

**Northern/Orangewood Storm Drain Project  
CONCEPT/ROUTING STUDY  
UPDATE**

FCD Contract 94-12

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Flood Control District of MC Library  
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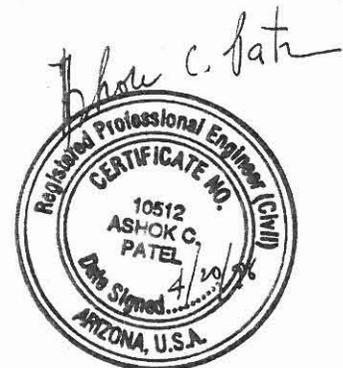
**Northern/Orangewood Storm Drain Project  
CONCEPT/ROUTING STUDY  
UPDATE**

FCD Contract 94-12

April 20, 1996

*Prepared for:*  
**Flood Control District of Maricopa County**  
2801 West Durango Street  
Phoenix, AZ 85009

*Prepared by:*  
**Wood, Patel & Associates, Inc.**  
1550 East Missouri  
Suite 203  
Phoenix, AZ 85014  
WP # 94153



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April 16, 1996

Mr. R.W. Shobe, P.E.  
Flood Control District of Maricopa County  
2801 West Durango Street  
Phoenix, AZ 85009

Re: **Northern/Orangewood Storm Drain Project**  
***Concept/Routing Study - Option Update***  
WP #94153

Dear Mr. Shobe:

We are pleased to submit this update to the *Concept/Routing Study* in conjunction with the *Northern/Orangewood Storm Drain Project*, as follows:

Six (6) copies to the Flood Control District of Maricopa County  
Two (2) copies to the City of Glendale  
Two (2) copies to the City of Peoria.

Should you require clarification, please feel free to contact us.

Sincerely,

**WOOD, PATEL & ASSOCIATES, INC.**

  
Ashok C. Patel, P.E., R.L.S.  
Principal

ACP/sld  
enclosure

GENCOR\94153.A09

## TABLE OF CONTENTS

### INTRODUCTION

### DESCRIPTION OF MODIFICATIONS

### DESCRIPTION OF THE ADDED OPTIONS

### RECOMMENDATION

#### TABLES

TABLE 5-2	Option Cost Summary
TABLE II-1	Northern Avenue Alignment and Butler Drive, Option A
TABLE II-2	Northern Avenue Alignment and Butler Drive, Option B
TABLE II-3	Orangewood Avenue Alignment, West and East Basin Options
TABLE II-4	Orangewood Avenue Alignment, Option 1A
TABLE II-5	Orangewood Avenue Alignment, Option 1B
TABLE II-6	Orangewood Avenue Alignment, Option 2A
TABLE II-7	Orangewood Avenue Alignment, Option 2B (with East Basin)
TABLE II-7A	Orangewood Avenue Alignment, Option 2B (with East Basin) and 50 cfs Bypass flow @ West Basin
TABLE II-8	Glendale Avenue Alignment (with West Basin)
TABLE II-8A	Glendale Avenue Alignment (with East Basin)
TABLE II-8B	Glendale Avenue Alignment (with East Basin) and 50 cfs bypass flow @ West Basin
TABLE II-8C	Glendale Avenue Alignment (with East Basin) and 100 cfs bypass flow @ West Basin
TABLE II-8D	Glendale Avenue Alignment (with East Basin) and 200 cfs bypass flow @ West Basin

#### PLATES

PLATE II-3A	Selected Alignments
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## INTRODUCTION

On March 14, 1996, the *Concept/Routing Study* for the Northern/Orangewood project was submitted to the Flood Control District of Maricopa County (District) and the Cities of Glendale and Peoria. The study included a number of storm drain alignment options and Wood, Patel & Associates, Inc.'s (WPA) recommended options.

A meeting was held with the ADMP team (District, Glendale, and Peoria) at the City of Glendale on April 3, 1996 to discuss the results of the *Concept/Routing Study* as well as get feedback on WPA's recommended options.

The City of Peoria was in general agreement with the recommended option in Peoria per the *Concept/Routing Study*. Accordingly, Option B, with storm drain alignments along Butler Drive and Northern Avenue, was selected for further consideration. A minor change in the easement acquisition cost through the Transmission line Corridor was requested by Peoria. That change is incorporated in the attached Table 5-2 in items 1 & 2. The selected options are presented on Plate II-3A.

The City of Glendale expressed a significant concern for the WPA recommended Orangewood alignment, more specifically, the conflict with the land use plan in the Delta Project. A further analysis with the Glendale Avenue outfall option with an East Basin and a combination of an East Basin and a partial use of the West Basin was requested by the City of Glendale. Additionally, adjustments to the easement acquisition cost through the Delta Project were also requested.

This *Concept/Routing Update* includes all the changes requested by the City of Glendale. The attached Table 5-2 includes newly added options (items 7, 9, 10, 11, and 12) along the Glendale Avenue alignment.

Among the new options studied, the option presented as item 10, the Glendale Avenue alignment with the East Basin and partial use of the West Basin with 50 cfs bypass was found the most cost-effective and, therefore, was selected for further consideration.

## **DESCRIPTION OF MODIFICATIONS**

### **Peoria Watershed:**

Item 1: These costs are the same per the *Concept/Routing Study* except an easement acquisition cost for pipe no. 14 is added for the transmission corridor area near the Peoria Basin.

Item 2: These costs are the same per the *Concept/Routing Study* except an easement acquisition cost for pipe no. 14 is added for the transmission corridor area near the Peoria Basin. This option is selected and recommended for further consideration.

### **Glendale Watershed:**

#### **Orangewood Alignment**

Item 3: These costs are the same per the *Concept/Routing Study* except the right-of-way cost for the Orangewood alignment. More specifically, right-of-way costs for the alignment at pipe nos. 1, 2, and 3 are revised to \$1.03 per square foot from \$0.37 per square foot per the City of Glendale's input.

Items 4, 5, and 6: same as above.

## DESCRIPTION OF THE ADDED OPTIONS

Item 7: This option is the same as the Orangewood alignment per Plate II-1 in the *Concept/Routing Study*, except a small surge basin (approximately 9 acres) is added at the West Basin location. This alignment utilizes a 10' x 6' box culvert (pipe #1 per Plate II-1 in the *Concept/Routing Study*) between the Agua Fria Freeway (AFF) outlet channel and 91st Avenue.

Cost: \$12,986,000

Item 8: This option is duplicated from the *Concept/Routing Study* without any modification

Cost: \$12,962,000

Item 9: This option is the same as the Glendale Avenue alignment per Plate II-3 in the *Concept/Routing Study*, except that an East Basin is used instead of a West Basin. No use was made of the West Basin.

Cost: \$15,912,000

Item 10: This option is the same as the Glendale Avenue alignment per Plate II-3 in the *Concept/Routing Study*, except that a small surge basin (approximately 9 acres) is added at the West Basin location. The surge basin will allow about 50 cfs to bypass the basin. This option is selected and recommended for further consideration.

Cost: \$13,118,000

Item 11: This option is the same as above except it allows 100 cfs to bypass the West Basin.

Cost: \$13,506,000

Item 12: This option is also the same as above, except it allows 200 cfs to bypass the West Basin.

Cost: \$14,507,000

## RECOMMENDATION

### Peoria Watershed

Based on input from the District and the City of Peoria, we concur that the Option B (Item 2) as recommended in the *Concept/Routing Study* will be adopted for further use.

### Glendale Watershed

Based on input from the District and the City of Glendale, we recommend that the Glendale Avenue alignment with East Basin and a partial West Basin, item 10 above, (with 50 cfs bypass flow) be selected for further consideration.

It is recognized that the recommended alignment follows the existing right-of-way for the majority of the reach and will ease the right-of-way constraints through the Delta project. It is also understood that this alignment will not be fully functional until the year 2002/2003, when ADOT's AFF outlet channel south of Glendale Avenue will be built. However, this limitation is acceptable to the City as well as the District.

After receiving the ADMP team written concurrence, Wood/Patel will prepare the Construction Phasing Plan, including 15% complete plans and profiles for the approved storm drain alignments.

TABLE 5-2

Concept/Routing Study  
Option Cost Summary (d, e)  
(costs rounded to nearest \$1000)

ITEM	REF. TABLE	OPTION	DESCRIPTION	COST (a)	STORM DRAIN RIGHT-OF- WAY (ac)	BASIN RIGHT-OF- WAY (ac)	COST DISTRIBUTION	
							ADMP (b)	ADOT (c)
<b>Peoria Watershed:</b>								
1	II-1	Northern Ave./Butler Dr. alignment, Option A		\$3,067,000	2.2	23	\$3,067,000	
2	II-2	<b>Northern Ave./Butler Dr. alignment, Option B</b>		<b>\$2,866,000</b>	<b>2.2</b>	<b>23</b>	<b>\$2,866,000</b>	
<b>Glendale Watershed:</b>								
<b>Orangewood Avenue alignment:</b>								
3	II-4	Option 1A w/ box @ 91st Ave	w/ west basin	\$12,862,000	6.36	36.92	\$12,514,000	\$348,000
4	II-5	Option 1B w/ channel @ 91st Ave	w/ west basin	\$11,788,000	12.42	36.92	\$11,440,000	\$348,000
5	II-6	Option 2A w/ box @ 91st Ave	w/ east basin	\$14,653,000	6.74	39	\$14,340,000	\$313,000
6	II-7	Option 2B w/ channel @ 91st Ave	w/ east basin	\$12,462,000	12.8	39	\$12,149,000	\$313,000
7	II-7A	(***) with box @ 91st Ave, 50 cfs west basin bypass	w/ east & west basins	\$12,986,000	4.72	47.5	\$12,673,000	\$313,000
<b>Glendale Avenue alignment:</b>								
8	II-8	West Basin	w/ west basin only	\$12,962,000	1.52	36.92	\$12,614,000	\$348,000
9	II-8A	(***) no west basin	w/ east basin only	\$15,912,000	1.29	39	\$15,564,000	\$348,000
10	II-8B	<b>(***) 50 cfs west basin bypass</b>	<b>w/ east &amp; west basins</b>	<b>\$13,118,000</b>	<b>1.29</b>	<b>47.1</b>	<b>\$12,770,000</b>	<b>\$348,000</b>
11	II-8C	(***) 100 cfs west basin bypass	w/ east & west basins	\$13,506,000	1.29	44	\$13,158,000	\$348,000
12	II-8D	(***) 200 cfs west basin bypass	w/ east & west basins	\$14,507,000	1.29	41.4	\$14,159,000	\$348,000

## NOTES:

(a) Costs include Basin Land; Right-of way Acquisition; contingencies related to Engineering, Construction & Construction Administration (estimated 40 %).

(b) ADMP costs to be shared by Agencies (FCDMC 50%, Glendale 25%, Peoria 25%). Includes ADMP & extended service area.

(c) It is anticipated that ADOT will contribute this amount for improvements within Grand Avenue.

(d) (\*\*\*) Updated 4/4/96 based on comments from City of Glendale.

(e) **Recommended options are highlighted in italic and bold.**

**TABLE II-1**  
Option A

**Peoria Watershed Storm Drain System**

Northern Avenue; 83rd Avenue to the AFF Channel; Butler; Peoria Laterals

16-Apr-96

02:00 PM

Peoria Watershed Storm Drain Alignment (SEE PLATE II-3)

Manning's "n"= 0.013

STORM SEWER LINE STATION LOCATION	PIPE #	STORM SEWER STATION	PIPE DIA (in)	REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	DESIGN Q (cfs)	PREL GRADE LINE ELEV		CHECK D+INV +.2 v <sup>2</sup> /2g	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	(c)	DEPTH TO INVERT	PIPE UNIT PRICE \$	PIPE COST \$		
								ENERGY	HYDRAULIC												
<b>Northern Ave Alignment</b>																					
@ AFF Pipe		-251				1079.2		1083.70	1083.70				1083.70	1083.70	1088.0	ok	8.8				
93rd Ave (13+00)		1300	60	U	1551	0.0007		1080.2	92	1085.97	1085.63	1085.27	0.4	ok	1085.63	1085.97	1094.0	ok	13.8	EXISTING	0
91st Ave (24+60)		2460	60	U	1160	0.0006		1080.9	89	1087.29	1086.97	1085.96	1.0	ok	1086.97	1087.29	1095.5	ok	14.6	EXISTING	0
@ Sta (24+74)		2474	60	U	14	0.1643		1083.2	77	1087.22	1086.99	1088.25	-1.3	ocf	1088.25	1088.49	1095.5	ok	12.3	EXISTING	0
@ Sta (25+00)		2500	60	U	26	0.0077		1083.4	77	1087.25	1087.01	1088.45	-1.4	ocf	1088.45	1088.69	1095.6	ok	12.2	EXISTING	0
@ Sta (25+75)		2575	60	U	75	0.0080		1084.0	77	1087.31	1087.07	1089.05	-2.0	ocf	1089.05	1089.29	1096.0	ok	12.0	EXISTING	0
@ Sta (28+00)		2800	60	U	225	0.0007		1084.2	77	1087.51	1087.27	1089.21	-1.9	ocf	1089.21	1089.45	1096.0	ok	11.8	EXISTING	0
91st Ave to 89th Ave	10	3820	60	U	1020	0.0005		1084.7	77	1088.40	1088.16	1089.72	-1.6	ocf	1089.72	1089.96	1098.0	ok	13.3	132	134854
89th Ave to 85th Ave	11	6460	54	U	2640	0.0005		1086.0	73	1092.10	1091.78	1090.56	1.2	ok	1091.78	1092.10	1096.0	ok	10.0	119	313720
85th Ave to 83rd Ave	12	7780	72	U	1320	0.0005		1086.7	214	1096.02	1095.13	1092.83	2.3	ok	1095.13	1096.02	1102.0	ok	15.3	157	207305

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL 40 % \$655,880 \$918,232

<b>Peoria Laterals</b>																					
@ Northern & 85th Ave	13	1320	24	R	1320	0.0064		1086.0	73.0	1092.1	1091.8	1090.6	1.2	ok	1091.8	1092.1	1096.0	ok	10.0	69	91739
85th, Northern to Elec Corr	14	2640	66	R	1320	0.0010		1094.5	19	1101.58	1101.01	1096.61	4.4	ok	1101.01	1101.58	1106.0	ok	11.5	121	159725
Elec Corridor, 83rd to 85th		2640						1095.8	132	1103.52	1103.04	1101.40	1.6	ok	1103.04	1103.52	1106.0	ok	10.2		

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL 40 % \$251,465 \$352,050

<b>Butler Drive Alignment</b>																					
@ AFF Channel	21	0	48	R	840	0.0065		1089.0	78	1092.50	1092.50				1092.50	1092.50	1102.0	ok	13.0	91	76475
AFF to 91st Ave	22	840	42	U	1320	0.0020		1094.5	78	1095.56	1094.96	1098.62	-3.7	ocf	1098.62	1099.22	1102.8	ok	8.3	105	138822
91st Ave to 89th Ave	23	2160	36	U	1100	0.0020		1097.1	71	1102.34	1101.50	1100.81	0.7	ok	1101.50	1102.34	1105.8	ok	8.7	100	109867
89th Ave to 87th Ave		3260						1099.3	32	1104.33	1104.01	1102.40	1.6	ok	1104.01	1104.33	1107.0	ok	7.7		

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL 40 % \$325,164 \$455,230

**DETENTION BASIN**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
18 AC (+/-) PEORIA BASIN EXCAVATION	LAND	23	\$27,437	\$630,502
	CY	225,000	\$3	\$675,000

**COST OF RIGHT OF WAY PURCHASE**

DESCRIPTION	AREA SF	UNIT COST	COST
Butler, 91st to AFF	41,265	\$0.37	\$15,326
Elec Corridor	52,800	\$0.37	\$19,536

**BASIN TOTAL**

\$1,305,502

**RIGHT OF WAY TOTAL**

\$35,000

**STORM DRAIN W/CONTINGENCIES**

\$1,726,000

**BASIN AND RIGHT OF WAY TOTAL**

\$1,341,000

**GRAND TOTAL**

\$3,067,000

Only major friction losses have been considered in the computation of the hydraulic grade line. Minor losses have been ignored.

(a) This column depicts the difference between the calculated hydraulic grade & the elevation of (top of pipe + 0.2 v<sup>2</sup>/2g)

(b) If HGL is significantly lower than the top of pipe elevation, open channel flow may exist, "ocf" statement then appears here.

(c) If natural ground is lower than EGL, "pb" statement appears here.

**TABLE II-2**

Option B

**Peoria Watershed Storm Drain System**

Northern Avenue; 83rd Avenue to the AFF Channel; Butler; Peoria Laterals

16-Apr-96

Peoria Watershed Storm Drain Alignment (SEE PLATE II-3)

Manning's "n" =

0.013

02:01 PM

STORM SEWER LINE STATION LOCATION	PIPE #	STORM SEWER STATION	PIPE DIA (in)	REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	DESIGN Q (cfs)	PREL GRADE LINE ELEV		CHECK D+INV + 2 v <sup>2</sup> /2g	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	(c)	DEPTH TO INVERT		
								ENERGY	HYDRAULIC										
<b>Northern Ave Alignment</b>																			
@ AFF Pipe		-251				1079.2		1083.70	1083.70				1083.70	1083.70	1088.0	ok	8.8		
93rd Ave (13+00)		1300	60	U	1551	1080.2	36	1084.05	1083.99	1085.21	-1.2	ocf	1085.21	1085.26	1094.0	ok	13.8	EXISTING	0
91st Ave (24+60)		2460	60	U	1160	1080.9	33	1084.22	1084.18	1085.91	-1.7	ocf	1085.91	1085.95	1095.5	ok	14.6	EXISTING	0
@ Sta (24+74)		2474	60	U	14	1083.2	33	1084.23	1084.18	1088.21	-4.0	ocf	1088.21	1088.25	1095.5	ok	12.3	EXISTING	0
@ Sta (25+00)		2500	60	U	26	1083.4	33	1084.23	1084.19	1088.41	-4.2	ocf	1088.41	1088.45	1095.6	ok	12.2	EXISTING	0
@ Sta (25+75)		2575	60	U	75	1084.0	33	1084.24	1084.20	1089.01	-4.8	ocf	1089.01	1089.05	1096.0	ok	12.0	EXISTING	0
@ Sta (28+00)		2800	60	U	225	1084.2	33	1084.28	1084.23	1089.17	-4.9	ocf	1089.17	1089.21	1096.0	ok	11.8	EXISTING	0
	10		27	U	1020	1084.7	21	1089.32	1088.89	1087.01	1.9	ok	1088.89	1089.32	1098.0	ok	13.3	83	85056
91st Ave to 89th Ave	11	3820	27	U	2640	1086.0	12	1092.96	1092.82	1088.27	4.6	ok	1092.82	1092.96	1096.0	ok	10.0	83	220145
89th Ave to 85th Ave	12	6460	72	U	1320	1086.7	214	1097.07	1096.18	1092.83	3.4	ok	1096.18	1097.07	1102.0	ok	15.3	157	207305
85th Ave to 83rd Ave		7780																	

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$512,507
40 %	\$717,510

<b>Peoria Laterals</b>																			
@ Northern & 85th Ave						1086.0	12.0	1093.0	1092.8	1088.3	4.6	ok	1092.8	1093.0	1096.0	ok	10.0		
85th, Northern to Elec. Corridor	13	1320	24	R	1320	1094.5	19	1102.63	1102.06	1096.61	5.4	ok	1102.06	1102.63	1106.0	ok	11.5	69	91739
Elec. Corridor, 83rd to 85th	14	2640	66	R	1320	1095.8	132	1104.57	1104.09	1101.40	2.7	ok	1104.09	1104.57	1106.0	ok	10.2	121	159725

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$251,465
40 %	\$352,050

<b>Butler Drive Alignment</b>																			
@ AFF Channel		0				1089.0	78	1092.50	1092.50				1092.50	1092.50	1102.0	ok	13.0		
AFF to 91st Ave	21	840	48	R	840	1094.5	78	1095.56	1094.96	1098.62	-3.7	ocf	1098.62	1099.22	1102.8	ok	8.3	91	76475
91st Ave to 89th Ave	22	2160	42	U	1320	1097.1	71	1102.34	1101.50	1100.77	0.7	ok	1101.50	1102.34	1105.8	ok	8.7	105	138822
89th Ave to 87th Ave	23	3260	36	U	1100	1099.3	32	1104.33	1104.01	1102.40	1.6	ok	1104.01	1104.33	1107.0	ok	7.7	100	109867

Note: R = Rural Section  
U = Urban Section

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$325,164
40 %	\$455,230

**DETENTION BASIN**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
18AC (+/-) PEORIA BASIN	LAND	23	\$27,437	\$630,502
EXCAVATION	CY	225,000	\$3	\$675,000

**BASIN TOTAL** \$1,305,502

**COST OF RIGHT OF WAY PURCHASE**

DESCRIPTION	AREA SF	UNIT COST	COST
Butler, 91st to AFF	41,265	\$0.37	\$15,326
Elec Corridor	52,800	\$0.37	\$19,536

**RIGHT OF WAY TOTAL** \$35,000

**STORM DRAIN W/CONTINGENCIES**

\$1,525,000

**BASIN AND RIGHT OF WAY TOTAL**

\$1,341,000

**GRAND TOTAL**

\$2,866,000

Only major friction losses have been considered in the computation of the hydraulic grade line. Minor losses have been ignored.

- (a) This column depicts the difference between the calculated hydraulic grade & the elevation of (top of pipe + 0.2 v<sup>2</sup>/2g)
- (b) If HGL is significantly lower than the top of pipe elevation, open channel flow may exist, "ocf" statement is appears here.
- (c) If natural ground is lower than EGL, "pb" statement appears here.

**NORTHERN/ORANGEWOOD PROJECT**  
**ORANGEWOOD AVENUE STORM DRAIN ALIGNMENT**

16-Apr-96

**TABLE II-3**

**PROPOSED ALTERNATIVE COST ANALYSIS SUMMARY TABLE**

<b><i>Name</i></b>	<b><i>Basin Location</i></b>	<b><i>Probable Cost</i></b>
Option 1A	West Basin Box Culvert - 91st Ave to Agua Fria Freeway Channel	\$12,862,000
Option 1B	West Basin Open Channel - 91st Ave to Agua Fria Freeway Channel	\$11,788,000
Option 2A	East Basin Box Culvert - 91st Ave to Agua Fria Freeway Channel	\$14,653,000
Option 2B	East Basin Open Channel - 91st Ave to Agua Fria Freeway Channel	\$12,462,000

## TABLE II-4 Option 1A: Glendale Watershed Storm Drain System (with West Basin)

& Box Culvert Between 91st Avenue and the Agua Fria Freeway Channel

ORANGEWOOD AVENUE STORM DRAIN ALIGNMENT  
(SEE PLATE II-2)

16-Apr-96

Manning's "n" = 0.013

01:43 PM

STORM SEWER LINE STATION LOCATION	PIPE #	STATION	PIPE DIA (in)	REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	DESIGN Q (cfs)	PREL GRADE LINE ELEV		CHECK D+INV + 2vel hd	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	(c)	DEPTH TO INVERT	
								ENERGY	HYDRAULIC									
<b>Orangewood Alignment</b>																		
AFF Channel Outlet		0																
used 1-10x8	1		Box	R	4750	0.0007			1076.00	1076.00			1076.00	1076.00	1081	ok	11.0	
91 st Ave		4750					348	1079.50	1079.50	1079.50	0.0	ok	1079.50	1080.02	1085	ok	11.5	
87th Ave	2	7390	90	R	2640	0.0009			1084.92	1084.10	1083.66	0.4	ok	1084.10	1084.92	1088	ok	12.0
83rd Ave	3	10030	66	R	2640	0.0063			1100.25	1098.55	1098.34	0.2	ok	1098.55	1100.25	1106	ok	13.5
79th Ave	4	12670	66	R	2640	0.0019			1106.62	1105.76	1103.17	2.6	ok	1105.76	1106.62	1114	ok	16.5
75th Ave	5	15310	66	U	2640	0.0021			1109.97	1109.52	1108.59	0.9	ok	1109.52	1109.97	1121	ok	18.0
71st Ave	6	17950	60	U	2640	0.0019			1113.30	1112.95	1113.07	-0.1	ok	1113.07	1113.43	1127	ok	19.0
69th Ave	7	19270	48	U	1320	0.0030			1116.34	1115.89	1116.09	-0.2	ok	1116.09	1116.55	1130	ok	18.0
66th Ave	8	21250	108	R	1980	0.0020			1116.0	1129.48	1125.82	3.7	ok	1129.48	1133.60	1138	ok	22.0
Alignment as Noted	9	22570	120	R	1320	0.0030			1120.0	1137.06	1134.46	3.9	ok	1134.46	1137.06	1140	ok	20.0
Along 66th to Frier	10	23230	126	U	660	0.0015			1121.0	1138.52	1136.38	4.4	ok	1136.38	1138.52	1142	ok	21.0
Along Frier to Grand																		

PIPE UNIT PRICE \$	PIPE COST \$
450	2137500
220	581578
121	319450
121	319450
145	381784
132	349034
110	145842
276	546481
345	455334
384	253334

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$5,489,787
40 %	\$7,685,702

<b>City of Glendale</b>																			
Along 65th to Northern	11	1320	132	R	1320	0.0030			1125.0	1139.09	1138.08	1136.20	1.9	ok	1138.08	1139.09	1145	ok	20.0
67th Ave to 65th Ave	12	1320	60	U	1320	0.0083			1136.0	1140.91	1140.42	1141.10	-0.7	ok	1141.10	1141.58	1143	ok	7.0
65th Ave to 63rd Ave	13	1320	102	U	1320	0.0045			1131.0	1145.17	1143.07	1139.92	3.1	ok	1143.07	1145.17	1147	ok	16.0

397	524061
132	174517
294	387805

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$1,086,383
40 %	\$1,520,936

<b>ADOT (Grand Avenue)</b>																			
63rd Ave	14	1880	60	U	1880	0.0048			1130.0	1140.63	1140.09	1135.11	5.0	ok	1140.09	1140.63	1145	ok	15.0

132	248554
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Note: R = Rural Section  
U = Urban Section

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$248,554
40 %	\$347,976

**COST OF WEST BASIN PER PURCHASE PRICE:**

DESCRIPTION	ITEM	UNIT	UNIT COS	COST
35 AC BASIN	LAND	36.92	\$42,338	\$1,563,119
BASIN EXCAVATION	CY	486,000	\$3	\$1,458,000

**COSTS OF STORM DRAIN RIGHT OF WAY PURCHASE:**

DESCRIPTION	AREA SF	UNIT COST	COST
65th Ave - Northern to Frier Dr	26,400	\$1.03	\$27,271
Frier Dr - 65th Ave to 66th Ave	13,200	\$1.03	\$13,636
66th Ave - Frier to Orangewood	26,400	\$1.03	\$27,271
83rd Ave to AFF Channel	211,200	\$1.03	\$217,536

**BASIN TOTAL** \$3,021,119

**RIGHT OF WAY TOTAL** \$285,714

**STORM DRAIN W/CONTINGENCIES BASIN AND RIGHT OF WAY TOTAL**

\$9,555,000
\$3,307,000

**GRAND TOTAL**

\$12,862,000
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Only major friction losses have been considered in the computation of the hydraulic grade line. Minor losses have been ignored.

(a) This column depicts the difference between the calculated hydraulic grade & the elevation of (top of pipe + 0.2 v<sup>2</sup>/2g)

(b) If HGL is significantly lower than the top of pipe elevation, open channel flow may exist, "ocf" statement then appears here.

(c) If natural ground is lower than EGL, "pb" statement appears here.

**TABLE II-5**  
**Option 1B: Glendale Watershed Storm Drain System (with West Basin)**

& Open Channel Between 91st Avenue and the Agua Fria Freeway Channel

ORANGEWOOD AVENUE STORM DRAIN ALIGNMENT  
 (SEE PLATE II-2)

16-Apr-96

Manning's "n" = 0.013

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STORM SEWER LINE STATION LOCATION	LINE #	STATION	PIPE DIA (in)	REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	DESIGN Q (cfs)	PREL GRADE LINE ELEV		CHECK D+INV +.2vel hd	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	(c)	DEPTH TO INVERT	PIPE UNIT PRICE \$	PIPE COST \$
								ENERGY	HYDRAULIC										
<b>Orangewood Alignment</b>																			
AFF Channel Outlet		0				1070.0		1074.00	1074.00				1074.00	1074.00	1081	ok	11.0		
Open Channel	1		Trap	R	4750	0.0007													
91 st Ave		4750				1073.5	348	1077.50	1077.50	1077.50	0.0	ok	1077.50	1078.02	1085	ok	11.5	189	897,750
	2		84	R	2640	0.0009													
87th Ave		7390				1076.0	321	1085.22	1084.14	1083.22	0.9	ok	1084.14	1085.22	1088	ok	12.0	198	523,910
	3		66	R	2640	0.0063													
83rd Ave		10030				1092.5	249	1100.29	1098.59	1098.34	0.2	ok	1098.59	1100.29	1106	ok	13.5	121	319,450
	4		66	R	2640	0.0019													
79th Ave		12670				1097.5	176	1106.66	1105.81	1103.17	2.6	ok	1105.81	1106.66	1114	ok	16.5	121	319,450
	5		66	U	2640	0.0021													
75th Ave		15310				1103.0	127	1110.01	1109.57	1108.59	1.0	ok	1109.57	1110.01	1121	ok	18.0	145	381,784
	6		60	U	2640	0.0019													
71st Ave		17950				1108.0	94	1113.34	1112.99	1113.07	-0.1	ok	1113.07	1113.43	1127	ok	19.0	132	349,034
	7		48	U	1320	0.0030													
69th Ave		19270				1112.0	68	1116.38	1115.93	1116.09	-0.2	ok	1116.09	1116.55	1130	ok	18.0	110	145,842
	8		108	R	1980	0.0020													
66th Ave		21250				1116.0	1036	1133.64	1129.52	1125.82	3.7	ok	1129.52	1133.64	1138	ok	22.0	276	546,481
Alignment as Noted	9		120	R	1320	0.0030													
Along 66th to Frier		22570				1120.0	1017	1137.10	1134.50	1130.52	4.0	ok	1134.50	1137.10	1140	ok	20.0	345	455,334
	10		120	U	660	0.0015													
Along Frier to Grand		23230				1121.0	1017	1139.59	1136.99	1131.52	5.5	ok	1136.99	1139.59	1142	ok	21.0	384	253,334
<b>STORM DRAIN SYSTEM WITH CONTINGENCY</b>																		TOTAL	\$4,192,369
																		40 %	\$5,869,317

<b>City of Glendale</b>																					
Along 65th to Northern	11	1320	144	R	1320	0.0030		1125.0	767	1138.78	1138.06	1137.14	0.9	ok	1138.06	1138.78	1145	ok	20.0	443	585,021
	12		60	U	1320	0.0083															
67th Ave to 65th Ave		1320				1136.0	110	1140.89	1140.40	1141.10	-0.7	ok	1141.10	1141.58	1143	ok	7.0	132	174,517		
	13		120	U	1320	0.0045															
63rd Ave to 65th Ave		1320				1131.0	660	1141.26	1140.16	1141.22	-1.1	ocf	1141.22	1142.32	1147	ok	16.0	384	506,667		

**STORM DRAIN SYSTEM WITH CONTINGENCY**  
 TOTAL \$1,266,205  
 40 % \$1,772,688

<b>ADOT (Grand Avenue)</b>																					
63rd Ave to 65th Ave	14	1880	60	U	1880	0.0048		1130.0	116	1141.24	1140.70	1135.11	5.6	ok	1140.70	1141.24	1145	ok	15.0	132	248,554

**STORM DRAIN SYSTEM WITH CONTINGENCY**  
 TOTAL \$248,554  
 40 % \$347,976

**COST OF WEST BASIN PER PURCHASE PRICE:**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
35 AC BASIN	LAND	36.92	\$42,253	\$1,559,988
BASIN EXCAVATION	CY	486,000	\$3	\$1,458,000
CHANNEL EX TO AFF	CY	74,000	\$3	\$222,000

**COSTS OF STORM DRAIN RIGHT OF WAY PURCHASE:**

DESCRIPTION	AREA SF	UNIT COST	COST
65th Ave - Northern to Frier Dr	26,400	\$1.03	\$27,271
Frier Dr - 65th Ave to 66th Ave	13,200	\$1.03	\$13,636
66th Ave - Frier to Orangewood	26,400	\$1.03	\$27,271
83rd Ave to AFF Channel	475,200	\$1.03	\$489,456

**BASIN TOTAL \$3,240,000**

**RIGHT OF WAY TOTAL \$558,000**

**STORM DRAIN W/CONTINGENCIES BASIN AND RIGHT OF WAY TOTAL \$7,990,000**  
**GRAND TOTAL \$11,788,000**

Only major friction losses have been considered in the computation of the hydraulic grade line. Minor losses have been ignored.

(a) This column depicts the difference between the calculated hydraulic grade & the elevation of (top of pipe + 0.2 v<sup>2</sup>/2g)

(b) If HGL is significantly lower than the top of pipe elevation, open channel flow may exist, "ocf" statement then appears here.

(c) If natural ground is lower than EGL, "pb" statement appears here.

**TABLE II-6**  
**Option 2A: Glendale Watershed Storm Drain System (with East Basin)**

& Box Culvert Between 91st Avenue and Agua Fria Freeway Channel

16-Apr-96

ORANGEWOOD AVENUE STORM DRAIN ALIGNMENT  
(SEE PLATE II-1)

Manning's "n"= 0.013

01:43 PM

LINE STATION	PIPE #	STATION	PIPE DIA (in)	REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	DESIGN Q (cfs)	PREL GRADE LINE ELEV		CHECK D+INV +2vel hd	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	CHECK NAT GRND VS. EGL (c)	DEPTH TO INVERT
								ENERGY	HYDRAULIC								
<b>Orangewood Alignment</b>																	
AFF Channel Outlet		0				1070.0		1075.00	1075.00	1075.00			1075.00	1075.00	1081	ok	11.0
used 2-8x6																	
91 st Ave	1	4750	BOX	R	4750	0.0007		1078.50	1078.50	1078.50	0.0	ok	1078.50	1079.32	1085	ok	11.5
87th Ave	2	7390	108	R	2640	0.0009	583	1085.04	1083.83	1085.24	-1.4	ocf	1085.24	1088.45	1088	ok	12.0
83rd Ave	3	10030	90	R	2640	0.0063	562	1096.56	1094.63	1100.39	-5.8	ocf	1100.39	1102.31	1106	ok	13.5
79th Ave	4	12670	90	R	2640	0.0019	492	1104.95	1103.39	1105.31	-1.9	ocf	1105.31	1108.87	1114	ok	16.5
75th Ave	5	15310	90	U	2640	0.0021	443	1112.31	1110.96	1110.77	0.2	ok	1110.96	1112.31	1121	ok	18.0
71st Ave	6	17950	84	U	2640	0.0019	412	1121.44	1119.98	1115.29	4.7	ok	1119.98	1121.44	1127	ok	19.0
67th Ave	7	20590	78	U	2640	0.0038	374	1126.09	1125.30	1124.66	0.6	ok	1125.30	1126.09	1130	ok	12.0
66th Ave	8	21250	60	R	660	0.0015	236	1129.70	1128.41	1124.26	4.1	ok	1128.41	1129.70	1138	ok	19.0
<i>Alignment as Noted</i>																	
Along 66th to Frier	9	22570	54	R	1320	0.0038	179	1133.08	1132.37	1128.64	3.7	ok	1132.37	1133.08	1140	ok	16.0
Along Frier to Grand	10	23230	54	U	660	0.0030	108	1135.06	1134.35	1130.64	3.7	ok	1134.35	1135.06	1142	ok	16.0

PIPE UNIT PRICE \$	PIPE COST \$
580	2755000
276	728642
220	581578
220	581578
252	665911
229	604577
175	460714
110	72592
98	129360
119	78430

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$6,658,381
40 %	\$9,321,734

<b>City of Glendale</b>																	
Along 65th to Northern	11	24550	48	R	1320	0.0038		1138.05	1137.55	1135.10	2.5	ok	1137.55	1138.05	1145	ok	14.0
Northern 67th to 65th	12	25870	60	U	1320	0.0038		1140.44	1139.94	1141.10	-1.2	ocf	1141.10	1141.60	1143	ok	7.0
Northern 63rd to 65th	13	1320	36	R	1320	0.0008		1143.30	1142.75	1135.11	7.6	ok	1142.75	1143.30	1147	ok	15.0

91	120175
132	174517
83	109841

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$404,533
40 %	\$566,346

<b>ADOT (Grand Avenue)</b>																	
Grand Ave 63rd to 65th	14	1880	54	U	1880	0.0021		1141.81	1140.97	1134.67	6.3	ok	1140.97	1141.81	1145	ok	15.0

119	223407
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**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$223,407
40 %	\$312,770

Note: R = Rural Section  
U = Urban Section

**REVISED COSTS OF EAST BASIN:**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
39 AC(+/-) BASIN	LAND	39	\$56,400	\$2,199,600
BASIN EXCAVATION	CY	650,000	\$3	\$1,950,000

**COSTS OF STORM DRAIN RIGHT OF WAY PURCHASE:**

DESCRIPTION	AREA SF	UNIT COST	COST
Frier Dr - 65th Ave to 66th Av	9,900	\$1.03	\$10,227
66th Ave - Frier to Orangewo	19,800	\$1.03	\$20,453
83rd Ave to AFF Channel	264,000	\$1.03	\$271,920

**BASIN TOTAL** \$4,149,600

**RIGHT OF WAY TOTAL** \$302,600

**STORM DRAIN W/CONTINGENCIES BASIN AND RIGHT OF WAY TOTAL**

\$10,201,000
\$4,452,000

**GRAND TOTAL**

\$14,653,000
--------------

Only major friction losses have been considered in the computation of the hydraulic grade line. Minor losses have been ignored.  
 (a) This column depicts the difference between the calculated hydraulic grade & the elevation of (top of pipe + 0.2 v<sup>2</sup>/2g)  
 (b) If HGL is significantly lower than the top of pipe elevation, open channel flow may exist, "ocf" statement then appears here.  
 (c) If natural ground is lower than EGL, "pb" statement appears here.

**TABLE II-7**

**Option 2B: Glendale Watershed Storm Drain System (with East Basin)**

& Open Channel Between 91st Avenue and the Agua Fria Freeway Channel

ORANGEWOOD AVENUE STORM DRAIN ALIGNMENT  
(SEE PLATE II-1)

Manning's "n" = 0.013

16-Apr-96

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STORM SEWER LINE STATION LOCATION	PIPE #	STATION	PIPE DIA (in)	REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	DESIGN Q (cfs)	PREL GRADE LINE ELEV		CHECK D+INV +2vel hd	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	CHECK NAT GRND W/EGL (c)	DEPTH TO INVERT
								ENERGY	HYDRAULIC								
<b>Orangewood Alignment</b>																	
AFF Channel Outlet		0				1070.0		1074.00	1074.00				1074.00	1074.00	1081	ok	11.0
Open Channel	1		Trap	R	4750	0.0007											
91 st Ave		4750				1073.5	583	1077.50	1077.50	1077.50	0.0	ok	1077.50	1077.92	1085	ok	11.5
87th Ave	2	7390	102	R	2640	0.0009		1086.25	1084.73	1084.80	-0.1	ok	1084.80	1086.33	1088	ok	12.0
83rd Ave	3	10030	90	R	2640	0.0063		1092.5	1095.53	1100.39	-4.9	ocf	1100.39	1102.31	1106	ok	13.5
79th Ave	4	12670	90	R	2640	0.0019		1097.5	1104.29	1105.31	-1.0	ocf	1105.31	1106.87	1114	ok	16.5
75th Ave	5	15310	90	U	2640	0.0021		1103.0	1111.86	1110.77	1.1	ok	1111.86	1113.21	1121	ok	18.0
71st Ave	6	17950	84	U	2640	0.0019		1108.0	1120.87	1115.29	5.6	ok	1120.87	1122.34	1127	ok	19.0
67th Ave	7	20590	78	U	2640	0.0038		1118.0	1126.20	1124.66	1.5	ok	1126.20	1126.99	1130	ok	12.0
66th Ave	8	21250	60	R	660	0.0015		1119.0	1129.31	1124.26	5.0	ok	1129.31	1130.60	1138	ok	19.0
Alignment as Noted Along 66th to Frier	9	22570	54	R	1320	0.0038		1124.0	1133.27	1128.64	4.6	ok	1133.27	1133.98	1140	ok	16.0
Along Frier to Grand	10	23230	54	U	660	0.0030		1126.0	1135.25	1130.64	4.6	ok	1135.25	1135.96	1142	ok	16.0

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$4,898,933
40 %	\$6,858,506

<b>City of Glendale</b>																		
Along 65th to Northern	11	24550	48	R	1320	0.0038		1131.0	1138.95	1138.45	1135.10	3.4	ok	1138.45	1138.95	1145	ok	14.0
Northern 67th to 65th	12	25870	60	U	1320	0.0038		1136.0	1141.34	1140.84	1141.10	-0.3	ok	1141.10	1141.60	1143	ok	7.0
Northern 63rd to 65th	13	27190	36	R	1320	0.0008		1132.0	1144.20	1143.65	1135.11	8.5	ok	1143.65	1144.20	1147	ok	15.0

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$404,533
40 %	\$566,346

<b>ADOT (Grand Avenue)</b>																		
Grand Ave 63rd to 65th	14	1880	54	U	1880	0.0021		1130.0	1142.71	1141.87	1134.67	7.2	ok	1141.87	1142.71	1145	ok	15.0

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$223,407
40 %	\$312,770

Note: R = Rural Section  
U = Urban Section

**REVISED COSTS OF EAST BASIN:**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
39 AC(+/-) BASIN	LAND	39	\$56,400	\$2,199,600
BASIN EXCAVATION	CY	650,000	\$3	\$1,950,000

**BASIN TOTAL \$4,149,600**

**COSTS OF STORM DRAIN RIGHT OF WAY PURCHASE:**

DESCRIPTION	AREA SF	UNIT COST	COST
Frier Dr - 65th Ave to 66th Ave	9,900	\$1.03	\$10,197
66th Ave - Frier to Orangewood	19,800	\$1.03	\$20,394
83rd Ave to AFF Channel	528,000	\$1.03	\$543,840

**RIGHT OF WAY TOTAL \$574,431**

**STORM DRAIN W/CONTINGENCIES BASIN AND RIGHT OF WAY TOTAL**

\$7,738,000
\$4,724,000

**GRAND TOTAL**

\$12,462,000
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Only major friction losses have been considered in the computation of the hydraulic grade line. Minor losses have been ignored.

(a) This column depicts the difference between the calculated hydraulic grade & the elevation of (top of pipe + 0.2 v<sup>2</sup>/2g)

(b) If HGL is significantly lower than the top of pipe elevation, open channel flow may exist, "ocf" statement then appears here.

(c) If natural ground is lower than EGL, "pb" statement appears here.

TABLE II-7A

**Option 2B: Glendale Watershed Storm Drain System (with East Basin)**

Box Culvert Between 91st Avenue and Agua Fria Freeway Channel  
and Partial use (50 cfs bypass) of West Basin

16-Apr-96

ORANGEWOOD AVENUE STORM DRAIN ALIGNMENT  
(SEE PLATE II-1)

Manning's "n" = 0.013

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STORM SEWER LINE STATION LOCATION	PIPE #	STATION	PIPE DIA (in)	REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	NO. OF MANHOLES IN REACH	DESIGN Q (cfs)	PREL GRADE LINE ELEV		CHECK D+INV +.2vel hd	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	CHECK NAT GRND VS. EGL (c)	DEPTH TO INVERT	
									ENERGY	HYDRAULIC									
<b>Orangewood Alignment</b>		0																	
AFF Channel Outlet used 1-10x6	1		<b>BOX</b>	R	4750	0.0007		7		1075.00	1075.00	1075.00			1075.00	<b>1075.00</b>	<b>1081</b>	ok	11.0
91 st Ave	2	4750	<b>90</b>	R	2640	0.0009		4		1078.70	1079.50	1079.90	-0.4	ok	1079.90	<b>1080.30</b>	<b>1085</b>	ok	11.5
87th Ave	3	7390	<b>86</b>	R	2640	0.0063		4		1085.10	1084.45	1083.63	0.8	ok	1084.45	<b>1085.10</b>	<b>1088</b>	ok	12.0
83rd Ave	4	10030	<b>80</b>	R	2640	0.0019		4		1099.04	1097.77	1098.25	-0.5	ok	1098.25	<b>1099.53</b>	<b>1106</b>	ok	13.5
79th Ave	5	12670	<b>80</b>	U	2640	0.0021		4		1110.61	1109.59	1102.70	6.9	ok	1109.59	<b>1110.61</b>	<b>1114</b>	ok	16.5
75th Ave	6	15310	<b>54</b>	U	2640	0.0019		4		1117.41	1116.79	1108.12	8.7	ok	1116.79	<b>1117.41</b>	<b>1121</b>	ok	18.0
71st Ave	7	17950	<b>84</b>	U	2640	0.0038		4		1122.74	1122.31	1112.58	9.7	ok	1122.31	<b>1122.74</b>	<b>1127</b>	ok	19.0
67th Ave	8	20590	<b>78</b>	R	660	0.0015		1		1127.61	1127.03	1125.12	1.9	ok	1127.03	<b>1127.61</b>	<b>1130</b>	ok	12.0
66th Ave	9	21250	<b>66</b>	R	1320	0.0038		2		1128.47	1128.02	1125.59	2.4	ok	1128.02	<b>1128.47</b>	<b>1138</b>	ok	19.0
<b>Alignment as Noted</b>																			
Along 66th to Frier	10	22570	<b>84</b>	U	660	0.0030		1		1130.02	1129.70	1129.56	0.1	ok	1129.70	<b>1130.02</b>	<b>1140</b>	ok	16.0
Along Frier to Grand		23230								1132.76	1132.04	1130.64	1.4	ok	1132.04	<b>1132.76</b>	<b>1142</b>	ok	16.0

PIPE UNIT PRICE \$	PIPE COST \$
580	2755000
220	581578
121	319450
110	290367
132	349034
119	313720
229	604577
148	97762
121	159725
119	78430

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$5,549,643
40 %	\$7,769,501

City of Glendale	PIPE #	STATION	PIPE DIA (in)	REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	NO. OF MANHOLES IN REACH	DESIGN Q (cfs)	ENERGY	HYDRAULIC	CHECK D+INV +.2vel hd	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	CHECK NAT GRND VS. EGL (c)	DEPTH TO INVERT	
Along 65th to Northern	11	24550	<b>48</b>	R	1320	0.0038		2		1136.24	1135.74	1135.10	0.6	ok	1135.74	<b>1136.24</b>	<b>1145</b>	ok	14.0
Northern 67th to 65th	12	25870	<b>54</b>	U	1320	0.0038		2		1141.44	1140.68	1140.65	0.0	ok	1140.68	<b>1141.44</b>	<b>1143</b>	ok	7.0
Northern 63rd to 65th	13	1320	<b>36</b>	R	1320	0.0008		2		1142.04	1141.49	1135.11	6.4	ok	1141.49	<b>1142.04</b>	<b>1147</b>	ok	15.0

91	120175
119	156860
83	109841

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$386,876
40 %	\$541,627

ADOT (Grand Avenue)	PIPE #	STATION	PIPE DIA (in)	REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	NO. OF MANHOLES IN REACH	DESIGN Q (cfs)	ENERGY	HYDRAULIC	CHECK D+INV +.2vel hd	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	CHECK NAT GRND VS. EGL (c)	DEPTH TO INVERT	
Grand Ave 63rd to 65th	14	1880	<b>54</b>	U	1880	0.0021		3		1140.76	1139.92	1134.67	5.3	ok	1139.92	<b>1140.76</b>	<b>1145</b>	ok	15.0

119	223407
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Note: R = Rural Section  
U = Urban Section

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$223,407
40 %	\$312,770

**REVISED COSTS OF EAST BASIN:**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
39 AC(+/-) BASIN	LAND	39	\$56,400	\$2,199,600
BASIN EXCAVATION	CY	650,000	\$3	\$1,950,000

**BASIN TOTAL \$4,149,600**

**COSTS OF STORM DRAIN RIGHT OF WAY PURCHASE:**

DESCRIPTION	AREA SF	UNIT COST	COST
Frier Dr - 65th Ave to 66th Ave	9,900	\$1.03	\$10,227
66th Ave - Frier to Orangewood	19,800	\$1.03	\$20,453
83rd Ave to AFF Channel	176,000	\$1.03	\$181,280
<b>RIGHT OF WAY TOTAL</b>			<b>\$211,960</b>

**STORM DRAIN W/CONTINGENCIES BASIN AND RIGHT OF WAY TOTAL**

<b>\$8,624,000</b>
<b>\$4,362,000</b>

**COST OF WEST BASIN PER PURCHASE PRICE:**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
8.5 AC BASIN	LAND	8.5	\$42,253	\$359,152
BASIN EXCAVATION	CY	139,000	\$3	\$417,000

**BASIN TOTAL \$776,000**

**GRAND TOTAL**

<b>\$12,986,000</b>
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- (a) This column depicts the difference between the calculated hydraulic grade & the elevation of (top of pipe + 0.2 v<sup>2</sup>/2g)
- (b) If HGL is significantly lower than the top of pipe elevation, open channel flow may exist, "ocf" statement then appears here.
- (c) If natural ground is lower than EGL, "pb" statement appears here.

**TABLE II-8  
Glendale Avenue Alignment, Glendale Watershed Storm Drain System**

SAME AS ORANGEWOOD AVE ALIGNMENT WITH WEST BASIN OPTION DOWNSTREAM TO 83RD AVENUE  
THEN SOUTH ON 83RD AVE TO GLENDALE AVE AND WEST ON GLENDALE AVE TO THE AFF CHANNEL  
0.013

SEE PLATE II-3  
Manning's "n" =

STORM SEWER LINE STATION LOCATION	PIPE #	STATION	PIPE DIA (in)	REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	DESIGN Q (cfs)	PREL GRADE LINE ELEV		CHECK D+INV +2 v^2/2g	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	(c)	DEPTH TO INVERT	PIPE UNIT PRICE \$	PIPE COST \$
								ENERGY	HYDRAULIC										
<b>Glendale Ave Alignment</b>																			
AFF Cha Outlet @ 98th Ave		0				1052.0		1060.00	1060.00				1060.00	1060.00	1087	ok	15.0		
95 th Ave	41	2100	102	U	2100	0.0019		1056.0	1064.25	1064.73	-0.5	ok	1064.73	1065.85	1088	ok	12.0	294	616963
83rd Ave @ Glendale	42,43	10100	90	U	8000	0.0034		1083.0	1091.75	1090.82	0.9	ok	1091.75	1093.37	1095	ok	12.0	252	2017912
83rd Ave @ Orangewood	44	12740	66	U	2640	0.0036		1092.5	1103.13	1098.27	4.9	ok	1103.13	1104.47	1108	ok	13.5	145	381784
<b>Orangewood Alignment</b>																			
79th Ave	4	15380	66	R	2640	0.0019		1097.5	1110.35	1103.17	7.2	ok	1110.35	1111.20	1114	ok	16.5	121	319450
75th Ave	5	18020	60	U	2640	0.0021		1103.0	1116.60	1108.13	8.5	ok	1116.60	1117.25	1121	ok	18.0	132	349034
71st Ave	6	20660	54	U	2640	0.0019		1108.0	1122.60	1112.61	10.0	ok	1122.60	1123.14	1127	ok	19.0	119	313720
69th Ave	7	21980	48	U	1320	0.0030		1112.0	1125.54	1116.09	9.4	ok	1125.54	1125.99	1130	ok	18.0	110	145842
66th Ave	8	23960	126	R	1980	0.0020		1116.0	1131.50	1126.94	4.6	ok	1131.50	1133.72	1138	ok	22.0	345	683001
<b>Alignment as Noted</b>																			
Along 66th to Frier	9	25280	126	R	1320	0.0030		1120.0	1137.48	1135.34	4.4	ok	1135.34	1137.48	1140	ok	20.0	345	455334
Along Frier to Grand	10	25940	126	U	660	0.0015		1121.0	1137.26	1131.93	5.3	ok	1137.26	1139.40	1142	ok	21.0	384	253334
<b>STORM DRAIN SYSTEM WITH CONTINGENCY</b>																		TOTAL	\$5,536,375
																		40 %	\$7,750,924

<b>City of Glendale</b>																			
Along 65th to Northern	11	27260	126	R	1320	0.0030		1125.0	1140.66	1139.44	3.7	ok	1139.44	1140.66	1145	ok	20.0	345	455334
67th Ave to 65th Ave	12	28580	60	U	1320	0.0076		1135.0	1141.79	1140.10	1.7	ok	1141.79	1142.28	1143	ok	8.0	132	174517
65th Ave to 63rd Ave	13	1320	114	U	1320	0.0045		1131.0	1142.20	1140.77	1.4	ok	1142.20	1143.55	1147	ok	16.0	345	456008
<b>STORM DRAIN SYSTEM WITH CONTINGENCY</b>																		TOTAL	\$1,085,859
																		40 %	\$1,520,203

<b>ADOT (Grand Avenue)</b>																			
65th Ave to 63rd Ave	14	1880	60	U	1880	0.0048		1130.0	1141.51	1140.97	5.9	ok	1140.97	1141.51	1145	ok	15.0	132	248554
<b>STORM DRAIN SYSTEM WITH CONTINGENCY</b>																		TOTAL	\$248,554
																		40 %	\$347,976

Note: R = Rural Section  
U = Urban Section

**COST OF WEST BASIN PER PURCHASE PRICE:**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
35 AC BASIN	LAND	36.92	\$42,253	\$1,559,988
BASIN EXCAVATION	CY	486,000	\$3	\$1,458,000

**COST OF STORM DRAIN RIGHT OF WAY PURCHASE:**

DESCRIPTION	AREA SF	UNIT COS	COST
65th Ave - Northern to Frier Dr	26,400	\$1.03	\$27,271
Frier Dr - 65th Ave to 66th Ave	13,200	\$1.03	\$13,636
66th Ave - Frier to Orangewood	26,400	\$1.03	\$27,271

**COST OF MODIFYING AFF OUTFALL CHANNEL**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
Glendale Ave to	Lining SF	60,768	\$3	\$182,304
Bethany Home Road	Excav CY	24,906	\$3	\$74,718
<b>AFF CHANNEL MODIFICATION TOTAL</b>				<b>\$257,022</b>

<b>BASIN TOTAL</b>	<b>\$3,018,000</b>																		<b>RIGHT OF WAY TOTAL</b>	<b>\$68,000</b>	
<b>STORM DRAIN W/CONTINGENCIES</b>																		<b>\$9,619,000</b>			
<b>BASIN, R/W AND AFF CHANNEL TOTAL</b>																		<b>\$3,343,000</b>			
<b>GRAND TOTAL</b>																		<b>\$12,962,000</b>			

Only major friction losses have been considered in the computation of the hydraulic grade line. Minor losses have been ignored.  
 (a) This column depicts the difference between the calculated hydraulic grade & the elevation of (top of pipe + 0.2 v^2/2g)  
 (b) If HGL is significantly lower than the top of pipe elevation, open channel flow may exist, "ocf" statement then appears here.  
 (c) If natural ground is lower than EGL, "pb" statement appear here.

**TABLE 8A**  
**Glendale Avenue Alignment with East Basin**

No diversion into west basin

16-Apr-96

ORANGEWOOD AVENUE STORM DRAIN ALIGNMENT  
(SEE PLATE II-1)

Manning's "n" = 0.013

01:16 PM

STORM SEWER LINE STATION LOCATION	PIPE #	STATION	PIPE DIA (in)	REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	NO. OF MANHOLES IN REACH	DESIGN Q (cfs)	PREL GRADE LINE ELEV		CHECK D+INV +.2vel hd	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	CHECK NAT GRND VS. EGL (c)	DEPTH TO INVERT	PIPE UNIT PRICE \$	PIPE COST \$
									ENERGY	HYDRAULIC										
<b>Glendale Ave Alignment</b>																				
AFF Cha Outlet @ 98th Ave.		0				1052.0			1060.00	1060.00				1060.00	1060.00	1067	ok	15.0		
95 th Ave	41	2100	120	U	2100	0.0019	3	751	1067.87	1066.45	1066.28	0.2	ok	1066.45	1067.87	1068	pb (d)	12.0	384	806062
83rd Ave @ Glendale	42,43	10100	120	U	8000	0.0034	12	727	1091.18	1089.85	1093.27	-3.4	ocf	1093.27	1094.60	1095	pb (d)	12.0	384	3070712
83rd Ave @ Orangewood	44	12740	102	U	2640	0.0036	4	497	1099.08	1097.89	1101.24	-3.3	ocf	1101.24	1102.43	1106	ok	13.5	294	775610
<b>Orangewood Alignment</b>																				
79th Ave	4	15380	96	R	2640	0.0019	4	440	1107.58	1106.39	1105.74	0.7	ok	1106.39	1107.58	1114	ok	16.5	242	639322
75th Ave	5	18020	96	U	2640	0.0021	4	410	1114.81	1113.78	1111.21	2.6	ok	1113.78	1114.81	1121	ok	18.0	276	727322
71st Ave	6	20660	96	U	2640	0.0019	4	373	1120.74	1119.89	1116.17	3.7	ok	1119.89	1120.74	1127	ok	19.0	276	727322
67th Ave	7	23300	78	U	2640	0.0038	4	235	1127.51	1126.73	1124.66	2.1	ok	1126.73	1127.51	1130	ok	12.0	175	460714
66th Ave	8	23960	72	R	660	0.0015	1	179	1128.84	1128.21	1125.12	3.1	ok	1128.21	1128.84	1138	ok	19.0	132	87153
<b>Alignment as Noted</b>																				
Along 66th to Frier	9	25280	66	R	1320	0.0038	2	108	1130.21	1129.89	1129.56	0.3	ok	1129.89	1130.21	1140	ok	16.0	121	159725
Along Frier to Grand	10	25940	60	U	660	0.0030	1	108	1131.73	1131.26	1131.09	0.2	ok	1131.26	1131.73	1142	ok	16.0	132	87258

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$7,541,202
40 %	\$3,057,682

<b>City of Glendale</b>																				
Along 65th to Northern	11	27260	48	R	1320	0.0038	2	71	1135.46	1134.96	1135.10	-0.1	ok	1135.10	1135.59	1145	ok	14.0	91	120175
Northern 67th to 65th	12	28580	54	U	1320	0.0038	2	111	1140.66	1139.90	1140.65	-0.8	ok	1140.65	1141.41	1143	ok	7.0	119	156860
Northern 63rd to 65th	13	1320	36	R	1320	0.0008	2	42	1141.26	1140.71	1135.11	5.6	ok	1140.71	1141.26	1147	ok	15.0	83	109841

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$386,876
40 %	\$154,751

<b>ADOT (Grand Avenue)</b>																				
Grand Ave 63rd to 65th	14	1880	60	U	1880	0.0021	3	117	1136.41	1135.86	1135.11	0.8	ok	1135.86	1136.41	1145	ok	15.0	132	248554

Note: R = Rural Section  
U = Urban Section

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$248,554
40 %	\$99,422

**REVISED COSTS OF EAST BASIN:**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
39 AC(+/-) BASIN	LAND	39	\$56,400	\$2,199,600
BASIN EXCAVATION	CY	650,000	\$3	\$1,950,000

**COSTS OF STORM DRAIN RIGHT OF WAY PURCHASE:**

DESCRIPTION	AREA SF	UNIT COST	COST
Frier Dr - 65th Ave to 66th Ave	9,900	\$1.03	\$10,227
66th Ave - Frier to Orangewood	19,800	\$1.03	\$20,453
66th Ave - Northern to Frier Dr	26,400	\$1.03	\$27,271

**COST OF MODIFYING AFF OUTFALL CHANNEL**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
Glendale Ave to	Lining SF	60,768	\$3	\$182,304
Bethany Home Road	Excav CY	24,906	\$3	\$74,718
<b>AFF CHANNEL MODIFICATION TOTAL</b>				<b>\$257,022</b>

**BASIN TOTAL** \$4,149,600

**RIGHT OF WAY TOTAL** \$57,951

**COST OF WEST BASIN PER PURCHASE PRICE:**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
35 AC BASIN	LAND		\$42,253	\$0
BASIN EXCAVATION	CY		\$3	\$0

**BASIN TOTAL** \$0

**STORM DRAIN W/CONTINGENCIES  
BASIN, RW AND AFF CHANNEL TOTAL  
GRAND TOTAL**

\$11,447,000
\$4,465,000
<b>\$15,912,000</b>

- (a) This column depicts the difference between the calculated hydraulic grade & the elevation of (top of pipe + 0.2 v<sup>2</sup>/2g)
- (b) If HGL is significantly lower than the top of pipe elevation, open channel flow may exist, "ocf" statement then appears here
- (c) If natural ground is less than 1.5 feet above EGL, "pb" statement appears here.
- (d) At these locations, pipe was designed with HGL a minimum of one foot below natural ground.

**TABLE 8B**  
**Glendale Avenue Alignment with East Basin**

Partial use (50 cfs bypass) of West Basin

16-Apr-96

**ORANGEWOOD AVENUE STORM DRAIN ALIGNMENT**  
**(SEE PLATE II-1)**

Manning's "n" = 0.013

11:38 AM

STORM SEWER LINE STATION LOCATION	PIPE #	STATION	PIPE DIA (in)	REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	NO. OF MANHOLES IN REACH	DESIGN Q (cfs)	PREL GRADE LINE ELEV		CHECK D+INV + 2vel hd	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	CHECK NAT GRND VS. EGL (c)	DEPTH TO INVERT	PIPE UNIT PRICE \$	PIPE COST \$
									ENERGY	HYDRAULIC										
<b>Glendale Ave Alignment</b>																				
AFF Cha Outlet @ 98th Ave.		0				1052.0			1060.00	1060.00				1060.00	1060.00	1067	ok	15.0		
95 th Ave	41	2100	108	U	0.0019	1056.0	3	487	1065.46	1064.55	1065.18	-0.6	ok	1065.18	1066.09	1068	ok	12.0	312	655435
83rd Ave @ Glendale	42,43	10100	96	U	0.0034	1083.0	12	455	1093.30	1092.03	1091.25	0.8	ok	1092.03	1093.30	1095	ok	12.0	276	2204007
83rd Ave @ Orangewood	44	12740	72	U	0.0036	1092.5	4	220	1101.94	1101.00	1098.69	2.3	ok	1101.00	1101.94	1106	ok	13.5	157	414611
<b>Orangewood Alignment</b>																				
79th Ave	4	15380	66	R	0.0019	1097.5	4	159	1108.98	1108.28	1103.14	5.1	ok	1108.28	1108.98	1114	ok	16.5	121	319450
75th Ave	5	18020	60	U	0.0021	1103.0	4	124	1116.10	1115.48	1108.12	7.4	ok	1115.48	1116.10	1121	ok	18.0	132	349034
71st Ave	6	20660	54	U	0.0019	1108.0	4	83	1121.42	1121.00	1112.58	8.4	ok	1121.00	1121.42	1127	ok	19.0	119	313720
69th Ave	7	21980	48	U	0.0038	1113.0	2	50	1123.08	1122.84	1117.05	5.8	ok	1122.84	1123.08	1130	ok	17.0	110	145842
67th Ave	7a	23300	78	U	0.0038	1118.0	2	235	1127.04	1126.26	1124.66	1.6	ok	1126.26	1127.04	1130	ok	12.0	175	230357
66th Ave	8	23960	66	R	0.0015	1119.0	1	179	1129.45	1128.56	1124.68	3.9	ok	1128.56	1129.45	1138	ok	19.0	121	79863
<b>Alignment as Noted</b>																				
Along 66th to Frier	9	25280	66	R	0.0038	1124.0	2	108	1130.57	1130.24	1129.56	0.7	ok	1130.24	1130.57	1140	ok	16.0	121	159725
Along Frier to Grand	10	25940	60	U	0.0030	1126.0	1	108	1132.08	1131.61	1131.09	0.5	ok	1131.61	1132.08	1142	ok	16.0	132	87258

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$4,959,302
40 %	\$6,943,023

<b>City of Glendale</b>																				
Along 65th to Northern	11	27260	48	R	0.0038	1131.0	2	71	1135.81	1135.31	1135.10	0.2	ok	1135.31	1136.81	1145	ok	14.0	91	120175
Northern 67th to 65th	12	28580	54	U	0.0038	1136.0	2	111	1141.01	1140.25	1140.65	-0.4	ok	1140.65	1141.41	1143	ok	7.0	119	156860
Northern 63rd to 65th	13	1320	36	R	0.0008	1132.0	2	42	1141.61	1141.06	1135.11	5.9	ok	1141.06	1141.61	1147	ok	15.0	83	109841

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$386,876
40 %	\$541,627

<b>ADOT (Grand Avenue)</b>																				
Grand Ave 63rd to 65th	14	1880	60	U	0.0021	1130.0	3	117	1136.76	1136.21	1135.11	1.1	ok	1136.21	1136.76	1145	ok	15.0	132	248554

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$248,554
40 %	\$347,976

Note: R = Rural Section  
U = Urban Section

**REVISED COSTS OF EAST BASIN:**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
39 AC (+/-) BASIN	LAND	39	\$56,400	\$2,199,600
BASIN EXCAVATION	CY	650,000	\$3	\$1,950,000

**BASIN TOTAL \$4,149,600**

**COSTS OF STORM DRAIN RIGHT OF WAY PURCHASE:**

DESCRIPTION	AREA SF	UNIT COST	COST
Frier Dr - 65th Ave to 66th Ave	9,900	\$1.03	\$10,227
66th Ave - Frier to Orangewood	19,800	\$1.03	\$20,453
66th Ave - Northern to Frier Dr	26,400	\$1.03	\$27,271

**RIGHT OF WAY TOTAL \$57,951**

**COST OF MODIFYING AFF OUTFALL CHANNEL**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
Glendale Ave to	Lining SF	60,768	\$3	\$182,304
Bethany Home Road	Excav CY	24,906	\$3	\$74,718

**AFF CHANNEL MODIFICATION TOTAL \$257,022**

**COST OF WEST BASIN PER PURCHASE PRICE:**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
9.4 AC BASIN	LAND	9.1	\$42,253	\$384,504
BASIN EXCAVATION	CY	145,000	\$3	\$435,000

**BASIN TOTAL \$820,000**

**STORM DRAIN W/CONTINGENCIES BASIN, R/W AND AFF CHANNEL TOTAL**

\$7,833,000
\$5,285,000

**GRAND TOTAL**

\$13,118,000
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- (a) This column depicts the difference between the calculated hydraulic grade & the elevation of (top of pipe + 0.2 v<sup>2</sup>/2g)
- (b) If HGL is significantly lower than the top of pipe elevation, open channel flow may exist, "oc" statement then appears here
- (c) If natural ground is less than 1.5 feet above EGL, "pb" statement appears here.

**TABLE 8C**  
**Glendale Avenue Alignment with East Basin**  
 Partial use (100 cfs bypass) of West Basin

**ORANGEWOOD AVENUE STORM DRAIN ALIGNMENT**  
 (SEE PLATE II-1)

Manning's "n"= 0.013

STORM SEWER LINE STATION LOCATION	PIPE #	STATION	PIPE DIA (in)	REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	NO. OF MANHOLES IN REACH	DESIGN Q (cfs)	PREL GRADE LINE ELEV		CHECK D+INV +.2vel hd	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	CHECK NAT GRND VS. EGL (c)	DEPTH TO INVERT
									ENERGY	HYDRAULIC								
<b>Glendale Ave Alignment</b>																		
AFF Cha Outlet @ 98th Ave		0				1052.0			1060.00	1060.00				1060.00	1060.00	1067	ok	15.0
95 th Ave	41	2100	108	U	2100	0.0019	3							1065.55	1066.66	1068	pb (d)	12.0
83rd Ave @ Glendale	42,43	10100	102	U	8000	0.0034	12	538	1066.66	1065.55	1065.22	0.3	ok	1065.55	1066.66	1068	pb (d)	12.0
83rd Ave @ Orangewood	44	12740	78	U	2640	0.0036	4	505	1091.86	1090.63	1091.75	-1.1	ocf	1091.75	1092.98	1095	ok	12.0
Orangewood Alignment	4	15380	72	R	2640	0.0019	4	209	1108.60	1099.66	1099.21	0.5	ok	1099.66	1100.68	1106	ok	13.5
79th Ave	5	18020	66	U	2640	0.0021	4	174	1108.60	1107.75	1103.67	4.1	ok	1107.75	1108.60	1114	ok	16.5
75th Ave	6	20660	66	U	2640	0.0019	4	133	1117.31	1116.48	1108.67	7.8	ok	1116.48	1117.31	1121	ok	18.0
71st Ave	7	23300	84	U	2640	0.0038	4	235	1122.06	1121.57	1113.60	8.0	ok	1121.57	1122.06	1127	ok	19.0
67th Ave	8	23960	78	R	660	0.0015	1	179	1126.87	1126.29	1125.12	1.2	ok	1126.29	1126.87	1130	ok	12.0
66th Ave	9	25280	60	R	1320	0.0038	2	108	1127.73	1127.28	1125.59	1.7	ok	1127.28	1127.73	1138	ok	19.0
Alignment as Noted Along 66th to Frier	10	25940	60	U	660	0.0030	1	108	1130.48	1130.01	1129.09	0.9	ok	1130.01	1130.48	1140	ok	16.0
Along Frier to Grand		25940						108	1131.84	1131.37	1131.09	0.3	ok	1131.37	1131.84	1142	ok	16.0

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$5,513,442
40 %	\$7,718,819

<b>City of Glendale</b>																		
Along 65th to Northern	11	27260	48	R	1320	0.0038	2	71	1135.57	1135.08	1135.10	-0.0	ok	1135.10	1135.59	1145	ok	14.0
Northern 67th to 65th	12	28580	54	U	1320	0.0038	2	111	1140.77	1140.02	1140.65	-0.6	ok	1140.65	1141.41	1143	ok	7.0
Northern 63rd to 65th	13	1320	36	R	1320	0.0008	2	42	1141.37	1140.82	1135.11	5.7	ok	1140.82	1141.37	1147	ok	15.0

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$386,876
40 %	\$541,627

<b>ADOT (Grand Avenue)</b>																		
Grand Ave 63rd to 65th	14	1880	60	U	1880	0.0021	3	117	1136.53	1135.98	1135.11	0.9	ok	1135.98	1136.53	1145	ok	15.0

Note: R = Rural Section  
 U = Urban Section

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$248,554
40 %	\$347,976

**REVISED COSTS OF EAST BASIN:**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
39 AC (+-) BASIN	LAND	39	\$56,400	\$2,199,600
BASIN EXCAVATION	CY	650,000	\$3	\$1,950,000

**BASIN TOTAL** \$4,149,600

**COSTS OF STORM DRAIN RIGHT OF WAY PURCHASE:**

DESCRIPTION	AREA SF	UNIT COST	COST
Frier Dr - 65th Ave to 66th Ave	9,900	\$1.03	\$10,227
66th Ave - Frier to Orangewood	19,800	\$1.03	\$20,453
66th Ave - Northern to Frier Dr	26,400	\$1.03	\$27,271

**RIGHT OF WAY TOTAL** \$57,951

**COST OF MODIFYING AFF OUTFALL CHANNEL**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
Glendale Ave to Bethany Home Road	Lining SF	60,768	\$3	\$182,304
	Excav CY	24,906	\$3	\$74,718
<b>AFF CHANNEL MODIFICATION TOTAL</b>				<b>\$257,022</b>

**STORM DRAIN W/CONTINGENCIES  
 BASIN, R/W AND AFF CHANNEL TOTAL  
 GRAND TOTAL**

\$8,608,000
\$4,898,000
<b>\$13,506,000</b>

- (a) This column depicts the difference between the calculated hydraulic grade & the elevation of (top of pipe + 0.2 v^2/2g)
- (b) If HGL is significantly lower than the top of pipe elevation, open channel flow may exist, "ocf" statement then appears here
- (c) If natural ground is less than 1.5 feet above EGL, "pb" statement appears here.
- (d) At this location, pipe was designed with HGL a minimum of one foot below natural ground.

**TABLE 8D**  
**Glendale Avenue Alignment with East Basin**

Partial use (200 cfs bypass) of West Basin

**ORANGEWOOD AVENUE STORM DRAIN ALIGNMENT**  
 (SEE PLATE II-1)

Manning's "n" = 0.013

STORM SEWER LINE STATION LOCATION	PIPE #	STATION	PIPE DIA (in)	REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	NO. OF MANHOLES IN REACH	DESIGN Q (cfs)	PREL GRADE LINE ELEV		CHECK D+INV + 2vel hd	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	CHECK NAT GRND VS. EGL (c)	DEPTH TO INVERT	PIPE UNIT PRICE \$	PIPE COST \$
									ENERGY	HYDRAULIC										
<b>Glendale Ave Alignment</b>																				
AFF Cha Outlet @ 98th Ave.		0				1052.0			1060.00	1060.00				1060.00	1060.00	1067	ok	15.0		
95th Ave	41	2100	114	U	2100	0.0019	3	636	1067.20	1065.95	1065.75	0.2	ok	1065.95	1067.20	1068	pb (d)	12.0	345	725468
83rd Ave @ Glendale	42,43	10100	108	U	8000	0.0034	12	605	1094.50	1093.10	1092.28	0.8	ok	1093.10	1094.50	1095	pb (d)	12.0	312	2496894
83rd Ave @ Orangewood	44	12740	90	U	2640	0.0036	4	370	1102.47	1101.39	1100.22	1.2	ok	1101.39	1102.47	1106	ok	13.5	252	665911
<b>Orangewood Alignment</b>																				
79th Ave	4	15380	84	R	2640	0.0019	4	309	1110.54	1109.54	1104.70	4.8	ok	1109.54	1110.54	1114	ok	16.5	198	523910
75th Ave	5	18020	84	U	2640	0.0021	4	276	1116.79	1116.00	1110.16	5.8	ok	1116.00	1116.79	1121	ok	18.0	229	604577
71st Ave	6	20660	84	U	2640	0.0019	4	233	1121.21	1120.64	1115.11	5.5	ok	1120.64	1121.21	1127	ok	19.0	229	604577
67th Ave	7	23300	78	U	2640	0.0038	4	235	1128.26	1127.48	1124.66	2.8	ok	1127.48	1128.26	1130	ok	12.0	175	460714
66th Ave	8	23960	72	R	660	0.0015	1	179	1129.59	1128.96	1125.12	3.8	ok	1128.96	1129.59	1138	ok	19.0	132	87153
<b>Alignment as Noted</b>																				
Along 66th to Frier	9	25280	66	R	1320	0.0038	2	108	1130.96	1130.64	1129.56	1.1	ok	1130.64	1130.96	1140	ok	16.0	121	159725
Along Frier to Grand	10	25940	60	U	660	0.0030	1	108	1132.48	1132.01	1131.09	0.9	ok	1132.01	1132.48	1142	ok	16.0	132	87258

11:28 AM

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$6,416,187
40 %	\$8,982,661

City of Glendale	PIPE #	STATION	PIPE DIA (in)	REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	NO. OF MANHOLES IN REACH	DESIGN Q (cfs)	ENERGY	HYDRAULIC	CHECK D+INV + 2vel hd	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	CHECK NAT GRND VS. EGL (c)	DEPTH TO INVERT	PIPE UNIT PRICE \$	PIPE COST \$
Along 65th to Northern	11	27260	48	R	1320	0.0038	2	71	1136.21	1135.71	1135.10	0.6	ok	1135.71	1136.21	1145	ok	14.0	91	120175
Northern 67th to 65th	12	28580	54	U	1320	0.0038	2	111	1141.41	1140.65	1140.65	-0.0	ok	1140.65	1141.41	1143	ok	7.0	119	156860
Northern 63rd to 65th	13	1320	36	R	1320	0.0008	2	42	1142.01	1141.46	1135.11	6.3	ok	1141.46	1142.01	1147	ok	15.0	83	109841

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$386,876
40 %	\$541,627

ADOT (Grand Avenue)	PIPE #	STATION	PIPE DIA (in)	REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	NO. OF MANHOLES IN REACH	DESIGN Q (cfs)	ENERGY	HYDRAULIC	CHECK D+INV + 2vel hd	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	CHECK NAT GRND VS. EGL (c)	DEPTH TO INVERT	PIPE UNIT PRICE \$	PIPE COST \$
Grand Ave 63rd to 65th	14	1880	60	U	1880	0.0021	3	117	1137.16	1136.61	1135.11	1.5	ok	1136.61	1137.16	1145	ok	15.0	132	248554

Note: R = Rural Section  
 U = Urban Section

**STORM DRAIN SYSTEM WITH CONTINGENCY**

TOTAL	\$248,554
40 %	\$347,976

**REVISED COSTS OF EAST BASIN:**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
39 AC (+/-) BASIN	LAND	39	\$56,400	\$2,199,600
BASIN EXCAVATION	CY	650,000	\$3	\$1,950,000

**BASIN TOTAL \$4,149,600**

**COSTS OF STORM DRAIN RIGHT OF WAY PURCHASE:**

DESCRIPTION	AREA SF	UNIT COST	COST
Frier Dr - 65th Ave to 66th Ave	9,900	\$1.03	\$10,227
66th Ave - Frier to Orangewood	19,800	\$1.03	\$20,453
66th Ave - Northern to Frier Dr	26,400	\$1.03	\$27,271

**RIGHT OF WAY TOTAL \$57,951**

**COST OF MODIFYING AFF OUTFALL CHANNEL**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
Glendale Ave to	Lining SF	60,768	\$3	\$182,304
Bethany Home Road	Excav CY	24,906	\$3	\$74,718

**AFF CHANNEL MODIFICATION TOTAL \$257,022**

**COST OF WEST BASIN PER PURCHASE PRICE:**

DESCRIPTION	ITEM	UNIT	UNIT COST	COST
2.4 AC BASIN	LAND	2.4	\$42,253	\$101,408
BASIN EXCAVATION	CY	22,740	\$3	\$68,220

**BASIN TOTAL \$170,000**

**STORM DRAIN W/CONTINGENCIES  
 BASIN, R/W AND AFF CHANNEL TOTAL  
 GRAND TOTAL**

\$9,872,000
\$4,635,000
<b>\$14,507,000</b>

- (a) This column depicts the difference between the calculated hydraulic grade & the elevation of (top of pipe + 0.2 v<sup>2</sup>/2g)
- (b) If HGL is significantly lower than the top of pipe elevation, open channel flow may exist, "ocf" statement then appears here.
- (c) If natural ground is less than 1.5 feet above EGL, "pb" statement appears here.
- (d) At these locations, pipe was designed with HGL a minimum of one foot below natural ground.

# NORTHERN/ORANGEWOOD STORM DRAIN PROJECT

## CONCEPT/ROUTING STUDY

Contract FCD 94-12



### LEGEND

- | <u>Existing</u>   | <u>Proposed</u>                    |
|---|------------------------------------|
| Storm Drain Pipe  | Storm Drain Pipe                   |
| AFF Outlet Channel  | Detention/Surge Basin              |
|   | Future Outfall Channel             |
| NOTE: See Pertinent Table II for Pipe #'s, Sizes and Flows. |                                    |
|   | Butler Drive Storm Drain Pipe #    |
|   | Northern Avenue Storm Drain Pipe # |
|   | Glendale Avenue Storm Drain Pipe # |



**SELECTED ALIGNMENTS**  
**BUTLER AVENUE, NORTHERN AVENUE AND**  
**GLENDALE AVENUE ALIGNMENTS**

Wood, Patel & Associates, Inc.

PLATE II-3A