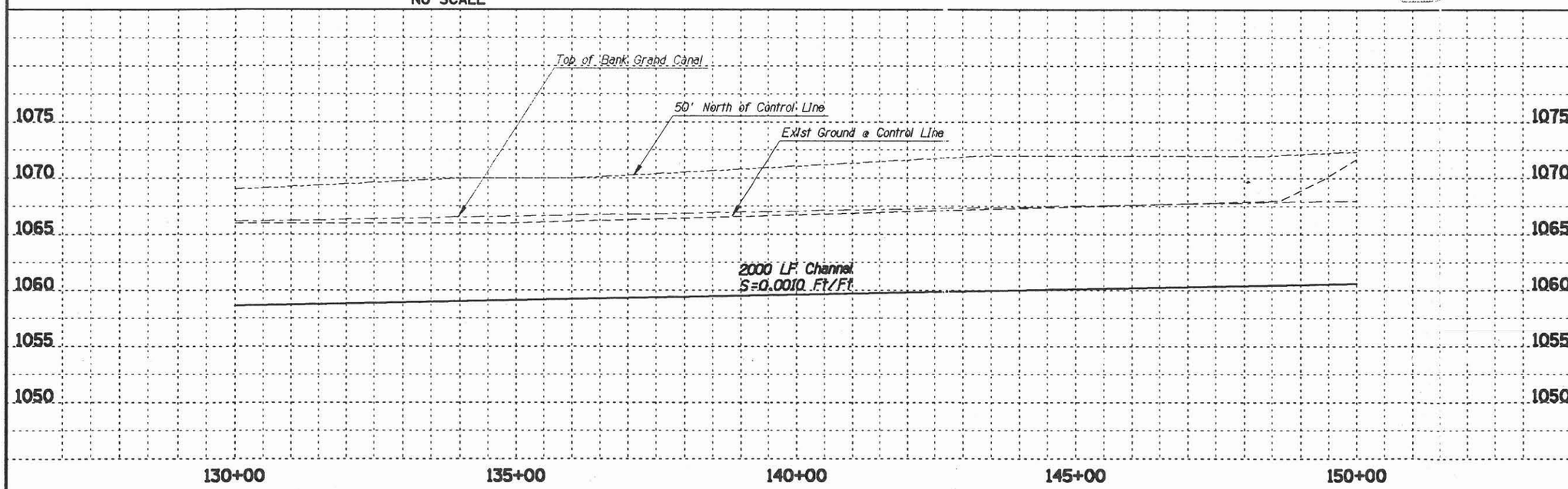
DRAINAGE SYSTEM PLAN STA 110+00 TO 130+00	FIGURE	SHEET OF
	9	33 44

TRACS NO.



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE



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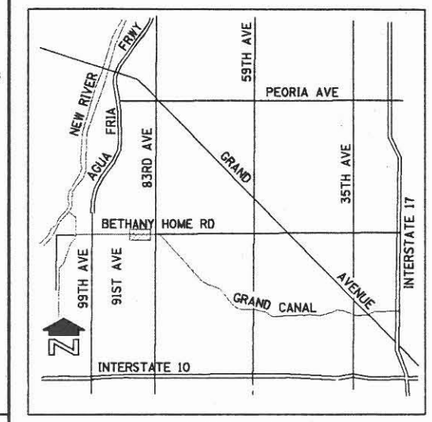
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND CANAL 67TH AVENUE TO AGUA FRIA FREEWAY

MITIGATION OPTION 4, 100-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
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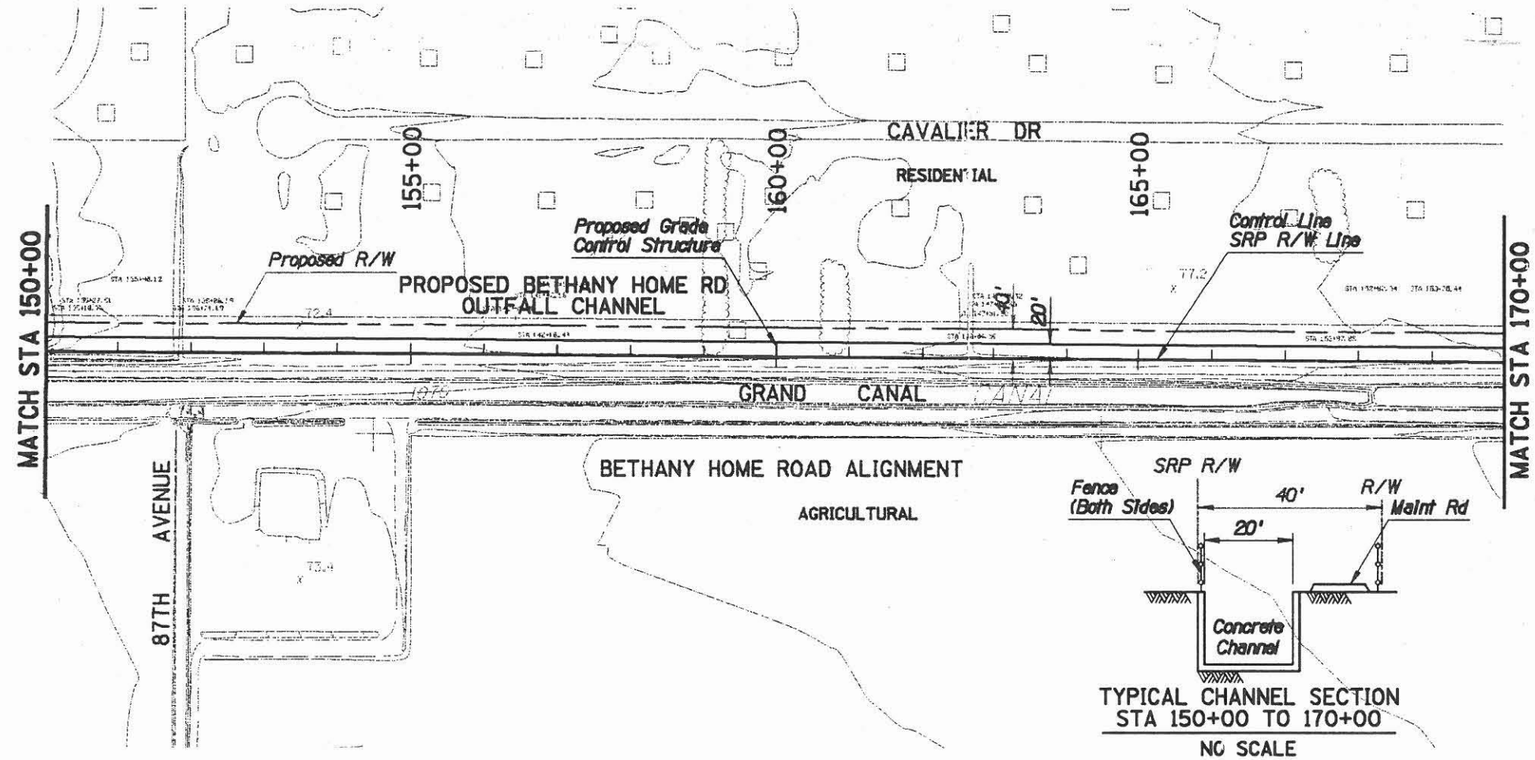
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 130+00 TO 150+00

FIGURE 9 | SHEET 34 OF 44

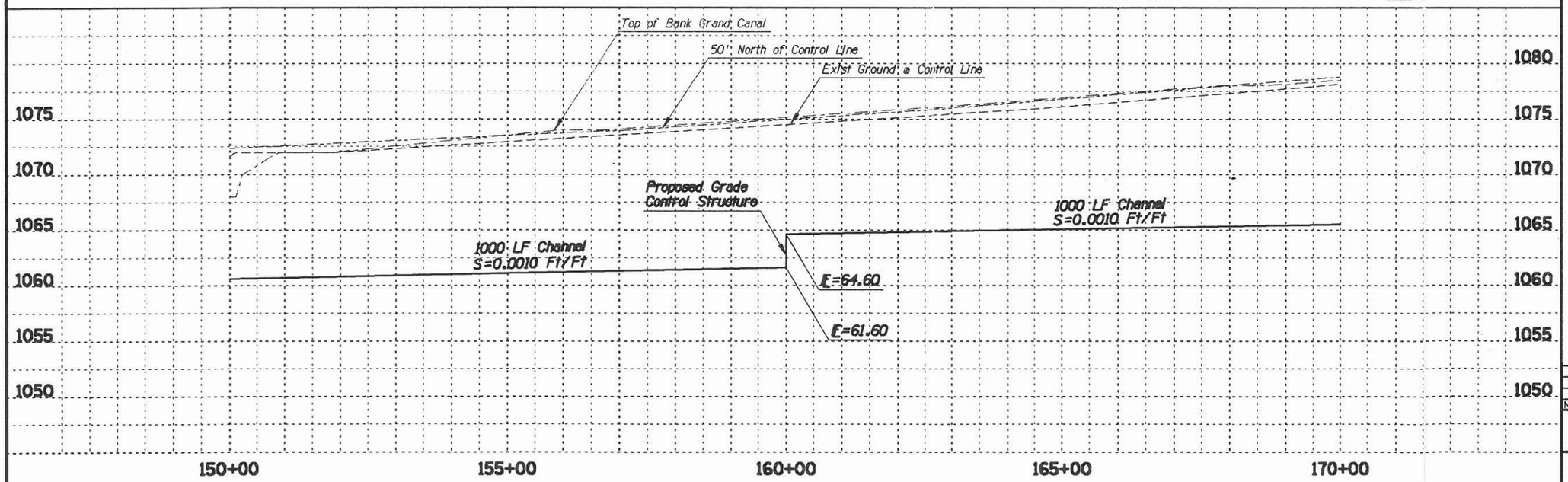
TRACS NO.



TYPICAL CHANNEL SECTION
STA 150+00 TO 170+00
NO SCALE

LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE



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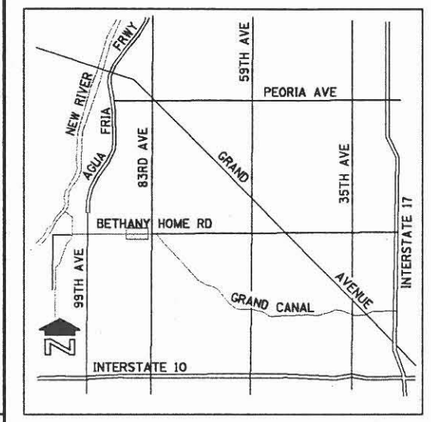
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

MARYVALE AREA DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION LEVEL III

GRAND CANAL 67TH AVENUE TO AGUA FRIA FREEWAY

MITIGATION OPTION 4, 100-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

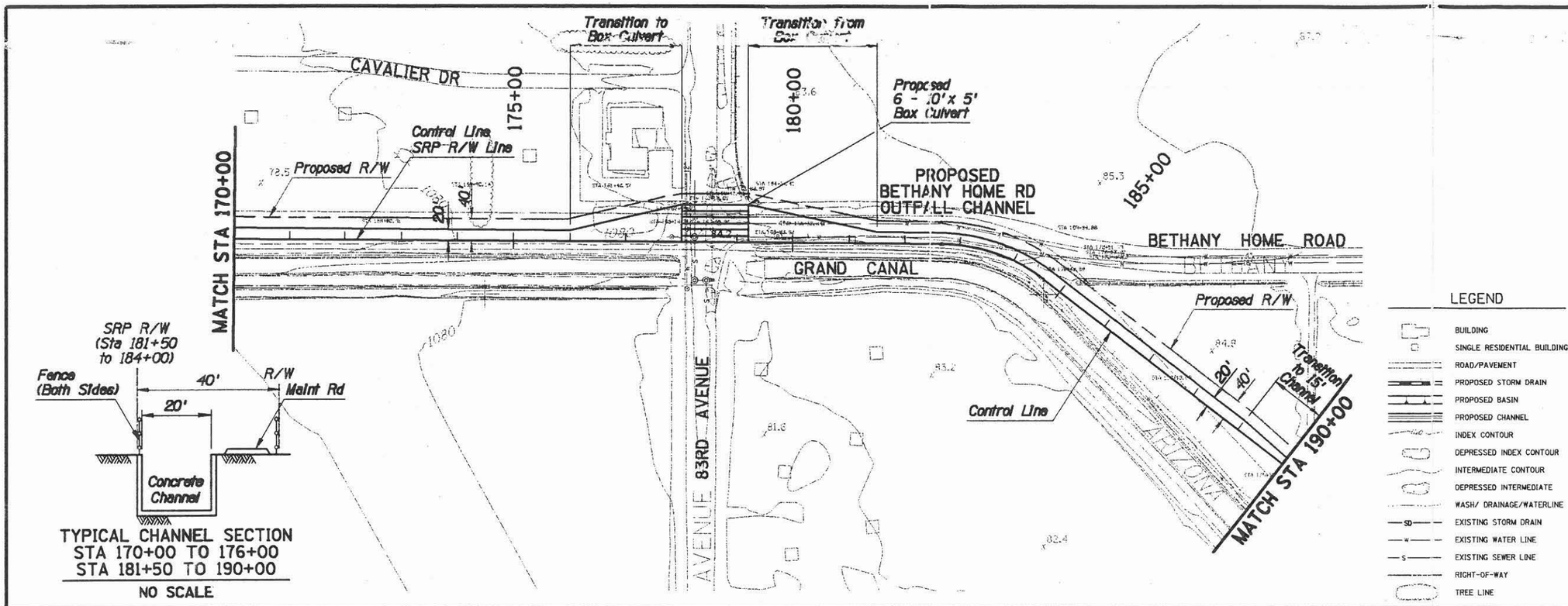
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 150+00 TO 170+00

FIGURE 9 | SHEET 35 OF 44

TRACS NO.

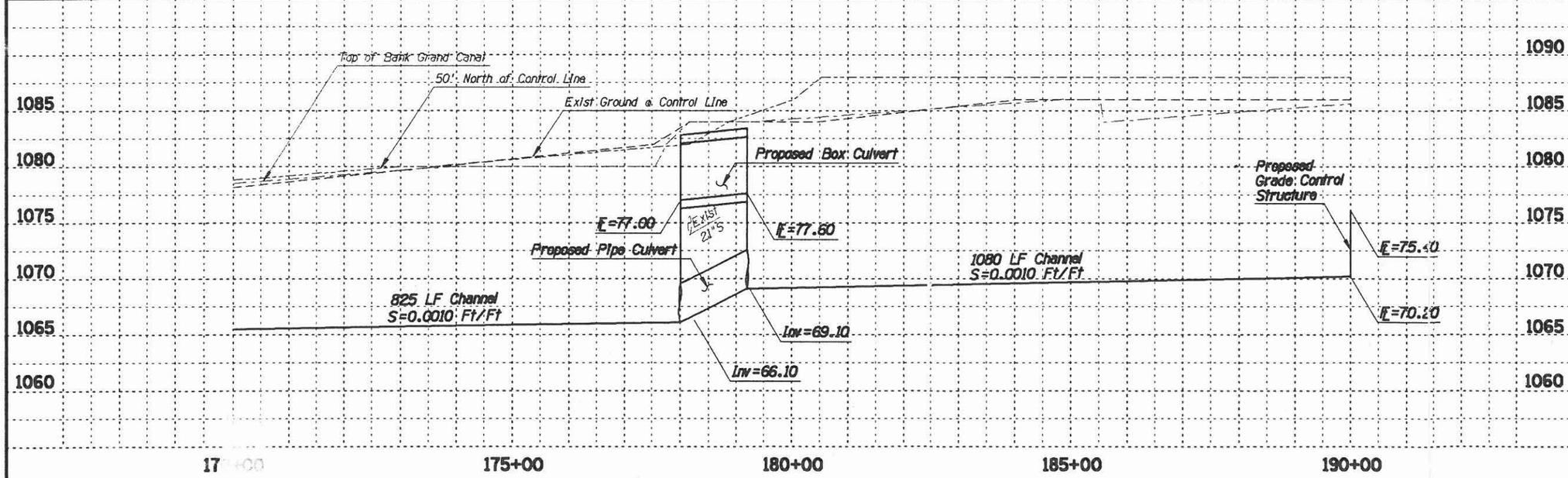


TYPICAL CHANNEL SECTION
STA 170+00 TO 176+00
STA 181+50 TO 190+00

NO SCALE

LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE



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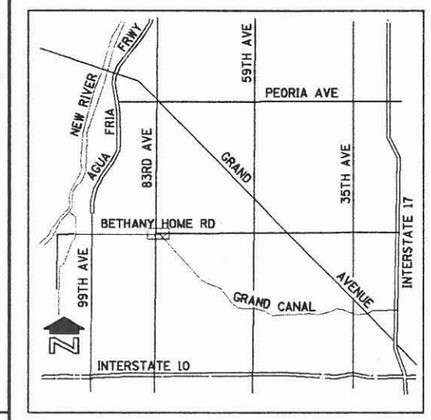
BY KENNEY AERIAL MAPPING AND IS [illegible]N GROUND CONTROL SURVEY DATA PROVIDED
BY KAMINSKI-HUBBARD ENGINEERING I[illegible] [illegible]ROJECT ENGINEERING CONSULTANTS, LTD.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

MARYVALE AREA DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION LEVEL III

GRAND CANAL 67TH AVENUE TO AGUA FRIA FREEWAY

MITIGATION OPTION 4, 100-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

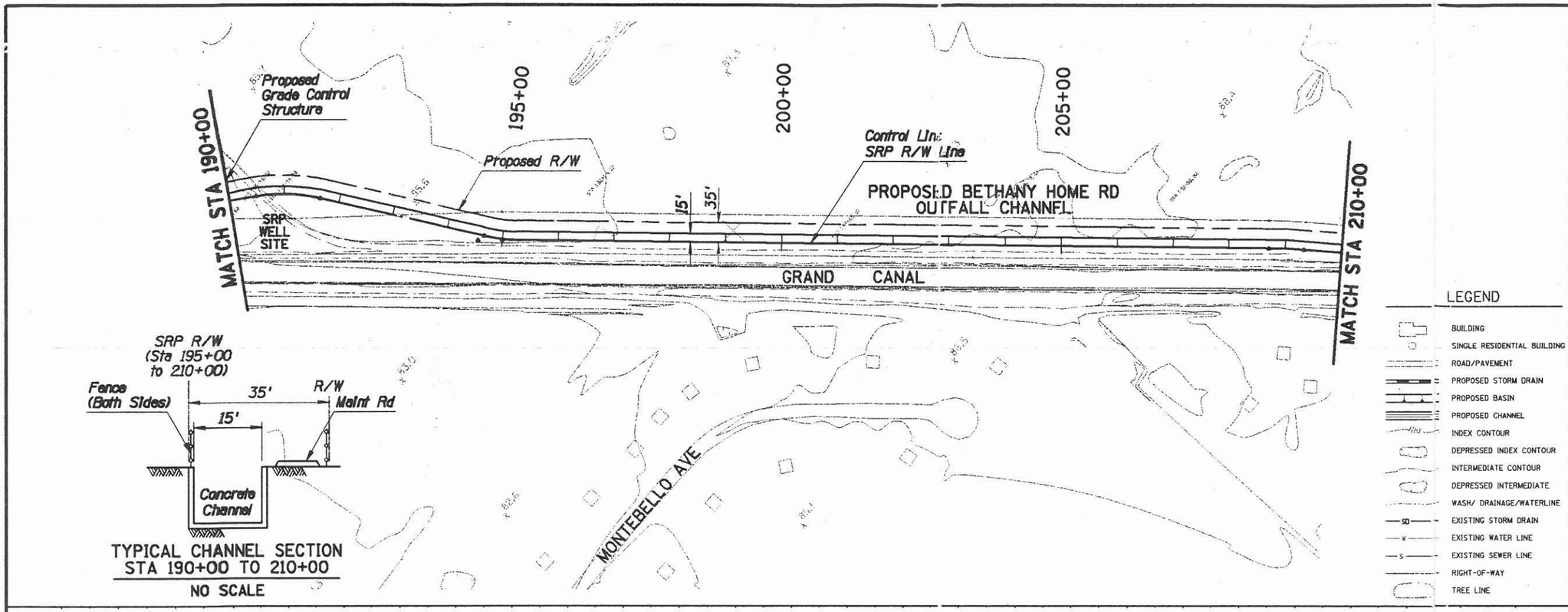
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

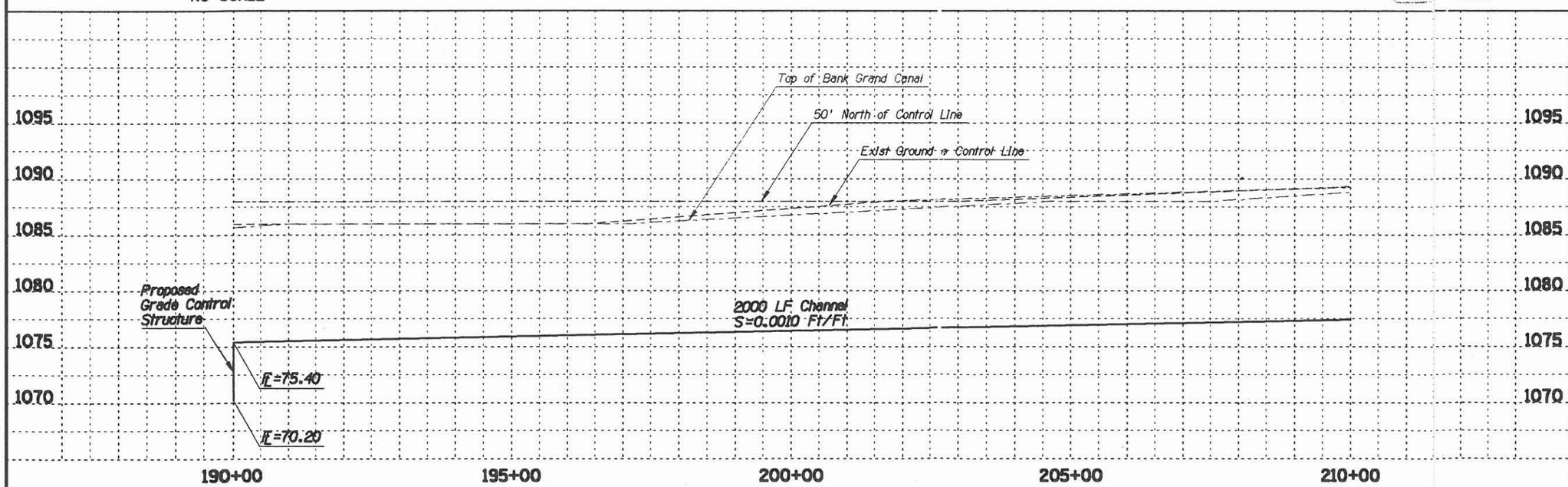
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 170+00 TO 190+00

FIGURE 9 | SHEET 36 OF 44

TRACS NO.





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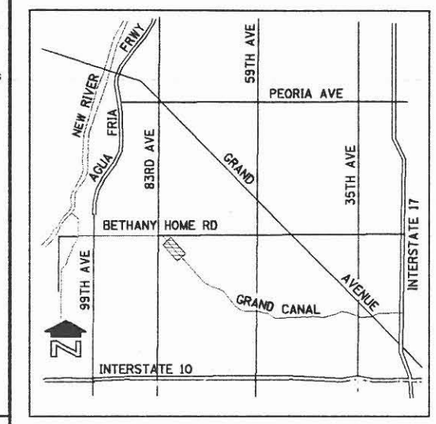
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

MARYVALE AREA DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION LEVEL III

GRAND CANAL 67TH AVENUE TO AGUA FRIA FREEWAY

MITIGATION OPTION 4, 100-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

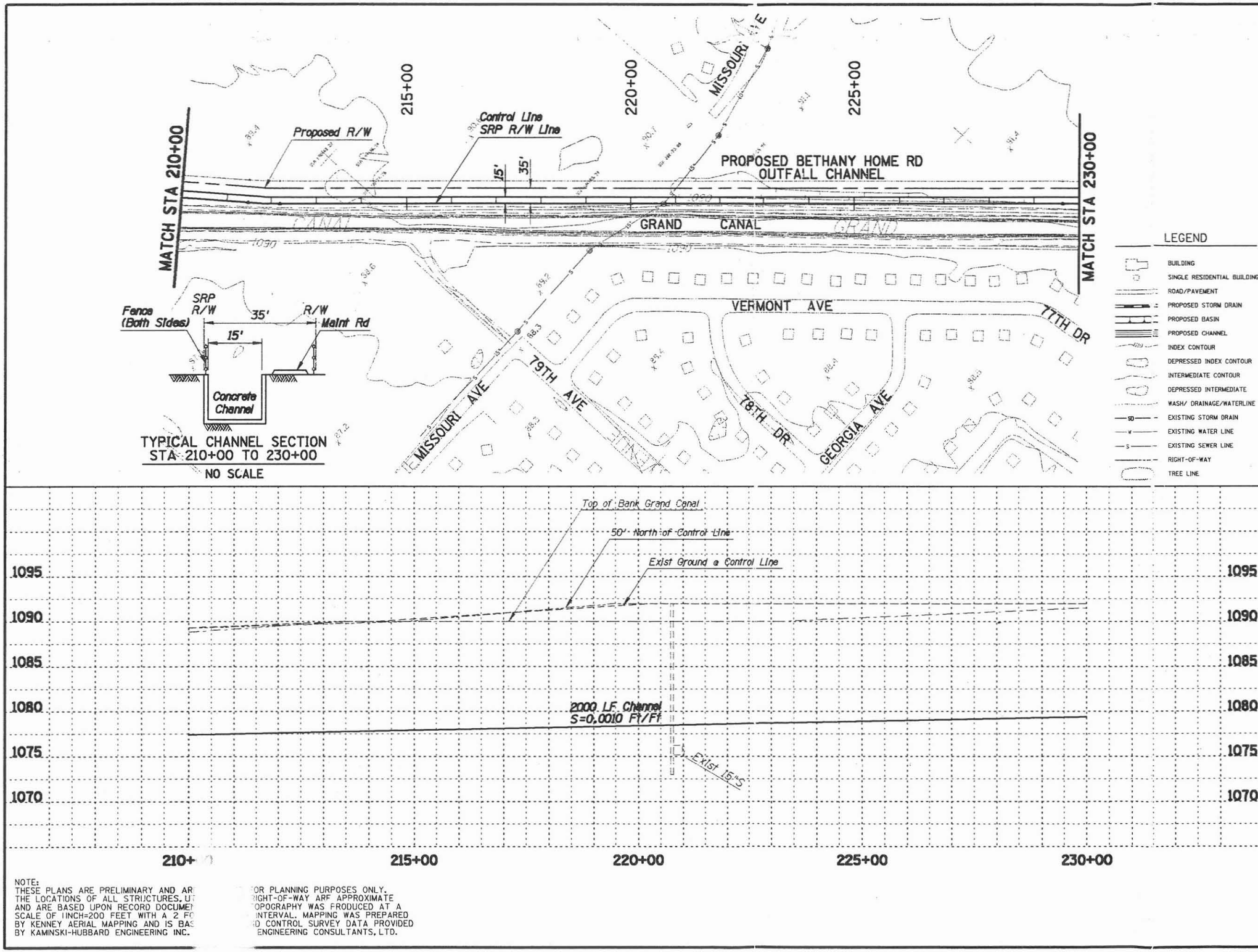
CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 190+00 TO 210+00

FIGURE 9 SHEET 37 OF 44

TRACS NO.



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THE LOCATIONS OF ALL STRUCTURES, U
AND ARE BASED UPON RECORD DOCUME
SCALE OF 1INCH=200 FEET WITH A 2 F
BY KENNEY AERIAL MAPPING AND IS BA
BY KAMINSKI-HUBBARD ENGINEERING INC.

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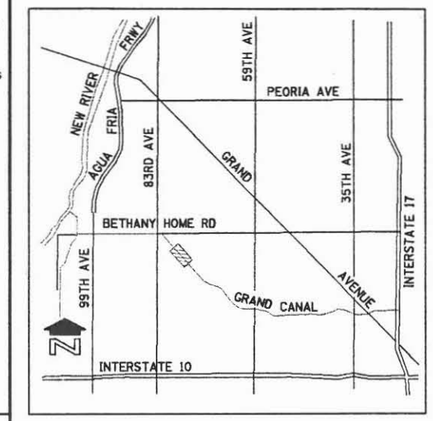
D CONTROL SURVEY DATA PROVIDED
ENGINEERING CONSULTANTS, LTD.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND CANAL 67TH AVENUE TO AGUA FRIA FREEWAY

MITIGATION OPTION 4, 100-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
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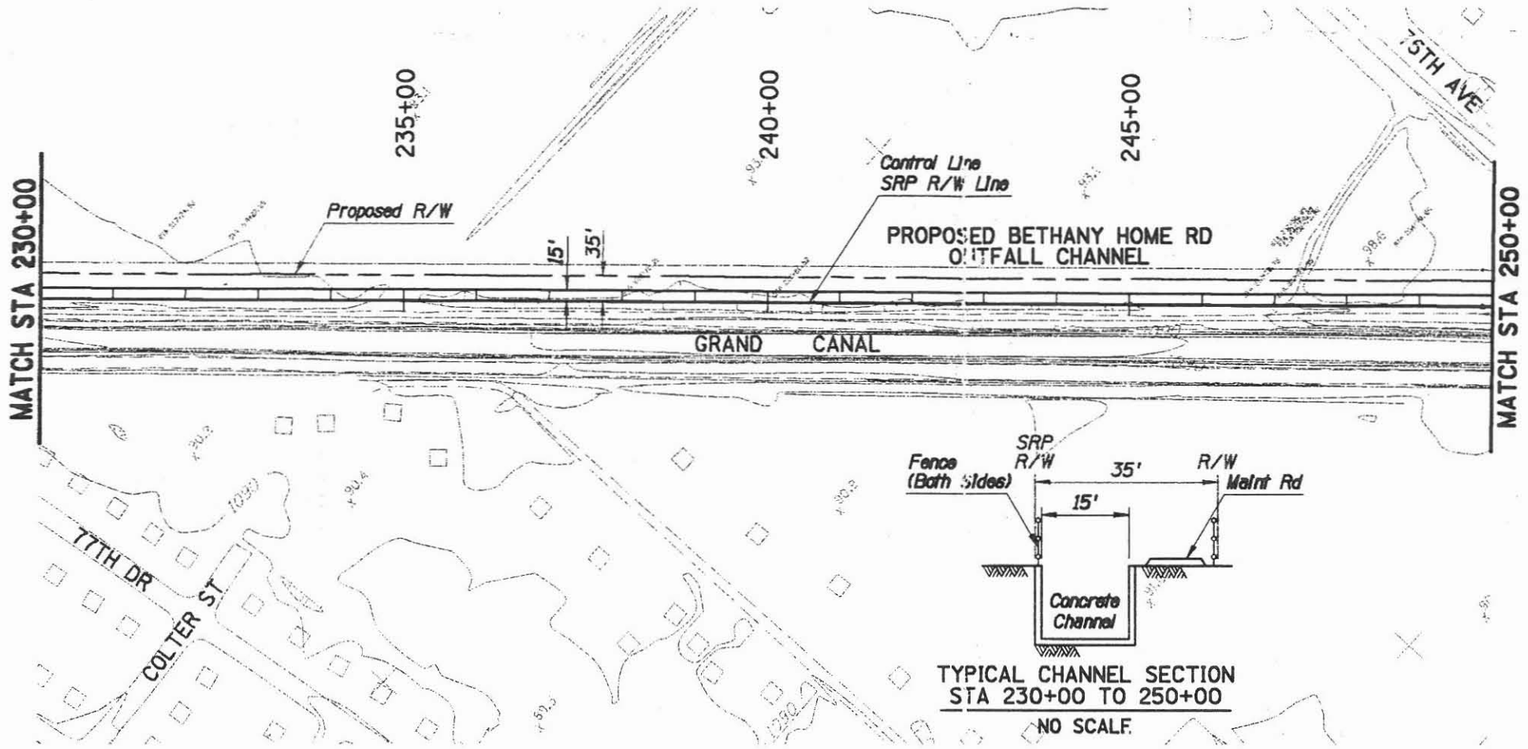
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 210+00 TO 230+00

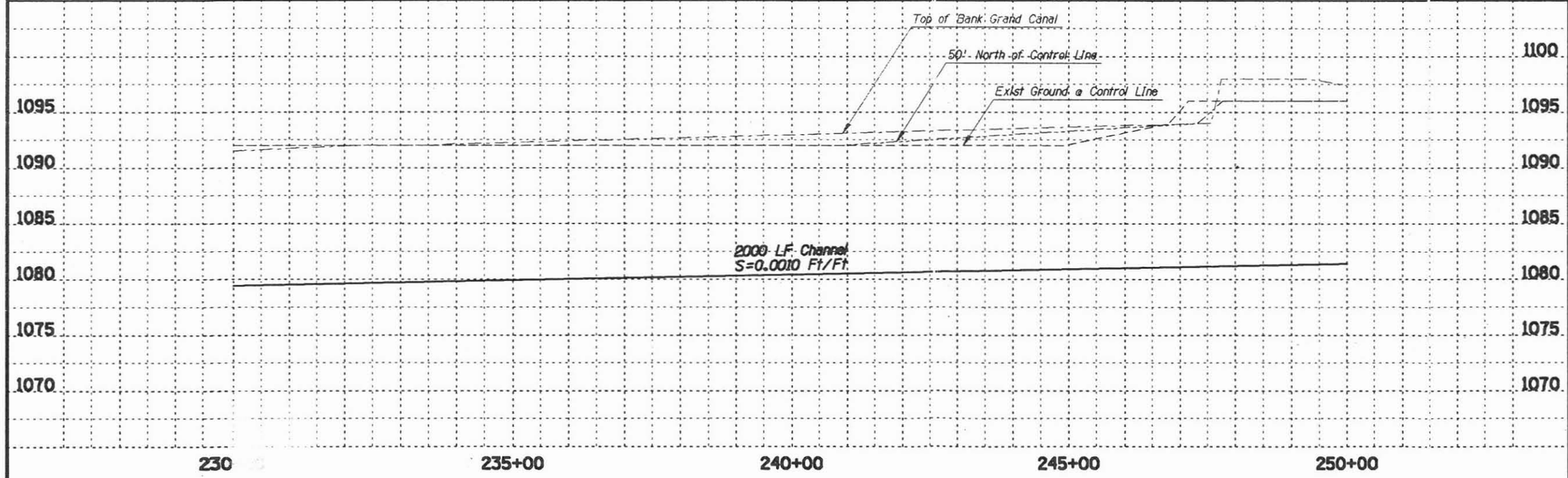
FIGURE 9 | SHEET 38 OF 44

TRACS NO.



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE



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R PLANNING PURPOSES ONLY.
GHT-OF-WAY ARE APPROXIMATE
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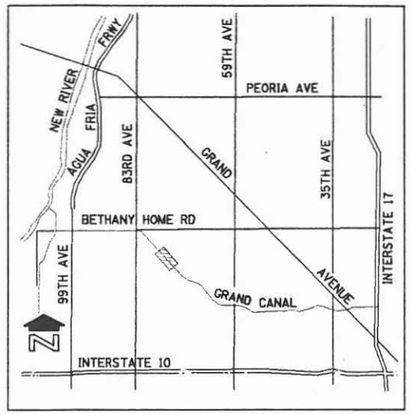
NTERVAL. MAPPING WAS PREPARED
O CONTROL SURVEY DATA PROVIDED
ENGINEERING CONSULTANTS, LTD.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND CANAL 67TH AVENUE TO AGUA FRIA FREEWAY

MITIGATION OPTION 4, 100-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
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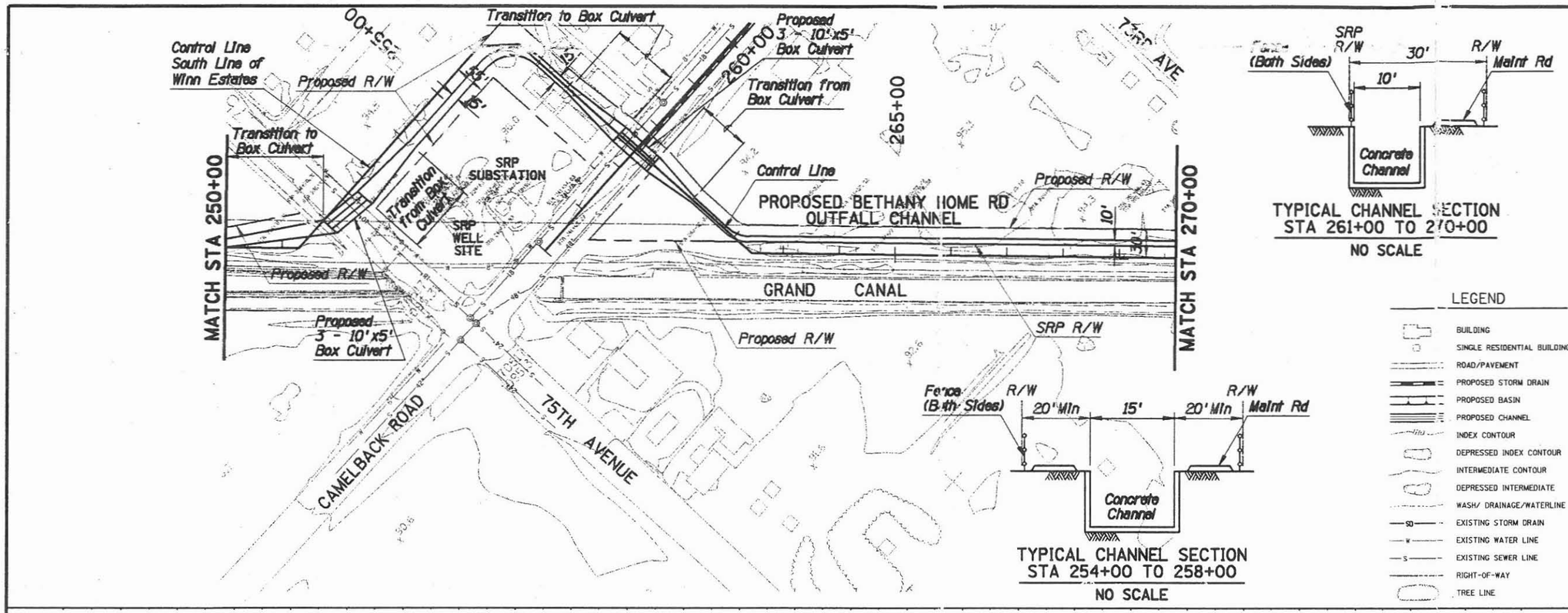
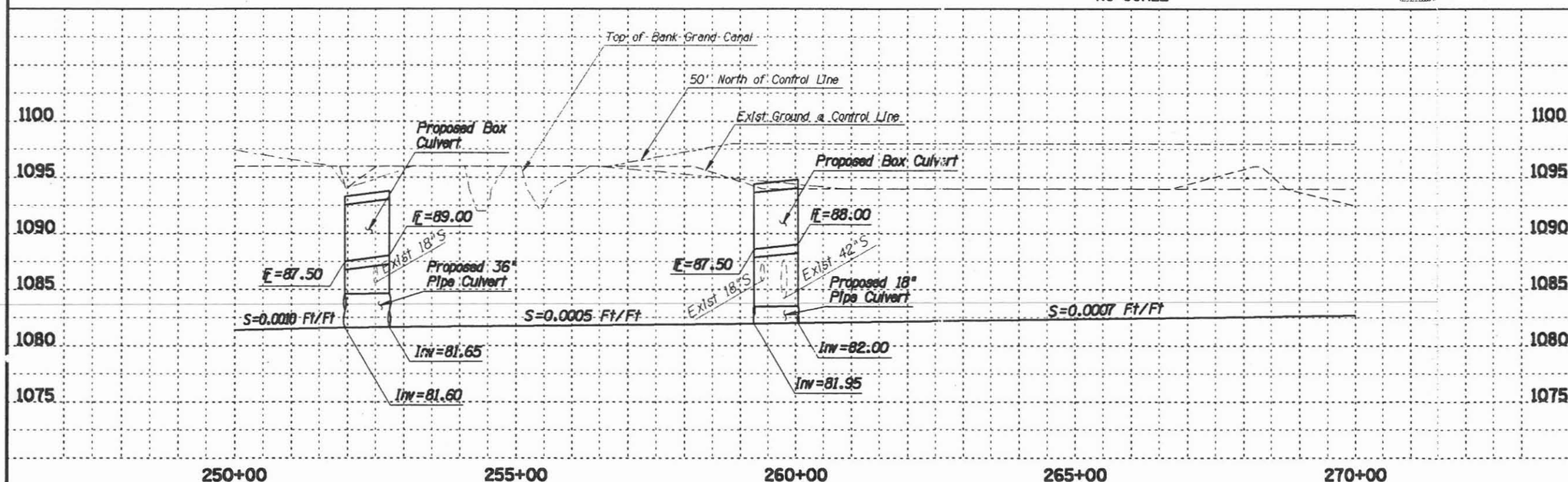
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 230+00 TO 250+00

FIGURE 9 | SHEET 39 OF 44

TRACS NO.





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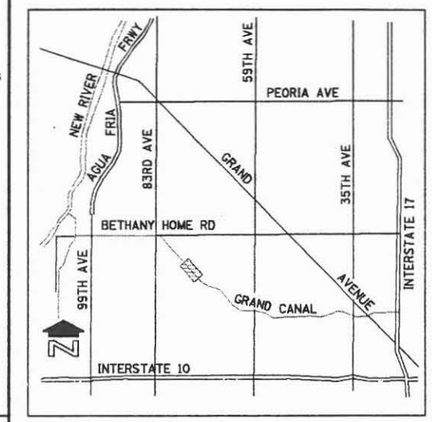
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND CANAL 67TH AVENUE TO AGUA FRIA FREEWAY

MITIGATION OPTION 4, 100-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
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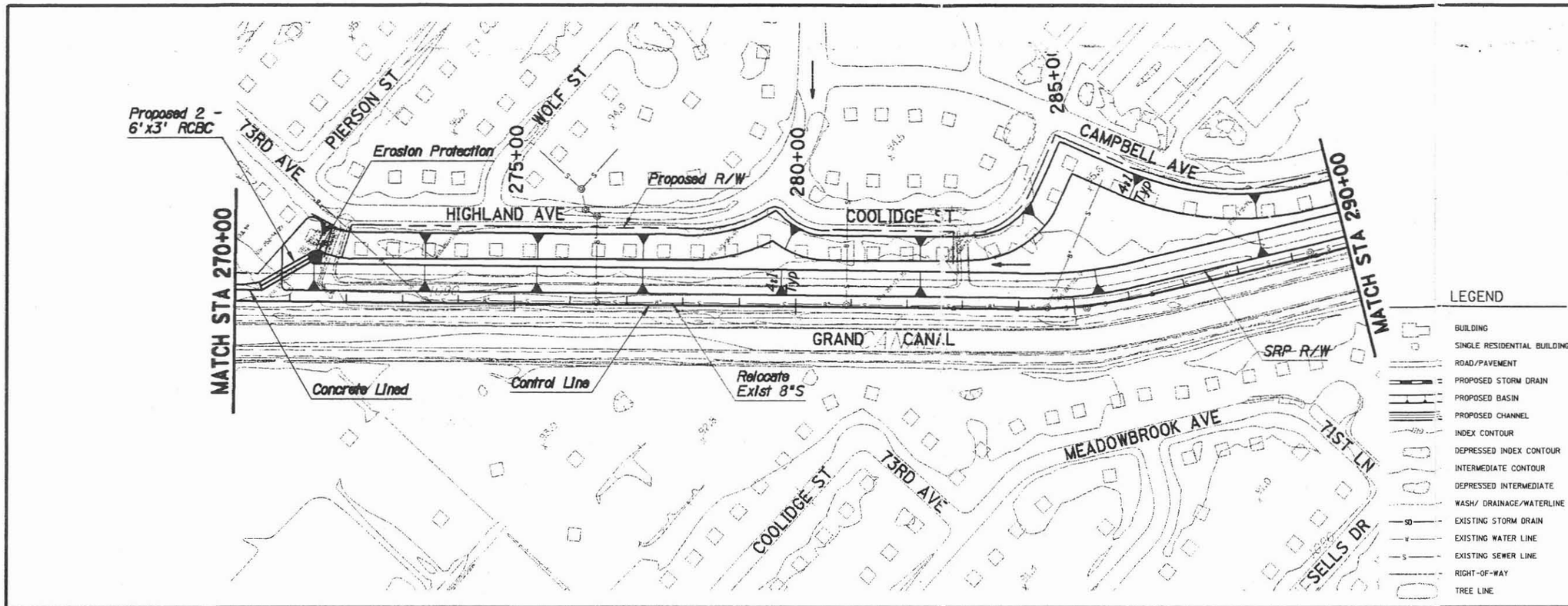
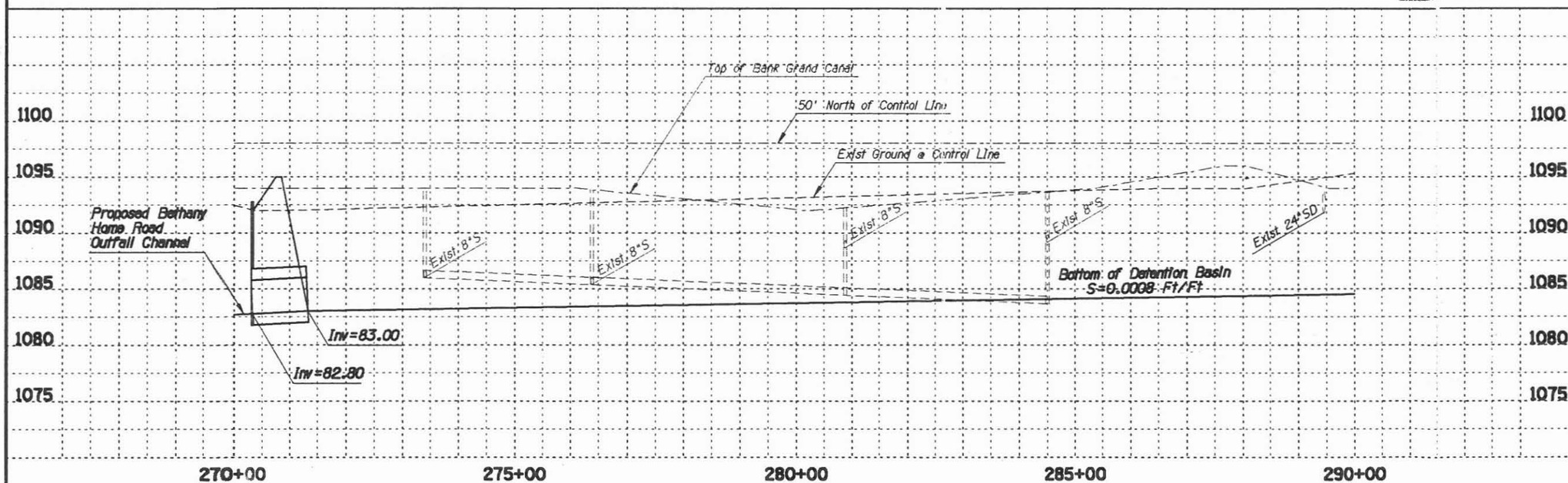
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 250+00 TO 270+00

FIGURE 9 | SHEET 40 OF 44

TRACS NO.





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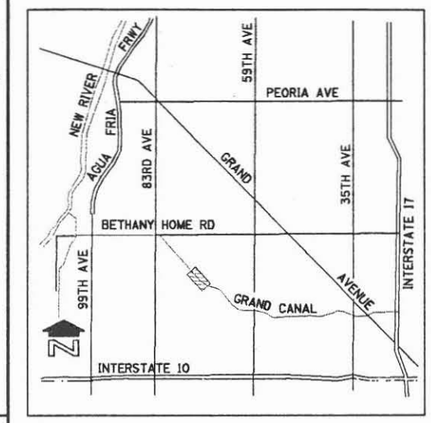
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND CANAL 67TH AVENUE TO AGUA FRIA FREEWAY

MITIGATION OPTION 4, 100-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
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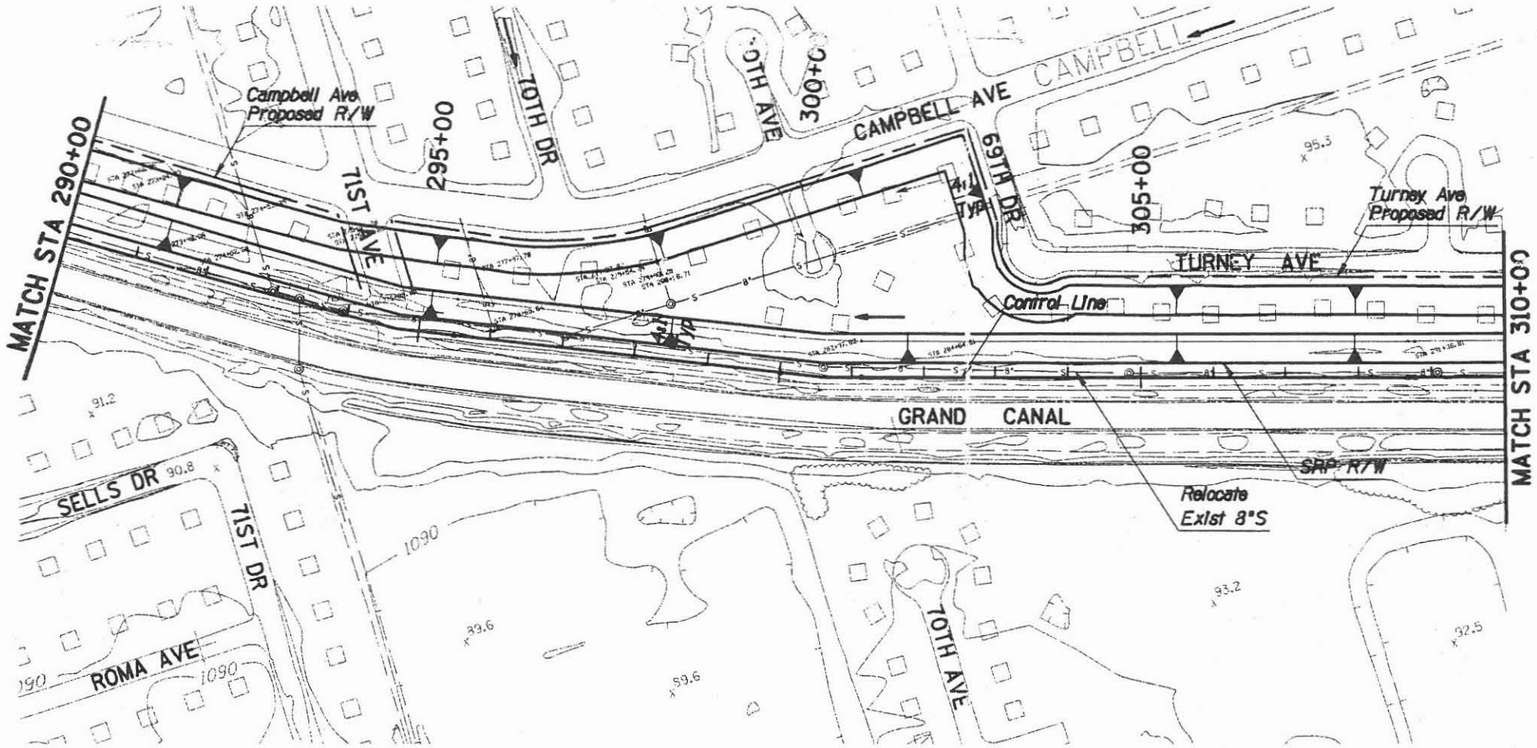
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN STA 270+00 TO 290+00	FIGURE	SHEET OF
	9	41 44

TRACS NO.



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
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- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
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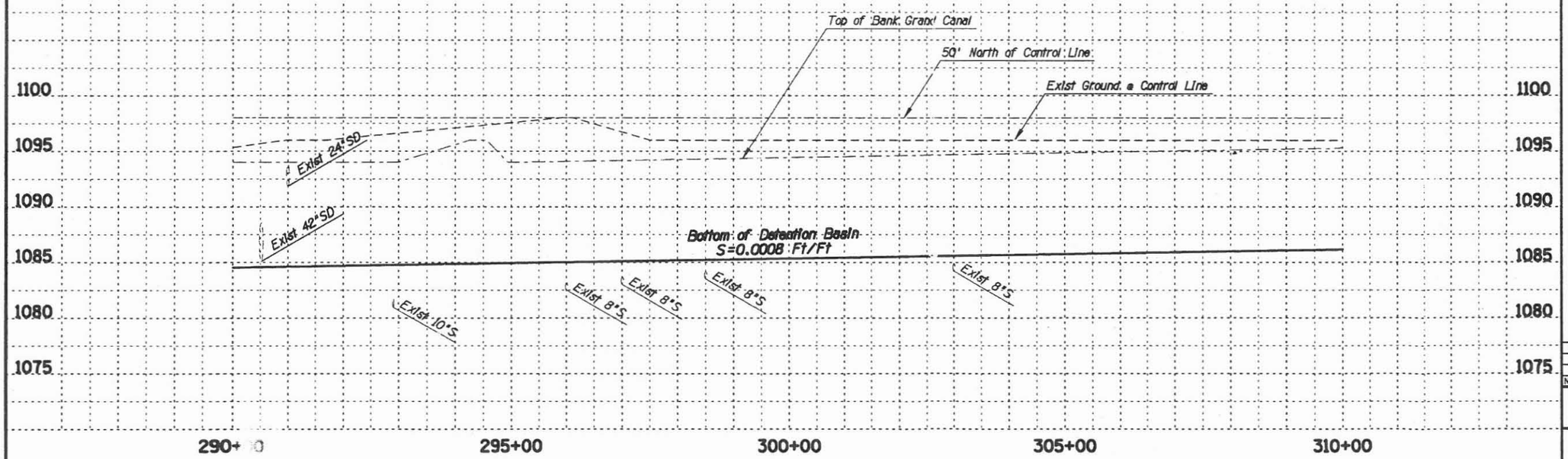
- TREE LINE



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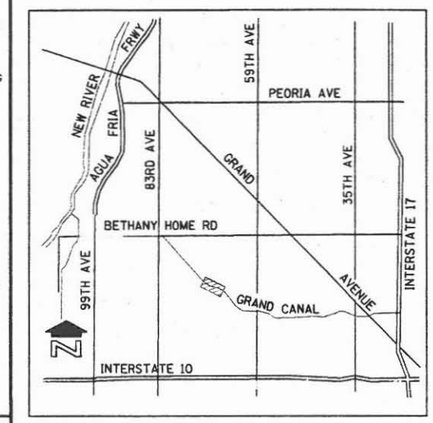
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND CANAL 67TH AVENUE TO AGUA FRIA FREEWAY

MITIGATION OPTION 4, 100-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
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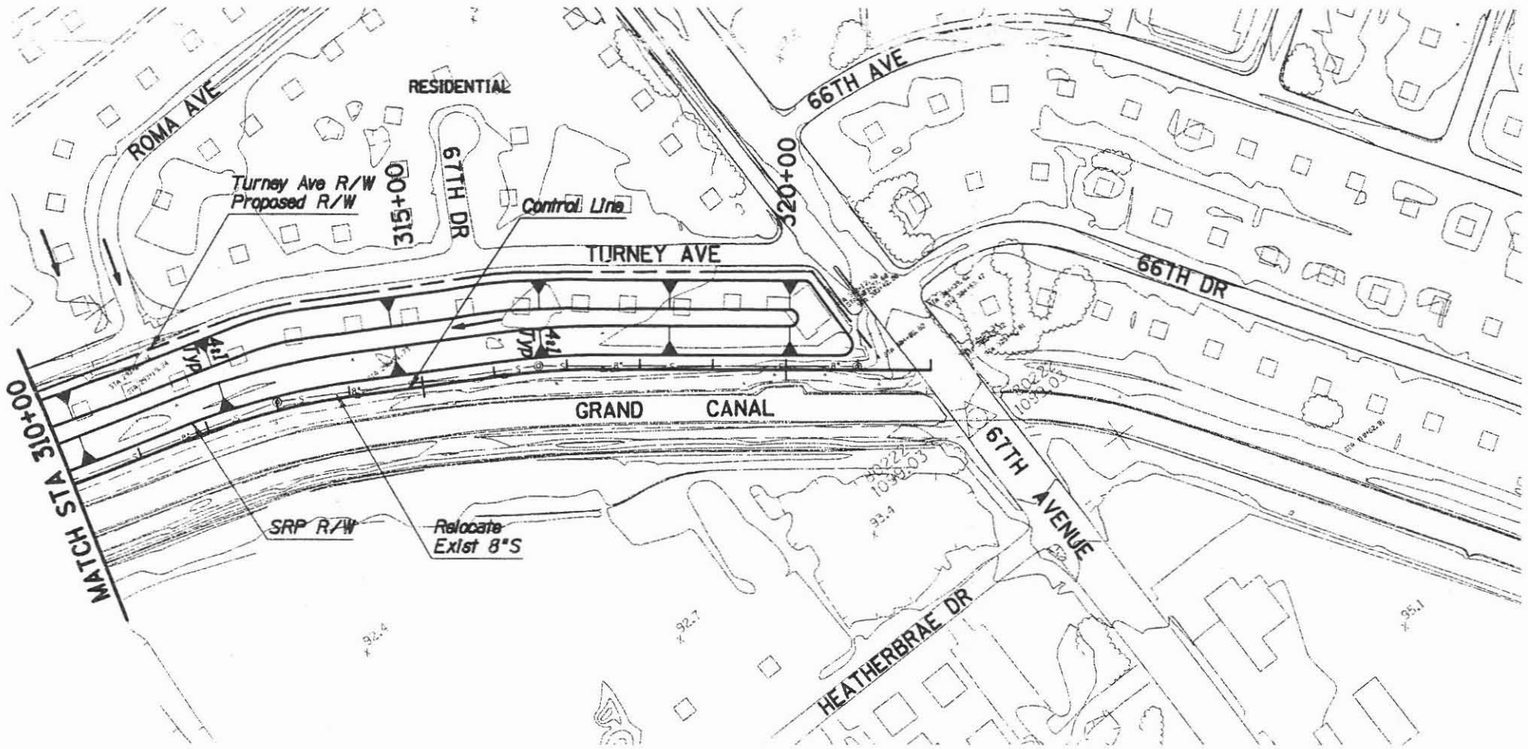
WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 290+00 TO 310+00

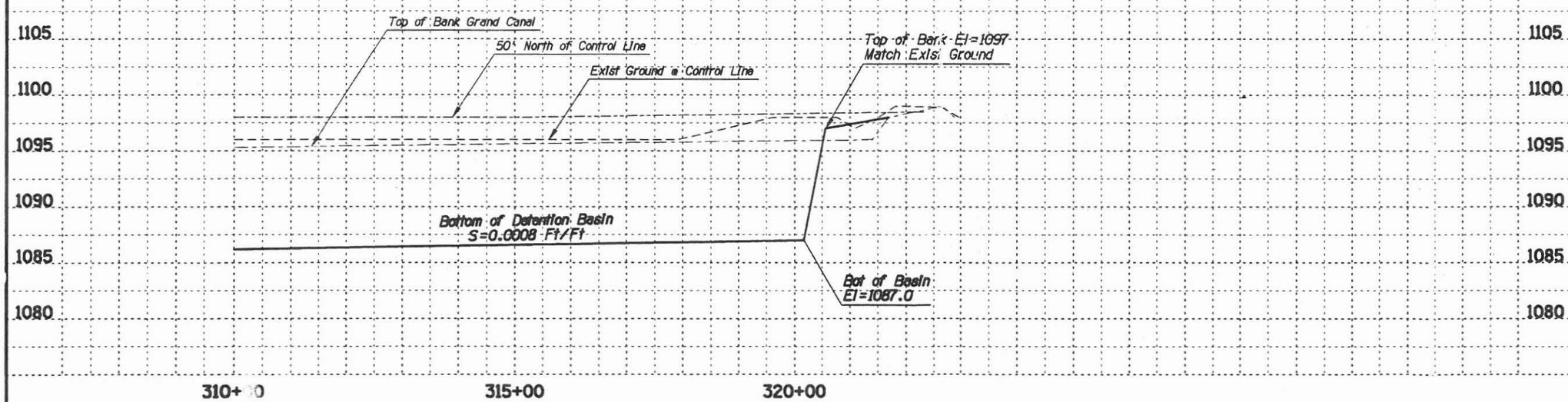
FIGURE 9 | SHEET 42 OF 44

TRACS NO.



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- SD — EXISTING STORM DRAIN
- W — EXISTING WATER LINE
- S — EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE



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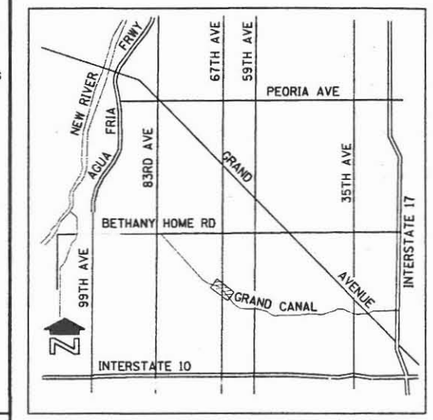
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

MARYVALE AREA
DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION
LEVEL III

GRAND CANAL 67TH AVENUE TO AGUA FRIA FREEWAY

MITIGATION OPTION 4, 100-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN
STA 310+00 TO 321+00

FIGURE 9 | SHEET 43 OF 44

TRACS NO.

WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

PROJECT Maryvale ADMS

PROJECT NO. 94154 SHEET NO. 1 OF 1

CALCULATED BY DTP DATE 6 FEB 98 CHECKED BY _____ DATE _____

BACKUP DATA FOR SELECTED ALTERNATIVE

GRAND CANAL @ 31ST AVE

OPTION 1, 5-YEAR

DATA PROVIDED:

Existing Condition Hydrology: 5-YEAR

HEC-1 KK Card ID: C2622N

PEAK INFLOW: 1140 cfs

RUNOFF VOLUME: 272 ac-ft

TYPE OF MITIGATION:

DETENTION STORAGE: (Yes) / ~~No~~

Comments:

By-Pass Q = 250 cfs

BASIN TYPE: SURGE

VOLUME: 152 ac-ft

OUTFALL: Gravity

PEAK STAGE: 1112 ft

Surrounding Ground EL: 1112 ft @ Bottom and

Ave Ponding = 15-16 ft deep

STORM DRAIN: (Yes) / ~~No~~

Comments:

Bleed off pipe to tie into existing 72 inch stormdrain in 30th Ave, Use 72 inch Ø.

4-60" RCP: Equalizer pipe to connect two storage basins.

Equilizer pipe will intercept and drain stormdrain in Weldon Ave.

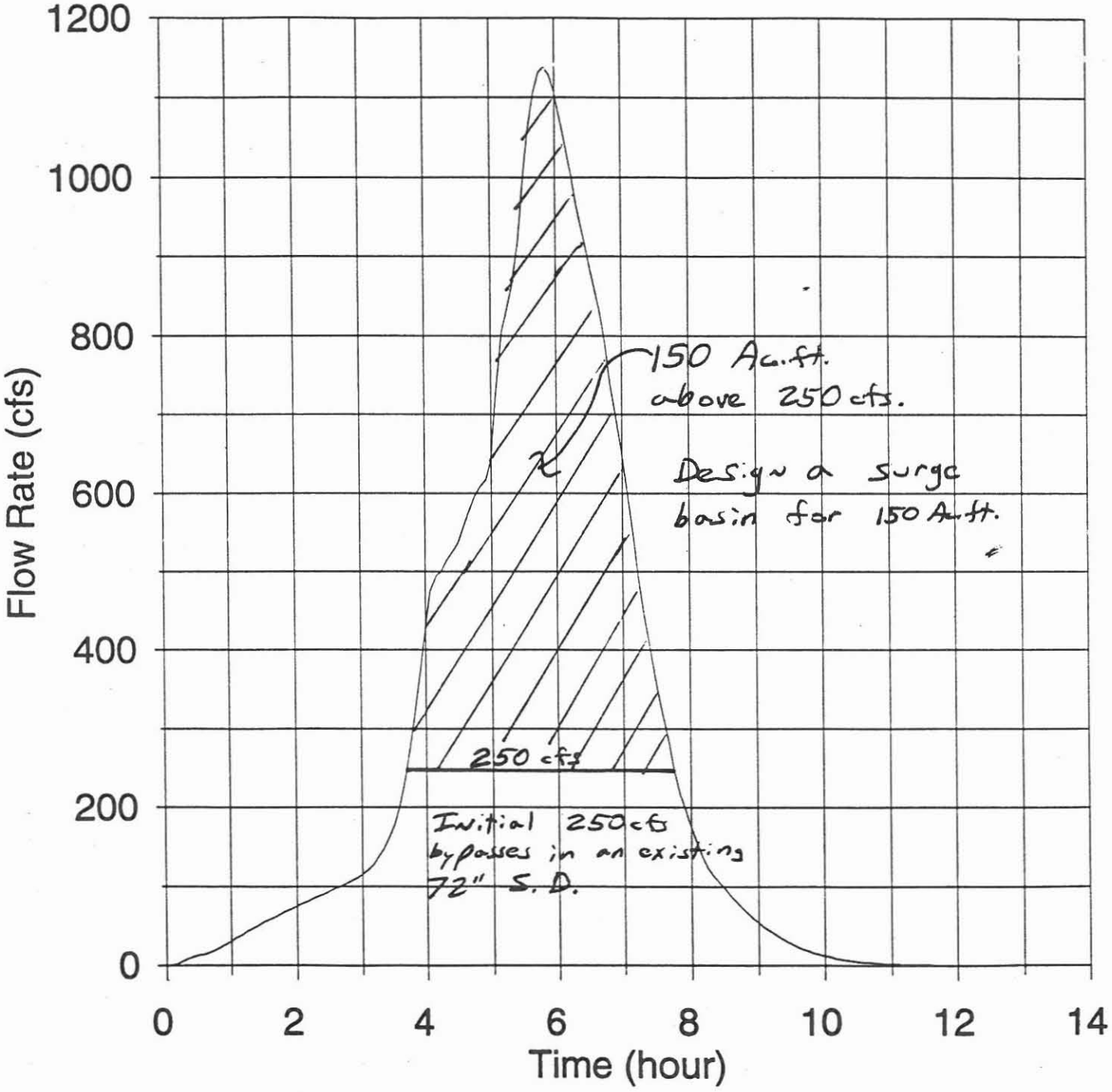
CHANNEL CONSIDERATIONS: ~~Yes~~ / (No)

Comments:

Hydrograph of C2622N

Grand Ave. @ 31st Ave.

5 - Year



Wood/Patel and Associates Inc.

MARYVALE AREA DRAINAGE MASTER STUDY

Flood Control District of Maricopa County 20-Aug-97

FLOOD MITIGATION OPTIONS **Contract FCD 93-29**
LEVEL II ANALYSIS, OPTION 1, 5-year **W/P # 94154.00**

STUDY AREA: Grand Avenue at Grand Canal near 31st Avenue

South Detention Basin

Average Bottom Width =	130 ft		
Average Bottom Length =	1050 ft		
Side Slope =	4 :1 (h:v)	Total Storage V:	152
Average Basin Bottom =	1097.5 ft Elev	South	North
High Water =	1112 ft Elev	71.4	80.6
Average Natural Ground =	1113 ft Elev		
Basin Type =	1 1 = Rectangular, 2 = Triangular		

Depth to Bottom (Feet)	Water Surface Elevation	Surface Area (Acres)	Storage Volume		Earth Work Volume	
			Incrimental (Ac-ft)	Cumulative (Ac-ft)	Incrimental (CY)	Cumulative (CY)
0.5	1098	3.2	1.6	1.6	2,615	2,615
1.5	1099	3.5	3.5	5.1	5,585	8,201
2.5	1100	3.7	3.7	8.8	5,944	14,145
3.5	1101	3.9	3.9	12.7	6,308	20,454
4.5	1102	4.1	4.1	16.8	6,677	27,130
5.5	1103	4.4	4.4	21.2	7,050	34,181
6.5	1104	4.6	4.6	25.8	7,428	41,609
7.5	1105	4.8	4.8	30.6	7,811	49,420
8.5	1106	5.1	5.1	35.7	8,199	57,619
9.5	1107	5.3	5.3	41.0	8,591	66,210
10.5	1108	5.6	5.6	46.6	8,988	75,198
11.5	1109	5.8	5.8	52.4	9,390	84,587
12.5	1110	6.1	6.1	58.5	9,796	94,384
13.5	1111	6.3	6.3	64.8	10,208	104,591
14.5	1112	6.6	6.6	71.4	10,624	115,215
15.5	1113	6.8	6.8	--	11,044	126,259
16.5	1114	7.1	7.1	--	11,470	--
17.5	1115	7.4	7.4	--	11,900	--
18.5	1116	7.6	7.6	--	12,335	--

MARYVALE AREA DRAINAGE MASTER STUDY

Flood Control District of Maricopa County 20-Aug-97

FLOOD MITIGATION OPTIONS **Contract FCD 93-29**
LEVEL II ANALYSIS, OPTION 1, 5-year **W/P # 94154.00**

STUDY AREA: Grand Avenue at Grand Canal near 31st Avenue

North Detention Basin

Average Bottom Width =	260 ft
Average Bottom Length =	720 ft
Side Slope =	4 :1 (h:v)
Average Basin Bottom =	1098 ft Elev
High Water =	1112 ft Elev
Average Natural Ground =	1114 ft Elev
Basin Type =	1 1 = Rectangular, 2 = Triangular

Depth to Bottom (Feet)	Water Surface Elevation	Surface Area (Acres)	Storage Volume		Earth Work Volume	
			Incrimental (Ac-ft)	Cumulative (Ac-ft)	Incrimental (CY)	Cumulative (CY)
0	1098	4.3	0.0	0.0	0	0
1	1099	4.5	4.5	4.5	7,226	7,226
2	1100	4.7	4.7	9.1	7,524	14,750
3	1101	4.9	4.9	14.0	7,826	22,575
4	1102	5.0	5.0	19.0	8,133	30,708
5	1103	5.2	5.2	24.3	8,444	39,153
6	1104	5.4	5.4	29.7	8,761	47,913
7	1105	5.6	5.6	35.3	9,082	56,996
8	1106	5.8	5.8	41.2	9,408	66,404
9	1107	6.0	6.0	47.2	9,739	76,142
10	1108	6.2	6.2	53.4	10,074	86,216
11	1109	6.5	6.5	59.9	10,414	96,631
12	1110	6.7	6.7	66.6	10,759	107,390
13	1111	6.9	6.9	73.4	11,109	118,498
14	1112	7.1	7.1	80.6	11,463	129,961
15	1113	7.3	7.3	--	11,822	141,784
16	1114	7.6	7.6	--	12,186	153,970
17	1115	7.8	7.8	--	12,555	--
18	1116	8.0	8.0	--	12,928	--
19	1117	8.2	8.2	--	13,306	--
20	1118	8.5	8.5	--	13,689	--

WOOD/PATEL

CIVIL ENGINEERS • HYDROLOGISTS • LAND SURVEYORS

PROJECT Maryvale ADMS Grand Ave @ Grand Canal near 31st Ave

PROJECT NO. 94154 SHEET NO. 1 OF 1

CALCULATED BY DTP DATE 14 Aug 97 CHECKED BY _____ DATE _____

5-yr Option
- Surge Basin Volume = 150 Ac-ft
- Outlet = 250 cfs (By Pass)

Outlet size:

$Q = 250$ cfs

$S = (95 - 94.6)/90$ ft $= 0.0044$ ft/ft

From Manning's Normal Depth $\Rightarrow$ D = 72in (6 ft)

Equalizer Size:

Prorate Inflows w/ respect to storage volumes

5yr - 6hr Q = 1138 cfs

$$\frac{V_{D/S}}{V_{TOTAL}} = \frac{Q_{EQUALIZER}}{Q_{TOTAL}}$$

Available Stor V_{NORTH} = 80.6 Ac-ft

Available Stor V_{SOUTH} = 71.4 Ac-ft

$$Q_{equ} = Q_{TOT} \frac{V_{U/S}}{V_{TOT}} = 1138 \frac{71.4}{152}$$

$Q_{equ.} = 534$ cfs

$$\text{Slope} \simeq \frac{0.5\text{ ft}}{200\text{ ft}} = 0.0025 \text{ ft/ft}$$

Note: SS Invert = 1101.9
Thus max Equalizer Pipe = 5

USE 4 - 60" RCP $\rightarrow$ $\simeq$ 0.6 ft Seperation

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 14, 1997
Maryvale ADMS - LEVEL 2
Grand Ave @ Grand Canal near 31st AVE
5-yr option EQUALIZER Pipes

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	5.00
FHWA Chart Number (1,2 or 3)	1
Scale Number on Chart (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.0130
Entrance Loss Coefficient of Culvert Opening	0.50
Culvert Length (feet)	200.0
Culvert Slope (feet per foot)	0.0025

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
178.0	0.00	6.62	6.75	5.00	3.82	3.82	11.05
178.0	16.00	6.62	18.34	5.00	3.82	5.00	9.07
178.0	15.00	6.62	17.34	5.00	3.82	5.00	9.07
180.0	15.00	6.69	17.41	5.00	3.84	5.00	9.17
135.0	15.00	5.26	16.14	4.28	3.33	5.00	6.88
135.0	16.00	5.26	17.14	4.28	3.33	5.00	6.88
135.0	0.00	5.26	5.30	4.28	3.33	3.33	9.73

==========

PIPE CULVERT ANALYSIS COMPUTER PROGRAM Version 1.7 Copyright (c)1986
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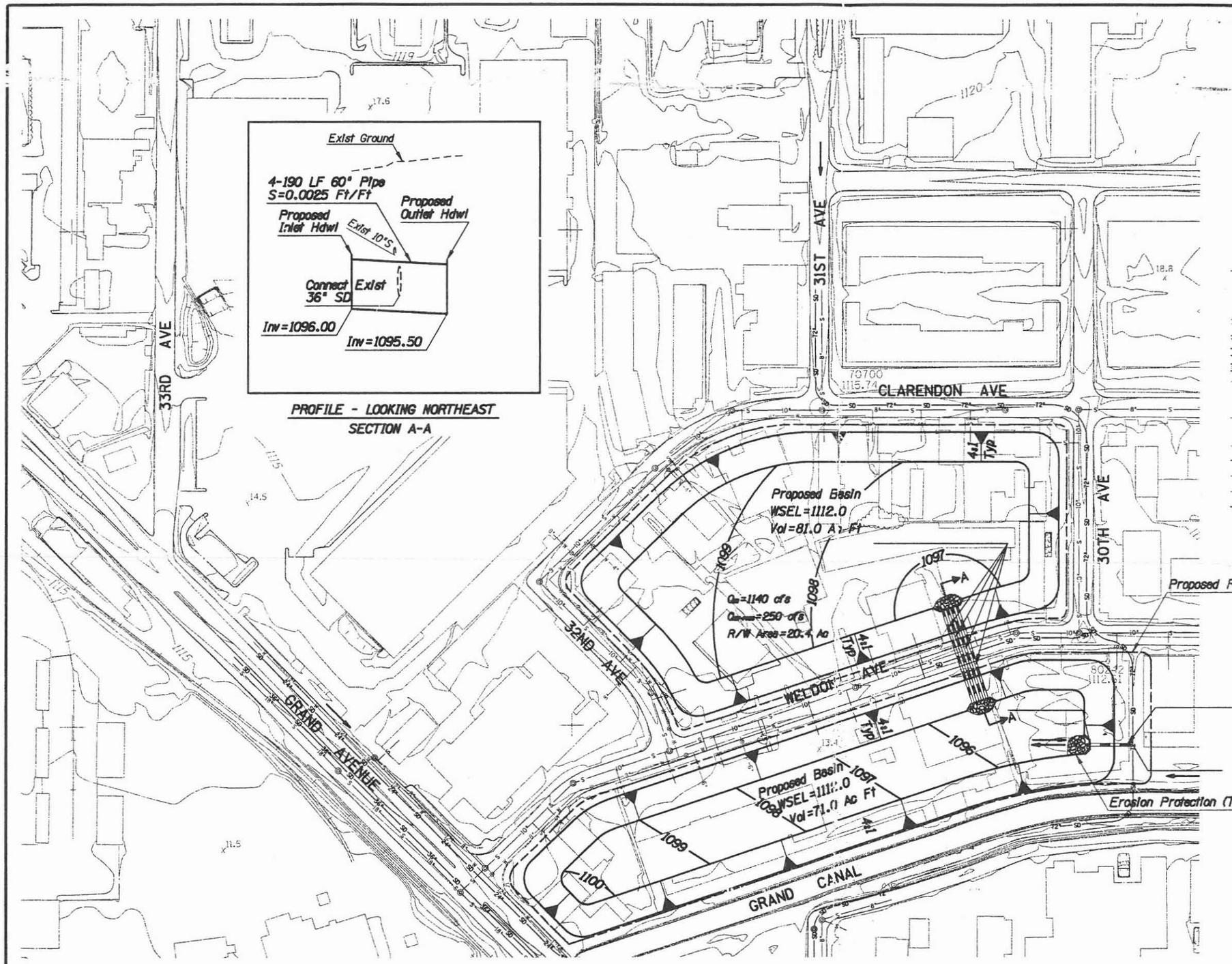
→ USE 4 - 5 ft ø RCP



LEGEND

- BUILDING
- SINGLE RESIDENTIAL BUILDING
- ROAD/PAVEMENT
- PROPOSED STORM DRAIN
- PROPOSED BASIN
- PROPOSED CHANNEL
- INDEX CONTOUR
- DEPRESSED INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSED INTERMEDIATE
- WASH/ DRAINAGE/WATERLINE
- EXISTING STORM DRAIN
- EXISTING WATER LINE
- EXISTING SEWER LINE
- RIGHT-OF-WAY
- TREE LINE

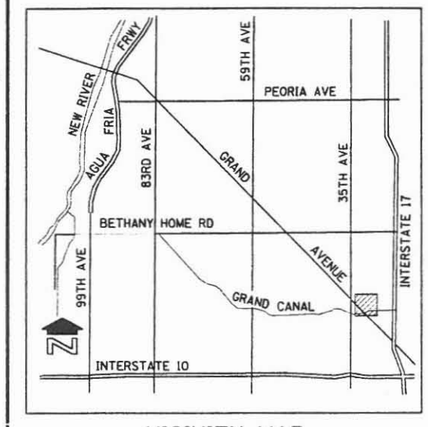
NOTE:
THESE PLANS ARE PRELIMINARY AND ARE PROVIDED FOR PLANNING PURPOSES ONLY. THE LOCATIONS OF ALL STRUCTURES, UTILITIES AND RIGHT-OF-WAY ARE APPROXIMATE AND ARE BASED UPON RECORD DOCUMENTS. AERIAL TOPOGRAPHY WAS PRODUCED AT A SCALE OF 1INCH=200 FEET WITH A 2 FOOT CONTOUR INTERVAL. MAPPING WAS PREPARED BY KENNEY AERIAL MAPPING AND IS BASED ON GROUND CONTROL SURVEY DATA PROVIDED BY KAMINSKI-HUBBARD ENGINEERING INC. AND PROJECT ENGINEERING CONSULTANTS, LTD.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

MARYVALE AREA DRAINAGE MASTER STUDY

CONTRACT NO. FCD 93-29

FLOOD MITIGATION OPTIONS



VICINITY MAP

OPTION EVALUATION LEVEL III

GRAND CANAL AT 31ST AVENUE

MITIGATION OPTION 1, 5-YEAR

100 0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

CONCEPT PLAN		BY	DATE
	DESIGNED	D. PHELPS, S. ZOU	9/97
	DRAWN	S. RASMUSSEN, A. LINN	9/97
	CHECKED	J. MOODY, A. PATEL	9/97

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602) 234-1344

DRAINAGE SYSTEM PLAN | FIGURE 9 | SHEET 44 OF 44

TRACS NO.