ENG 'RG

FINAL DRAINAGE REPORT

RED MOUNTAIN FREEWAY (PHASE III)

McKELLIPS ROAD TO COUNTRY CLUB DRIVE

Prepared for:

ARIZONA DEPARTMENT OF TRANSPORTATION

December 1996

Prepared by:

STANLEY CONSULTANTS, INC.

in association with

WOOD/PATEL ASSOCIATES

STANLEY CONSULTANTS, INC.

2929 East Camelback Road, Suite 130 • Phoenix, AZ 85016-4425 Tel: 602/912-6500 • Fax: 602/912-6599

March 17, 1997

Mr. Richard G. Perreault
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Planning and Project Management
2801 West Durango
Phoenix, Arizona 85009

FLOOD CONTROL
RECEIVED
MAR 18 1997

RE: **FINAL DRAINAGE REPORT ADDENDUM**

Contract No. 94-29
Project No. STP 600-8-(009)
TRACS No. H3878 01C
RED MOUNTAIN FREEWAY (SR 202L)
(McKellips Road - Country Club Drive)

REMARKS
1
3/18

Dear Mr. Perreault:

Enclosed please find the revised Final Drainage Report information for the above referenced project. These revised Tables were the result of review comments received during the Final I Design (95%) Submittal review process.

One copy of the revised Final Drainage Report Tables are enclosed, itemized as follows:

- o Table I: Off-Site Watershed Sub-Basin Parameters.
- o Table III: Offsite Watershed Soil Types.
- o Table IV: Calculation of Subbasin Composite XKSAT.
- o Table V: Green-Ampt Infiltration Parameters.
- o Table VII: Summary of HEC-1 Routing Parameters.
- o Table VIII: Peak Discharges for the Red Mountain Freeway, Phase III Off-Site Drainage Areas.

Please include these revised Tables in the Final Drainage Report, which was provided to your office at the Final I (95%) Design Submittal.

OK 3/25/1997 included in the Report

Thank you for your assistance in the development of this project. If you need additional information or have any questions, please contact me at 912-6500.

Sincerely,

STANLEY CONSULTANTS, INC.

Steven Wilcox, P.E.
Project Manager

sw/tlb:MAR042.60/13194

Enclosures

cc: S. Jimenez - ADOT VPM
Project Files (13194)

Superseded

TABLE I
RED MOUNTAIN FREEWAY, PHASE II
Off-Site Watershed Sub-Basin Parameters

Subarea Number	Area (sq mi)	Length (ft)	Length (mi)	Lca (ft)	Lca (mi)	Top Elevation	Bottom Elevation	Slope (ft/mi)	Percent Imperv. Area	Watershed Type	Time of Conc. (hr)	Storage Coefficient (hr)
10	0.868	12985	2.459	6800	1.288	1300	1259	16.67	1	AGRI	5.395	5.350
20	0.108	6000	1.136	2900	0.549	1258	1241	14.96	14	URBAN	0.603	0.830
30	1.411	12800	2.424	5400	1.023	1270	1241	11.96	1	AGRI	5.693	4.256
40	0.279	7090	1.343	3450	0.653	1244	1229	11.17	0	AGRI	3.785	4.248
50	0.489	8500	1.610	4000	0.758	1249	1227	13.67	14	URBAN	0.840	0.670
60	0.115	3000	0.568	1900	0.360	1227	1217	17.60	29	URBAN	0.344	0.247
70	0.164	6700	1.269	3300	0.625	1242	1227	11.82	14	URBAN	0.690	0.831
80	0.202	5800	1.098	2850	0.540	1241	1227	12.74	15	URBAN	0.630	0.595
90	0.098	3400	0.644	1640	0.311	1227	1222	7.76	12	URBAN	0.524	0.478
100	0.073	3700	0.701	2100	0.398	1224	1216	11.42	8	AGRI	2.474	3.387
110	0.130	4000	0.758	2450	0.464	1240	1232	10.56	7	AGRI	2.822	2.997
120	0.030	350	0.066	200	0.038	1251.5	1251	7.54	34	URBAN	0.107	0.026
130	0.028	1740	0.330	670	0.127	1235	1232	9.10	32	URBAN	0.214	0.209
140	0.015	1500	0.284	700	0.133	1233	1228.3	16.54	85	URBAN	0.126	0.151
150	0.084	3000	0.568	1600	0.303	1233	1227.9	8.98	43	URBAN	0.305	0.259
160	0.014	1200	0.227	500	0.095	1228	1226.5	6.60	54	URBAN	0.146	0.154
170	0.007	900	0.170	450	0.085	1228.3	1227.2	6.45	85	URBAN	0.105	0.125
180	0.028	1600	0.303	800	0.152	1228	1227	3.30	35	URBAN	0.244	0.228
185	0.056	1550	0.294	600	0.114	1228	1227	3.41	35	URBAN	0.240	0.147
190	0.012	1500	0.284	800	0.152	1227	1226	3.52	47	URBAN	0.197	0.280
200	0.048	2200	0.417	900	0.170	1227	1224.5	6.00	54	URBAN	0.226	0.198
210	0.046	3100	0.587	1600	0.303	1226.8	1221	9.88	75	URBAN	0.234	0.281
220	0.019	1600	0.303	900	0.170	1224	1223	3.30	54	URBAN	0.206	0.238
230	0.029	1750	0.331	850	0.161	1222	1221	3.02	54	URBAN	0.220	0.214
240	0.012	1200	0.227	500	0.095	1223	1221	8.80	85	URBAN	0.117	0.131

Superseded

Superseded

TABLE I
RED MOUNTAIN FREEWAY, PHASE II
Off-Site Watershed Sub-Basin Parameters

Subarea Number	Area (sq mi)	Length (ft)	Length (mi)	Lca (ft)	Lca (mi)	Top Elevation	Bottom Elevation	Slope (ft/mi)	Percent Imperv. Area	Watershed Type	Time of Conc. (hr)	Storage Coefficient (hr)
250	0.018	1000	0.189	300	0.057	1221	1219.8	6.34	85	URBAN	0.107	0.082
260	0.114	3700	0.701	1450	0.275	1222	1216	8.56	56	URBAN	0.297	0.250
270	0.068	2400	0.455	1600	0.303	1216	1200	35.20	64	URBAN	0.203	0.155
280	0.058	800	0.152	350	0.066	1260	1250	66.00	5	URBAN	0.237	0.084
290	0.069	2300	0.436	1200	0.227	1233	1225.9	16.30	30	URBAN	0.274	0.207
300	0.026	1750	0.331	875	0.166	1228.3	1225.1	9.65	54	URBAN	0.187	0.188
* 310	0.210	5870	1.112	2340	0.443	1256	1224.6	10.94	36	URBAN	0.451	0.405
320	0.027	1900	0.360	1050	0.199	1226.6	1224.6	5.56	54	URBAN	0.216	0.234
330	0.013	750	0.142	300	0.057	1255	1254	7.04	54	URBAN	0.113	0.081
340	0.082	2440	0.462	700	0.133	1254	1250	8.66	35	URBAN	0.255	0.182
350	0.018	600	0.114	300	0.057	1230	1225	44.00	22	URBAN	0.118	0.059
360	0.090	2400	0.455	600	0.114	1227.5	1222.8	10.34	35	URBAN	0.240	0.160
370	0.107	3500	0.663	2000	0.379	1224	1219.8	6.34	35	URBAN	0.390	0.335
380	0.070	1940	0.367	650	0.123	1254.8	1251	10.34	10	URBAN	0.356	0.240
* 390	0.063	2600	0.492	1300	0.246	1251	1220.5	22.63	45	URBAN	0.235	0.204
400	0.125	1200	0.227	500	0.095	1253.6	1250	15.84	5	URBAN	0.371	0.123
410	0.035	1840	0.348	650	0.123	1240	1220	57.39	47	URBAN	0.148	0.130
420	0.065	2000	0.379	700	0.133	1220	1214.1	15.58	40	URBAN	0.208	0.141
430	0.092	1692	0.320	700	0.133	1218	1216.5	4.68	36	URBAN	0.254	0.127
440	0.116	2500	0.473	1750	0.331	1221.4	1216	11.40	39	URBAN	0.310	0.190
450	0.026	1300	0.246	900	0.170	1216.4	1215.1	5.28	10	URBAN	0.347	0.300
460	0.026	2200	0.417	1000	0.189	1218	1215.6	5.76	85	URBAN	0.186	0.229
470	0.056	2400	0.455	900	0.170	1216	1212.3	8.14	54	URBAN	0.225	0.193
480	0.128	3200	0.606	600	0.114	1216	1210	9.90	57	URBAN	0.226	0.154
* 490	0.611	7192	1.362	2840	0.538	1253	1206.4	19.24	31	URBAN	0.540	0.317
500	0.011	870	0.165	400	0.076	1210	1205	30.34	54	URBAN	0.100	0.090

* SLOPE NOT BASED ON TOTAL CHANGE IN ELEVATION

10/02/96

TABLE III
RED MOUNTAIN FREEWAY, PHASE II
Offsite Watershed Soil Types

SOIL UNIT AREAS IN SQUARE MILES

Subarea ID	Total Area	SOIL UNIT										
	Soil Type	Am	Av	Gf	Gm	LaA	Pm	PnC	PvA	RIA	RIB	Ru
		Alluvial Land	Clay Loam	Fine Sand Loam	Loam	Loam	Clay Loam	Gravelly Loam	V. Grav. Loam	Gravelly Loam	Gravelly Loam	Rough Broken Land
10	0.8681				0.2394	0.4142			0.0941	0.0432		0.0772
20	0.1084		0.0868						0.0185			0.0031
30	1.4111		0.7038		0.5189		0.1158		0.0726			
40	0.2791		0.2714		0.0062				0.0015			
50	0.4893		0.3951		0.0108				0.0710			0.0124
60	0.1151	0.0216	0.0441		0.0216		0.0278					
70	0.1640		0.1161						0.0479			
80	0.2016		0.1491		0.0216				0.0309			
90	0.0979		0.0654		0.0124		0.0124		0.0077			
100	0.0728	0.0185	0.0234		0.0139		0.0170					
110	0.1301		0.0853		0.0293				0.0031			0.0124
120	0.0295							0.0095		0.0015		0.0185
130	0.0284		0.0114		0.0170							
140	0.0145		0.0145									
150	0.0839		0.0607						0.0232			
160	0.0137		0.0069		0.0034				0.0034			
170	0.0070		0.0039						0-0031			
180	0.0280		0.014		0.0112				0.0028			
185	0.0562		0.0084		0.0422				0.0056			
190	0.0117		0.0006		0.0111							
200	0.0484		0.029		0.0194							
210	0.0455		0.0455									
220	0.0187		0.0178				0.0009					
230	0.0291		0.0262				0.0029					
240	0.0119		0.0119									
250	0.0175		0.0175									
260	0.1140	0.0031	0.0846				0.0263					
270	0.0678	0.0124	0.0124		0.0124		0.0306					
280	0.0578					0.0062		0.017		0.03		0.0046
290	0.0689		0.031		0.0379							
300	0.0264		0.0264									
310	0.2102		0.0077		0.0386	0.1268		0.0077		0.0232		0.0062
320	0.0268		0.0268									
330	0.0133					0.0133						
340	0.0823					0.0544				0.0062	0.0093	0.0124
350	0.0183				0.0183							
360	0.0896		0.0762		0.0134							
370	0.1073		0.0965		0.0015		0.0093					
380	0.0701					0.0655				0.0046		
390	0.0630		0.0124		0.0243					0.0077	0.0062	0.0124
400	0.1245					0.089				0.0355		
410	0.0345				0.0172		0.0052					0.0121
420	0.0654		0.0216				0.0438					
430	0.0923		0.0552				0.0371					
440	0.1156		0.0523		0.0247		0.0293					0.0093
450	0.0257		0.0139				0.0118					
460	0.0256		0.0102				0.0154					
470	0.0564		0.0045		0.0119		0.0401					
480	0.1276				0.1021		0.0255					
490	0.6112	0.0163	0.0133	0.0103	0.3392	0.0385	0.1493			0.0252		0.0192
500	0.0108				0.0108							

Superseded

FILE = RIOSOILS.WQ2

TABLE IV
RED MOUNTAIN FREEWAY, PHASE II
Calculation of Subbasin Composite XKSAT

10/02/96

Composite XKSAT = antilog {sum[A(i) * log(XKSAT(i))] / A}
where A(i) = Area of Soil Unit within Subbasin (from Table III-A)
A = Total Subbasin Area (from Table III-A)
XKSAT(i) = XKSAT Value for Soil Unit (below)

Subarea ID	*Composite XKSAT, in/hr*	*A(i) * log(XKSAT(i))* Am	Av	Gf	Gm	LaA	Pm	PnC	PvA	RIA	RIB	Ru
10	0.28				-0.14	-0.25			-0.04	-0.02		-0.03
20	0.06		-0.12						-0.01			-0.00
30	0.09		-0.98		-0.31		-0.16		-0.03			
40	0.04		-0.38		-0.00				-0.00			
50	0.06		-0.55		-0.01				-0.03			-0.00
60	0.11	0.00	-0.06		-0.01		-0.04					
70	0.08		-0.16						-0.02			
80	0.07		-0.21		-0.01				-0.01			
90	0.06		-0.09		-0.01		-0.02		-0.00			
100	0.13	0.00	-0.03		-0.01		-0.02					
110	0.08		-0.12		-0.02				-0.00			-0.00
120	0.40							-0.00		-0.00		-0.01
130	0.12		-0.02		-0.01							
140	0.04		-0.02									
150	0.08		-0.08						-0.01			
160	0.11		-0.01		-0.00				-0.00			
170	0.11		-0.01						-0.00			
180	0.10		-0.02		-0.01				-0.00			
185	0.20		-0.01		-0.03				-0.00			
190	0.23		-0.00		-0.01							
200	0.08		-0.04		-0.01							
210	0.04		-0.06									
220	0.04		-0.02				-0.00					
230	0.04		-0.04				-0.00					
240	0.04		-0.02									
250	0.04		-0.02									
260	0.04	0.00	-0.12				-0.04					
270	0.10	0.00	-0.02		-0.01		-0.04					
280	0.38					-0.00		-0.01		-0.01		-0.00
290	0.11		-0.04		-0.02							
300	0.04		-0.04									
310	0.25		-0.01		-0.02	-0.08		-0.00		-0.01		-0.00
320	0.04		-0.04									
330	0.25					-0.01						
340	0.29					-0.03				-0.00	-0.00	-0.00
350	0.25				-0.01							
360	0.05		-0.11		-0.01							
370	0.04		-0.13		-0.00		-0.01					
380	0.26					-0.04				-0.00		
390	0.21		-0.02		-0.01					-0.00	-0.00	-0.00
400	0.29					-0.05				-0.01		
410	0.22				-0.01		-0.01					-0.00
420	0.04		-0.03				-0.06					
430	0.04		-0.08				-0.05					
440	0.07		-0.07		-0.01		-0.04					-0.00
450	0.04		-0.02				-0.02					
460	0.04		-0.01				-0.02					
470	0.06		-0.01		-0.01		-0.06					
480	0.17				-0.06		-0.04					
490	0.17	0.00	-0.02	-0.01	-0.20	-0.02	-0.21			-0.01		-0.01
500	0.25				-0.01							
XKSAT for Soil Unit		1.2	0.04	0.25	0.25	0.25	0.04	0.4	0.4	0.4	0.4	0.4
log XKSAT		0.0792	-1.3979	-0.6021	-0.6021	-0.6021	-1.3979	-0.3979	-0.3979	-0.3979	-0.3979	-0.3979

Supersedes

FILE = RIOSOILS.WQ2

TABLE V

10/02/96

RED MOUNTAIN FREEWAY, PHASE II

Green-Ampt Infiltration Parameters

Superseded

Subarea ID	Composite XKSAT, in/h	Vegetative Cover, %	Ck	IA, in	DTHETA (normal)	PSIF, in	Adjusted XKSAT	RTIMP, %
10	0.28	90	1.88	0.47	0.25	4.9	0.53	1
20	0.06	43	1.36	0.14	0.15	8.5	0.09	14
30	0.09	2	1.00	0.48	0.15	7.5	0.09	1
40	0.04	0	1.00	0.50	0.15	9.6	0.04	0
50	0.06	43	1.36	0.14	0.15	8.5	0.08	14
60	0.11	28	1.20	0.20	0.16	7.0	0.13	29
70	0.08	43	1.36	0.14	0.15	7.8	0.11	14
80	0.07	42	1.36	0.13	0.15	8.1	0.09	15
90	0.06	30	1.22	0.26	0.15	8.5	0.07	12
100	0.13	6	1.00	0.45	0.21	6.5	0.13	8
110	0.08	18	1.09	0.36	0.15	7.8	0.09	7
120	0.40	33	1.25	0.12	0.25	4.2	0.50	34
130	0.12	34	1.26	0.12	0.19	6.7	0.15	32
140	0.04	8	1.00	0.07	0.15	9.6	0.04	85
150	0.08	28	1.20	0.11	0.15	7.8	0.09	43
160	0.11	23	1.14	0.10	0.16	7.0	0.13	54
170	0.11	8	1.00	0.07	0.16	7.0	0.11	85
180	0.10	33	1.25	0.12	0.15	7.1	0.13	35
185	0.20	33	1.25	0.12	0.25	5.5	0.25	35
190	0.23	27	1.18	0.10	0.25	5.2	0.27	47
200	0.08	23	1.14	0.10	0.15	7.8	0.10	54
210	0.04	13	1.03	0.08	0.15	9.6	0.04	75
220	0.04	23	1.14	0.10	0.15	9.6	0.05	54
230	0.04	23	1.14	0.10	0.15	9.6	0.05	54
240	0.04	8	1.00	0.07	0.15	9.6	0.04	85
250	0.04	8	1.00	0.07	0.15	9.6	0.04	85
260	0.04	22	1.13	0.09	0.15	9.6	0.05	56
270	0.10	18	1.09	0.09	0.15	7.1	0.11	64
280	0.38	48	1.41	0.15	0.25	4.2	0.54	5
290	0.11	35	1.28	0.12	0.16	7.0	0.14	30
300	0.04	23	1.14	0.10	0.15	9.6	0.05	54
310	0.25	32	1.24	0.11	0.25	5.0	0.32	36
320	0.04	23	1.14	0.10	0.15	9.6	0.05	54
330	0.25	23	1.14	0.10	0.25	5.0	0.29	54
340	0.29	33	1.25	0.12	0.25	4.8	0.37	35
350	0.25	39	1.32	0.13	0.25	5.0	0.33	22
360	0.05	33	1.25	0.12	0.15	9.0	0.07	35
370	0.04	33	1.25	0.12	0.15	9.6	0.05	35
380	0.26	50	1.44	0.50	0.25	5.0	0.37	10
390	0.21	28	1.19	0.11	0.25	5.4	0.25	45
400	0.29	47	1.41	0.47	0.25	4.8	0.40	5
410	0.22	27	1.18	0.10	0.25	5.3	0.26	47
420	0.04	30	1.22	0.11	0.15	9.6	0.05	40
430	0.04	32	1.24	0.11	0.15	9.6	0.05	36
440	0.07	31	1.23	0.11	0.15	8.1	0.09	39
450	0.04	80	1.77	0.50	0.15	9.6	0.07	10
460	0.04	8	1.00	0.07	0.15	9.6	0.04	85
470	0.06	23	1.14	0.10	0.15	8.5	0.07	54
480	0.17	22	1.13	0.09	0.25	5.8	0.20	57
490	0.17	25	1.16	0.23	0.25	5.8	0.19	31
500	0.25	23	1.14	0.10	0.25	5.0	0.29	54

TABLE VII

10/02/96

RED MOUNTAIN FREEWAY, PHASE II

Summary of HEC-1 Routing Parameters

Superseded

HEC-1 Operation	Manning's "n" Left Overbank	Manning's "n" Main Channel	Manning's "n" Right Overbank	Length (ft)	Slope (ft/ft)	Channel Bottom Width (ft)	Estimated Avg Veloc (fps)	Approx. Travel Time (min)	NSTPS
11	0.035	0.030	0.035	6000	0.0030	10	3.2	31.3	16
21	0.040	0.040	0.040	5800	0.0022	250	0.8	120.8	60
36	0.035	0.030	0.035	4800	0.0025	60	3.4	23.5	12
56	0.040	0.040	0.040	3000	0.0037	250	2.1	23.8	12
66	0.035	0.030	0.035	3000	0.0003	60	1.8	27.8	14
86	0.040	0.040	0.040	2900	0.0017	250	0.9	53.7	27
96	0.030	0.016	0.030	2650	0.0023	25	4.7	9.4	5
106	0.035	0.030	0.035	2700	0.0059	60	6.3	7.1	4
121	0.030	0.016	0.030	1250	0.0152	44	4.9	4.3	2
137	0.030	0.016	0.030	1400	0.0026	68	2.3	10.1	5
146	0.030	0.016	0.030	500	0.0008	68	1.7	4.9	2
176	0.030	0.016	0.030	650	0.0011	68	2.6	4.2	2
187	0.030	0.016	0.030	1350	0.0004	64	2.1	10.7	5
196	0.030	0.016	0.030	1000	0.0015	68	2.9	5.7	3
226	0.030	0.016	0.030	950	0.0021	68	3.2	4.9	2
246	0.030	0.016	0.030	600	0.0035	68	4.3	2.3	1
256	0.030	0.016	0.030	2000	0.0019	68	3.7	9.0	5
266	0.030	0.016	0.030	2450	0.0065	68	2.1	19.4	10
281	0.030	0.016	0.030	800	0.0176	800	1.6	8.3	4
296	0.030	0.016	0.030	700	0.0011	25	2.9	4.0	2
306	0.030	0.016	0.030	600	0.0008	25	3.2	3.1	2
324	0.030	0.016	0.030	1350	0.0014	64	2.6	8.7	4
326	0.030	0.016	0.030	1250	0.0014	50	3.8	5.5	3
346	0.030	0.016	0.030	550	0.0091	300	3.8	2.4	1
356	0.030	0.016	0.030	500	0.0080	25	4.3	1.9	1
366	0.030	0.016	0.030	800	0.0023	25	5.1	2.6	1
368	0.030	0.016	0.030	1250	0.0010	75	2.8	7.4	4
386	0.030	0.030	0.030	1900	0.0043	300	3.8	8.3	4
398	0.030	0.016	0.030	1800	0.0021	75	4.2	7.1	4
401	0.030	0.016	0.030	1900	0.0105	64	5.2	6.1	3
416	0.030	0.016	0.030	650	0.0091	64	4.1	2.6	1
431	0.030	0.016	0.030	1350	0.0004	25	1.7	13.2	7
447	0.030	0.016	0.030	1350	0.0014	64	4.3	5.2	3
459	0.030	0.016	0.030	1700	0.0006	64	2.1	13.5	7
467	0.030	0.016	0.030	700	0.0014	64	3.1	3.8	2
469	0.030	0.016	0.030	1250	0.0017	64	4.9	4.3	2
476	0.030	0.016	0.030	1650	0.0015	64	5.0	5.5	3
481	0.030	0.016	0.030	1300	0.0010	25	2.5	8.7	4
486	0.030	0.016	0.030	2150	0.0015	64	5.1	7.0	4

filename: routparm.wq2

Table VIII
Peak Discharge Values for the Red Mountain Freeway
Phase II Off-Site Drainage Areas

Concentration Point	Description of Concentration Point	Q_{100} (cfs)
35C	North Channel McDowell and Stapley Roads	370
45C	North Channel McDowell Road and Mesa Drive	420
65C	South Channel Lehi Road and Center Street	590
100C	Country Club Drive Detention Basin	90
274C2	McKellips Road Detention Basin	210

Superseded

FINAL DRAINAGE REPORT

Flo:

RED MOUNTAIN FREEWAY
(PHASE III)

McKELLIPS ROAD TO COUNTRY CLUB DRIVE

Prepared for:

ARIZONA DEPARTMENT OF TRANSPORTATION

December 1996

Prepared by:

STANLEY CONSULTANTS, INC.

in association with

WOOD/PATEL ASSOCIATES

FINAL DRAINAGE REPORT

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I. INTRODUCTION

A. Introduction and Purpose

The Red Mountain Freeway, between the Red Mountain Traffic Interchange and Country Club Drive, will be designed and constructed in three phases. The Phase I Dobson Road Connection project is complete. Phase I construction included a portion of the eastbound mainline traffic lanes, Ramp B of the Dobson Road Traffic Interchange, and the southern portion of Dobson Road.

The Phase II Red Mountain Freeway project is under construction. Phase II will construct the remaining freeway improvements adjacent to Phase I, and extend the full freeway improvements east of Alma School Road. A temporary connection will be built to terminate the freeway at McKellips Road. New traffic interchanges will be constructed at Dobson Road and Alma School Road as part of Phase II.

The Phase III Red Mountain Freeway project will construct the remaining freeway improvements adjacent to Phase II west of McKellips Road, and extend the full freeway improvements to the mainline back-of-gore for the Country Club Ramps A and B. A new half-diamond traffic interchange will be constructed at McKellips Road, and Country Club Ramps A and B will be constructed to temporarily terminate the freeway at Country Club Drive (SR 87). Permanent roadway improvements will also be constructed along Country Club Drive.

In support of the Phase III Final I Design Submittal (95%), this report summarizes the hydrologic and hydraulic analyses performed, and describes the on-site and off-site drainage design. In addition, a brief summary of the Salt River analyses and proposed bank stabilization improvements is presented in this report.

The drainage design for the Red Mountain Freeway was prepared in accordance with current ADOT and FHWA design criteria. The drainage design also conforms to the requirements of the Red Mountain Freeway Final Environmental Impact Statement (EIS). The proposed system is designed to be compatible with existing adjacent ADOT and City of Mesa local drainage improvements. The ultimate freeway design will reduce the flood potential along the south bank of the Salt River and provide outfalls for runoff generated from the contributing watershed.

B. Project Location

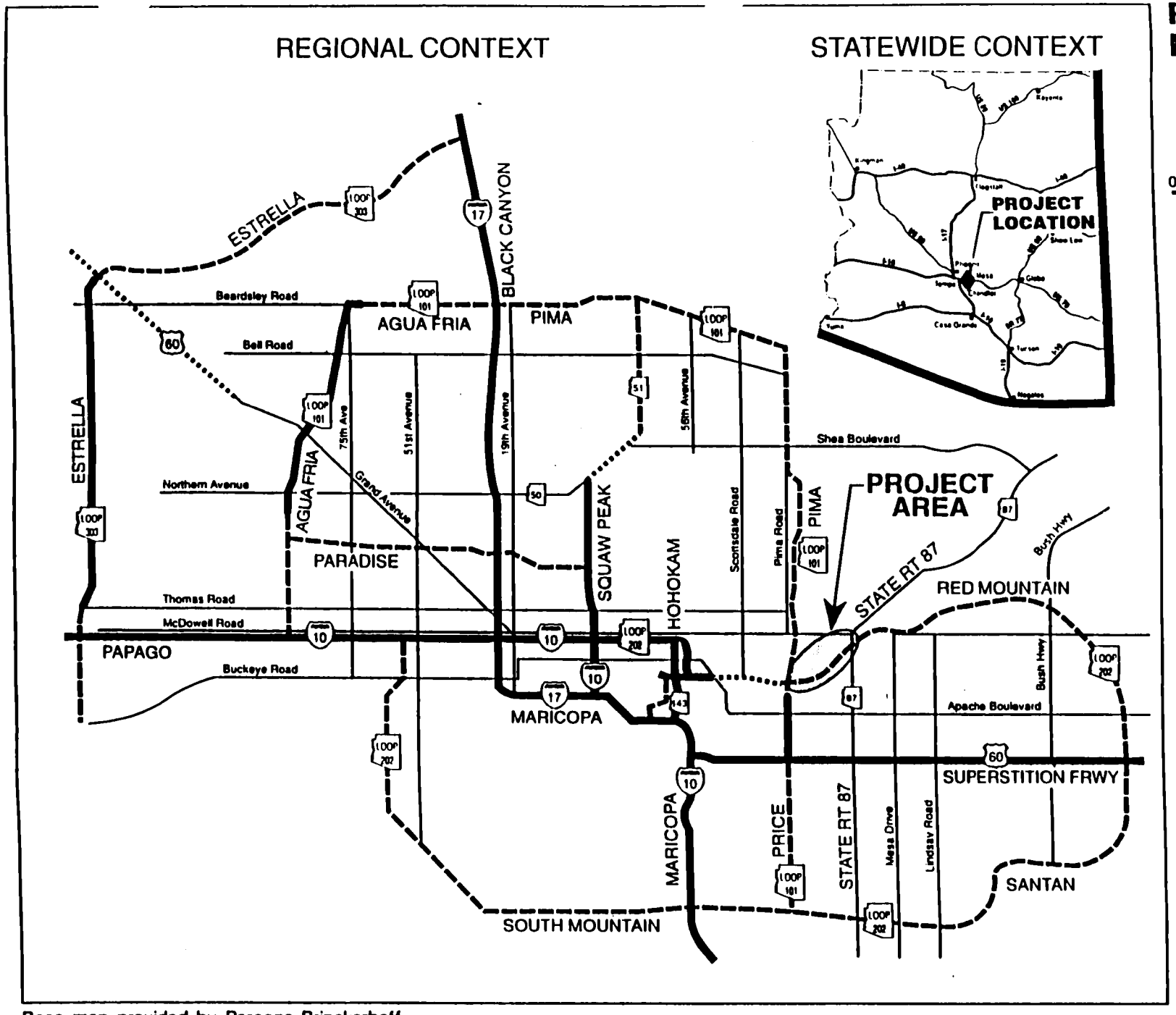
The Red Mountain Freeway (Phases I, II and III) is located in Maricopa County, Arizona, within Sections 3, 4, 8, 9, 17, and 18 of Township 1 North, Range 5 East of the Gila and Salt River Baseline & Meridian. A vicinity map for the project is illustrated in Figure 1.

C. Description of Improvements

1. Existing Conditions

   Phase III of the proposed Red Mountain Freeway is bounded on the west by McKellips Road; on the north by the Salt River; and on the south by commercial and light industrial land uses. The Red Mountain Freeway alignment also traverses a sand and gravel mining operation and a mobile home park.

RED MOUNTAIN FREEWAY



0 2 4 6 8 Mile
approx.

NORTH

GRAPHIC LEGEND

- Existing
- Proposed
- Under Construction

Base map provided by Parsons Brinckerhoff.

Vicinity Map

FIGURE 1

STANLEY CONSULTANTS, INC.

Several existing City of Mesa storm drains exist within the subject watershed. Generally, they were designed to collect roadway drainage generated by a 10-year (or less) storm event and route it to the Salt River. Engineering documentation (as-built drawings) was available for some of the facilities within the watershed.

Country Club Drive - a 72" storm drain collects street flow and discharges into a concrete ditch which outfalls directly into the Salt River. In 1986, ADOT constructed a 24" storm drain to collect street drainage in Country Club Drive near the Salt River. The existing 24" storm drain system is located in the vicinity of the proposed Red Mountain Freeway Traffic Interchange.

2. Proposed Roadway Improvements

Phase III of the Red Mountain Freeway project lies primarily within the incorporated limits of the City of Mesa. Phase III will construct the eastbound and westbound mainline lanes beginning west of McKellips Road (Sta 498+00) and ending west of Country Club Drive (Sta 525+00). The mainline will provide three through lanes in each direction of travel. A traffic interchange will be constructed at McKellips Road. Two detention basins are proposed to route existing and future on-site and off-site runoff to the Salt River.

D. Concept Drainage Plans

The final on-site drainage plans for Phase III of the Red Mountain Freeway are provided in Exhibit I. The Salt River bank protection plans are presented in a separate report. However, the bank protection is illustrated graphically on the drainage plan and profiles provided in Exhibit I.

II. OFF-SITE HYDROLOGIC ANALYSES

A. General Discussion

Hydrologic analyses were performed for the on-site and off-site contributing drainage areas. The on-site hydrology and detention basin routing analyses was performed by Stanley Consultants, Inc. (SCI) and is discussed in detail in Sections III and IV. Wood/Patel Associates, Inc. (WPA) performed the off-site hydrologic analysis for the Red Mountain Freeway. Presented below is a summary of the off-site hydrologic analysis utilized to design the off-site drainage system for Phase III.

Due to limited right-of-way at McKellips Road and Country Club Drive, it was assumed that stormwater runoff collected along the south side of the Red Mountain Freeway will be routed to the Salt River near Center Street. This is a key design assumption for the drainage design of the Country Club Drive to Gilbert Road Section of the Red Mountain Freeway.

B. Watershed Characteristics

1. General Discussion

Off-site hydrologic analyses were performed in accordance with procedures and methodologies outlined in the ADOT drainage design manual. The hydrologic analysis was performed for the existing condition scenario. The existing hydrologic analyses were performed to generate the largest peak discharge and volume of runoff from the contributing watershed. The existing condition incorporated the City of Mesa's detention/retention requirements for new development (50-year, 24-hour for 1973-1987 and 100-year, 2-hour for 1987 to present) which will occur in the vicinity of the Red Mountain Freeway.

2. Watershed Description

The area of the watershed contributing to Phase III of the Red Mountain Freeway is approximately 6.7 square miles. It consists of a variety of land uses (single-family residential development, apartment complexes, commercial properties, industrial areas, irrigated fields, and untilled land). The drainage characteristics of the watershed may be divided into two distinct categories. The rural environment of the Salt River Pima Maricopa Indian Community/Lehi area and the urban environment of the City of Mesa.

Runoff from the agricultural land on the Salt River Pima Maricopa Indian Community is characterized by sheet flow toward the southwest. The flat slopes (0.2%) and tilled fields in this area result in long times of concentration and significant attenuation of the flow. It is anticipated that this flow will be collected and conveyed in a channel along the north side of the proposed freeway. The channel outfall may be located along the McDowell Road alignment. The final alignment will be determined during design of the Country Club Drive to Gilbert Road Section of the Red Mountain Freeway.

South of the proposed freeway and north of McKellips Road, the watershed consists of large residential lots (one acre or more) in the Lehi area. This area is generally characterized by flat slopes, little local relief and flow from east to west. Some flow will follow local east-west residential streets, but most runoff will occur as shallow sheet flow. For this reason, long times of concentration will occur (relative to more urban areas to the south). The westward direction of flow in this area is intercepted by the proposed freeway. Along portions of the freeway where this occurs; flow may be collected and routed along the south right-of-way parallel to the freeway in an channel or storm drain, or flow may be directed across the freeway via cross drainage structures.

Adjacent to McKellips Road, commercial and residential properties drain to McKellips Road, where concentrated flow continues westerly toward the Salt River. Many of the mobile home parks and commercial areas along McKellips Road have a high percentage of impervious areas and do not include any retention facilities. Therefore, a significant volume of runoff will originate from these sub-basins. Slopes range from 0.14 percent to 0.21 percent along McKellips Road.

The southernmost portion of the watershed (roughly between McKellips Road and the Tempe Canal) consists of single-family residential areas, apartment complexes, and commercial property. The majority of this area was developed prior to the development of strict drainage guidelines. Therefore, the volume of runoff created from this area is relatively high in comparison to other portions of the watershed. The City of Mesa currently requires new developments to retain the 100-year 2-hour storm event.

Stormwater runoff follows a natural swale in the topography from east to west with the low point located between McKellips Road and McLellan Road. Although the runoff originates as sheet flow on residential and commercial lots, flow quickly becomes concentrated along local collector and arterial streets.

This part of the watershed also includes the historic south bank of the Salt River. Side slopes along this bank are very steep (as much as 20% in many areas) but the overbank areas are fairly flat (slopes less than 1 percent). The Utah Canal, owned and operated by Salt River Project, is located midway down the historic Salt River south bank. The canal is an earth-lined ditch used for urban irrigation deliveries, and has a capacity of approximately 300 to 400 miner's inches, or 7.5 to 10 cfs. The canal is tiled in areas where flow would otherwise be likely to enter the canal, thereby allowing flow to pass over the canal unobstructed. In areas where residential development is located adjacent to the canal, block walls and local residential drainage patterns direct flow away from the canal and on to streets that pass over the canal. The canal outfall is an 18" RGRCP connected to the Country Club 54" storm drain.

The Tempe Cross Cut Canal forms the southern boundary of the watershed and the Consolidated Canal forms the eastern boundary of the watershed. Because Salt River Project's operating procedure to evacuate the canals in advance of and during major storm events to reduce the possibility of overtopping; it was assumed that these canals do not contribute flow to the watershed. This is accomplished by discharging water through wasteways that convey canal water to the Salt River. The Hennessy Wasteway is located on the Southern Canal upstream of the watershed, and the Tempe Drain (Alma School Drain) is located along the Tempe Cross Cut Canal just east of Alma School Road.

C. Previous Hydrologic Studies

The majority of existing hydrologic studies were performed to identify off-site and on-site runoff within individual developments. In addition, hydrologic studies were performed for the City of Mesa to design the storm drain systems within the watershed. A master drainage study has not been developed for the watershed. City of Mesa topographic mapping, aerial photographs, as-built plans, subdivision drainage plans, etc. were reviewed as part of the development of the off-site hydrologic analyses.

D. Watershed Computer Modeling

1. General Discussion

In order to evaluate the hydrologic performance of a watershed, a database of physical properties was established for the watershed. The primary factors which affect the hydrologic response of a watershed are drainage area size, topography, soil/vegetation type and distribution, and rainfall characteristics. The off-site hydrologic analysis for the Red Mountain Freeway was performed according to procedures outlined in ADOT's drainage design manual.

A computerized rainfall/runoff model was developed for the off-site contributing watershed using the U.S. Army Corps of Engineers Flood Hydrograph Package (HEC-1). The amount and temporal distribution of the rainfall, the runoff characteristics of the watershed, and the hydraulic properties of the channels that collect and convey the direct runoff are entered as numerical parameters in the HEC-1 program. The output then provides a hydrograph at user-selected locations which can be used for the design of drainage channels and cross-drainage structures.

The 1991 extended array version of HEC-1 was used for this study. The models presented with this report should only be run with the 1991 program. The use of the 1990 (or earlier) version of HEC-1 to execute the input files developed for this project may result in different peak discharge values. The following sections present a general overview of the primary factors described above as they relate to the contributing watershed for the Red Mountain Freeway.

2. Drainage Pattern & Sub-Basin Delineation

The off-site watershed was divided into fifty (50) sub-basins in order to maximize the homogeneity in the HEC-1 modeling parameters. Each sub-basin was considered to have relatively uniform hydrologic parameters. Sub-basin delineations and drainage flow paths are illustrated in Exhibit II. The delineations were made on the basis of topographic mapping and local residential area flow patterns. Field investigations were used to verify the sub-basin delineations.

The majority of the contributing watershed consists of residential and agricultural areas which both have mostly overland flow (sheet flow) and shallow channel flow along streets. In general, an attempt was made to confine a single major channel element, or prominent flow path, to each sub-basin. Sub-basins were terminated at the confluence with other major channel elements. The drainage area sizes, slopes, and other physical basin parameters are presented in Table I.

TABLE I
RED MOUNTAIN FREEWAY, PHASE III
Off-Site Watershed Sub-Basin Parameters

Subarea Number	Area (sq mi)	Length (ft)	Length (mi)	Lca (ft)	Lca (mi)	Top Elevation	Bottom Elevation	Slope (ft/mi)	Percent Imperv. Area	Watershed Type	Time of Conc. (hr)	Storage Coefficient (hr)
10	0.868	12985	2.459	6800	1.288	1300	1259	16.67	1	AGRI	5.395	5.350
20	0.108	6000	1.136	2900	0.549	1258	1241	14.96	14	URBAN	0.603	0.830
30	1.411	12800	2.424	5400	1.023	1270	1241	11.96	1	AGRI	5.693	4.256
40	0.279	7090	1.343	3450	0.653	1244	1229	11.17	0	AGRI	3.785	4.248
50	0.489	8500	1.610	4000	0.758	1249	1227	13.67	14	URBAN	0.840	0.670
60	0.115	3000	0.568	1900	0.360	1227	1217	17.60	29	URBAN	0.344	0.247
70	0.164	6700	1.269	3300	0.625	1242	1227	11.82	14	URBAN	0.690	0.831
80	0.202	5800	1.098	2850	0.540	1241	1227	12.74	15	URBAN	0.630	0.595
90	0.098	3400	0.644	1640	0.311	1227	1222	7.76	12	URBAN	0.524	0.478
100	0.073	3700	0.701	2100	0.398	1224	1216	11.42	8	AGRI	2.474	3.387
110	0.130	4000	0.758	2450	0.464	1240	1232	10.56	7	AGRI	2.822	2.997
120	0.030	350	0.066	200	0.038	1251.5	1251	7.54	34	URBAN	0.107	0.026
130	0.028	1740	0.330	670	0.127	1235	1232	9.10	32	URBAN	0.214	0.209
140	0.015	1500	0.284	700	0.133	1233	1228.3	16.54	85	URBAN	0.126	0.151
150	0.084	3000	0.568	1600	0.303	1233	1227.9	8.98	43	URBAN	0.305	0.259
160	0.014	1200	0.227	500	0.095	1228	1226.5	6.60	54	URBAN	0.146	0.154
170	0.007	900	0.170	450	0.085	1228.3	1227.2	6.45	85	URBAN	0.105	0.125
180	0.028	1600	0.303	800	0.152	1228	1227	3.30	35	URBAN	0.244	0.228
185	0.056	1550	0.294	600	0.114	1228	1227	3.41	35	URBAN	0.240	0.147
190	0.012	1500	0.284	800	0.152	1227	1226	3.52	47	URBAN	0.197	0.280
200	0.048	2200	0.417	900	0.170	1227	1224.5	6.00	54	URBAN	0.226	0.198
210	0.046	3100	0.587	1600	0.303	1226.8	1221	9.88	75	URBAN	0.234	0.281
220	0.019	1600	0.303	900	0.170	1224	1223	3.30	54	URBAN	0.206	0.238
230	0.029	1750	0.331	850	0.161	1222	1221	3.02	54	URBAN	0.220	0.214
240	0.012	1200	0.227	500	0.095	1223	1221	8.80	85	URBAN	0.117	0.131

TABLE I
RED MOUNTAIN FREEWAY, PHASE III
Off-Site Watershed Sub-Basin Parameters

Subarea Number	Area (sq mi)	Length (ft)	Length (mi)	Lca (ft)	Lca (mi)	Top Elevation	Bottom Elevation	Slope (ft/mi)	Percent Imperv. Area	Watershed Type	Time of Conc. (hr)	Storage Coefficient (hr)
250	0.018	1000	0.189	300	0.057	1221	1219.8	6.34	85	URBAN	0.107	0.082
260	0.114	3700	0.701	1450	0.275	1222	1216	8.56	56	URBAN	0.297	0.250
270	0.068	2400	0.455	1600	0.303	1216	1200	35.20	64	URBAN	0.203	0.155
280	0.058	800	0.152	350	0.066	1260	1250	66.00	5	URBAN	0.237	0.084
290	0.069	2300	0.436	1200	0.227	1233	1225.9	16.30	30	URBAN	0.274	0.207
300	0.026	1750	0.331	875	0.166	1228.3	1225.1	9.65	54	URBAN	0.187	0.188
* 310	0.210	5870	1.112	2340	0.443	1256	1224.6	10.94	36	URBAN	0.451	0.405
320	0.027	1900	0.360	1050	0.199	1226.6	1224.6	5.56	54	URBAN	0.216	0.234
330	0.013	750	0.142	300	0.057	1255	1254	7.04	54	URBAN	0.113	0.081
340	0.082	2440	0.462	700	0.133	1254	1250	8.66	35	URBAN	0.255	0.182
350	0.018	600	0.114	300	0.057	1230	1225	44.00	22	URBAN	0.118	0.059
360	0.090	2400	0.455	600	0.114	1227.5	1222.8	10.34	35	URBAN	0.240	0.160
370	0.107	3500	0.663	2000	0.379	1224	1219.8	6.34	35	URBAN	0.390	0.335
380	0.070	1940	0.367	650	0.123	1254.8	1251	10.34	10	URBAN	0.356	0.240
* 390	0.063	2600	0.492	1300	0.246	1251	1220.5	22.63	45	URBAN	0.235	0.204
400	0.125	1200	0.227	500	0.095	1253.6	1250	15.84	5	URBAN	0.371	0.123
410	0.035	1840	0.348	650	0.123	1240	1220	57.39	47	URBAN	0.148	0.130
420	0.065	2000	0.379	700	0.133	1220	1214.1	15.58	40	URBAN	0.208	0.141
430	0.092	1692	0.320	700	0.133	1218	1216.5	4.68	36	URBAN	0.254	0.127
440	0.116	2500	0.473	1750	0.331	1221.4	1216	11.40	39	URBAN	0.310	0.190
450	0.026	1300	0.246	900	0.170	1216.4	1215.1	5.28	10	URBAN	0.347	0.300
460	0.026	2200	0.417	1000	0.189	1218	1215.6	5.76	85	URBAN	0.186	0.229
470	0.056	2400	0.455	900	0.170	1216	1212.3	8.14	54	URBAN	0.225	0.193
480	0.128	3200	0.606	600	0.114	1216	1210	9.90	57	URBAN	0.226	0.154
* 490	0.611	7192	1.362	2840	0.538	1253	1206.4	19.24	31	URBAN	0.540	0.317
500	0.011	870	0.165	400	0.076	1210	1205	30.34	54	URBAN	0.100	0.090

* SLOPE NOT BASED ON TOTAL CHANGE IN ELEVATION

3. Rainfall Data

The hydrologic response of a watershed is dependent upon rainfall characteristics such as depth, duration, spatial and temporal distribution of the rainfall event. The rainfall depth is a function of the probability of occurrence and the duration of the event. This probability is expressed as a recurrence interval (50-year, 100-year, etc.) which is often defined as the average interval of time within which the magnitude of an event will be equaled or exceeded at least one time. The 100-year 24-hour storm event in conjunction with the Corps hypothetical distribution were utilized for this study.

Rainfall depths for the project drainage area were developed using isopluvial maps and regression equations developed by the National Oceanic and Atmospheric Administration. Point rainfall estimates were computed using the Bureau of Reclamation's PREFRE computer program. Table II summarizes point precipitation values for the project watershed.

TABLE II
Point Rainfall Depths

Duration	2-yr (in.)	5-yr (in.)	10-yr (in.)	25-yr (in.)	50-yr (in.)	100-yr (in.)	500-yr (in.)
5-min	0.29	0.40	0.47	0.56	0.64	0.71	0.89
10-min	0.44	0.60	0.71	0.86	0.98	1.10	1.36
15-min	0.54	0.75	0.90	1.10	1.25	1.41	1.76
30-min	0.71	1.01	1.21	1.48	1.69	1.91	2.39
1-hr	0.87	1.25	1.50	1.85	2.12	2.38	3.00
2-hr	0.95	1.36	1.63	2.01	2.30	2.59	3.26
3-hr	1.00	1.43	1.72	2.12	2.43	2.73	3.44
6-hr	1.10	1.58	1.89	2.33	2.67	3.00	3.77
12-hr	1.20	1.73	2.08	2.56	2.93	3.30	4.15
24-hr	1.30	1.88	2.26	2.79	3.20	3.60	4.53

4. Soil Properties & Surface Cover

Soil data from the Soil Conservation Service (SCS) was used in conjunction with procedures and methodologies outlined in the ADOT drainage design manual to determine the infiltration parameters for the watershed. The vegetative cover ranges from 0% for the agricultural fields between growing seasons, to 60% in the residential areas. The soil types occurring in the study watershed are presented in Table III.

5. Interception and Infiltration Losses

The Green-Ampt infiltration equation was used to simulate rainfall losses due to infiltration into the soil matrix. The surface retention loss and the rate of rainfall infiltration must be estimated. The parameters for this equation are estimated as a function of soil texture. The soil is placed in one of twelve texture classes based on the percentage sand, silt, and clay and the size gradation.

The three Green-Ampt infiltration parameters used in the 1991 version of HEC-1 are: 1) hydraulic conductivity at natural section (XKSAT); 2) wetting front capillary suction (PSIF); and 3) volumetric soil moisture deficit at the start of rainfall (DTHETA). One of these parameters (hydraulic conductivity) can be adjusted for the effects of vegetation ground cover. These parameters are functions of soil characteristics, ground surface characteristics, and land management practices.

Soil horizon data from the SCS soil survey was combined with Green-Ampt parameter values published by ADOT to develop Green-Ampt infiltration parameters for the soil associations listed in Table III of this report. Table V lists the calculated Green-Ampt parameters used in the HEC-1 model.

Most drainage areas will be composed of more than one soil type and may require the determination of composite values for the Green-Ampt parameters. The procedure used to determine these values is to average the area-weighted logarithms of the individual subarea XKSAT values and to select the PSIF and DTHETA values from a graph. Table IV shows the area-weighted logarithm procedure for determining the sub-basin composite XKSAT values. After the composite XKSAT value is determined, the values of PSIF and DTHETA are selected from Figure 3-3 in the ADOT drainage design manual.

6. Unit Hydrographs

Unit hydrograph methodology is used to route the time increments of excess rainfall from the watershed (or sub-basin) to the watershed outlet (or modeling concentration point). The hydrograph of one-inch of excess runoff from a storm of specified duration for a specific watershed is called a unit hydrograph. In order to properly develop a unit hydrograph for a particular watershed, an adequate database (rainfall and runoff records) is required.

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TABLE III
RED MOUNTAIN FREEWAY, PHASE III
Offsite Watershed Soil Types

SOIL UNIT AREAS IN SQUARE MILES

Subarea ID	Total Area	SOIL UNIT										
		Am	Av	Gf	Gm	LaA	Pm	PnC	PvA	RIA	RIB	Ru
	Soil Type	Alluvial Land	Clay Loam	Fine Sand Loam	Loam	Loam	Clay Loam	Gravelly Loam	V. Grav. Loam	Gravelly Loam	Gravelly Loam	Rough Broken Land
10	0.8681				0.2394	0.4142			0.0941	0.0432		0.0772
20	0.1084		0.0868						0.0185			0.0031
30	1.4111		0.7038		0.5189		0.1158		0.0726			
40	0.2791		0.2714		0.0062				0.0015			
50	0.4893		0.3951		0.0108				0.0710			0.0124
60	0.1151	0.0216	0.0441		0.0216		0.0278					
70	0.1640		0.1161						0.0479			
80	0.2016		0.1491		0.0216				0.0309			
90	0.0979		0.0654		0.0124		0.0124		0.0077			
100	0.0728	0.0185	0.0234		0.0139		0.0170					
110	0.1301		0.0853		0.0293				0.0031			0.0124
120	0.0295							0.0095		0.0015		0.0185
130	0.0284		0.0114		0.0170							
140	0.0145		0.0145									
150	0.0839		0.0607						0.0232			
160	0.0137		0.0069		0.0034				0.0034			
170	0.0070		0.0039						0.0031			
180	0.0280		0.014		0.0112				0.0028			
185	0.0562		0.0084		0.0422				0.0056			
190	0.0117		0.0006		0.0111							
200	0.0484		0.029		0.0194							
210	0.0455		0.0455									
220	0.0187		0.0178				0.0009					
230	0.0291		0.0262				0.0029					
240	0.0119		0.0119									
250	0.0175		0.0175									
260	0.1140	0.0031	0.0846				0.0263					
270	0.0678	0.0124	0.0124		0.0124		0.0306					
280	0.0578					0.0062		0.017		0.03		0.0046
290	0.0689		0.031		0.0379							
300	0.0264		0.0264									
310	0.2102		0.0077		0.0386	0.1268		0.0077		0.0232		0.0062
320	0.0268		0.0268									
330	0.0133					0.0133						
340	0.0823					0.0544				0.0062	0.0093	0.0124
350	0.0183				0.0183							
360	0.0896		0.0762		0.0134							
370	0.1073		0.0965		0.0015		0.0093					
380	0.0701					0.0655				0.0046		
390	0.0630		0.0124		0.0243					0.0077	0.0062	0.0124
400	0.1245					0.089				0.0355		
410	0.0345				0.0172		0.0052					0.0121
420	0.0654		0.0216				0.0438					
430	0.0923		0.0552				0.0371					
440	0.1156		0.0523		0.0247		0.0293					0.0093
450	0.0257		0.0139				0.0118					
460	0.0256		0.0102				0.0154					
470	0.0564		0.0045		0.0119		0.0401					
480	0.1276				0.1021		0.0255					
490	0.6112	0.0163	0.0133	0.0103	0.3392	0.0385	0.1493			0.0252		0.0192
500	0.0108				0.0108							

TABLE IV
RED MOUNTAIN FREEWAY, PHASE III
Calculation of Subbasin Composite XKSAT

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Composite XKSAT = antilog {sum[A(i) * log(XKSAT(i))] / A}

where A(i) = Area of Soil Unit within Subbasin (from Table III-A)
A = Total Subbasin Area (from Table III-A)
XKSAT(i) = XKSAT Value for Soil Unit (below)

Subarea ID	*Composite XKSAT, in/hr*	*A(i) * log(XKSAT(i))*										
		Am	*Av*	*Gf*	*Gm*	*LaA*	*Pm*	*PnC*	*PvA*	*RIA*	*RIB*	*Ru*
10	0.28				-0.14	-0.25			-0.04	-0.02		-0.03
20	0.06		-0.12						-0.01			-0.00
30	0.09		-0.98		-0.31		-0.16		-0.03			
40	0.04		-0.38		-0.00				-0.00			
50	0.06		-0.55		-0.01				-0.03			-0.00
60	0.11	0.00	-0.06		-0.01		-0.04					
70	0.08		-0.16						-0.02			
80	0.07		-0.21		-0.01				-0.01			
90	0.06		-0.09		-0.01		-0.02		-0.00			
100	0.13	0.00	-0.03		-0.01		-0.02					
110	0.08		-0.12		-0.02				-0.00			-0.00
120	0.40							-0.00		-0.00		-0.01
130	0.12		-0.02		-0.01							
140	0.04		-0.02									
150	0.08		-0.08						-0.01			
160	0.11		-0.01		-0.00				-0.00			
170	0.11		-0.01						-0.00			
180	0.10		-0.02		-0.01				-0.00			
185	0.20		-0.01		-0.03				-0.00			
190	0.23		-0.00		-0.01							
200	0.08		-0.04		-0.01							
210	0.04		-0.06									
220	0.04		-0.02				-0.00					
230	0.04		-0.04				-0.00					
240	0.04		-0.02									
250	0.04		-0.02									
260	0.04	0.00	-0.12				-0.04					
270	0.10	0.00	-0.02		-0.01		-0.04					
280	0.38					-0.00		-0.01		-0.01		-0.00
290	0.11		-0.04		-0.02							
300	0.04		-0.04									
310	0.25		-0.01		-0.02	-0.08		-0.00		-0.01		-0.00
320	0.04		-0.04									
330	0.25					-0.01						
340	0.29					-0.03				-0.00	-0.00	-0.00
350	0.25				-0.01							
360	0.05		-0.11		-0.01							
370	0.04		-0.13		-0.00		-0.01					
380	0.26					-0.04				-0.00		
390	0.21		-0.02		-0.01					-0.00	-0.00	-0.00
400	0.29					-0.05				-0.01		
410	0.22				-0.01		-0.01					-0.00
420	0.04		-0.03				-0.06					
430	0.04		-0.08				-0.05					
440	0.07		-0.07		-0.01		-0.04					-0.00
450	0.04		-0.02				-0.02					
460	0.04		-0.01				-0.02					
470	0.06		-0.01		-0.01		-0.06					
480	0.17				-0.06		-0.04					
490	0.17	0.00	-0.02	-0.01	-0.20	-0.02	-0.21			-0.01		-0.01
500	0.25				-0.01							
XKSAT for Soil Unit		1.2	0.04	0.25	0.25	0.25	0.04	0.4	0.4	0.4	0.4	0.4
log XKSAT		0.0792	-1.3979	-0.6021	-0.6021	-0.6021	-1.3979	-0.3979	-0.3979	-0.3979	-0.3979	-0.3979

FILE = RIOSOILS WQ2

TABLE V

01/21/97

RED MOUNTAIN FREEWAY, PHASE III

Green-Ampt Infiltration Parameters

Subarea ID	Composite XKSAT, in/hr	Vegetative Cover, %	Ck	IA, in	DTHETA (normal)	PSIF, in	Adjusted XKSAT	RTIMP, %
10	0.28	90	1.88	0.47	0.25	4.9	0.53	1
20	0.06	43	1.36	0.14	0.15	8.5	0.09	14
30	0.09	2	1.00	0.48	0.15	7.5	0.09	1
40	0.04	0	1.00	0.50	0.15	9.6	0.04	0
50	0.06	43	1.36	0.14	0.15	8.5	0.08	14
60	0.11	28	1.20	0.20	0.16	7.0	0.13	29
70	0.08	43	1.36	0.14	0.15	7.8	0.11	14
80	0.07	42	1.36	0.13	0.15	8.1	0.09	15
90	0.06	30	1.22	0.26	0.15	8.5	0.07	12
100	0.13	6	1.00	0.45	0.21	6.5	0.13	8
110	0.08	18	1.09	0.36	0.15	7.8	0.09	7
120	0.40	33	1.25	0.12	0.25	4.2	0.50	34
130	0.12	34	1.26	0.12	0.19	6.7	0.15	32
140	0.04	8	1.00	0.07	0.15	9.6	0.04	85
150	0.08	28	1.20	0.11	0.15	7.8	0.09	43
160	0.11	23	1.14	0.10	0.16	7.0	0.13	54
170	0.11	8	1.00	0.07	0.16	7.0	0.11	85
180	0.10	33	1.25	0.12	0.15	7.1	0.13	35
185	0.20	33	1.25	0.12	0.25	5.5	0.25	35
190	0.23	27	1.18	0.10	0.25	5.2	0.27	47
200	0.08	23	1.14	0.10	0.15	7.8	0.10	54
210	0.04	13	1.03	0.08	0.15	9.6	0.04	75
220	0.04	23	1.14	0.10	0.15	9.6	0.05	54
230	0.04	23	1.14	0.10	0.15	9.6	0.05	54
240	0.04	8	1.00	0.07	0.15	9.6	0.04	85
250	0.04	8	1.00	0.07	0.15	9.6	0.04	85
260	0.04	22	1.13	0.09	0.15	9.6	0.05	56
270	0.10	18	1.09	0.09	0.15	7.1	0.11	64
280	0.38	48	1.41	0.15	0.25	4.2	0.54	5
290	0.11	35	1.28	0.12	0.16	7.0	0.14	30
300	0.04	23	1.14	0.10	0.15	9.6	0.05	54
310	0.25	32	1.24	0.11	0.25	5.0	0.32	36
320	0.04	23	1.14	0.10	0.15	9.6	0.05	54
330	0.25	23	1.14	0.10	0.25	5.0	0.29	54
340	0.29	33	1.25	0.12	0.25	4.8	0.37	35
350	0.25	39	1.32	0.13	0.25	5.0	0.33	22
360	0.05	33	1.25	0.12	0.15	9.0	0.07	35
370	0.04	33	1.25	0.12	0.15	9.6	0.05	35
380	0.26	50	1.44	0.50	0.25	5.0	0.37	10
390	0.21	28	1.19	0.11	0.25	5.4	0.25	45
400	0.29	47	1.41	0.47	0.25	4.8	0.40	5
410	0.22	27	1.18	0.10	0.25	5.3	0.26	47
420	0.04	30	1.22	0.11	0.15	9.6	0.05	40
430	0.04	32	1.24	0.11	0.15	9.6	0.05	36
440	0.07	31	1.23	0.11	0.15	8.1	0.09	39
450	0.04	80	1.77	0.50	0.15	9.6	0.07	10
460	0.04	8	1.00	0.07	0.15	9.6	0.04	85
470	0.06	23	1.14	0.10	0.15	8.5	0.07	54
480	0.17	22	1.13	0.09	0.25	5.8	0.20	57
490	0.17	25	1.16	0.23	0.25	5.8	0.19	31
500	0.25	23	1.14	0.10	0.25	5.0	0.29	54

Since very few watersheds in Arizona have adequate data, an indirect method is usually used to develop a synthetic unit hydrograph. This synthetic hydrograph is representative of all of the composite effects of the storm and watershed characteristics that result in excess runoff from the watershed. The synthetic hydrograph procedure recommended by ADOT is the Clark unit hydrograph. The Clark unit hydrograph requires the estimation of three parameters; the time of concentration (T_c), the storage coefficient (R), and a time-area relation.

Time of concentration is the travel time, during the corresponding period of most intense rainfall excess, for a flood wave to travel from the hydraulically most distant point in the watershed to the point of interest. The agricultural/urban T_c equations used for the project site are presented below.

Agricultural:

$$T_c = 7.2\, A^{0.1}\, L^{0.25}\, L_{ca}^{0.25}\, S^{-0.2}$$

Urban:

$$T_c = 3.2\, A^{0.1}\, L^{0.25}\, L_{ca}^{0.25}\, S^{-0.14}\, RTIMP^{-0.36}$$

where:

T_c	=	Time of concentration, (hours);
A	=	Area, (square miles);
L	=	Length of watercourse to hydraulically most distant point, (miles);
L_{ca}	=	Length measured from the concentration point along L to a point on L that is perpendicular to the watershed centroid, (miles);
S	=	Watercourse slope, (ft/mile)
RTIMP	=	Effective impervious area, in percent.

The storage coefficient is a Clark unit hydrograph parameter that relates the effects of direct runoff storage in the watershed to unit hydrograph shape. The equation for estimating the storage coefficient (R) is:

$$R = 0.37\, T_c^{1.11}\, L^{0.80}\, A^{-0.57}$$

where:

R	=	Storage coefficient (hours);
T_c	=	Time of concentration (hours);
L	=	Length of watercourse to the hydraulically most distant point (miles);
A	=	Area (square miles).

The time-area relation is a graphical parameter that specifies the accumulated area of the watershed that is contributing runoff to a concentration point at any given time. Sufficient data was not available to analyze the watershed by producing areas that have equal incremental travel times to the outflow location. Therefore, synthetic time-area relationships "A" and "C" from ADOT Table 4-1 were utilized for this analyses. These relationships are presented in Table VI.

Table VI
Values of the Dimensionless Synthetic Time-Area Relations for the Clark Unit Hydrograph

TRAVEL TIME, AS A PERCENT OF T_c	Contributing Area, as a Percent of Total Area URBAN WATERSHED "A"	Contributing Area, as a Percent of Total Area AGRICULTURAL WATERSHED "C"
0	0	0
10	5	3
20	16	5
30	30	8
40	65	12
50	77	20
60	84	43
70	90	75
80	94	90
90	97	96
100	100	100

7. Channel Routing Parameters

Runoff from overland flow areas (yards, fields, etc.) will ultimately reach some type of defined channel (streets, etc.) where it joins with other runoff and continues downstream as open channel flow. The modified puls channel routing operations were used to route hydrographs from one sub-basin to the next. The "normal depth, storage outflow" option in HEC-1 was used for sub-basin routing operations.

Field observation, review of USGS quadrangle maps, and engineering judgement were used to develop channel routing geometries for the storage routing operations. The routing procedure utilizes input that describes the channel length, slope, roughness, and geometry. An 8-point cross-section with variable overbank and channel roughness values is utilized.

In residential areas, routed flows do not follow a specific street, but instead may spread out among several streets. Where this is likely to occur, the width and length of channels in the HEC-1 model were adjusted to accurately model the basin. On any street routing procedure, building or block wall offsets from the curb were included as part of the channel cross-section and were based on field observations and engineering judgement. In residential areas, a Manning's "n" value of 0.016 was used for street flow and 0.030 was used for flow outside of the street. A summary of HEC-1 routing parameters is provided in Table VII.

8. Flow Diversions

The City of Mesa storm drain system is designed to handle the 10-year storm event. Flows up to and including the 10-year event were diverted from the surface flow at the McKellips Road/Country Club Drive intersection and at the Alma School Road/McLellan Road intersection. The capacities of the storm drains were estimated assuming normal depth flow.

In addition to storm drain diversions, two other diversion points were included in the HEC-1 model. Field investigations determined that significant flow splits occur at the McKellips Road/Mesa Drive intersection and at the McKellips Road/Country Club Drive intersection. Flow distributions were estimated based on normal depth capacities of each roadway section. Diversion sub-routines were included in the HEC-1 model for these areas.

9. Off-site Retention/Detention Facilities

Many of the residential areas within the study watershed include at least some retention. From 1973 to 1987, the City of Mesa drainage design ordinances required retention of the 50-year, 24-hour storm volume for new development; in 1987 the drainage ordinance was modified to require retention of the 100-year, 2-hour storm volume. However, many areas within the urbanized watershed were constructed prior to 1973 and do not have stormwater retention.

In order to determine the quantity of retention provided within individual developments, City of Mesa subdivision design records were reviewed and, where data was not available, estimates of retention basin sizes were made based on field observation.

Subareas for which the retention requirement was known were modeled accordingly. If the design event was not known, but significant retention facilities were evident, the smaller of the 100-year 2-hour event or the 50-year 24-hour event was used to determine the retention volume. Subareas with little or no apparent retention facilities were modeled with no retention.

In order to account for on-site retention within particular sub-basins, "dummy reservoirs" were added to the HEC-1 model. Reservoir volumes were sized to model the 100-year 2-hour or 50-year 24-hour City of Mesa retention requirements. Runoff created by the 100-year 24-hour storm event was routed through the reservoir to simulate the attenuation and/or translation of the hydrographs. Runoff in excess of the reservoir capacity was allowed to flow out of the reservoir to the next downstream sub-basin.

TABLE VII

01/21/97

RED MOUNTAIN FREEWAY, PHASE III

Summary of HEC-1 Routing Parameters

HEC-1 Operation	Manning's "n" Left Overbank	Manning's "n" Main Channel	Manning's "n" Right Overbank	Length (ft)	Slope (ft/ft)	Channel Bottom Width (ft)	Estimated Avg Veloc (fps)	Approx. Travel Time (min)	NSTPS
11	0.035	0.030	0.035	6000	0.0030	10	3.2	31.3	16
21	0.040	0.040	0.040	5800	0.0022	250	0.8	120.8	60
36	0.035	0.030	0.035	4800	0.0025	60	3.4	23.5	12
56	0.040	0.040	0.040	3000	0.0037	250	2.1	23.8	12
66	0.035	0.030	0.035	3000	0.0003	60	1.8	27.8	14
86	0.040	0.040	0.040	2900	0.0017	250	0.9	53.7	27
96	0.030	0.016	0.030	2650	0.0023	25	4.7	9.4	5
106	0.035	0.030	0.035	2700	0.0059	60	6.3	7.1	4
121	0.030	0.016	0.030	1250	0.0152	44	4.9	4.3	2
137	0.030	0.016	0.030	1400	0.0026	68	2.3	10.1	5
146	0.030	0.016	0.030	500	0.0008	68	1.7	4.9	2
176	0.030	0.016	0.030	650	0.0011	68	2.6	4.2	2
187	0.030	0.016	0.030	1350	0.0004	64	2.1	10.7	5
196	0.030	0.016	0.030	1000	0.0015	68	2.9	5.7	3
226	0.030	0.016	0.030	950	0.0021	68	3.2	4.9	2
246	0.030	0.016	0.030	600	0.0035	68	4.3	2.3	1
256	0.030	0.016	0.030	2000	0.0019	68	3.7	9.0	5
266	0.030	0.016	0.030	2450	0.0065	68	2.1	19.4	10
281	0.030	0.016	0.030	800	0.0176	800	1.6	8.3	4
296	0.030	0.016	0.030	700	0.0011	25	2.9	4.0	2
306	0.030	0.016	0.030	600	0.0008	25	3.2	3.1	2
324	0.030	0.016	0.030	1350	0.0014	64	2.6	8.7	4
326	0.030	0.016	0.030	1250	0.0014	50	3.8	5.5	3
346	0.030	0.016	0.030	550	0.0091	300	3.8	2.4	1
356	0.030	0.016	0.030	500	0.0080	25	4.3	1.9	1
366	0.030	0.016	0.030	800	0.0023	25	5.1	2.6	1
368	0.030	0.016	0.030	1250	0.0010	75	2.8	7.4	4
386	0.030	0.030	0.030	1900	0.0043	300	3.8	8.3	4
398	0.030	0.016	0.030	1800	0.0021	75	4.2	7.1	4
401	0.030	0.016	0.030	1900	0.0105	64	5.2	6.1	3
416	0.030	0.016	0.030	650	0.0091	64	4.1	2.6	1
431	0.030	0.016	0.030	1350	0.0004	25	1.7	13.2	7
447	0.030	0.016	0.030	1350	0.0014	64	4.3	5.2	3
459	0.030	0.016	0.030	1700	0.0006	64	2.1	13.5	7
467	0.030	0.016	0.030	700	0.0014	64	3.1	3.8	2
469	0.030	0.016	0.030	1250	0.0017	64	4.9	4.3	2
476	0.030	0.016	0.030	1650	0.0015	64	5.0	5.5	3
481	0.030	0.016	0.030	1300	0.0010	25	2.5	8.7	4
486	0.030	0.016	0.030	2150	0.0015	64	5.1	7.0	4

filename: routparm.wq2

10. Red Mountain Freeway Detention Basins

The Phase III Red Mountain Freeway Phase construction from McKellips Road to Country Club will include two off-site detention basins. The basins will be located in the southeast quadrant of the McKellips Road T.I. and the southeast quadrant of the Country Club Drive T.I.

McKellips Road Detention Basin - The primary purpose of the McKellips Road detention basin is to limit the amount of the off-site stormwater runoff contributing to the interchange. Preliminary cost evaluations indicated that it is not economical to increase the bridge span length for drainage facilities. In addition, right-of-way is extremely limited north of the interchange. The proposed basin will collect runoff from the McKellips Road and route it under the freeway using two 48" pipes. The cross-culverts outfall approximately 12 feet below existing ground. A riprap lined channel will be constructed to outfall the detention basin outlet from the bank protection to the Salt River.

Country Club Drive - The purpose of the Country Club Drive detention basin is to collect off-site stormwater runoff and outlet it to the City of Mesa 72" storm drain at a rate which does not adversely impact the existing system. It should be noted that the detention basin volume was oversized to help reduce the borrow required for the project.

E. Summary of Results

The summary output from the HEC-1 computer program and for Phase III of the Red Mountain Freeway and supporting calculations is presented in Appendix A.

It was assumed that the flow at concentration point 65C will be routed to the Salt River east of Country Club Drive, near Center Street. It was further assumed that the flow arriving at concentration point 95C will be intercepted at Center Street and diverted through a future detention basin to the Salt River. This is a key design assumption for the drainage design for the Country Club Drive to Gilbert Road section of the Red Mountain Freeway.

The 100-year peak discharge arriving at concentration point 274C2 (McKellips Road) totals approximately 215 cfs. The design 100-year peak discharge includes runoff from the Red Mountain Freeway and right-of-way, McKellips Ramp B, and McKellips Road (FWYMC).

The 100-year peak discharge arriving at concentration point 100C (Country Club Drive) totals approximately 90 cfs. The design 100-year peak discharge assumes all the future mainline from Country Club Drive to Center Street, Country Club Ramp D, and the southern right-of-way of the Red Mountain Freeway (FWYCC) contributes to the proposed Country Club Drive detention basin. A summary of the off-site peak discharges is provided in Table VIII.

Table VIII
Peak Discharge Values for the Red Mountain Freeway
Phase III Off-Site Drainage Areas

Concentration Point	Description of Concentration Point	Q_{100} (cfs)
35C	North Channel McDowell and Stapley Roads	370
45C	North Channel McDowell Road and Mesa Drive	420
65C	South Channel Lehi Road and Center Street	590
100C	Country Club Drive Detention Basin	90
274C2	McKellips Road Detention Basin	210

III. ON-SITE DRAINAGE

A. General Discussion

The on-site drainage system is designed to optimize the number and location of storm drain catch basins, minimize maintenance requirements, provide safe and efficient access for maintenance operations; and allow for the staged construction of the Red Mountain Freeway projects into an integrated drainage system. Generally, on-site runoff is intercepted by catch basins and conveyed through storm drain laterals to cross-culverts or roadside ditches which outfall to the Salt River.

B. Previous Studies

The Final Drainage Report for the Phase I - Dobson Road Connection of the Red Mountain Freeway was completed in September 1994. The Final Drainage Report for Phase II - Red Mountain Traffic Interchange to McKellips Road was completed in January 1996. The Preliminary Drainage Report for Phase III - McKellips Road to Country Club Drive was submitted to ADOT in October 1996.

C. Design Criteria

The drainage design criteria for this project is based on ADOT's Design Procedures Manual. To reduce project construction costs, the HOV lane was removed and an open median will be constructed east of the Red Mountain T.I. However, the cross-road bridge will be constructed to the ultimate freeway width at McKellips Road.

Mainline pavement superelevated towards the median is designed for an open median condition. The contributing drainage area includes the interim pavement and the open median. Therefore, the drainage area and runoff contributing to the median catch basins is greatest for the interim condition. The storm drain laterals in the median are located to permit paving the median and relocating the basins adjacent to future barrier. The median storm drain laterals are also are located within the future shoulder to prevent sign foundation conflicts.

Since the open median section is considered a long-term interim condition, the design pavement spread was increased to 9 feet along the open median curb and gutter. Nine feet of spread encroaches into the adjacent 12 foot travel lane approximately 1 foot for the interim design. The design spread along the outside shoulder is designed based on no more than one-half travel lane encroachment for the 10-year frequency storm.

Normal crowned mainline pavement sections are designed for the ultimate closed median condition. All catch basins along the outside shoulder are sited assuming a future closed median condition which generates larger contributing drainage areas.

ADOT District Maintenance requested at the final inspection of the Phase I project that all outfalls to roadside ditches utilize ADOT standard flared end sections (C-13.20) with riprap pads to reduce outlet erosion. ADOT District Maintenance indicated that these facilities require less maintenance than alternative designs.

At McKellips Road and Country Club Drive, cross-road ramps superelevated towards the infield are designed to convey runoff to infield ditches using curb opening spillways (scuppers). It was considered cost prohibitive to construct a storm drain lateral and catch basin to intercept the ramp runoff at these locations. A detail of the proposed scupper is presented as Detail K in Exhibit I.

Runoff from the embankment along the north side of the Red Mountain Freeway roadway generally sheet flows into the Salt River. In locations where this runoff concentrates, infield (C-15.80) catch basins will be utilized to collect the local runoff.

Double catch basin systems were designed for all off-ramp gore locations. The first basin was placed approximately 105 feet behind the back-of-gore to intercept the contributing runoff. This basin is located on the upstream side of the barrier GET system where runoff depths can exceed the 3 inch height of the Type D curb and gutter section. A second basin was placed 13 feet behind the back-of-gore at the end of the gore curb and gutter transition. This basin intercepts all the contributing runoff an minimizes the flow crossing the gore onto the adjacent ramp.

Runoff: The on-site runoff was quantified using the rational method as outlined in ADOT's hydrology manual.

Runoff Coefficients:

Paved Surfaces	0.95
Highway Slopes (Decomposed granite with 3:1 slopes or less)	0.70
Highway Slopes (Decomposed granite with less than 5:1 slopes)	0.60

Time of Concentration: The time of concentration for the on-site runoff was determined using ADOT's hydrology procedures. The minimum time of concentration was assumed to be 10 minutes (overland flow plus routing time). All the roadway inlet catch basins default to the minimum 10 minute time of concentration. The computed time of concentration for some of the infield basin areas are in excess of 10 minutes.

Rainfall Intensity: ADOT's hydrology manual was used to determine rainfall intensities. This method is based upon the 6-hour and 24-hour precipitation depths at the project site. The rainfall intensity is iteratively determined at the point of interest using the actual time of concentration and the site specific intensity-duration-frequency curves developed for this project.

D. Study Methods

1. Hydrology

The rational method was used to estimate the peak discharge for the on-site drainage areas. These discharges were then used to determine the design gutter flow, pavement spread, catch basin size and spacing, temporary ditch design flow, and storm drain sizing. The catch basins were generally designed for 100 percent interception with little or no flow-by. Therefore, the contributing area for catch basins in series is assumed to extend only to the next upstream catch basin.

2. Hydraulics

The FHWA's Hydraulic Engineering Circular No. 12 (HEC-12) was used as the basis for gutter and catch basin interception hydraulics. HEC-12 uses a modified Manning's equation for gutter flow and a combination of weir, orifice and empirical relationships for catch basin hydraulics.

ADOT's roadway inlet design computer program, which is based on HEC-12, was used extensively for gutter and catch basin hydraulic design. The efficiency of the catch basins utilize criteria outlined in ADOT's Design Procedures Manual. Output presented with this submittal from the ADOT inlet computer program was spot checked for accuracy with HEC-12 procedures.

Temporary roadside ditch hydraulics are based primarily on FHWA's Hydraulic Design Circular No. 4. Criteria for minimum slope, maximum velocity, and freeboard, comply with ADOT design criteria. The 10-year water surface elevation in traffic interchange infield channels is designed for 1 foot below the adjacent subgrade elevation and under all circumstances, 3 inches below the lowest adjacent travel lane. Manning's equation was used to calculate normal depth for the temporary roadside ditches.

E. Inlet/Catch Basin Design

The rainfall intensity-duration-frequency relationship for the Red Mountain Freeway was determined using procedures outlined in ADOT's Hydrology Manual. The point rainfall depths at the project site are provided in Table III. The concept roadway drainage area maps are presented in Exhibit IV.

The catch basins are sized and spaced based on several considerations and design criteria. The roadway catch basins are located at all points of vertical sag and sized for 100 percent interception at acceptable ponding depths and pavement flow spread. Roadway catch basins on grade are located to meet acceptable ponding depth and spread, and are generally sized for 100 percent interception. Roadway catch basins are also located near points with zero percent superelevation, cross-road intersections, interim sump conditions at cross-road bridges, and at gore areas to prevent runoff from accumulating and crossing travel lanes. The ADOT pavement drainage analysis computer program output for the design of the Red Mountain Freeway inlets is presented in Appendix B. Inlet and catch basin efficiencies conform to ADOT standards and are indicated on the inlet program output. Grated catch basins on cross-roads and cross-road interchanges will be designed using Type EF grates for bicycle traffic safety considerations.

F. Storm Drain Design

Hydraulic grade line calculations were performed using the STORMCAD computer program. The STORMCAD program accounts for the impact of system flow time on the cumulative discharge. The pipe profiles presented with the Final I (95%) design submittal illustrate the design hydraulic gradeline or top of pipe, whichever is greater. The storm drain hydraulic gradeline is designed to a minimum of one foot below the top of the roadway grate elevations for the 10-year storm event.

Catch basins are connected to the median storm drain lateral with tee's or manholes which are spaced to meet ADOT design criteria. The first storm drain lateral in a series is connected directly to a manhole. The proposed storm drain lateral location should reduce pipe excavation and backfill depths by keeping the pipe higher in the roadway embankment. In addition, the proposed storm drain location will provide maintenance access from the shoulder.

G. Main Storm Drains

The cross-culverts which outfall to the Salt River are the main storm drain outfalls for the roadway and off-site drainage. New major storm drains proposed for the Red Mountain Freeway include the cross-culverts outfalling the McKellips Road detention basin in the southeast quadrant of the McKellips Road T.I. (Sta 515+25), and a cross-culvert between McKellips Road and Country Club Drive (Sta 523+00). The sizing of these cross-culverts is discussed in further detail in Section IV.

SCI has coordinated the concept drainage design of the Country Club Drive T.I. with the City of Mesa (COM) regarding the use of the existing 72" storm drain. COM engineering staff indicated they would permit connecting the proposed Red Mountain Freeway drainage system to the existing 72" storm drain if there are no adverse impacts. The COM defined the critical location in the Country Club Drive storm drain hydraulic grade line as the inlet capacity near the intersection of McLellan Road and Country Club Drive (stations 229+70 and 256+75).

The STORMCAD computer program was used to quantify the impact of the proposed Red Mountain Freeway drainage system on the existing Country Club Drive storm drain for the 10-year design storm event. Asbuilts, provided by the COM, were used to define the geometry of the existing storm drain network. Two manhole connections are proposed to the existing 72" storm drain.

The first manhole (MH 80, Sta 276+10) collects runoff from: Country Club Ramp B, right-of-way, and infield; the future Red Mountain Freeway east of Center Street, including right-of-way; and, the future Country Club Ramp D, right-of-way, and infield. The freeway runoff east of Country Club Drive is proposed to be diverted to the Country Club Drive detention basin in the southeast quadrant of the T.I. and metered out to the existing 72" storm drain. The hydrologic analysis presented in Appendix A indicates 8 cfs contributes from the detention basin to the storm drain peak discharge. A second, smaller detention basin was designed in the southwest quadrant of the Country Club T.I. to further reduce the peak discharge contributing to the 72" storm drain. The hydrologic analysis indicates that 5 cfs contributes to the storm drain peak discharge from the southwest detention basin. The outfall peak discharge for the detention basins was developed for the 100-year, 24-hour duration design storm using the HEC-1 computer model (Operations BASIN1, BASN1A). A multi-level detention basin outlet, Detail AL, is included in Exhibit I to meter the detention basin flows.

The detention basin grading provides approximately 3 feet of freeboard for the future 100-year, 24-hour design storm.

The second manhole (MH 110, Sta 280+40) collects runoff from: Country Club Ramp A and infield; Country Club Drive northbound and southbound; Country Club Ramp C and infield; and, the future Red Mountain Freeway north side right-of-way west of Center Street. The hydraulic analysis presented in Appendix C assumes a direct connection to the existing 72" storm drain. Runoff storage is not available for these connections. Table IX quantifies the impact of the Red Mountain Freeway drainage system on the existing 72" storm drain hydraulic grade line at critical inlets defined by the COM.

Table IX. Country Club Drive Storm Drain Critical Elevations

Roadway Inlet Station	Grate Elevation (ft)	Proposed Hydraulic Grade Line Elevation (ft)	Elevation Difference (ft)
229+70	1216.81	1215.99	0.82
256+75	1213.43	1212.30	1.13

The STORMCAD calculations for the Country Club Drive storm drain, which include the Red Mountain Freeway contributing area, are presented in Appendix C. The results indicate that the existing Country Club storm drain peak discharge lags significantly behind the Red Mountain Freeway contributing area. The resulting increase in the cumulative peak discharge of the Country Club Drive storm drain at the Red Mountain Freeway is approximately 22 cfs. However, the results indicate that the increased discharge does not adversely impact the performance of the storm drain system in the vicinity of McLellan Road.

H. Outlet Design

The on-site drainage system is generally connected to the off-site detention basins and cross-culvert which outfall to the Salt River. The cross-culverts are designed in accordance with ADOT and FHWA procedures and methodologies. The hydraulic grade line was analyzed for two conditions: 1) the 10-year off-site contributing discharge and a tailwater elevation based on the 100-year water surface elevation in the Salt River; 2) the 100-year off-site discharge and a tailwater elevation based on the 10-year water surface elevation in the Salt River. The water-surface elevation in the Salt River will be based on the hydraulic analyses for the Red Mountain Freeway and not the effective Salt River Flood Insurance Study.

I. Proposed Drainage Improvements

A summary of the on-site drainage systems to be constructed with Phase III of the Red Mountain Freeway is provided below:

1. Median Storm Drain Lateral (Sta 498+00±)

   The median lateral, constructed as part of the Phase II project, will be extended for Phase III. The system outfalls to a roadside ditch west of the McKellips Road T.I. The system intercepts both eastbound and westbound runoff west of the McKellips Road mainline crest vertical curve. This storm water eventually outfalls to the Salt River through the detention basin and cross-culvert outfall at Sta 489+95.

2. McKellips Road Ramp System (Sta 505+00±)

   Runoff from Ramp A is collected prior to McKellips Road and piped to the Salt River by a storm drain system partially constructed with the Phase II project. Runoff from Ramp B will is proposed to be routed to the McKellips Road detention basin and ultimately to the Salt River.

   The construction plans present a proposed revision to the Phase II P series pipe system. The revisions illustrate the impact of modifications to the Ramp B superelevation. Ramp B was revised to better match the ultimate McKellips Road section at the Red Mountain Freeway.

3. McKellips Road (Sta 509+00±)

   Runoff concentrating north of McKellips Ramp B will be conveyed to an existing roadside ditch along the east side of McKellips Road. A curb opening spillway illustrated in Detail AH should prevent embankment erosion.

4. McKellips Road Detention Basin (Sta 513+00±)

   The proposed detention basin at the southeast quadrant of the McKellips Road T.I. will detain on-site and off-site runoff. On-site runoff from McKellips Road south of the Red Mountain Freeway will be conveyed to the detention basin. Runoff east of the McKellips crest vertical curve to approximately Sta 517+00 will be conveyed to the detention basin.

   Off-site runoff conveyed along the north side of McKellips Road is proposed to be intercepted by the detention basin. A peak discharge of approximately 200 cfs is estimated to concentrate at this location during a 100-year design storm event. The on-site and off-site runoff will be routed to the Salt River through cross-culverts located at Sta 514+50±. The drainage concept for McKellips Road uses a series of four sidewalk scuppers (MAG Std. Dtl. 206.1 and 206.2) to convey the roadway runoff conveyance capacity into the adjacent detention basin. Runoff in excess of the roadway capacity will weir over the sidewalk into the detention basin. Riprap may be required to prevent erosion of the detention basin slopes from the off-site runoff.

5. Cross-Culvert Outfall (Sta 523+00±)

On-site mainline runoff from Sta 517+00± to the future crest vertical curve at Country Club Drive will be collected in a median storm drain and roadside ditch and conveyed to the cross-culvert. This outfall drains the south right-of-way between Sta 517+00 and 524+00 to the Salt River.

6. Country Club Drive T.I. (Sta 536+00±)

Runoff from the north half of the Country Club Drive T.I. is proposed to connect to the existing 72" Country Club Drive storm drain. Runoff from the south half of the Country Club Drive T.I. is also proposed to connect to the existing 72" Country Club Drive storm drain. Details of the hydrologic and hydraulic impacts are provided in Section III-D.

A detention basin is proposed in the southeast and southwest quadrant of the Country Club Drive T.I. to detain the 100-year, 24-hour design storm on-site and off-site runoff. Material excavated from these basins is proposed for use in the freeway embankment. The detention basins utilize a metered outfall to the existing 72" storm drain in Country Club Drive.

IV. OFF-SITE DRAINAGE

A. General Discussion

The purpose of the off-site drainage system is to collect and route the 100-year, 24-hour stormwater runoff generated by the contributing watershed under the Red Mountain Freeway to the Salt River. Generally, stormwater runoff flows in a southwesterly direction parallel to the freeway alignment. Therefore, the size of the off-site drainage facilities for this reach of the freeway may be smaller in comparison to other sections of the freeway. A detailed description of the assumptions and methodologies utilized in the off-site hydrologic analyses were presented in Section II. Results of these analyses were used in the design the off-site drainage system.

Outfalls for the off-site drainage system were designed to accommodate on-site flows where possible. The number of outfalls through the bank protection was minimized to meet National Pollutant Discharge Elimination System (NPDES) permit requirements. A draft Storm Water Pollution Prevention Plan (SWPPP) is provided in Exhibit I. The draft SWPPP will be used by ADOT's construction engineer and the contractor to provide erosion control from storm water during construction.

B. Coordination with Local Agencies

In 1991, ADOT and the COM negotiated the abandonment of SR 87 (Country Club Drive) and a permit to install a 72" storm sewer within what was then ADOT right-of-way. The negotiations resulted in the COM agreeing to permit ADOT to "drain the paved areas of the future Red Mountain Freeway Ramps and the existing Country Club Drive right-of-way into the proposed (72") storm drain." The letter from Mesa also indicates that "the flow from these areas should not exceed 20 cfs." The letter of agreement between COM and ADOT is provide at the end of Appendix C. Recent coordination with the COM regarding the use of the existing Country Club Drive storm drain are discussed in Section III-D.

C. Channel Design

The majority of the off-site drainage channels adjacent to the Red Mountain Freeway will collect and route runoff from the highway embankment and local drainage to an appropriate river outfall. The right-of-way channels are designed as earth ditches. Due to constructibility and maintenance concerns the channels will typically include an 8-foot bottom width and 3 or 4 (horizontal) to 1 (vertical) side slopes. In areas where excessive velocities may occur, or where right-of-way is limited, the channel may require riprap, gunite, or concrete erosion protection.

D. Culvert Selection and Design

Culverts for the project will be designed in accordance with ADOT's recently published Pipe Selection Manual. ADOT has approved the use of plastic pipe for highway projects. SCI determined that most pipe runs can be constructed with concrete or plastic pipe materials as indicated on the new pipe summary sheets in Exhibit I. A majority of the storm drain systems will be constructed in fill. Since the source and properties of the borrow material is unknown, metal pipe alternatives could not be specified.

1. **McKellips Road Detention Basin Outfall**

The McKellips Road detention basin outfall was sized using HEC-1 storage routing capabilities. The detention basin storage rating curve was developed using the contours illustrated on the detention basin plan. Due to outfall elevation limitations and the volume of the contributing off-site runoff, two 48" culverts were required to convey the runoff to the Salt River. The outfall rating curve was developed using HY-8 and is presented in Appendix A along with the HEC-1 output for the basin routing (BASIN2).

2. **Cross-Culvert (Sta 523+00)**

On-site runoff collecting in the south right-of-way channel between Sta 517+00 and Sta 524+00 is conveyed to the Salt River through a cross-culvert at Sta 523+00. A median lateral system collecting the mainline runoff through this superelevated freeway segment is connected to the cross-culvert. The cross-culvert was sized using STORMCAD to limit the design headwater to one-foot or more below the adjacent existing ground elevations along the new ADOT right-of-way. The STORMCAD output for this cross-culvert (System E) and is provided in Appendix C.

V. SALT RIVER HYDRAULICS

A. General Discussion

The hydraulic analyses performed on the Salt River for the Red Mountain Freeway (Phase III) is summarized in the following section. Detailed documentation for the hydraulic and sediment transport analyses performed in support of the bank protection design is presented in a separate report.

B. Design Conditions

A hydraulic model (HEC-2) was developed for this project to determine the impact that the Salt River has on the proposed Red Mountain Freeway. The model is a continuation of the hydraulic model developed for Red Mountain Freeway Phase II - Loop 101 to McKellips Road.

The HEC-2 model was developed using the Simons, Li & Associates, Inc. (SLA) model BASE.DAT presented in their report "Hydraulic and Sediment Transport Analysis Report, Salt River Bank Protection Design, South Bank Upstream of Pima Freeway, Bank Sta 33+00 to 73+00." The SLA model, which includes channelization between McClintock Drive to approximately 4000 feet east of the Red Mountain/Price Freeway Traffic Interchange, also includes updated topographic information based on field observations, and ADOT topographic mapping along the south bank of the Salt River. Encroachments (ET records) were added to that model to reflect the proposed Red Mountain Freeway bank protection.

The downstream starting water-surface elevation used in the design condition model was obtained from the analysis performed by CRSS Civil Engineers, Inc. in the report titled " Salt River Hydraulic Design Grade Control No. 4 to McClintock Drive Bridge.

Construction of Roosevelt Dam will reduce the 100-year peak discharge of the Salt River at Country Club Drive from 220,000 cfs to approximately 160,000 cfs.

The Salt River hydraulic model (HEC-2) developed for this project indicates that the Country Club Drive/Red Mountain Freeway T.I. will be within the 100-year floodplain in the pre-Roosevelt 100-year flood event (220,000 cfs flow in the Salt River). However, this flooding is primarily ponded, non-effective flow. The depth of ponding in the T.I. is approximately 1 foot.

In the post-Roosevelt 100-year flood event (160,000 cfs), however, the HEC-2 model indicates that the Country Club Driver T.I. will not be within the 100-year floodplain.

The Salt River bank protection for the proposed project ends west of Country Club Drive. The protection was designed in accordance with FCDMC criteria (220,000 cfs design storm plus freeboard). When constructed, this location will be the eastern end of the FCDMC maintained protection for the south bank of the Salt River. Extension of the Salt River south bank protection to the east does not appear to be required for construction of future phases of the Red Mountain Freeway.

Preliminary discussions with ADOT drainage personnel indicate that a 100-year flood event design based on a peak discharge of 160,000 cfs is reasonable for this project. This fundamental assumption eliminates the issue of backwater effects at Country Club Drive.

Table X summarizes the 10-year and 100-year water-surface elevation for pre and post-Roosevelt Dam improvements, respectively, along the project construction limits.

Table X
100-Year and 10-Year Design Salt River Water Surface Elevations

SR202L Cst. Centerline Station	HEC-2 Cross Section Number	CSA Control Line Station	100-Year WSE (ft)		10-Year WSE (ft)
			220,000 cfs	160,000 cfs	93,000 cfs
510+00	226.99	7+95.72	1205.76	1204.84	1201.56
516+00	227.08	14+08.54	1207.77	1205.42	1202.64
519+00	227.18	17+14.61	1212.10	1209.40	1205.80
526+00	227.27	24+28.60	1213.87	-1211.07	1207.25
530+00	227.37	28+39.28	1215.21	1212.23	1208.11
534+00	227.46	N/A	1215.64	1212.53	1208.46

The bank stabilization will be constructed in accordance with the existing 404 Permit (PDN NO. 954-0579-LSF). Construction activities within the "Waters of the U.S." will be limited to those locations specified in the permit. Additionally, the new right-of-way for the Red Mountain Freeway was defined to limit the contractor's activities within the "Waters of the U.S." to those areas defined in the permit.

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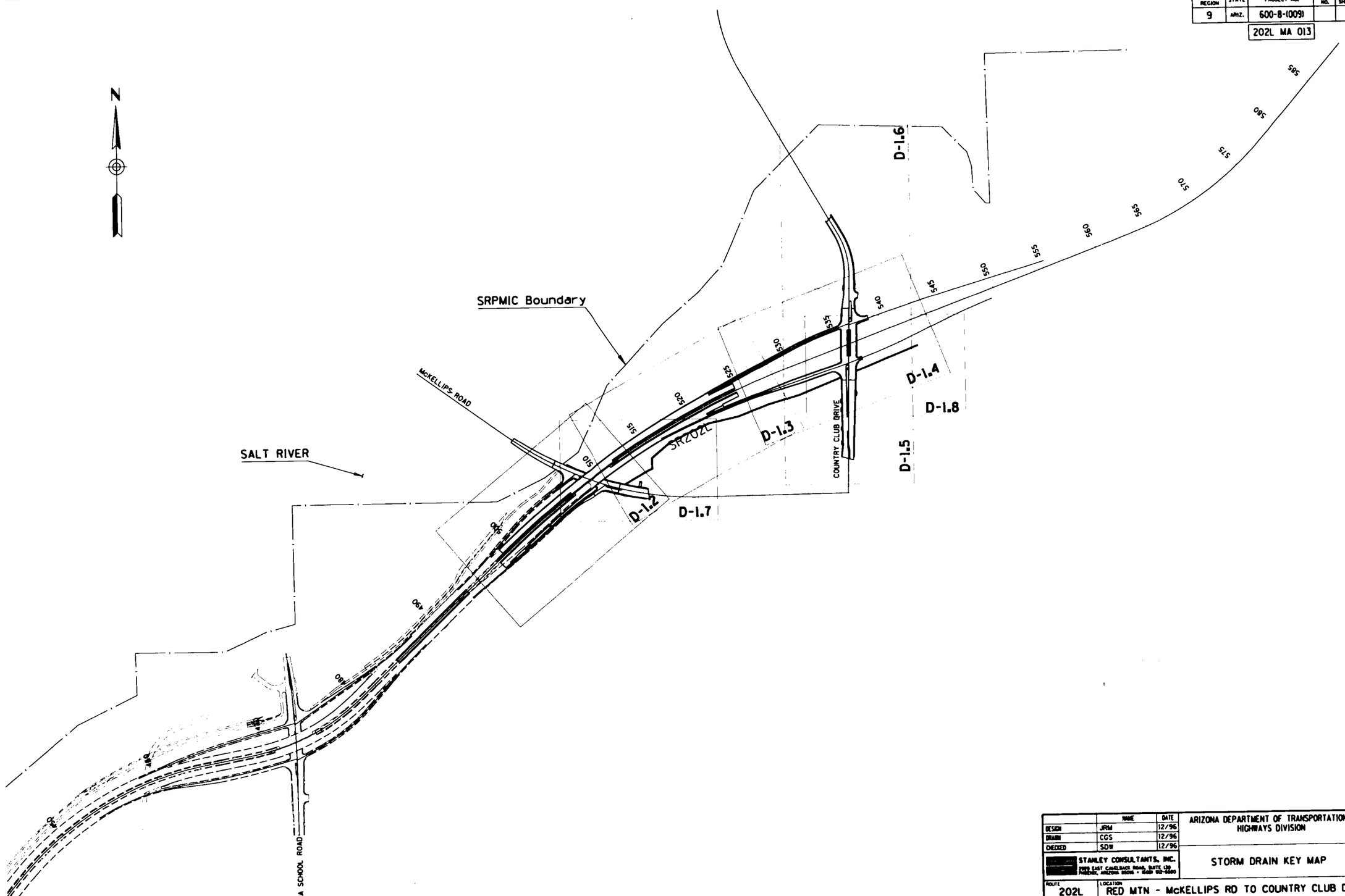
EXHIBIT I

Final Drainage Plans

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



	NAME	DATE
DESIGN	JRM	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

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ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

STORM DRAIN KEY MAP

ROUTE: 202L

LOCATION: RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.1

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM301-01.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

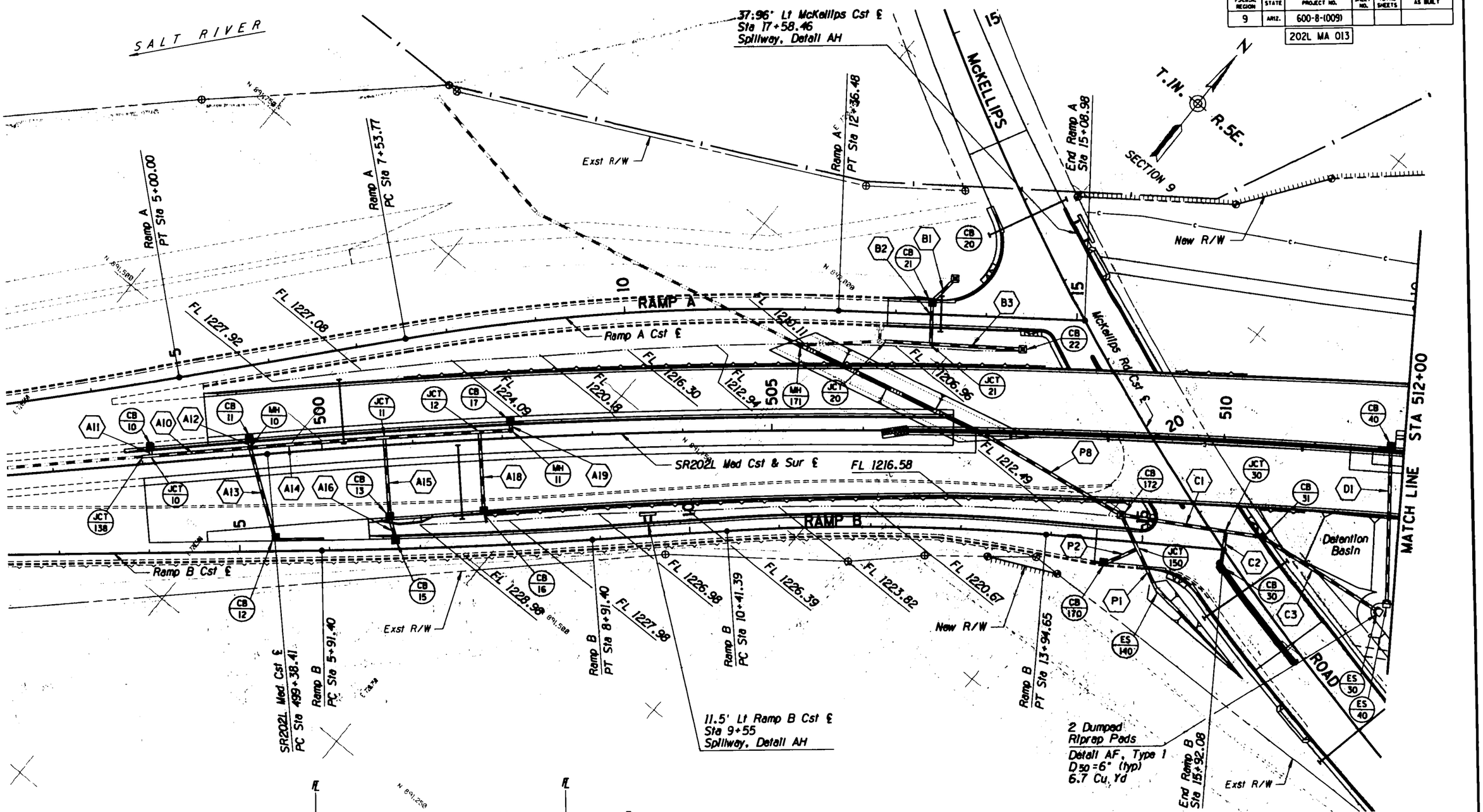
TRACS NO. H3878 01C

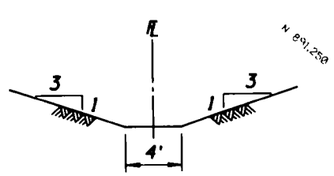
600-8-(009)

___ OF ___

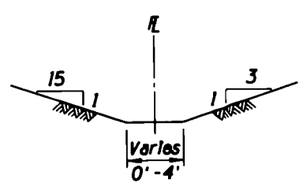
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013





SECTION A-A
NTS



SECTION B-B
NTS

NOTE:
PIPE RUNS P1, P2, P8 ARE REVISIONS TO PIPE RUNS P1 & P2 IN PROJECT STP 600-8-(6)P.

	NAME	DATE
DESIGN	JRW	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
1005 EAST CAMELBACK ROAD, SUITE 120
PHOENIX, ARIZONA 85014 • (602) 263-0600

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PLAN
SR202L
STA 497+00 TO STA 512+00

ROUTE: 202L
LOCATION: RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.2

SURVEY NO.	FINISHED PLANS	REVISIONS	LOCATION	DATE

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••
VIEW NAME: /13194/RW301-03.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

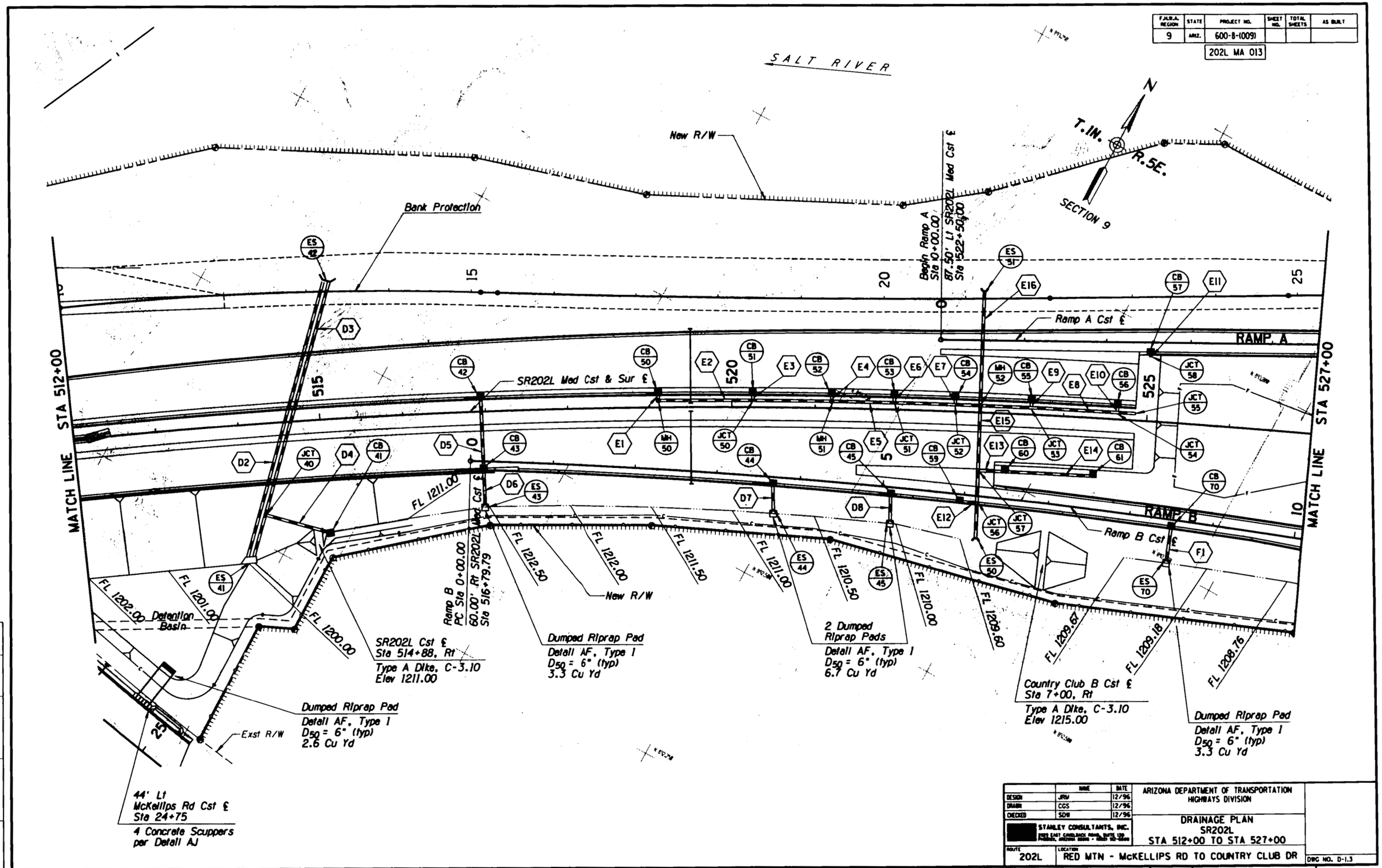
TRACS NO. H3878 01C

600-8-(009)

___ OF ___

F.A.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



	NAME	DATE
DESIGN	JRM	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
2905 EAST CAMELBACK ROAD, SUITE 120
PHOENIX, ARIZONA 85016 • (602) 95-2600

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PLAN
SR202L
STA 512+00 TO STA 527+00

ROUTE 202L | LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.3

SURVEY NO.	FIELD PLAN	REVISIONS	LOCATION	DATE

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

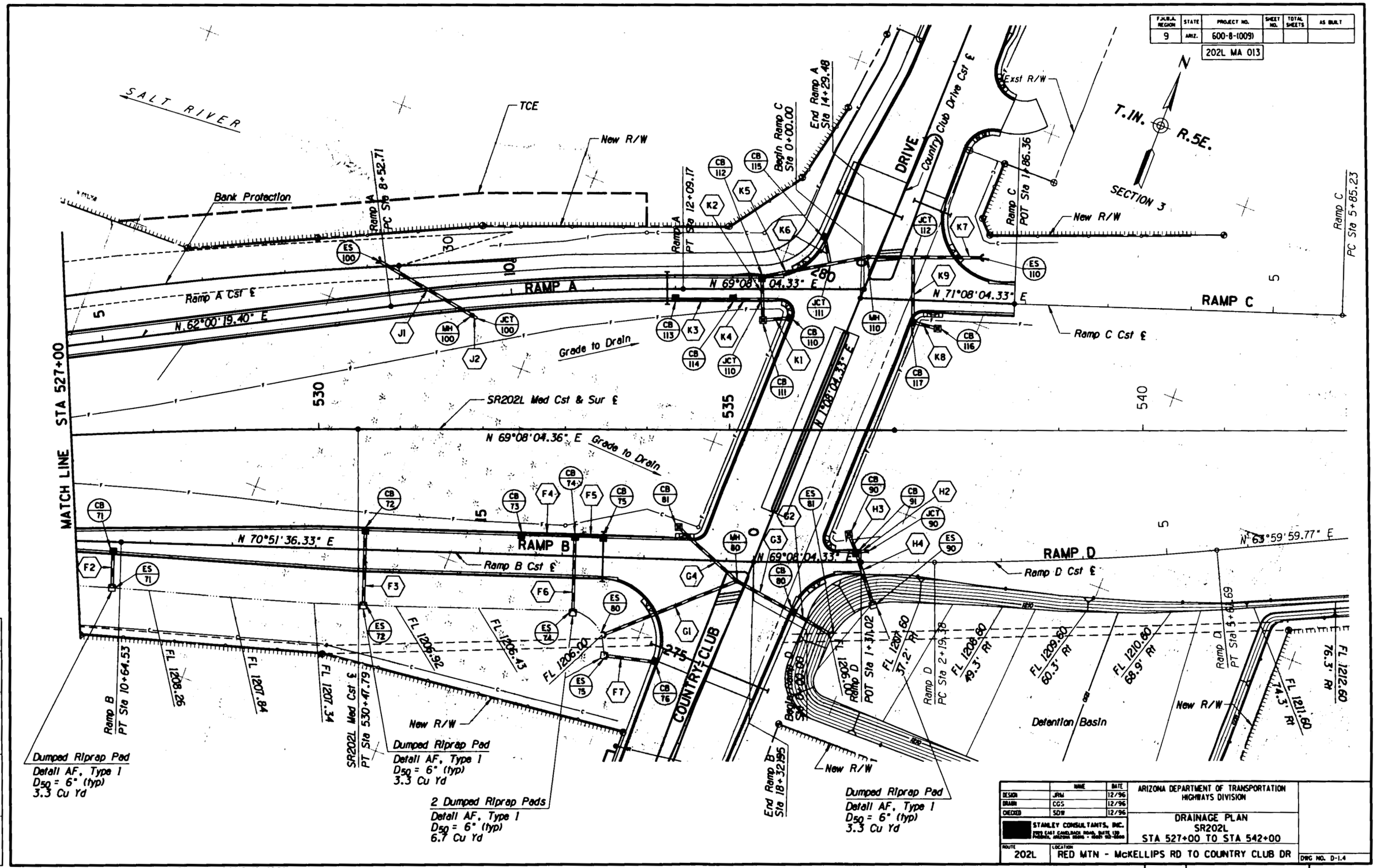
VIEW NAME: /13194/RM3D1-04.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



	NAME	DATE
DESIGN	JRM	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
1895 EAST CAMELBACK ROAD, SUITE 120
PHOENIX, ARIZONA 85016 • (602) 912-2600

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PLAN
SR202L
STA 527+00 TO STA 542+00

ROUTE 202L | LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR | DWG NO. D-1.4

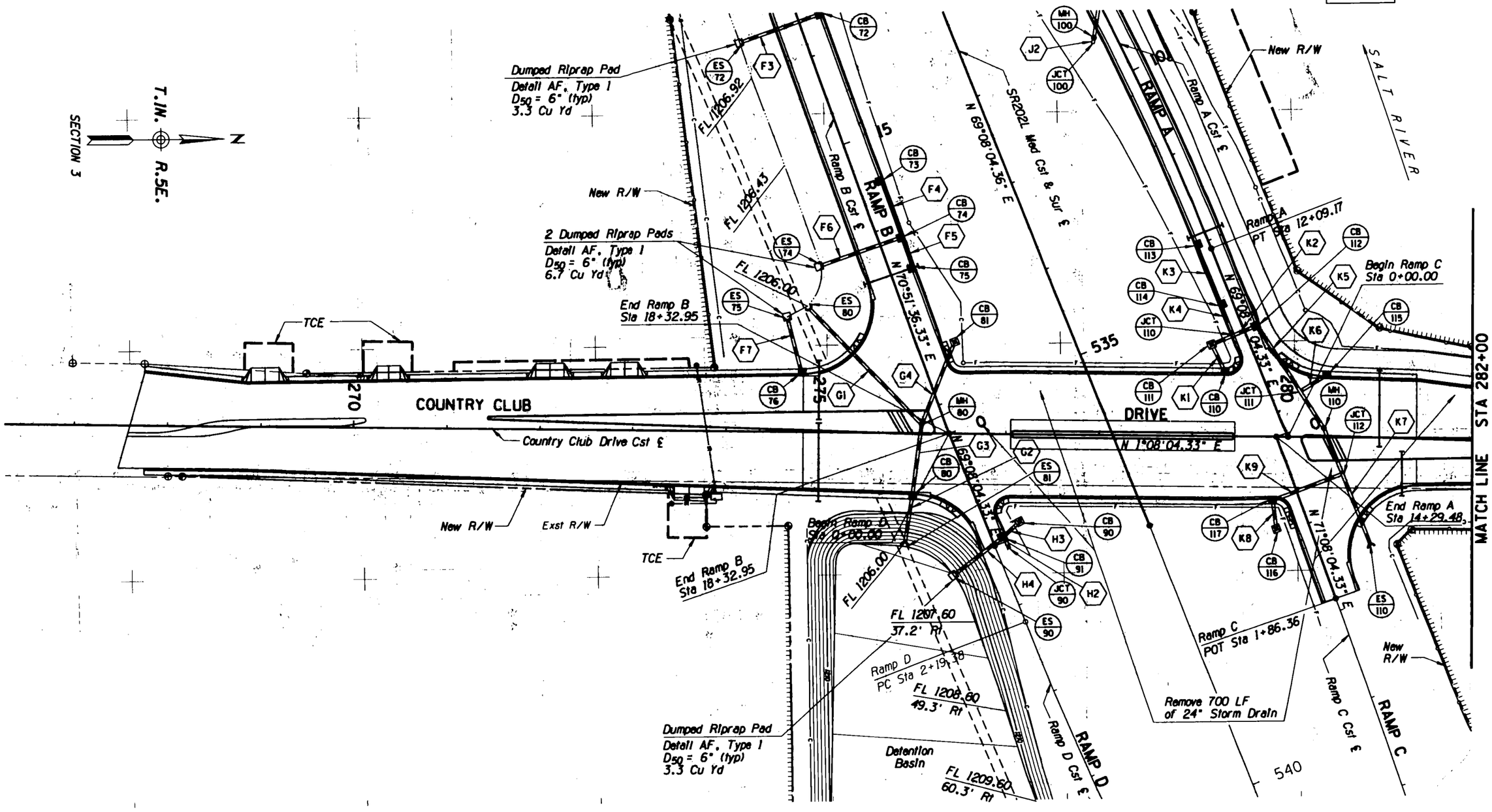
•••••DGN•SPECIFICATION••••• VIEW NAME: /13194/RM301-05.DGN
•••••SYSTIME•••••

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



	NAME	DATE
DESIGN	JRW	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PLAN
COUNTRY CLUB DRIVE
STA 266+00 TO STA 282+00

ROUTE 202L | LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR | DWG NO. D-1.5

DATE	LOCATION	REVISIONS	FINISHED PLANS	SURVEY NO.

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

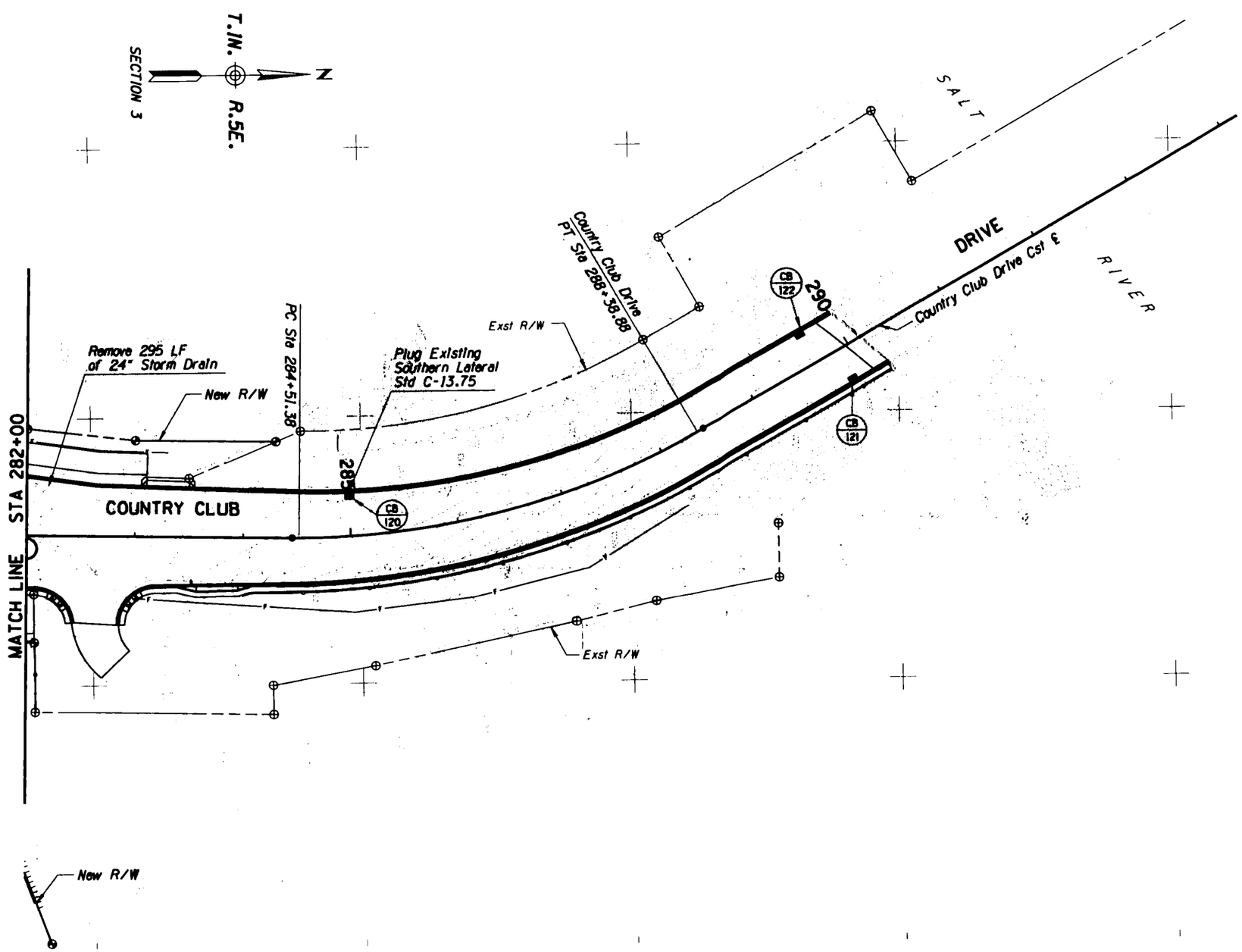
VIEW NAME: /13194/RM301-08.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



	NAME	DATE
DESIGN	JRW	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
2999 EAST GOODLAND ROAD, SUITE 120
PHOENIX, ARIZONA 85016 • (602) 955-4000

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PLAN
COUNTRY CLUB DRIVE
STA 282+00 TO STA 288+38.88

ROUTE 202L

LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.6

DATE	LOCATION	REVISIONS	FINISH PLANS	SURVEY NO.

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

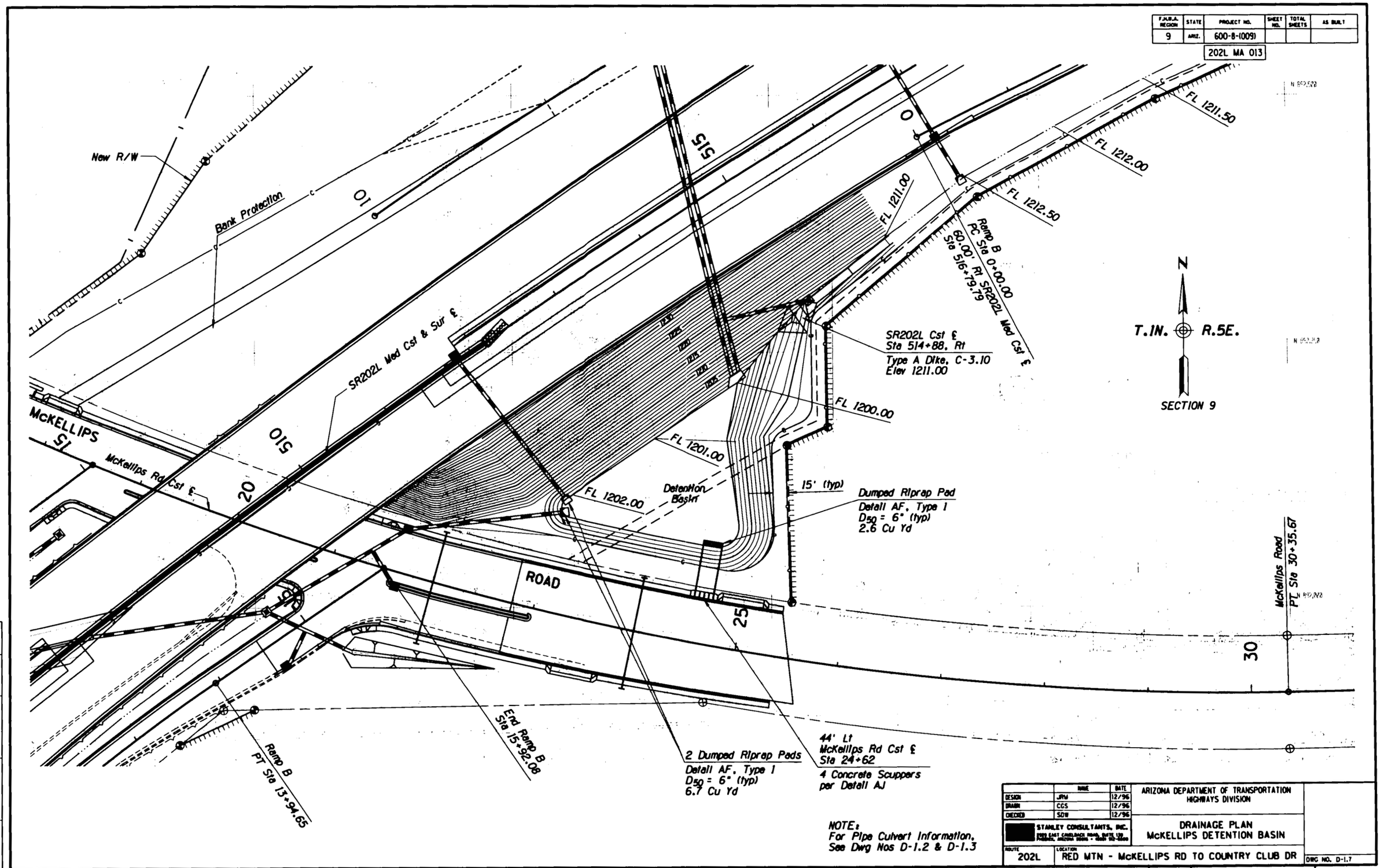
VIEW NAME: /13194/RM301-09.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-B-(009)			

202L MA 013



NOTE:
For Pipe Culvert Information,
See Dwg Nos D-1.2 & D-1.3

	NAME	DATE
DESIGN	JRW	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
3005 EAST CAMELBACK ROAD, SUITE 120
PHOENIX, ARIZONA 85016 • (602) 912-0500

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PLAN
McKELLIPS DETENTION BASIN

ROUTE 202L
LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.7

SURVEY NO.	FINISHED PLANS	REVISIONS	LOCATION	DATE

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

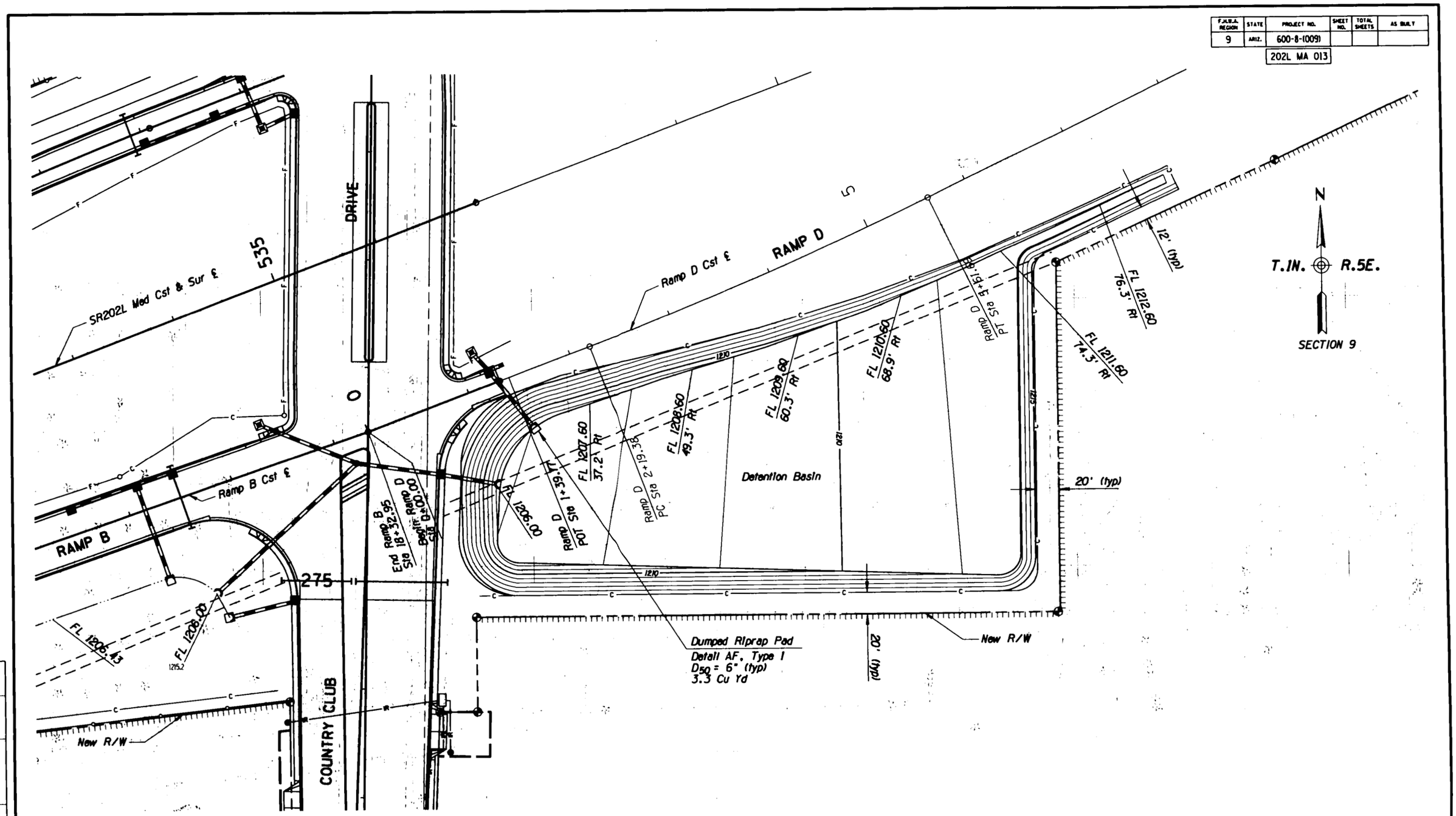
VIEW NAME: /13194/RM3D1-10.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C | 600-B-(009) | ___ OF ___

F.A.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



NOTE:
For Pipe Culvert Information,
See Dwg No. D-1.4

	NAME	DATE
DESIGN	JRW	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
5005 EAST CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85018 • (602) 952-0040

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PLAN
COUNTRY CLUB DETENTION BASIN

ROUTE 202L | LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR | DWG NO. D-1.8

SURVEY NO.	FINISHED PLANS	NO. REVISIONS	LOCATION	DATE

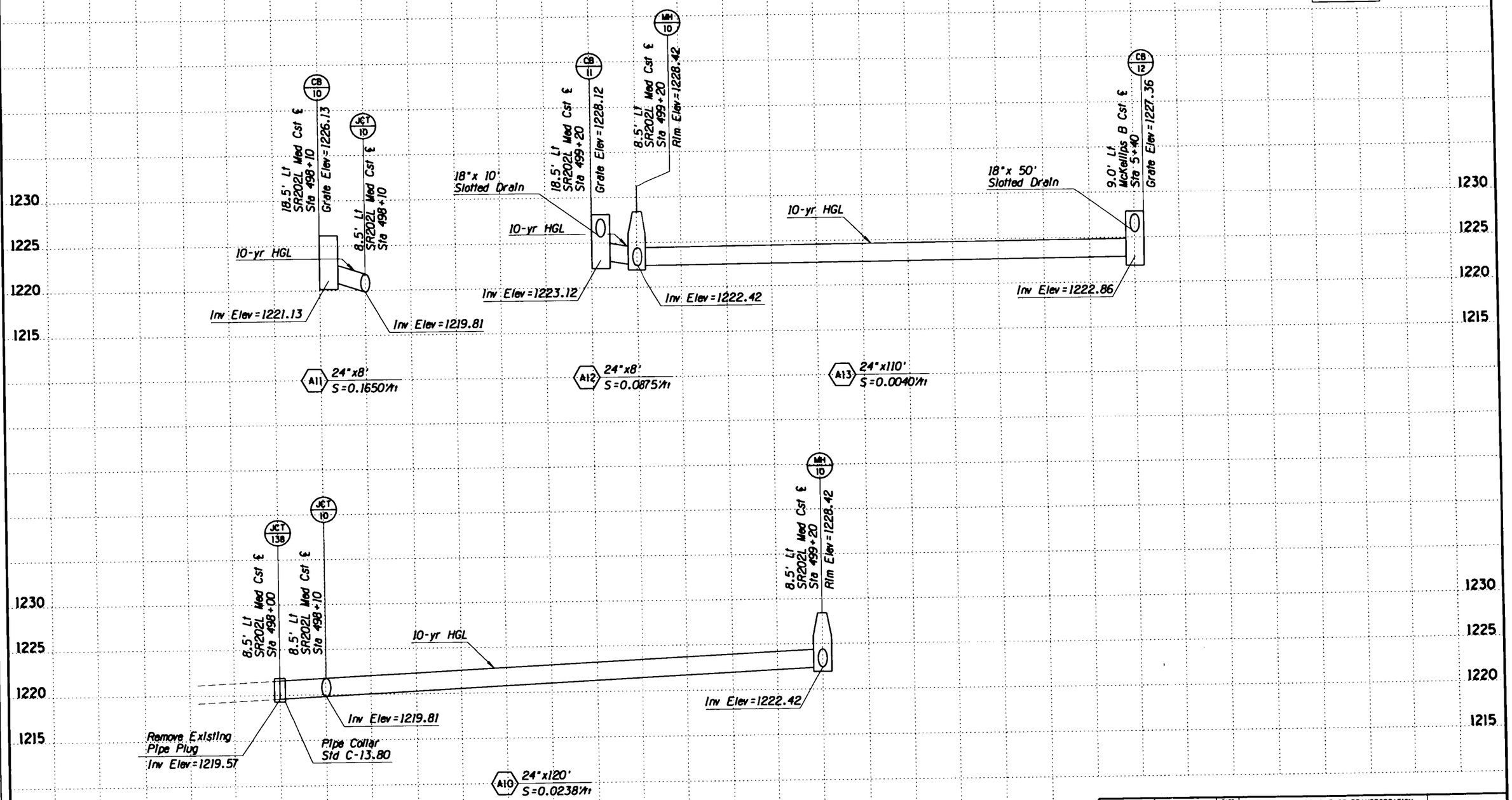
•••••DGN•SPECIFICATION••••• VIEW NAME: /13194/RM3D1-11.DGN
•••••SYSTIME•••••

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



	NAME	DATE
DESIGN	JRW	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
2905 EAST CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85016 • (602) 912-0880

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PROFILES

ROUTE 202L

LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.9

TRACS NO. H3878 01C

600-8-(009)

___ OF ___

SURVEY NO.	FINISHED PLANS	REVISIONS	LOCATION	DATE

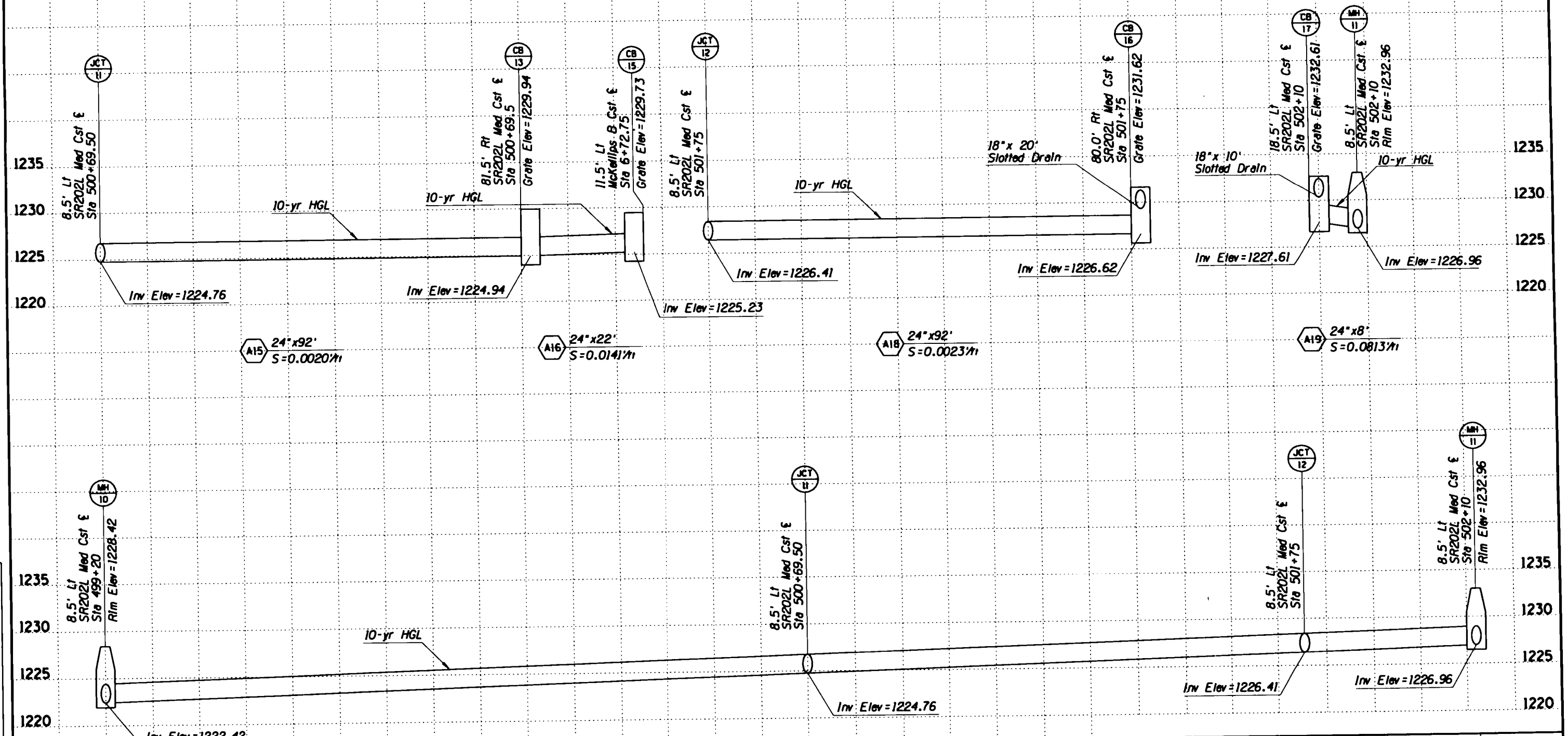
•••••DGN=SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM3DP-09.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



	NAME	DATE
DESIGN	JRM	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
8520 EAST CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85064 • (602) 945-7600

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PROFILES

ROUTE 202L

LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.10

TRACS NO. H3878 01C

600-8-(009)

___ OF ___

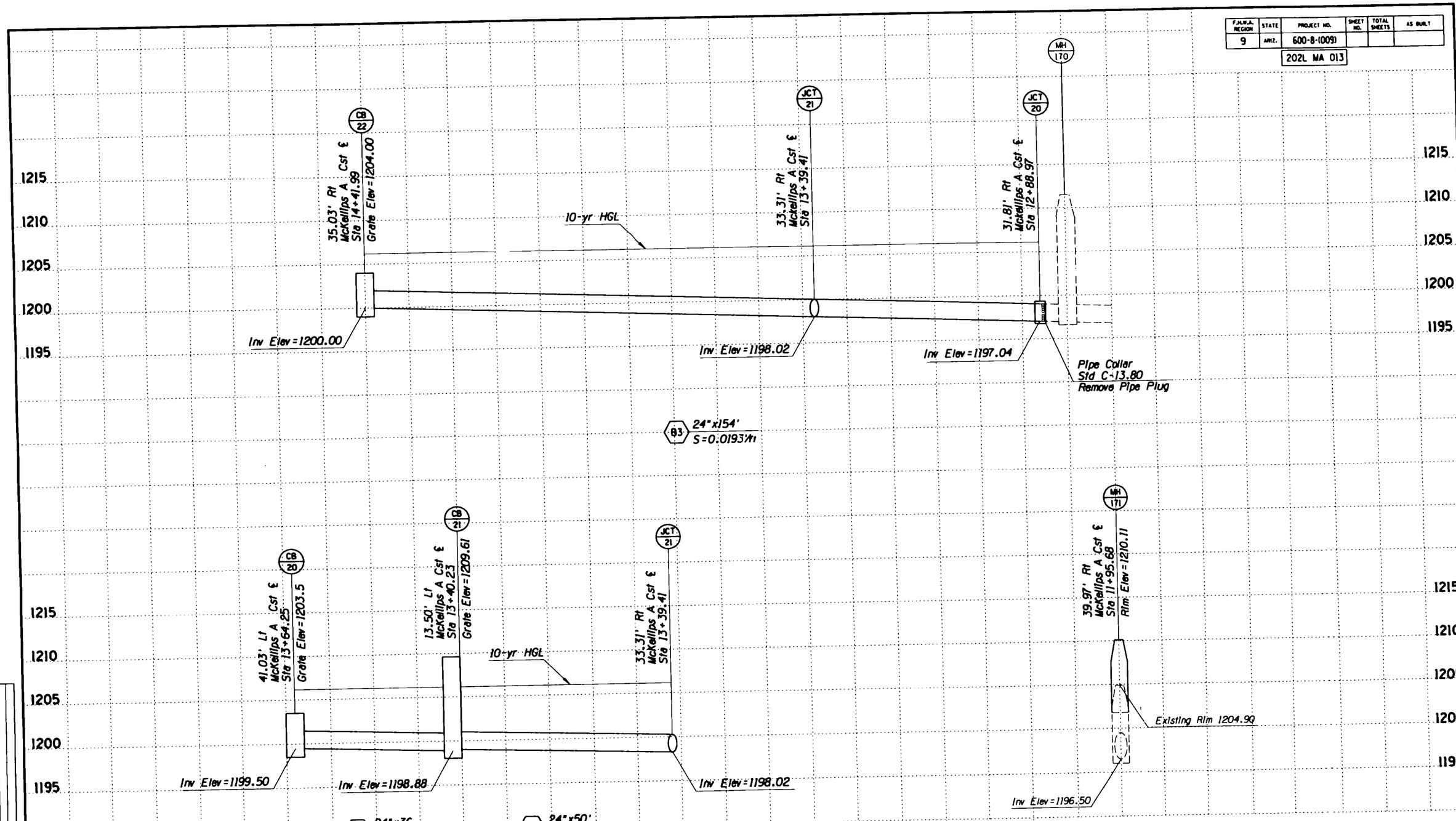
SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM3DP-10.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			
		202L MA 013			



	NAME	DATE
DESIGN	JRM	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
2929 EAST CAMELBACK ROAD, SUITE 120
PHOENIX, ARIZONA 85016 • (602) 957-1888

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PROFILES

ROUTE 202L

LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.11

TRACS NO. H3878 01C

600-8-(009)

___ OF ___

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

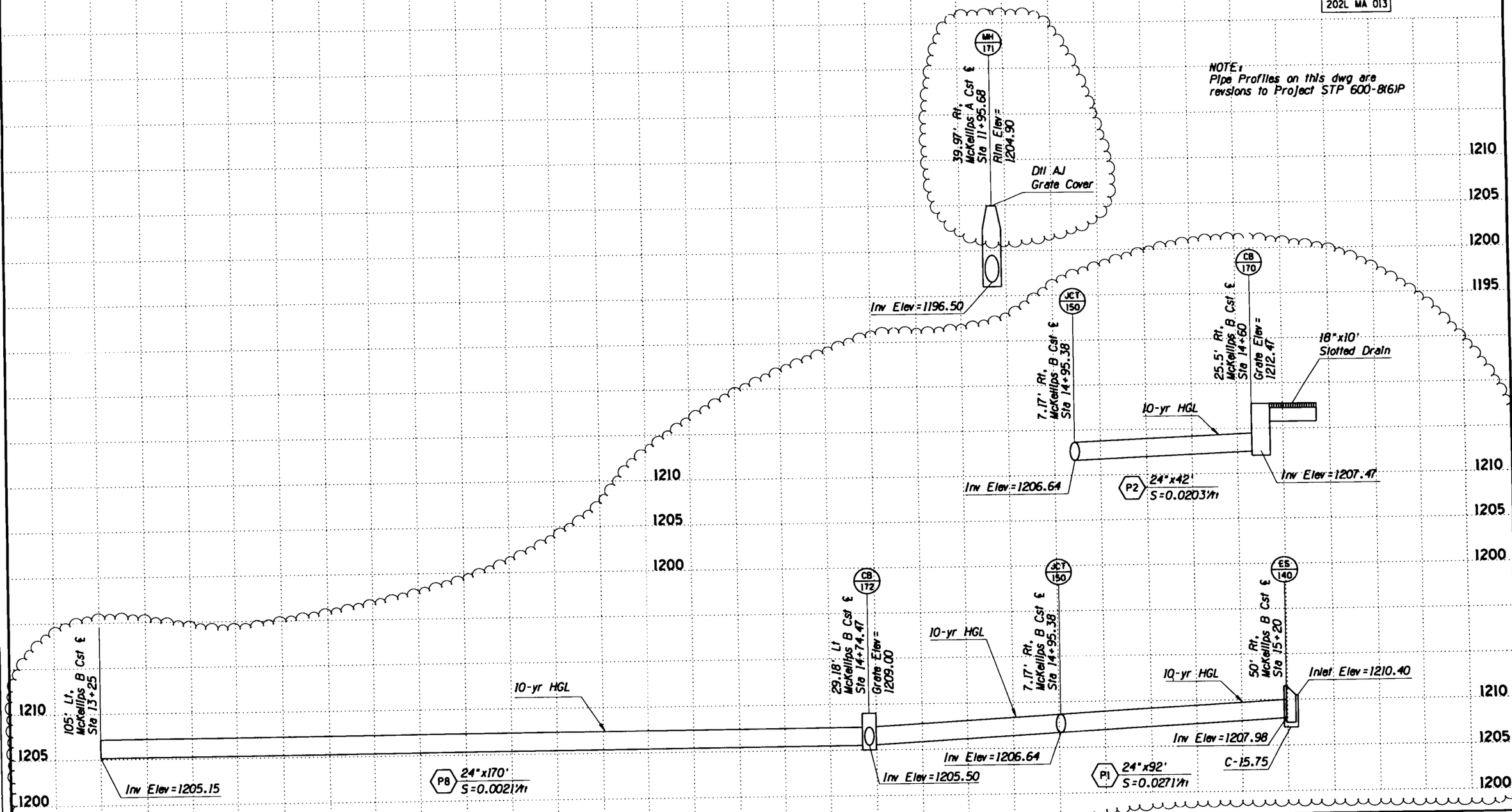
•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM3DP-11.DGN

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-B-(009)			

202L MA 013

NOTE:
Pipe Profiles on this dwg are revsions to Project STP 600-B(6)P



	NAME	DATE
DESIGN	JRM	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
3005 EAST CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85016 • (602) 952-0800

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PROFILES

ROUTE 202L | LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR | DWG NO. D-1.12

TRACS NO. H3878 01C | 600-B-(009) | ___ OF ___

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

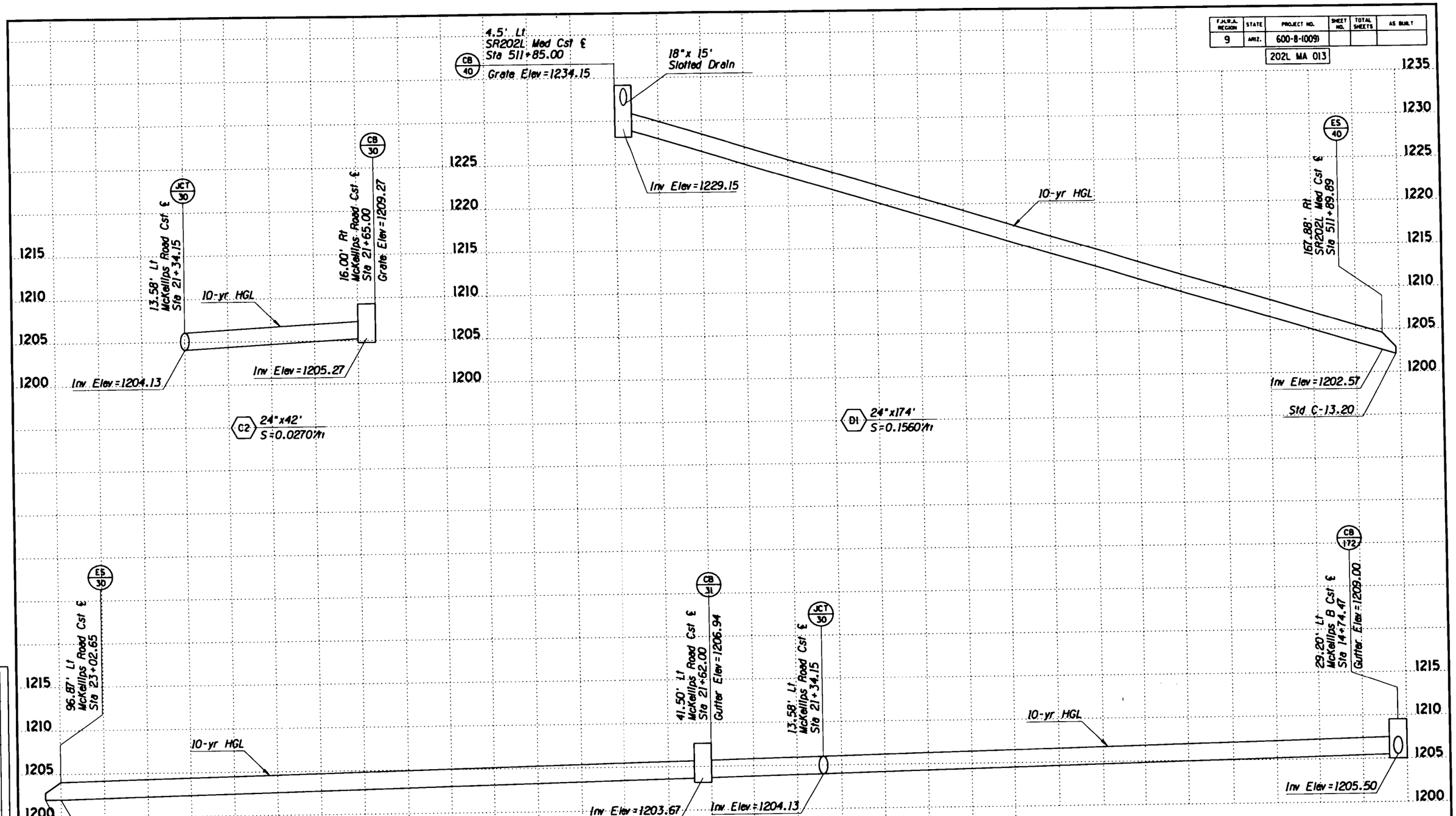
•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM30P-12.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-B-(009)			

202L MA 013



	NAME	DATE
DESIGN	JRM	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
7005 EAST CAMELBACK ROAD, SUITE 120
SCOTTSDALE, ARIZONA 85251 • (602) 945-8886

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PROFILES

ROUTE 202L

LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.13

TRACS NO. H3878 01C

600-8-(009)

___ OF ___

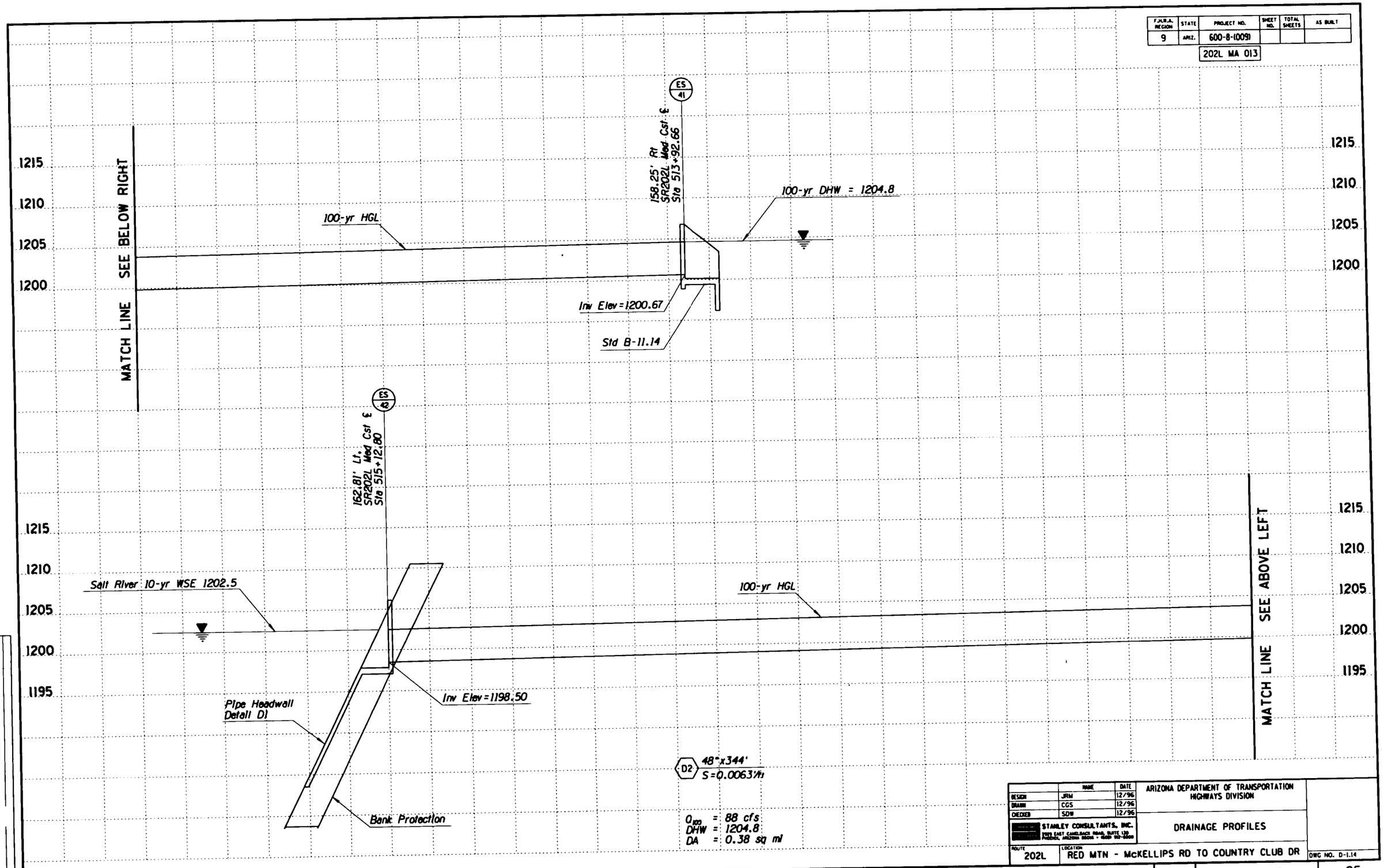
PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM30P-13.DGN

SURVEY NO. | FIELD BOOK | PAGE | ENGINEER | LOCATION | DATE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			
		202L MA 013			



	NAME	DATE
DESIGN	JRM	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
7095 EAST CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85016 • (602) 945-2600

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PROFILES

ROUTE 202L | LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR | DWG NO. D-1.14

TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

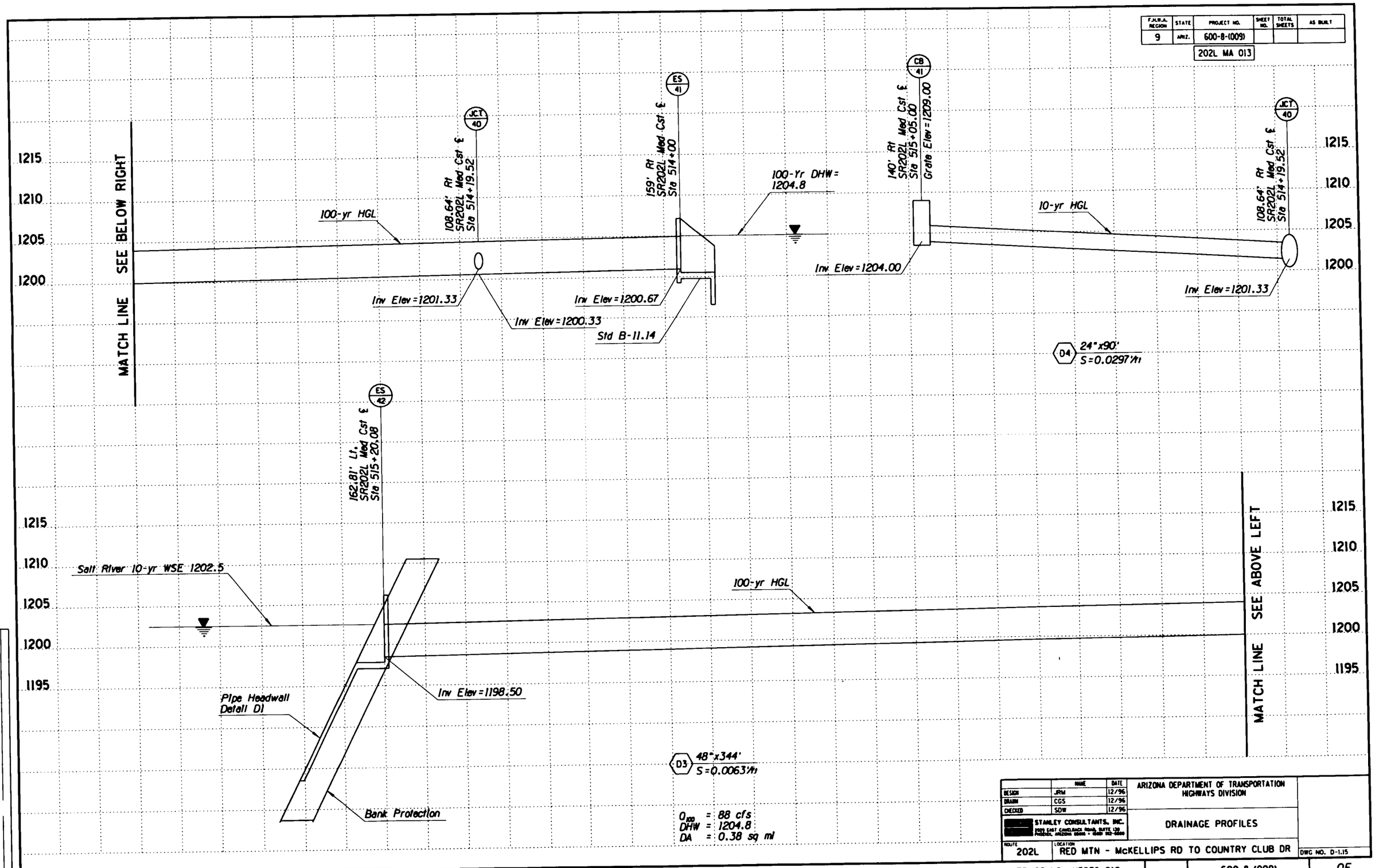
PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM3DP-14.DGN

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



	NAME	DATE
DESIGN	JRM	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
2929 EAST CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85016 • (602) 952-0060

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PROFILES

ROUTE 202L

LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.15

TRACS NO. H3878 01C

600-8-(009)

___ OF ___

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

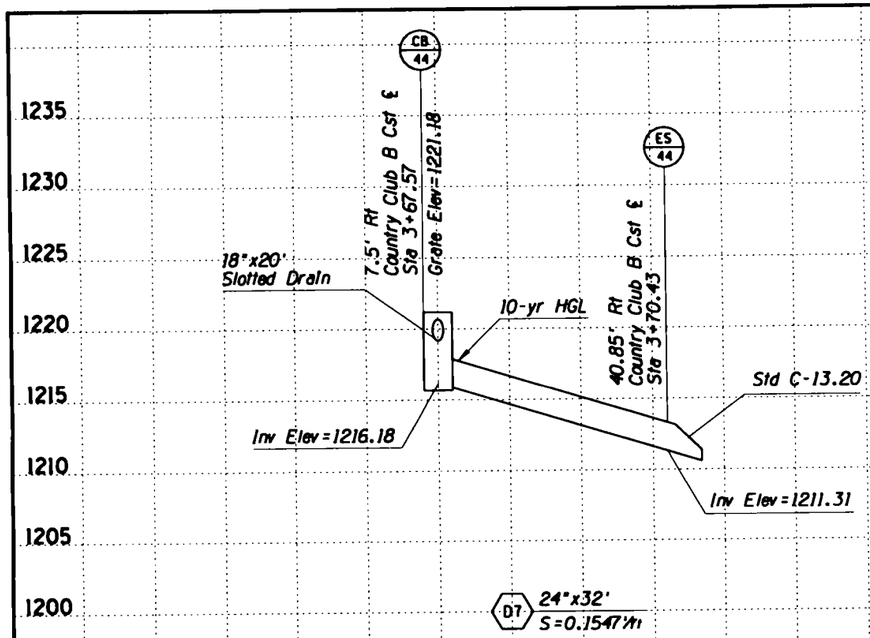
PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

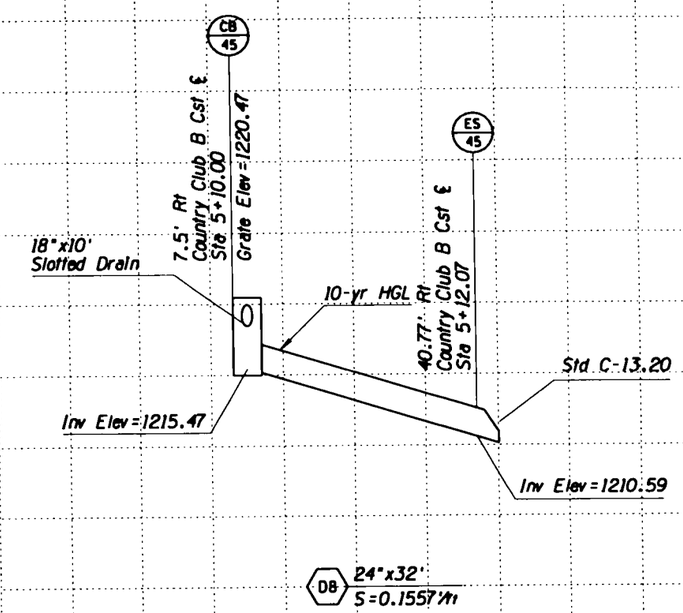
•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

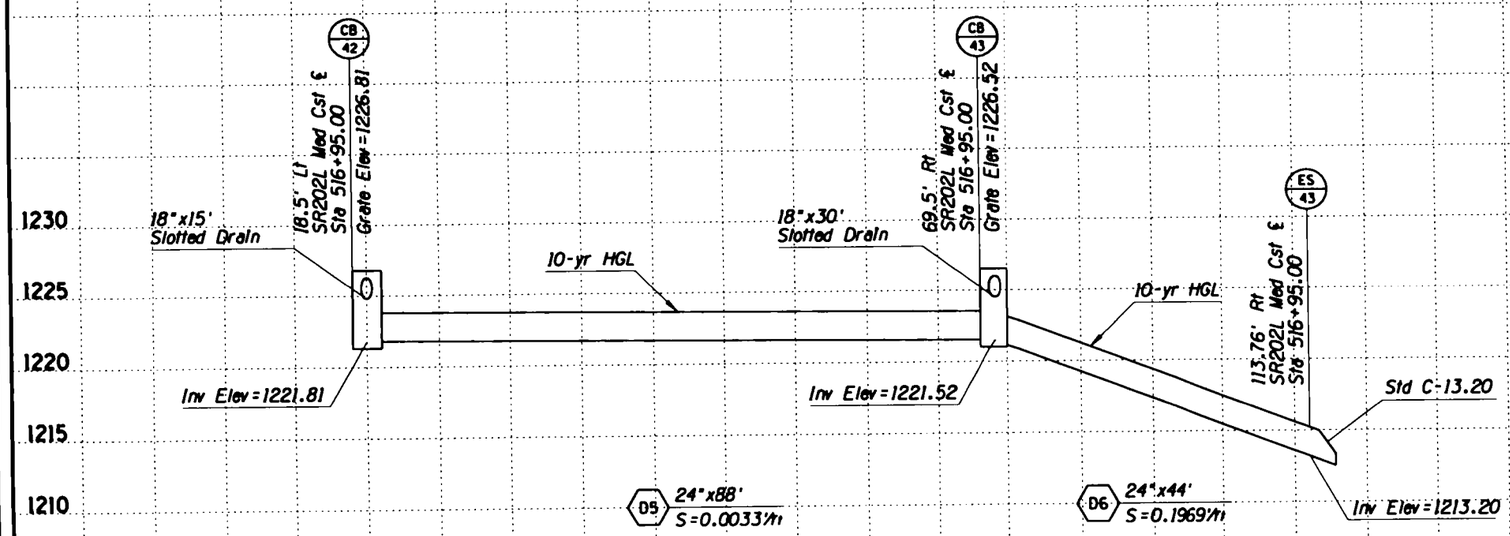
VIEW NAME: /13194/RM30P-15.DGN

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013







	NAME	DATE
DESIGN	JRM	12/96
DRAWN	CGS	12/96
CHECKED	SOW	12/96

STANLEY CONSULTANTS, INC.
2905 EAST CAMELBACK ROAD, SUITE 120
PHOENIX, ARIZONA 85016 • (602) 952-0800

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PROFILES

ROUTE 202L | LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR | DWG NO. D-1.16

TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

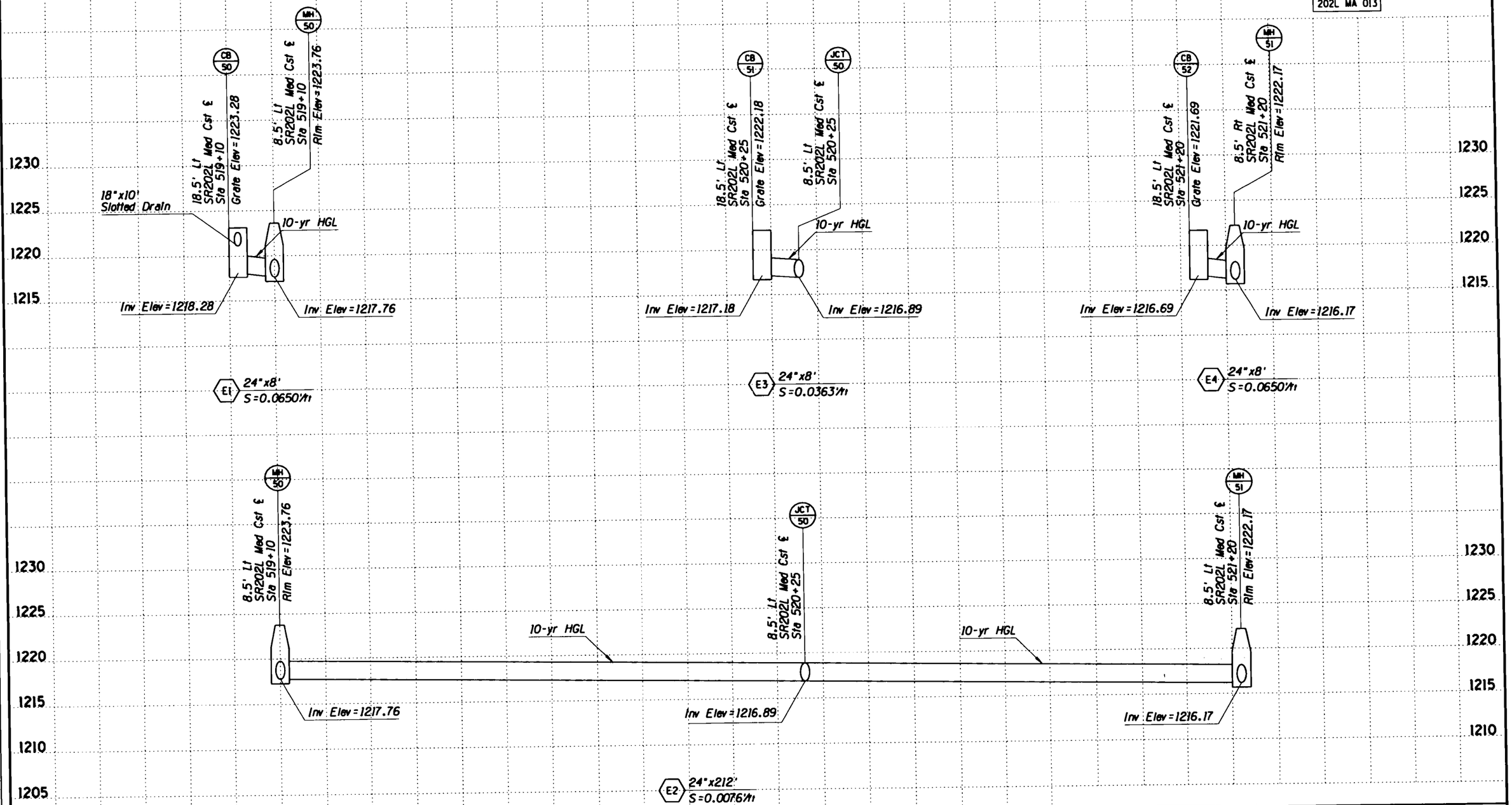
•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM30P-16.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



	NAME	DATE
DESIGN	JRM	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
2929 EAST CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85016 • (602) 912-5600

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PROFILES

ROUTE 202L

LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.17

SURVEY NO. | FIELD BOOK NO. | REVISIONS | LOCATION | DATE

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

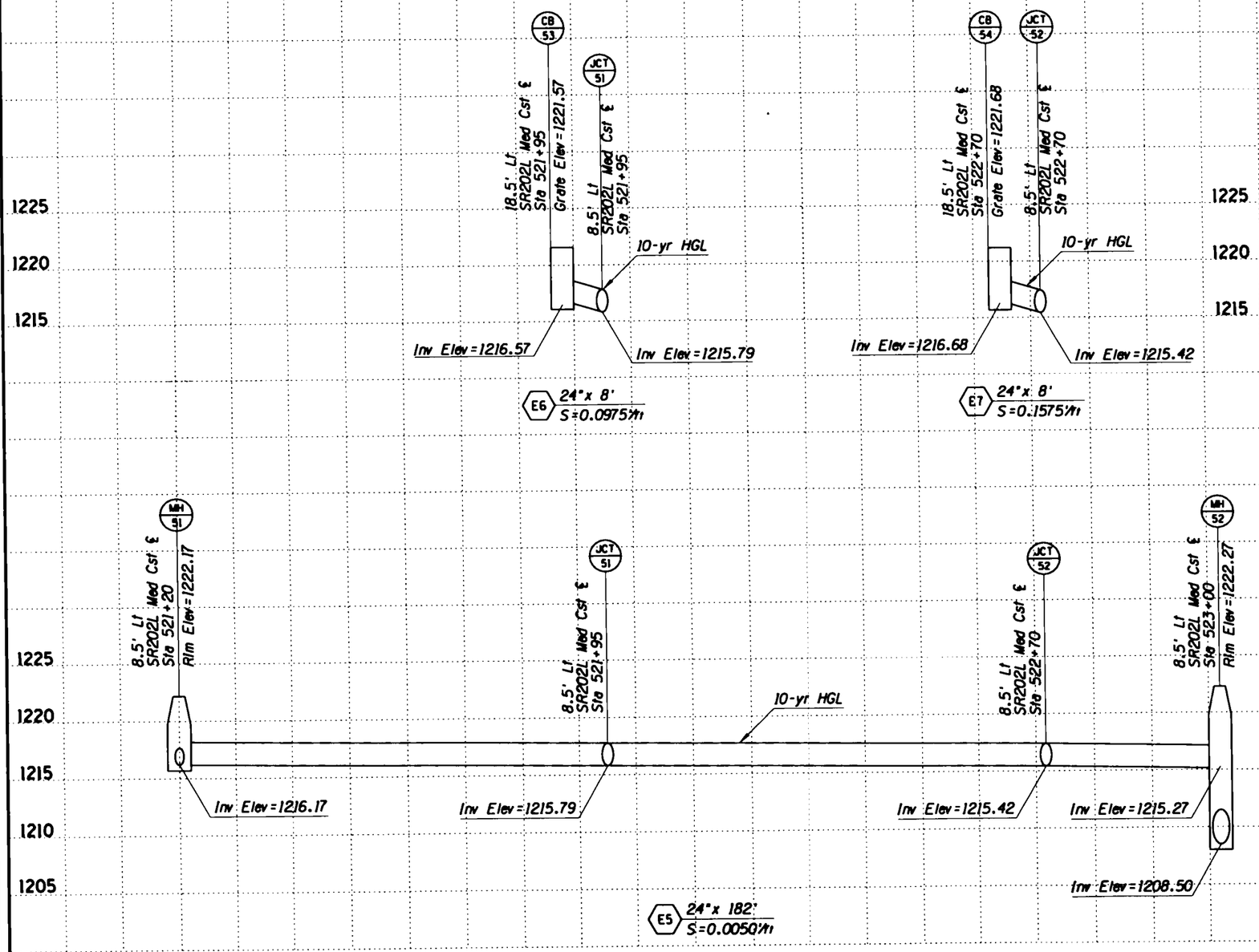
VIEW NAME: /13194/RM30P-17.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



	NAME	DATE
DESIGN	JRM	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
7051 EAST CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85018 • (602) 952-0600

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PROFILES

ROUTE 202L

LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.18

SURVEY NO. | FIELD BOOK NO. | REVISIONS | LOCATION | DATE

•••••DGN-SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM3DP-18.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

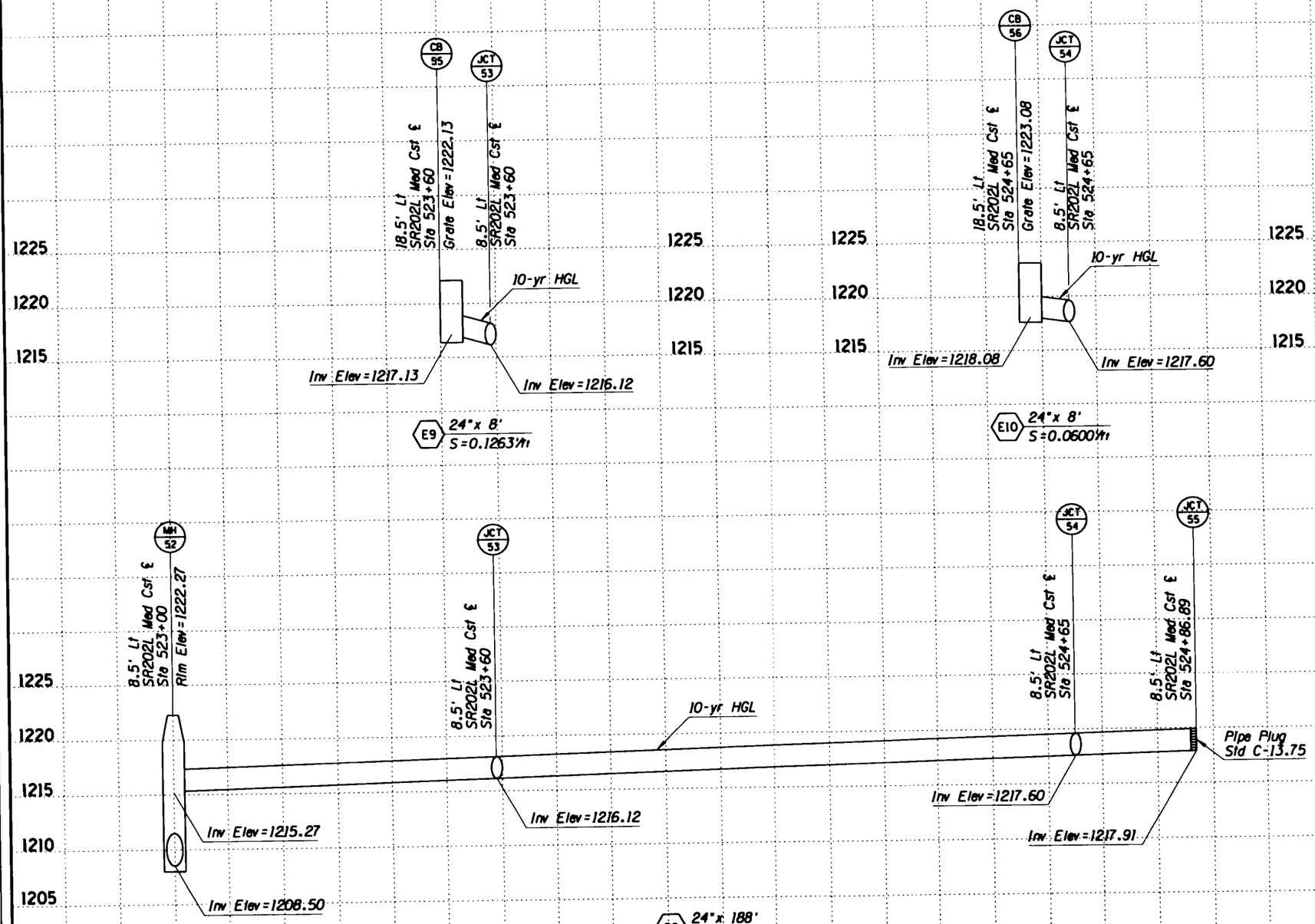
TRACS NO. H3878 01C

600-8-(009)

___ OF ___

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



	NAME	DATE
DESIGN	JRM	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
2929 EAST CAMELBACK ROAD, SUITE 120
PHOENIX, ARIZONA 85016 • (602) 952-0600

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PROFILES

ROUTE 202L | LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.19

TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

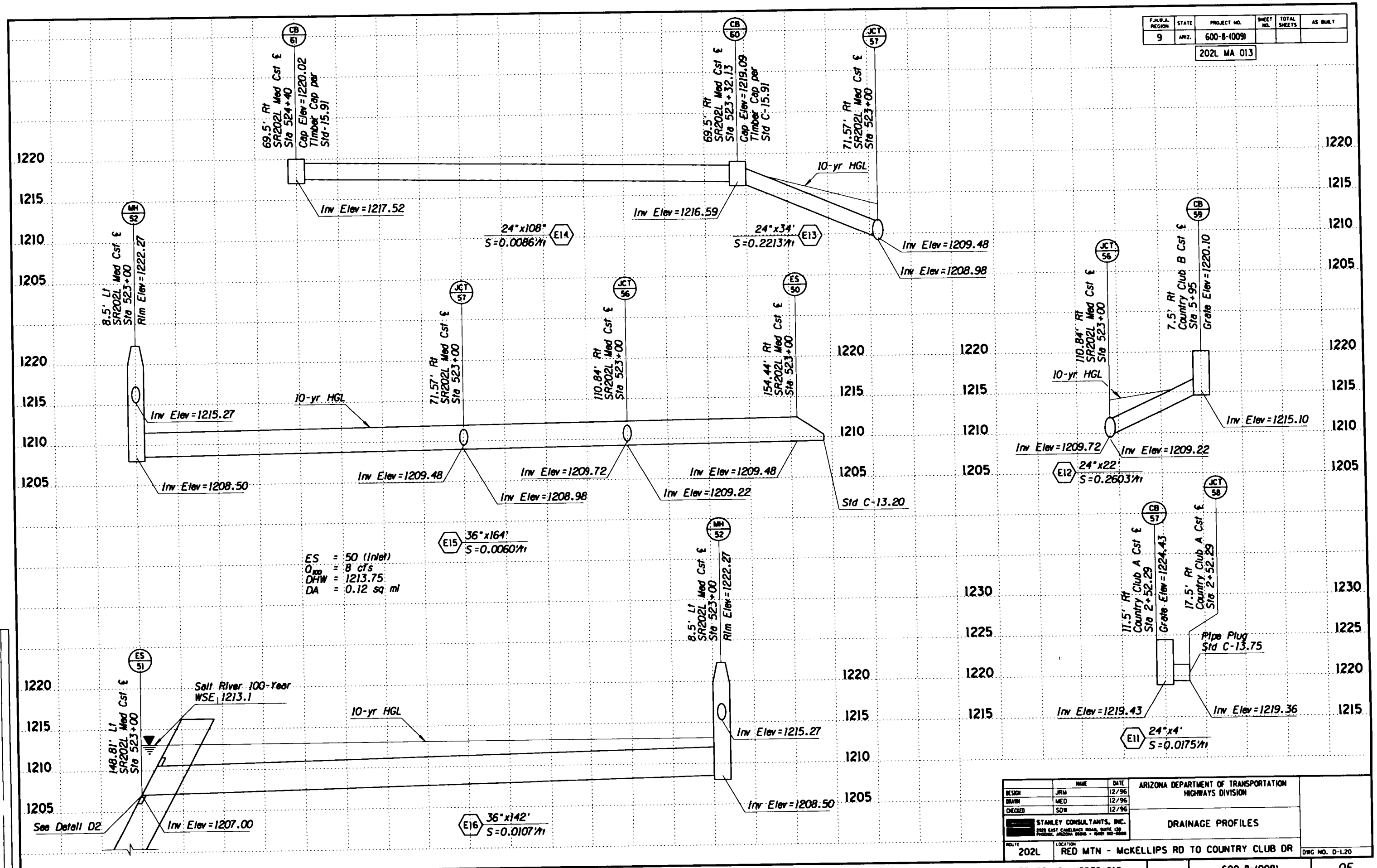
•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM3DP-19.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



	NAME	DATE
DESIGN	JRM	12/96
DRAWN	MED	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
2929 EAST CAMELBACK ROAD, SUITE 120
PHOENIX, ARIZONA 85016 • (602) 912-8500

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PROFILES

ROUTE 202L

LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.20

TRACS NO. H3878 01C

600-8-(009)

___ OF ___

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

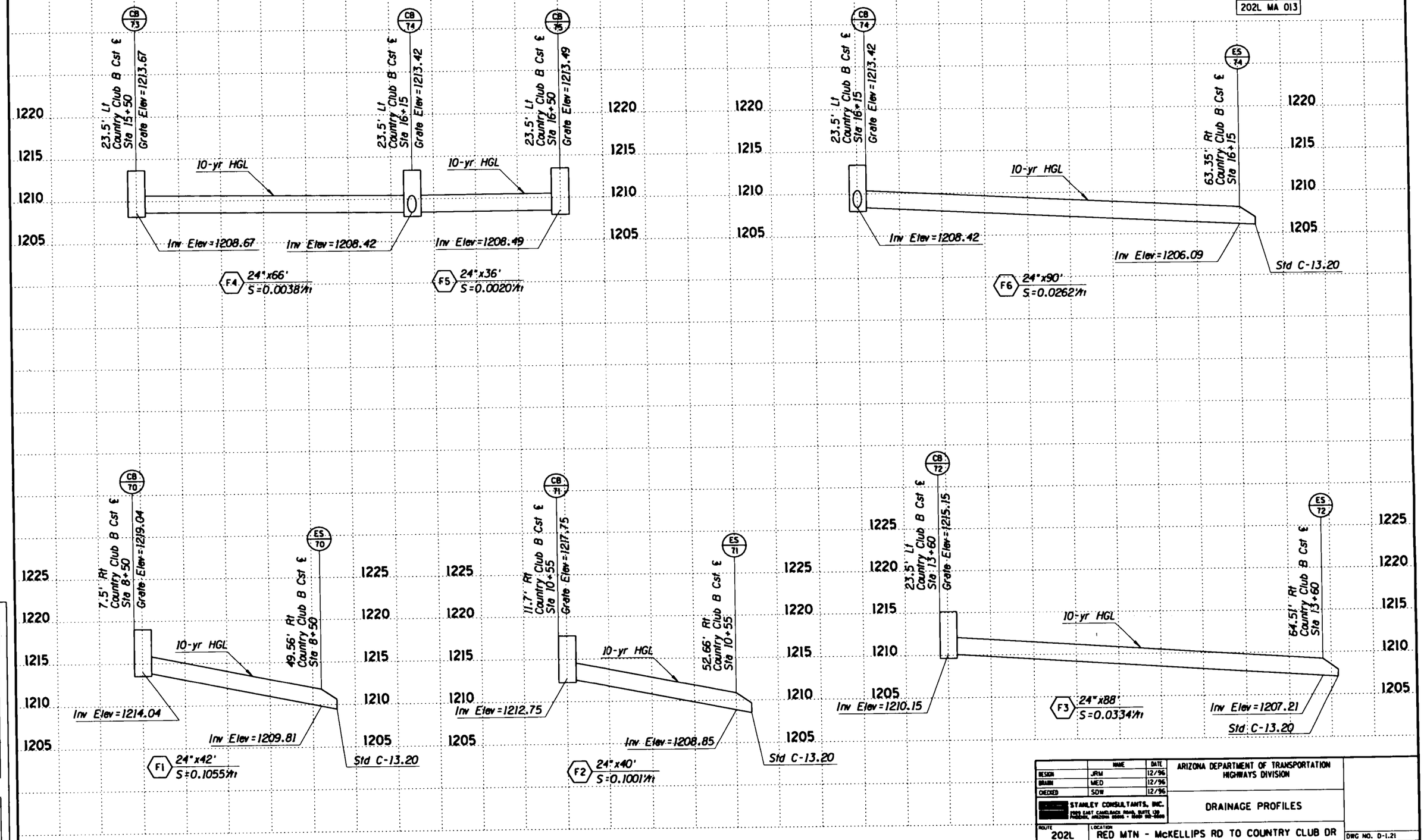
•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM30P-20.DGN

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



	NAME	DATE
DESIGN	JRM	12/96
DRAWN	MED	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
7095 EAST CAMELBACK ROAD, SUITE 120
SCOTTSDALE, ARIZONA 85251 • (602) 945-2600

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PROFILES

ROUTE 202L

LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.21

SURVEY NO.	FINISHED PLANS	REVISIONS	LOCATION	DATE

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM30P-21.DGN

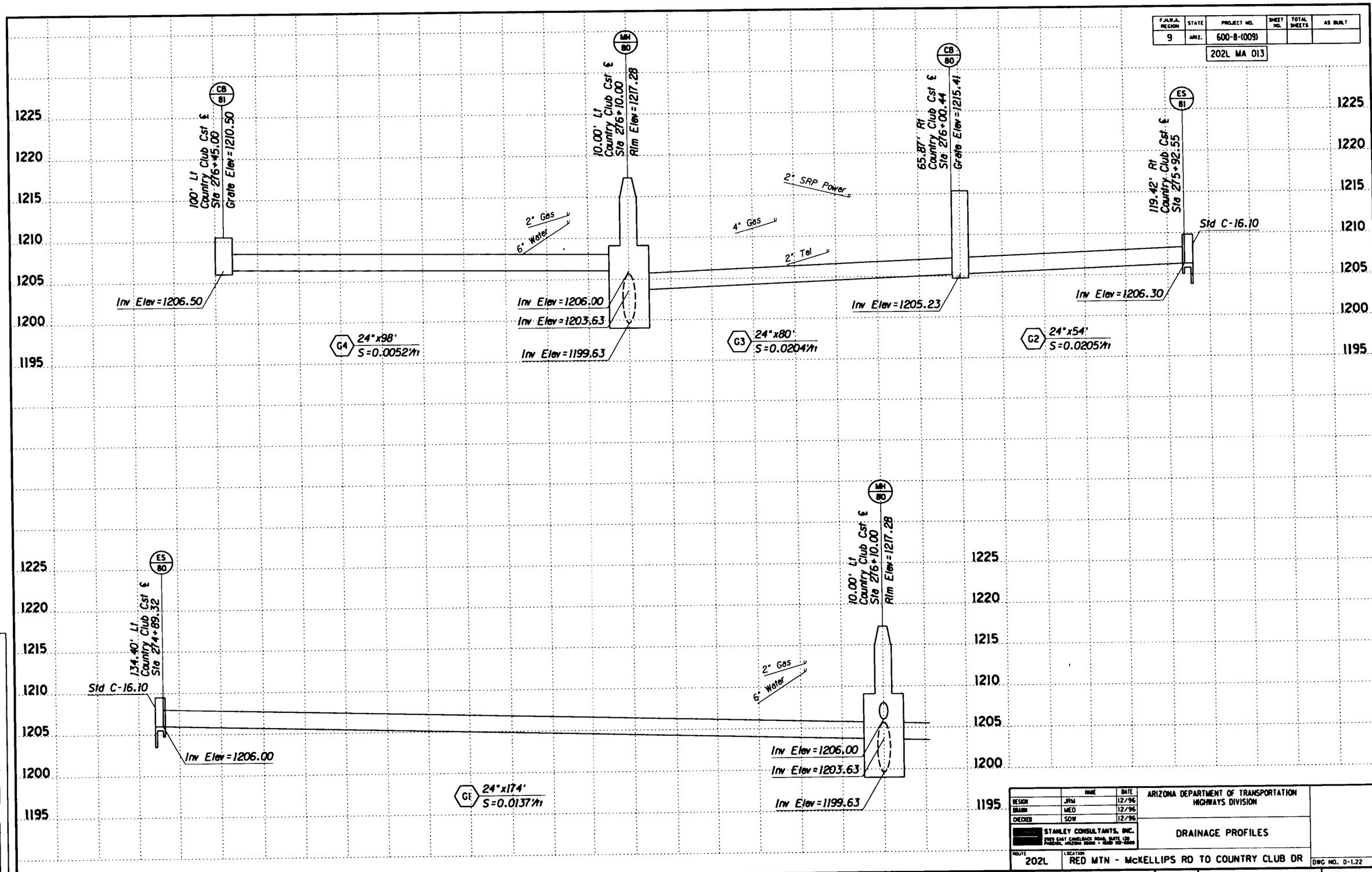
PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C

600-8-(009)

___ OF ___

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			
		202L MA 013			



	NAME	DATE
DESIGN	JRM	12/96
DRAWN	MED	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
2929 EAST CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85016 • (602) 952-0040

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PROFILES

ROUTE 202L | LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR | DWG NO. D-1.22

SURVEY NO.	TRIANGULATION PLANS	REVISIONS	LOCATION	DATE

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

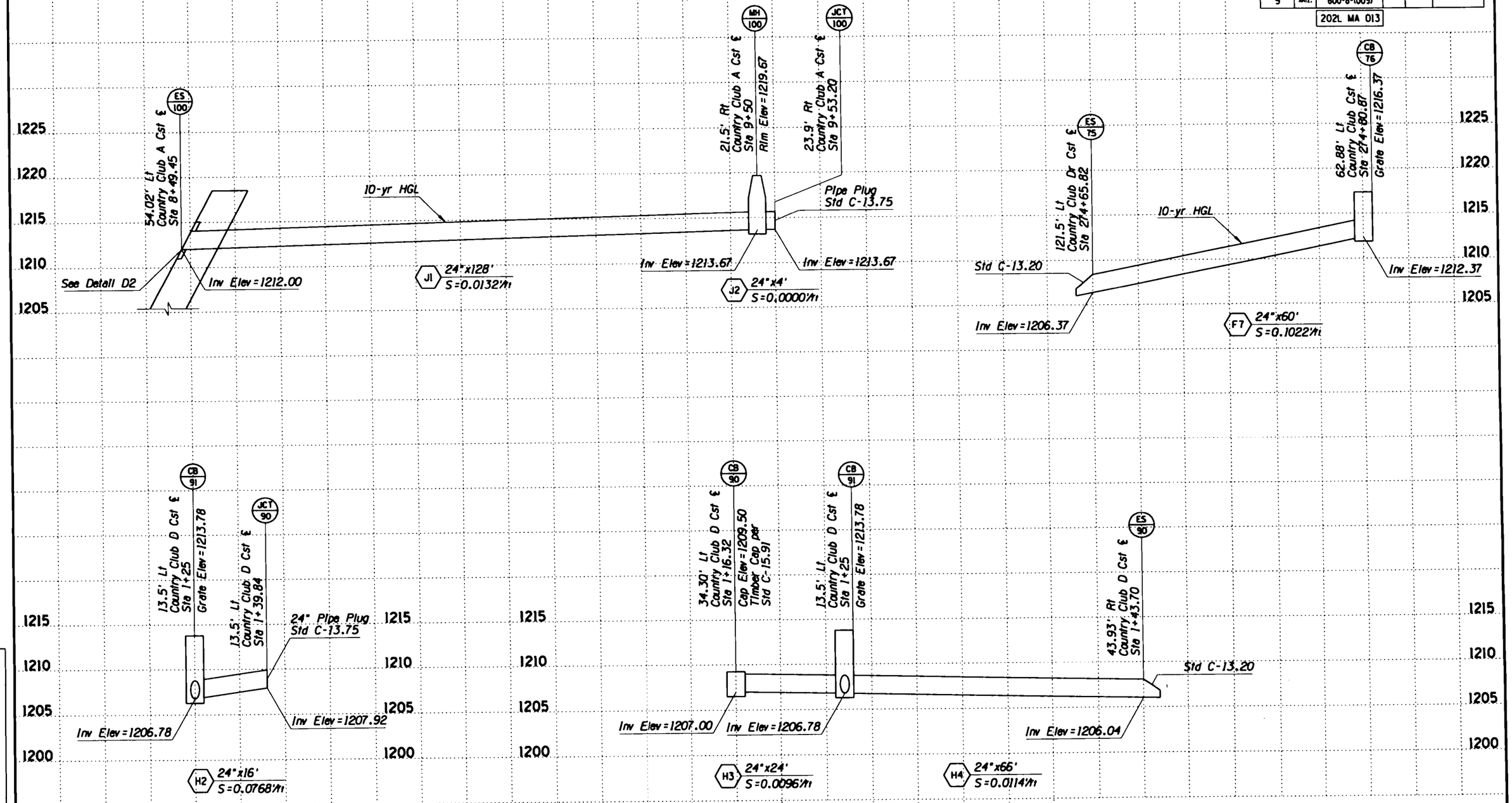
VIEW NAME: /13194/RM3DP-22.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



	NAME	DATE
DESIGN	JRM	12/96
DRAWN	MED	12/96
CHECKED	SOW	12/96

STANLEY CONSULTANTS, INC.
7202 EAST CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85251 • (602) 945-8500

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PROFILES

ROUTE 202L | LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR | DWG NO. D-1.23

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

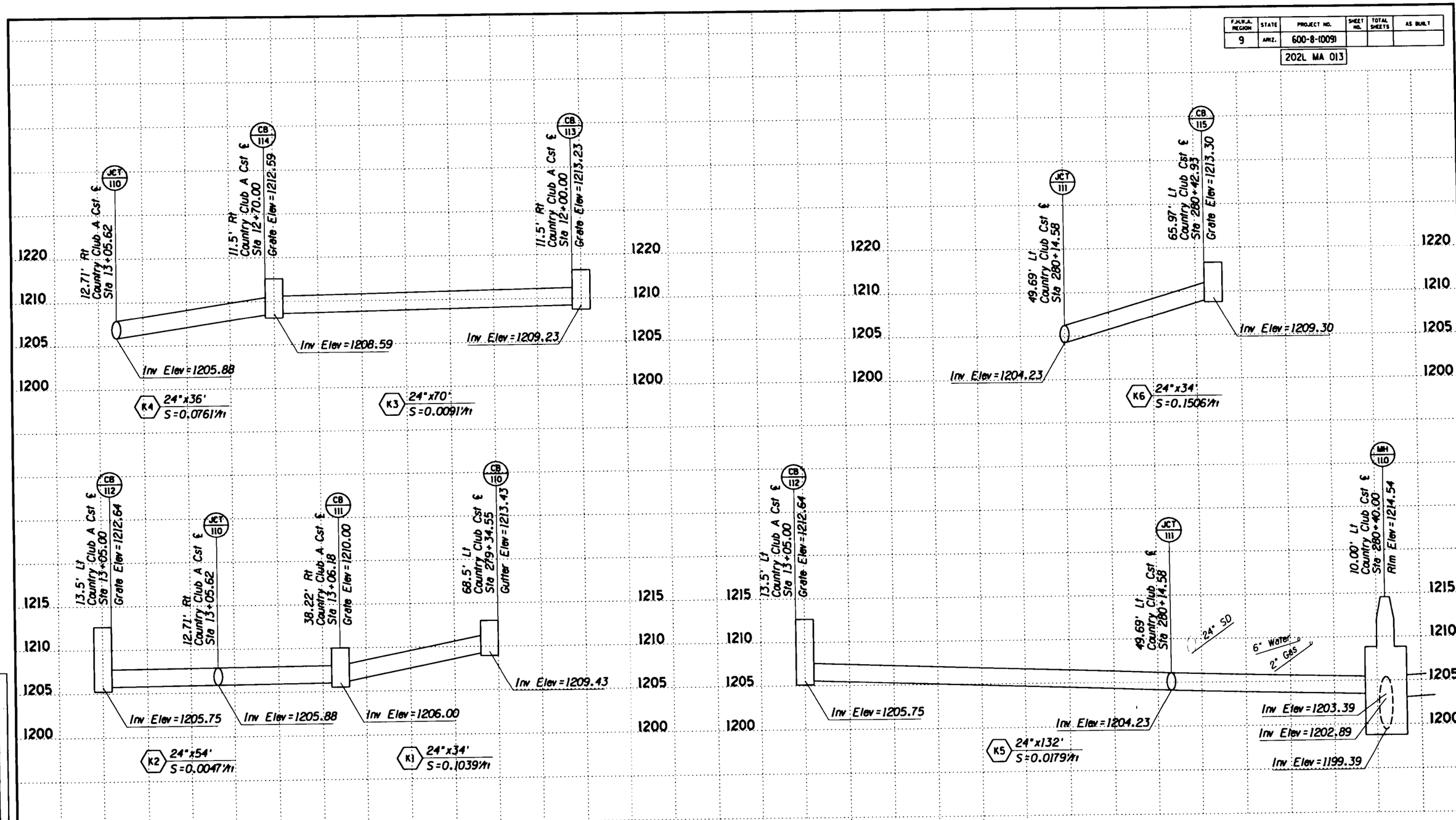
•••••DGN=SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RMSDP-23.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			
		202L MA 013			



	NAME	DATE
DESIGN	JRM	12/96
DRAWN	MED	12/96
CHECKED	SOW	12/96

STANLEY CONSULTANTS, INC.
2929 EAST CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85016 • (602) 912-0800

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PROFILES

ROUTE 202L

LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.24

SURVEY NO.	FINISHED PLANS	REVISIONS	LOCATION	DATE

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM30P-24.DGN

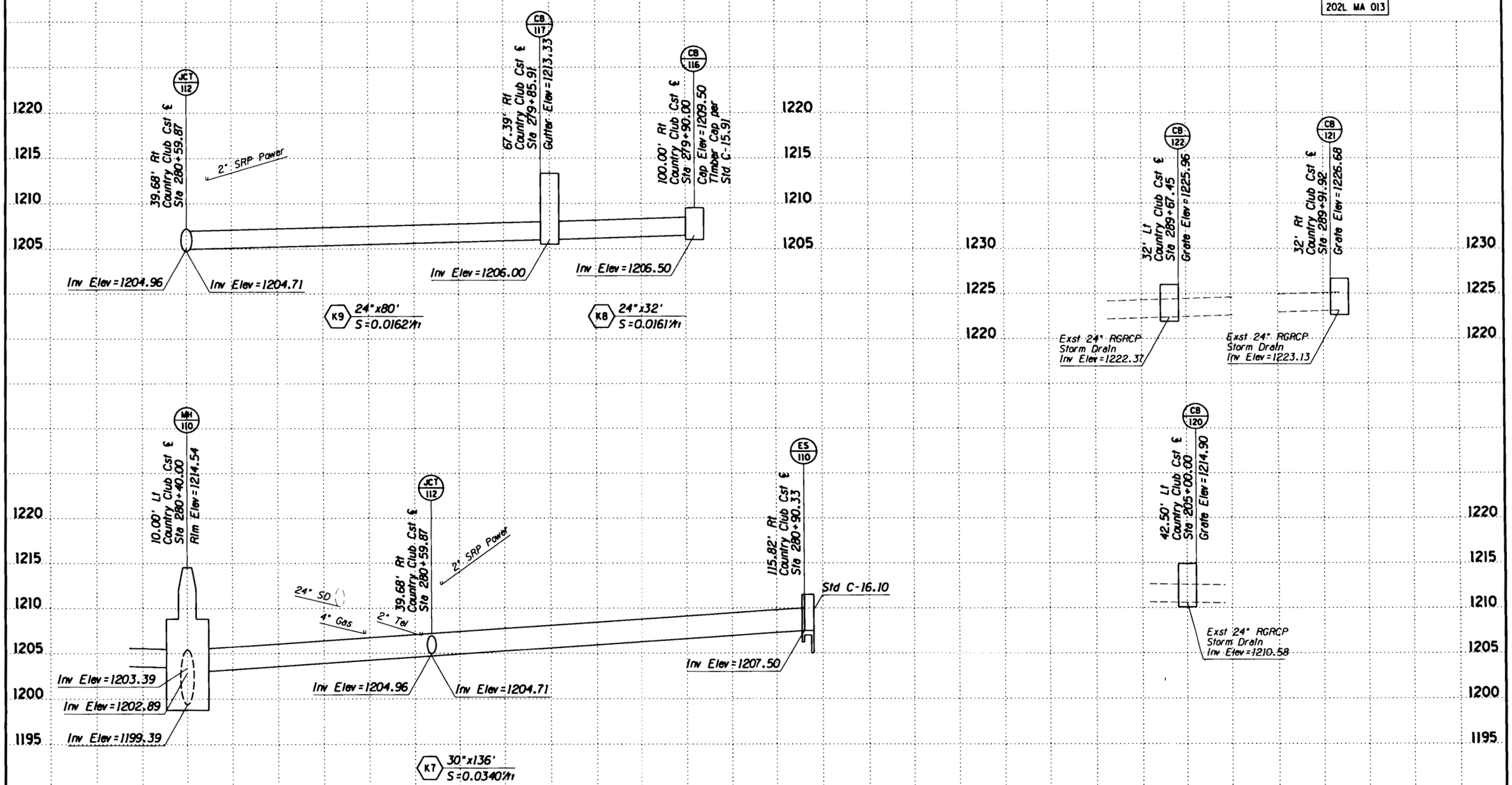
PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C

600-8-(009)

___ OF ___

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			
		202L MA 013			



	NAME	DATE
DESIGN	JRM	12/96
DRAWN	MED	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
7095 EAST CONDUCTOR ROAD, SUITE 120
PHOENIX, ARIZONA 85054 • PHONE 948-9400

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PROFILES

ROUTE 202L

LOCATION RED MTN - McKELLIPS RD TO COUNTRY COUNTRY CLUB DR

DWG NO. D-1.25

TRACS NO. H3878 01C

600-8-(009)

___ OF ___

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

•••••DGN=SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM30P-25.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

NOTE:
FOR PIPE CULVERT PLACEMENT
SEE STANDARD DRAWING C-13.15

SPECIAL NOTE:
PIPE OPTION ENTRYS LEFT BLANK
ARE NOT ALLOWABLE ALTERNATES.

CSP - CORRUGATED STEEL PIPE
CAP - CORRUGATED ALUMINUM PIPE
RCP - REINFORCED CONCRETE PIPE
NRCP - NON-REINFORCED CONCRETE PIPE
NRCIPCP - NON-REINFORCED CAST-IN-PLACE CONCRETE PIPE
CHDPEPP - CORRUGATED HIGH DENSITY POLYETHYLENE PLASTIC PIPE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			
		202L MA 013			

DESCRIPTION							CSP						CAP					RCP	NRCP	NRCIPCP	CHDPEPP	END TREATMENT														QUANTITIES				REMARKS
							Allowable Coating															End Sct	Catch Basin, Manhole, Headwall & Junction Structure											Headwall					
Station	Plan Ref No.	⬢ Controlling Fill Height Range (No.)	Size, (in.) Corrugated	Size, (in.) Smooth	Length (Ft.)	Skew (Degree)	⌀ Corrugation	Wall Thickness (in.)	Zinc	Aluminum	Bituminous	⌀ Corrugation	Wall Thickness (in.)	Uncoated	Bit. Coated	Class - Non Trench	Class - Trench	Class	Min Wall Thickness (in.)	AASHTO M-294 Type C	AASHTO M-294 Type S	C-13.20 & C-13.25	Manhole No. 3	Standard or Detail	Location	Height (Ft-in.)	Curb Opening Length (Ft-in)	18" Slotted Drn. Length (Ft)	Grate Type	Grate Elev.	Inlet Depression Depth (in.)	Inlet Depression Length (Ft.)	Headwall Standard or Detail	Headwall Location	Pipe Exc (CY)	Pipe Bk-fl (CY)	Drn Exc (CY)	Berm/Dike Emb (CY)	
202L 499+20, 8.5' Lt to 498+00, 8.5' Lt	A10	1		24	120										III	III	3			X			10	C-18.10 C-13.80		6.00				1228.42					115	34			MH 10 to JCT 138 Remove Existing Pipe Plug
202L 498+10, 18.5' Lt to 498+10, 8.5' Lt	A11	1		24	8										III	III	3			X				C-15.91		5.25			C-15.91	1226.13					8	2			CB 10 to JCT 10
202L 499+20, 18.5' Lt to 499+20, 8.5' Lt	A12	1		24	8										III	III	3			X				C-15.91		5.25		10	C-15.91	1228.12					8	2			CB 11 to MH 10
McKip B 5+40, 9' Lt to 202L 499+20, 8.5' Lt	A13	2		24	110										II	II	1			X				C-15.91		4.50		50	C-15.91	1227.36					101	31			CB 12 to MH 10
202L 502+10, 8.5' Lt to 499+20, 8.5' Lt	A14	2		24	292										II	II	1			X			11	C-18.10		6.00				1232.96					280	83			MH 11 to MH 10
202L 500+69.5, 81.5' Rt to 500+69.5, 8.5' Lt	A15	2		24	92										II	II	1			X				C-15.91		5.25			C-15.91	1229.94					77	26			CB 13 to JCT 11
McKip B 6+72.75, 11.5' Lt to 202L 500+69.5, 81.5' Rt	A16	1		24	22										III	III	3			X				C-15.92		4.67			C-15.92	1229.73					17	6			CB 15 to CB 13
202L 501+75, 80' Rt to 501+75, 8.5' Lt	A18	2		24	92										II	II	1			X				C-15.91		5.25		20	C-15.91	1231.62					77	26			CB 16 to JCT 12
202L 502+10, 18.5' Lt to 502+10, 8.5' Lt	A19	2		24	8										II	II	1			X				C-15.91		5.25		10	C-15.91	1232.61					7	2			CB 17 to MH 11
McKip A 13+64.25, 41.03' Lt to 13+40.23, 13.50' Lt	B1	1		24	36										III	III	3			X				C-15.80		4.00			C-15.80	1203.50					43	10			CB 20 to CB 21
McKip A 13+40.23, 13.50' Lt to 13+39.41, 33.31' Rt	B2	4		24	50										III	III								C-15.91		10.73			C-15.91	1209.61					88	14			CB 21 to JCT 21
McKip A 14+41.99, 35.03' Rt to 12+88.97, 31.81' Rt	B3	2		24	154										II	II	1			X				C-15.80		4.00			C-15.80	1204.00					96	44			CB 22 to JCT 20
McKip A 11+95.68, 39.97' Rt																							171	C-18.10		5.21				1210.11									MH 171
McKip B 14+74.47, 29.2' Lt to McKip Rd 21+62, 41.5' Lt	C1	1		24	160										III	III	3			X				C-15.80		3.50			C-15.80	1209.00					97	45			CB 172 to CB 31
McKip Rd 21+65, 16' Rt to 21+ 34.15, 13.58' Lt	C2	1		24	42										III	III	3			X				C-15.30		4.00			EF-2	1209.27					24	12			CB 30 to JCT 30
McKip Rd 21+62, 41.5' Lt to 23+02.65, 96.87' Lt	C3	1		24	148										III	III	3			X	C-13.20			C-15.20		3.86	13'-7"			1206.94					71	42			CB 31 to ES 30
202L 511+ 85, 4.5' Lt to 511+ 89.89, 167.88' Rt	D1	1		24	174										III	III	3			X	C-13.20			C-15.92		5.17		15	C-15.92	1234.15					143	49			CB 40 to ES 40
202L 513+92.66, 158.25' Rt to 515+12.80, 162.81' Lt	D2	8		48	344										V	V																	B-11.14 DTL D1		515	181			ES 41 to ES 42
Sheet Total																																								

FILL HEIGHT RANGE TABLE (Ft.)

RANGE NO.		1	2	3	4	5	6	7	8	9	10	11	12
FILL HEIGHT (Ft.)	>	1	3	5	8	11	15	20	25	30	40	55	70
	≤	3	5	8	11	15	20	25	30	40	55	70	90

⬢ SHOULD FIELD CONDITIONS VARY FROM THE RANGE INDICATED, CONTACT DESIGN FOR RE-EVALUATION OF PIPE DESIGN REQUIREMENTS.

⌀ PIPE CORRUGATION			
A	2⅔ x ½	D	6x2
B	3x1	E	3x1 or 9x2½
C	9x2½		

	NAME	DATE
DESIGN	JRM	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
5005 EAST CAMELBACK ROAD, SUITE 120
PHOENIX, ARIZONA 85018 • (602) 952-0050

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

NEW PIPE SUMMARY SHEET

ROUTE 202L
LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. G-4.4

REV. DATE: 03-01-95

SURVEY NO. | TRACED PLANS | REVISIONS | LOCATION | DATE

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••
VIEW NAME: /13194/RM3PIP-1.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

NOTE:
FOR PIPE CULVERT PLACEMENT
SEE STANDARD DRAWING C-13.15

SPECIAL NOTE:
PIPE OPTION ENTRYS LEFT BLANK
ARE NOT ALLOWABLE ALTERNATES.

CSP - CORRUGATED STEEL PIPE
CAP - CORRUGATED ALUMINUM PIPE
RCP - REINFORCED CONCRETE PIPE
NRCP - NON-REINFORCED CONCRETE PIPE
NRCIPCP - NON-REINFORCED CAST-IN-PLACE CONCRETE PIPE
CHDPEPP - CORRUGATED HIGH DENSITY POLYETHYLENE PLASTIC PIPE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			
		202L MA 013			

Station	Plan Ref No.	⊗ Controlling Fill Height Range (No.)	Size, (in.) Corrugated	Size, (in.) Smooth	Length (Ft.)	Skew (Degree)	☑ Corrugation	Wall Thickness (in.)	Zinc	Aluminum	Bituminous	☑ Corrugation	Wall Thickness (in.)	Uncoated	Bit. Coated	Class - Non Trench	Class - Trench	Class	Min Wall Thickness (in.)	AASHTO M-294 Type C	AASHTO M-294 Type S	C-13.20 & C-13.25	Manhole No. 3 Standard or Detail	Location	Height (Ft-in.)	Curb Opening Length (Ft-in)	18" Slotted Drn. Length (Ft)	Type	Elev.	Depth (in.)	Grate Length (Ft.)	Grate Standard or Detail	Grate Location	Pipe Exc (CY)	Pipe Bkfl (CY)	Drn Exc (CY)	Berm/Dike Emb (CY)	REMARKS
																						End Sct	Catch Basin, Manhole, Headwall & Junction Structure									Headwall						QUANTITIES				
202L 514+ 00, 159' Rt to 515+20.08, 162.81' Lt	D3	8		48	344										V	V																B-11.14 DTL D1		515	181			ES 41 to ES 42
202L 515+ 05, 140' Rt to 514+ 19.52, 108.64' Rt	D4	1		24	90										III	III	3			X			C-15.80	5.00			C-15.80	1209.00					71	26			CB 41 to JCT 40
202L 516+95, 18.5' Lt 516+95, 69.5' Rt	D5	1		24	88										III	III	3			X			C-15.91	5.25	15		C-15.91	1226.81					73	25			CB 42 to CB 43
202L 516+95, 69.5' Rt to 516+95, 113.76' Rt	D6	1		24	44										III	III	3			X	C-13.20		C-15.92	5.17	30		C-15.92	1226.52					39	13			CB 43 to ES 43
CCLB B 3+67.57, 7.5' Rt to 3+70.43, 40.85' Rt	D7	1		24	32										III	III	3			X	C-13.20		C-15.92	5.17	20		C-15.92	1221.18					28	9			CB 44 to ES 44
CCLB B 5+10, 7.5' Rt to 5+12.07, 40.77' Rt	D8	1		24	32										III	III	3			X	C-13.20		C-15.91	5.25	10		C-15.91	1220.47					29	9			CB 45 to ES 45
202L 519+10, 18.5' Lt to 519+10, 8.5' Lt	E1	1		24	8										III	III	3			X			C-15.91	5.25	10		C-15.91	1223.28					7	2			CB 50 to MH 50
202L 519+10, 8.5' Lt to 521+20, 8.5' Lt	E2	2		24	212										II	II	1			X		50	C-18.10	6.00				1223.76					203	60			MH 50 to MH 51
202L 520+25, 18.5' Lt to 520+25, 8.5' Lt	E3	1		24	8										III	III	3			X			C-15.91	5.25			C-15.91	1222.18					7	2			CB 51 to JCT 50
202L 521+20, 18.5' Lt to 521+20, 8.5 Lt	E4	1		24	8										III	III	3			X			C-15.91	5.25			C-15.91	1221.69					7	2			CB 52 to MH 51
202L 521+20, 8.5' Lt to 523+00, 8.5' Lt	E5	2		24	182										II	II	1			X		51	C-18.10	6.00				1222.17					292	52			MH 51 to MH 52
202L 521+95, 18.5' Lt to 521+95, 8.5' Lt	E6	1		24	8										III	III	3			X			C-15.91	5.25			C-15.91	1221.57					7	2			CB 53 to JCT 51
202L 522+70, 18.5' Lt to 522+70, 8.5' Lt	E7	1		24	8										III	III	3			X			C-15.91	5.25			C-15.91	1221.68					7	2			CB 54 to JCT 52
202L 524+86.89, 8.5' Lt to 523+00, 8.5' Lt	E8	2		24	188										II	II	1			X			C-13.75										208	53			JCT 55 to MH 52
202L 523+60, 18.5' Lt to 523+60, 8.5' Lt	E9	1		24	8										III	III	3			X			C-15.91	5.25			C-15.91	1222.13					7	2			CB 55 to JCT 53
202L 524+65, 18.5' Lt to 524+65, 8.5' Lt	E10	1		24	8										III	III	3			X			C-15.91	5.25			C-15.91	1223.08					7	2			CB 56 to JCT 54
CCLB A 2+52.29, 11.5' Rt to 2+52.29, 17.5' Rt	E11	1		24	4										III	III	3			X			C-15.91	5.25			C-15.91	1224.43					4	1			CB 57 to JCT 58
CCLB B 5+95, 7.5' Rt to 202L 523+00, 110.84' Rt	E12	1		24	22										III	III	3			X			C-15.91	5.25			C-15.91	1220.10					20	6			CB 59 to JCT 56
Sheet Total																																						

FILL HEIGHT RANGE TABLE (Ft.)

RANGE NO.		1	2	3	4	5	6	7	8	9	10	11	12
FILL HEIGHT (Ft.)	>	1	3	5	8	11	15	20	25	30	40	55	70
	≤	3	5	8	11	15	20	25	30	40	55	70	90

⊗ SHOULD FIELD CONDITIONS VARY FROM THE RANGE INDICATED, CONTACT DESIGN FOR RE-EVALUATION OF PIPE DESIGN REQUIREMENTS.

☑ PIPE CORRUGATION

A	2⅔ x ½	D	6x2
B	3x1	E	3x1 or 9x2½
C	9x2½		

	NAME	DATE
DESIGN	JRM	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
2999 EAST CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85016 • (602) 912-0500

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

NEW PIPE SUMMARY SHEET

ROUTE 202L
LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. G-4.5

REV. DATE: 03-01-95

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••
VIEW NAME: /13194/RM3PIP-2.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

NOTE:
FOR PIPE CULVERT PLACEMENT
SEE STANDARD DRAWING C-13.15

SPECIAL NOTE:
PIPE OPTION ENTRYS LEFT BLANK
ARE NOT ALLOWABLE ALTERNATES.

CSP - CORRUGATED STEEL PIPE
CAP - CORRUGATED ALUMINUM PIPE
RCP - REINFORCED CONCRETE PIPE
NRCP - NON-REINFORCED CONCRETE PIPE
NRCIPCP - NON-REINFORCED CAST-IN-PLACE CONCRETE PIPE
CHDPEPP - CORRUGATED HIGH DENSITY POLYETHYLENE PLASTIC PIPE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013

DESCRIPTION							CSP								CAP								RCP								NRCP	NRCIPCP	CHDPEPP	END TREATMENT																				QUANTITIES				REMARKS
							Allowable Coating																											End Set	Catch Basin, Manhole, Headwall & Junction Structure																Headwall							
Station	Plan Ref No.	⬡ Controlling Fill Height Range (No.)	Size, (in.) Corrugated	Size, (in.) Smooth	Length (Ft.)	Skew (Degree)	⊘ Corrugation	Wall Thickness (in.)	Zinc	Aluminum	Bituminous	⊘ Corrugation	Wall Thickness (in.)	Uncoated	Bit. Coated	Class - Non Trench	Class - Trench	Class	Min Wall Thickness (in.)	AASHTO M-294 Type C	AASHTO M-294 Type S	C-13.20 & C-13.25	Manhole No. 3	Standard or Detail	Location	Height (Ft-in.)	Curb Opening Length (Ft-in)	18" Slotted Drn. Length (Ft)	Type	Grate Elev.	Grate Depth (in.)	Inlet Depression Length (Ft.)	Inlet Depression Standard or Detail	Inlet Depression Location	Pipe Exc (CY)	Pipe Bk'fl (CY)	Drn Exc (CY)	Berm/Dike Emb (CY)	
202L 523+32.13, 69.5' Rt to 523+00, 71.57' Rt	E13	1		24	34										III	III	3			X				C-15.91		2.50				1219.09					23	10			CB 60 to JCT 57 Timber Cap CB 60 per Std C-15.91
202L 524+40, 69.5' Rt to 523+32.13, 69.5' Rt	E14	1		24	108										III	III	3			X				C-15.91		2.50				1220.02					72	31			CB 61 to CB 60 Timber Cap CB 61 per Std C-15.91
202L 523+00, 154.44' Rt to 523+00, 8.5' Lt	E15	4		36	164										III	III						C-13.20														231	65			ES 50 to MH 52
202L 523+00, 8.5' Lt to 523+00, 148.81' Lt	E16	4		36	142										III	III							52	C-18.10		13.77				1222.27			DTL D2		409	57			MH 52 to ES 51
CCLB B 8+50, 7.5' Rt to 8+50, 49.56' Rt	F1	1		24	42										III	III	3			X		C-13.20		C-15.91		5.25			C-15.91	1219.04					38	12			CB 70 to ES 70
CCLB B 10+55, 11.7' Rt to 10+55, 52.66' Rt	F2	1		24	40										III	III	3			X		C-13.20		C-15.91		5.25			C-15.91	1217.75					36	11			CB 71 to ES 71
CCLB B 13+60, 23.5' Lt to 13+60, 64.51' Rt	F3	1		24	88										III	III	3			X		C-13.20		C-15.91		5.25			C-15.91	1215.15					79	25			CB 72 to ES 72
CCLB B 15+50, 23.5' Lt to 16+15, 23.5' Lt	F4	1		24	66										III	III	3			X				C-15.91		5.25			C-15.91	1213.67					55	19			CB 73 to CB 74
CCLB B 16+50, 23.5' Lt to 16+15, 23.5 Lt	F5	1		24	36										III	III	3			X				C-15.91		5.25			C-15.91	1213.49					30	10			CB 75 to CB 74
CCLB B 16+15, 23.5' Lt to 16+15, 65.35' Rt	F6	1		24	90										III	III	3			X		C-13.20		C-15.91		5.25			C-15.91	1213.42					81	26			CB 74 to ES 74
CCLB Rd 274+80.87, 62.88' Lt to 274+65.82, 121.5' Lt	F7	1		24	60										III	III	3			X		C-13.20		C-15.20		4.58	13'-7"			1216.37	1				50	17			CB 76 to ES 75
CCLB 274+89.32, 134.4' Lt to 276+10, 10.0' Lt	G1	5		24	174										IV	IV																		DTL AL	138	49			ES 80 to MH 80
CCLB 275+92.55, 119.42' Rt to 276+00.44, 65.89' Rt	G2	3		24	54										II	II	2			X														DTL AL	38	15			ES 81 to CB 80
CCLB 276+00.44, 65.89' Rt to 276+10, 10.0' Lt	G3	4		24	80										III	III								C-15.20		10.85	20'-9"			1215.41					187	23			CB 80 to MH 80
CCLB 276+45, 100' Lt to 276+10, 10.0' Lt	G4	1		24	98										III	III	3			X				C-15.80		4.00			C-15.80	1210.50					173	28			CB 81 to MH 80
																							80	C-18.10		17.65				1199.63									
CCLB D 1+39.84, 13.5' Lt to 1+25, 13.5' Lt	H2	2		24	16										II	II	1			X				C-13.75											19	5			JCT 90 to CB 91
CCLB D 1+16.32, 34.3' Lt to 1+25, 13.5' Lt	H3	1		24	24										III	III	3			X				C-15.91		2.50				1209.50					19	7			CB 90 to CB 91 Timber Cap CB 90 per Std C-15.91
CCLB D 1+25, 13.5' Lt to 1+43.7, 43.93' Rt	H4	1		24	66										III	III	3			X		C-13.20		C-15.91		7.25			C-15.91	1213.78					77	19			CB 91 to ES 90
Sheet Total																																																										

FILL HEIGHT RANGE TABLE (Ft.)

RANGE NO.		1	2	3	4	5	6	7	8	9	10	11	12
FILL HEIGHT (Ft.)	≥	1	3	5	8	11	15	20	25	30	40	55	70
	≤	3	5	8	11	15	20	25	30	40	55	70	90

⬡ SHOULD FIELD CONDITIONS VARY FROM THE RANGE INDICATED, CONTACT DESIGN FOR RE-EVALUATION OF PIPE DESIGN REQUIREMENTS.

⊘ PIPE CORRUGATION

A	2⅔ x ½	D	6x2
B	3x1	E	3x1 or 9x2½
C	9x2½		

	NAME	DATE
DESIGN	JRM	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
2055 EAST CAMELBACK ROAD, SUITE 120
PHOENIX, ARIZONA 85016 • (602) 952-0600

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

NEW PIPE SUMMARY SHEET

ROUTE 202L
LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. C-4.6

REV. DATE: 03-01-95

SUBJECT NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

•••••DGN=SPECIFICATION•••••
•••••SYSTIME•••••
VIEW NAME: /13194/RM3PIP-3.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C

600-8-(009)

___ OF ___

NOTE:
FOR PIPE CULVERT PLACEMENT
SEE STANDARD DRAWING C-13.15

SPECIAL NOTE:
PIPE OPTION ENTRYS LEFT BLANK
ARE NOT ALLOWABLE ALTERNATES.

CSP - CORRUGATED STEEL PIPE
CAP - CORRUGATED ALUMINUM PIPE
RCP - REINFORCED CONCRETE PIPE
NRCP - NON-REINFORCED CONCRETE PIPE
NRCIPCP - NON-REINFORCED CAST-IN-PLACE CONCRETE PIPE
CHDPEPP - CORRUGATED HIGH DENSITY POLYETHYLENE PLASTIC PIPE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013

Station	Plan Ref No.	⬡ Controlling Fill Height Range (No.)	Size, (In.) Corrugated	Size, (In.) Smooth	Length (Ft.)	Skew (Degree)	⊘ Corrugation	Wall Thickness (In.)	Zinc	Aluminum	Bituminous	⊘ Corrugation	Wall Thickness (In.)	Uncoated	Bit. Coated	Class - Non Trench	Class - Trench	Class	Min Wall Thickness (In.)	AASHTO M-294 Type C	AASHTO M-294 Type S	C-13.20 & C-13.25	Manhole No. 3	Standard or Detail	Location	Height (Ft-In.)	Curb Opening Length (Ft-In)	18" Slotted Drn. Length (Ft)	Type	Elev.	Depth (In.)	Length (Ft.)	Standard or Detail	Location	Pipe Exc (CY)	Pipe Bkfl (CY)	Drn Exc (CY)	Berm/Dike Emb (CY)	REMARKS
																								End Sct	Catch Basin, Manhole, Headwall & Junction Structure								Headwall						
																													Grate			Inlet Depression							
CCLB A 9+50,21.5' Rt to 8+49.45, 54.02' Lt	J1	2		24	128										II	II	I			X		100	C-18.10		6.00				1219.67		DTL D2		123	36			MH 100 to ES 100
CCLB A 9+53.2, 23.9' Rt to 9+50, 21.5' Rt	J2	2		24	4										II	II	I			X			C-13.75											3	1			JCT 100 to MH 100
CCLB Rd 279+34.55, 68.5' Lt to CCLB A 13+06.18, 38.22' Rt	K1	1		24	34										III	III	3			X			C-15.20		4.58	6'-7"			1213.43					23	10			CB 110 to CB 111
CCLB A 13+06.18, 38.22' Rt to 13+05, 13.5' Lt	K2	2		24	54										II	II	I			X			C-15.80		4.00			C-15.80	1210.00					47	15			CB 111 to CB 112
CCLB A 12+00, 11.5' Rt to 12+70, 11.5' Rt	K3	1		24	70										III	III	3			X			C-15.91		4.25			C-15.91	1213.23					47	20			CB 113 to CB 114
CCLB A 12+70, 11.5' Rt to 13+05.62, 12.71' Rt	K4	1		24	36										III	III	3			X			C-15.91		4.25			C-15.91	1212.59					26	10			CB 114 to JCT 110
CCLB A 13+05, 13.5' Lt to CCLB Rd 280+40, 10.0' Lt	K5	4		24	132										III	III							C-15.30		6.89			EF-2	1212.64					237	38			CB 112 to MH 110
CCLB 280+42.93, 65.97' Lt to 280+14.58, 49.69' Lt	K6	4		24	34										III	III							C-15.20		4.58	20'-7"			1213.30					26	10			CB 115 to JCT 111
CCLB 280+90.33, 115.82' Rt to 280+40, 10.0' Lt	K7	4		30	136										III	III																C-16.10		265	46			ES 110 to MH 110
																						110	C-18.10		15.15				1214.54									
CCLB 279+90,100' Rt 279+85.91, 67.39' Rt	K8	2		24	32										II	II	I			X			C-15.91		3.00			C-15.91	1209.50					28	9			CB 116 to CB 117 Timber Cap CB 116 per Std C-15.91
CCLB 279+85.91, 67.39' Rt to 280+59.87, 39.68' Rt	K9	2		24	80										II	II	I			X			C-15.20		7.91	6'-7"			1213.33					103	23			CB 117 to JCT 112
CCLB 285+00, 42.5' LT																							C-15.30		4.49			EF-2	1214.90									CB 120 Constructed Over Exst 24" R.C.R.C.P.
CCLB 289+91.92, 32' Rt																							C-15.30		3.55			EF-2	1226.68									CB 121 Constructed Over Exst 24" R.C.R.C.P.
CCLB 289+67.45, 32' Lt																							C-15.30		3.59			EF-2	1225.96									CB 122 Constructed Over Exst 24" R.C.R.C.P.
Sheet Total																																							

FILL HEIGHT RANGE TABLE (Ft.)

RANGE NO.		1	2	3	4	5	6	7	8	9	10	11	12
FILL HEIGHT (Ft.)	>	1	3	5	8	11	15	20	25	30	40	55	70
	≤	3	5	8	11	15	20	25	30	40	55	70	90

⬡ SHOULD FIELD CONDITIONS VARY FROM THE RANGE INDICATED, CONTACT DESIGN FOR RE-EVALUATION OF PIPE DESIGN REQUIREMENTS.

⊘ PIPE CORRUGATION

A	2⅔ x ½	D	6x2
B	3x1	E	3x1 or 9x2½
C	9x2½		

	NAME	DATE
DESIGN	JRM	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
7055 EAST GUADALAPE ROAD, SUITE 130
PHOENIX, ARIZONA 85054 • (602) 951-6000

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

NEW PIPE SUMMARY SHEET

ROUTE 202L
LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. C-4.7

REV. DATE: 03-01-95

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

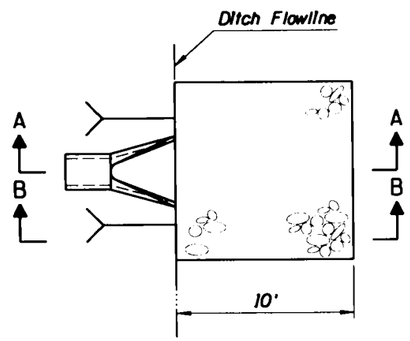
•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM3PIP-4.DGN

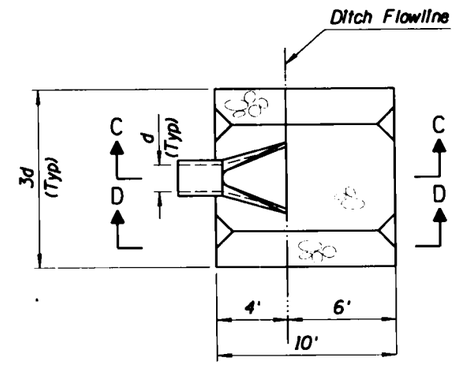
PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			
		202L MA 013			



PLAN



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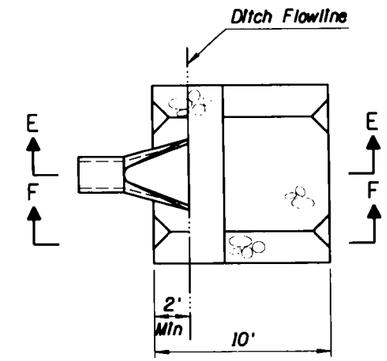

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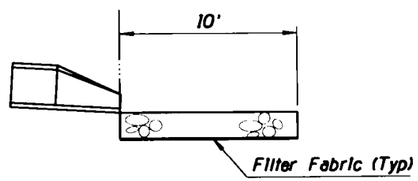
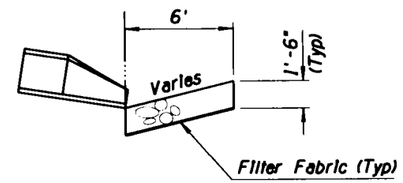
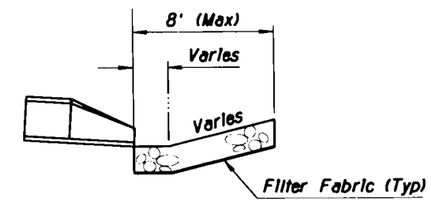


SECTION A-A



SECTION C-C



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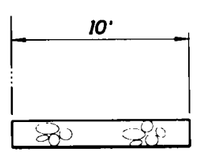
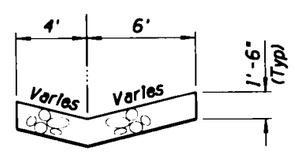


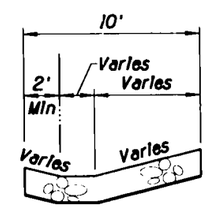
SECTION B-B

TYPE 1



SECTION D-D

TYPE 2



SECTION F-F

TYPE3

DETAIL AF

NOTE:

1. Riprap gradation shall be D_{50} =6"

RIPRAP DETAILS

	NAME	DATE
DESIGN	JRM	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
7095 EAST CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85016 • (602) 990-2600

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DETAIL AF

ROUTE 202L | LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR | DWG NO. C-5.23

SURVEY NO.	FIELDBOOK PLANE	REVISIONS	LOCATION	DATE

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

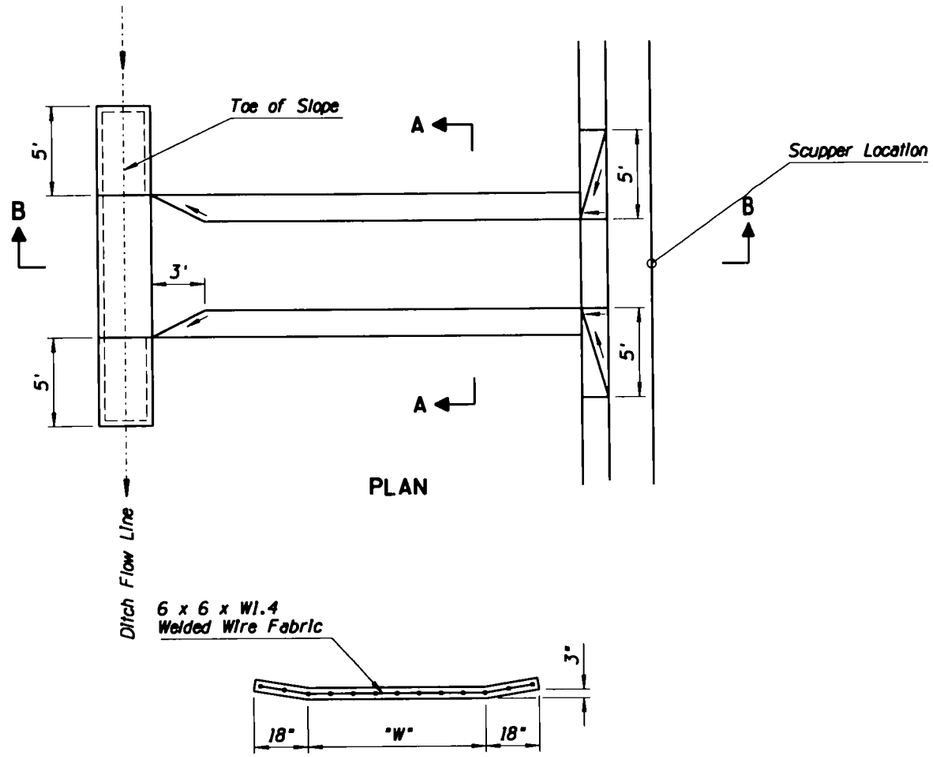
VIEW NAME: /13194/RM3GS-19.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013

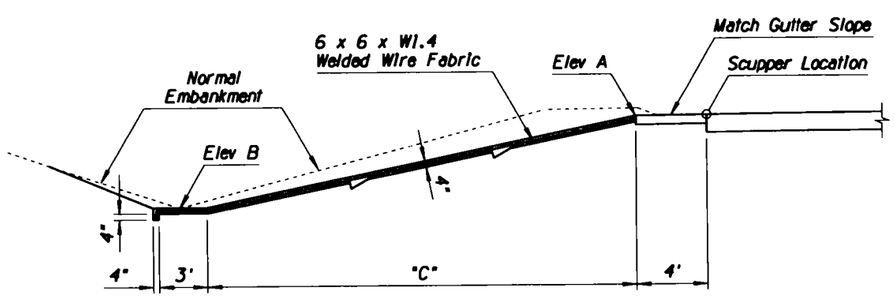


SECTION A-A

SCUPPER LOCATION	ELEVATION		DIST "C"	DIST "W"
	A	B		
11.5' Lt McKellips Ramp B Cst ℄ Sta 9+55.00	1229.05	1226.65	7.64	5
37.96' Lt McKellips Cst ℄ Sta 17+58.46	1201.36	1199.83	7.63	22

Notes:

1. All Concrete Shall be Class B.
2. For Spillway Details Not Shown, See Std C-04.10.



SECTION B-B

CURB OPENING WITH SPILLWAY

DETAIL AH

	NAME	DATE
DESIGN	JRM	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
2929 EAST CAMELBACK Road, SUITE 130
PHOENIX, ARIZONA 85016 • (602) 952-8400

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DETAIL AH

ROUTE 202L | LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR | DWG NO. G-5.25

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

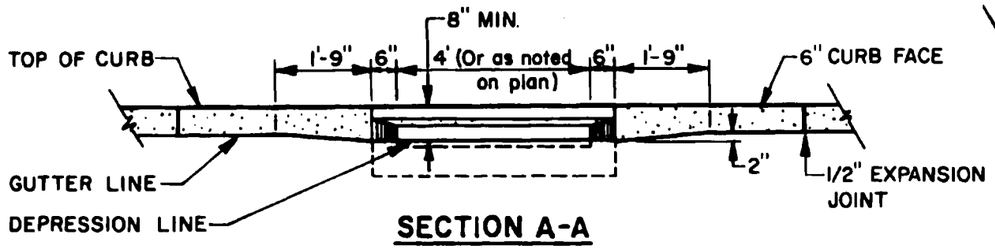
VIEW NAME: /13194/RM3G5-08.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

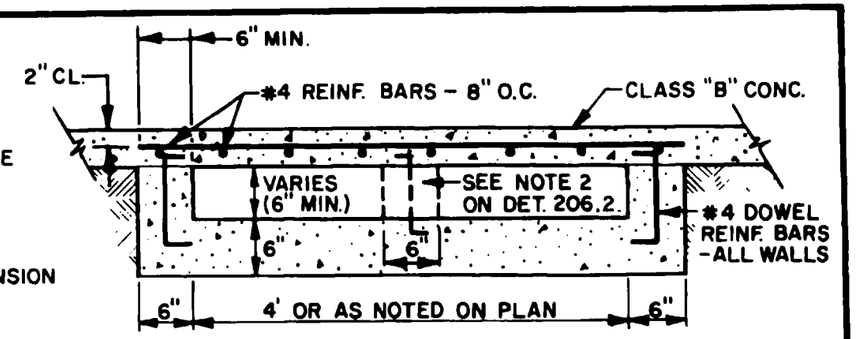
TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

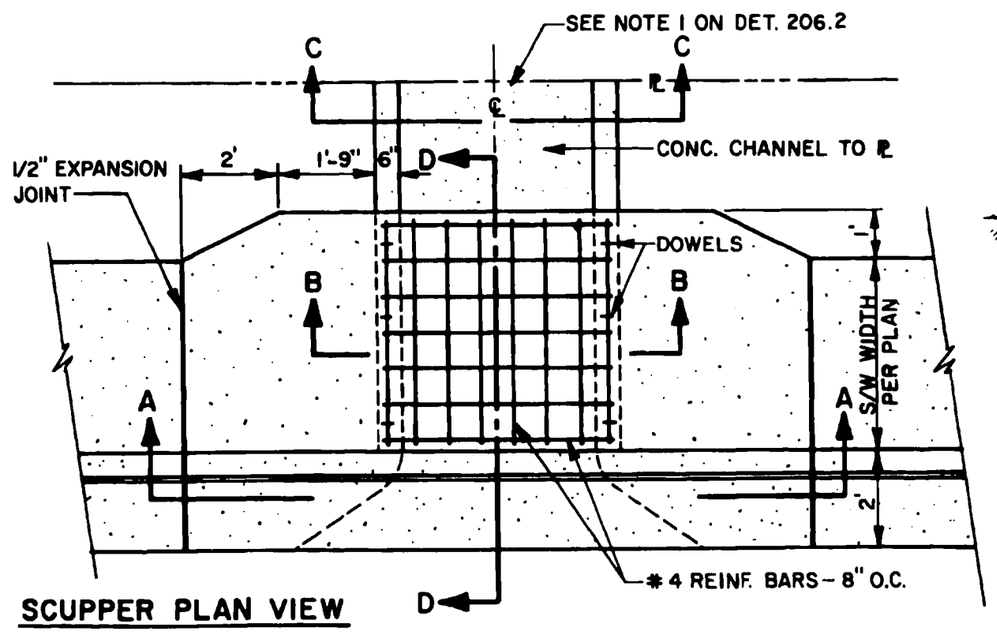
202L MA 013



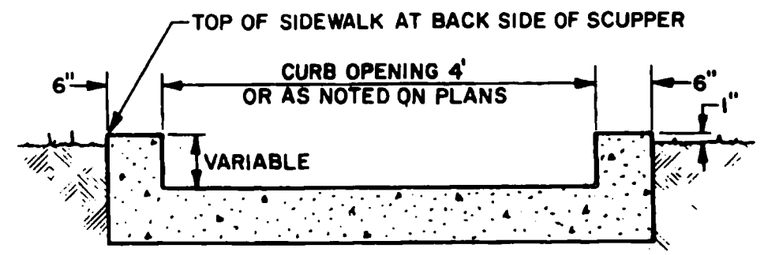
SECTION A-A



SECTION B-B



SCUPPER PLAN VIEW



SECTION C-C
SPILLWAY

DETAIL NO. 206.1	STANDARD DETAIL	CONCRETE SCUPPER		DETAIL NO. 206.1

REVISED 1989

DETAIL AJ

SHEET 1 OF 2

MARICOPA COUNTY
CATCH BASIN DETAILS
SHEET 1 OF 2

	NAME	DATE	ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION
DESIGN	MRC	12/96	
DRAWN	CGS	12/96	
CHECKED	SDW	12/96	
STANLEY CONSULTANTS, INC. 7055 EAST CAMELBACK ROAD, SUITE 130 SCOTTSDALE, ARIZONA 85251 • (602) 945-2600			DETAIL AJ
ROUTE 202L	LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR		DWG NO. C-5.26

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

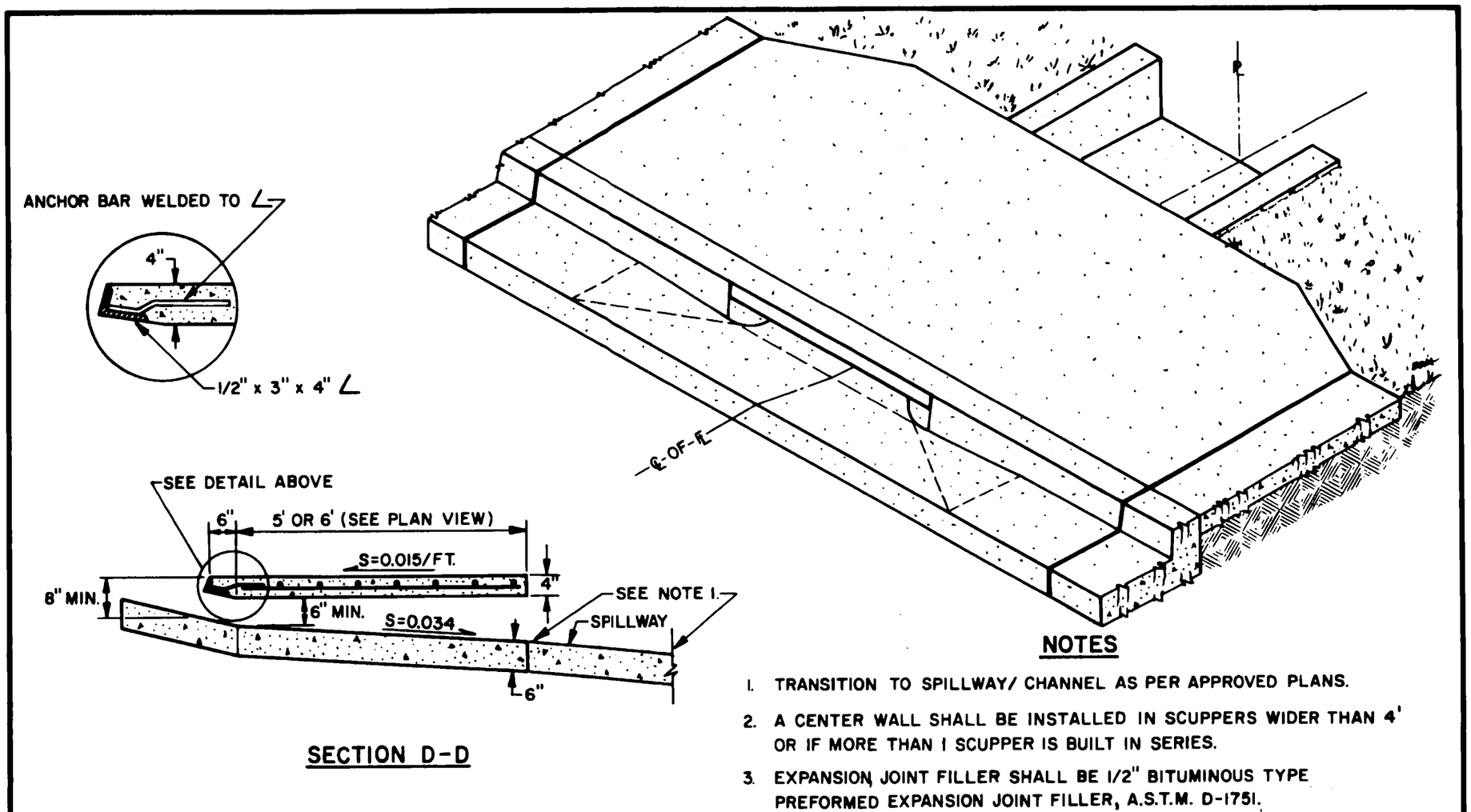
TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM3G5-29.DGN

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



REVISED 1989

DETAIL AJ

SHEET 2 OF 2

MARICOPA COUNTY
CATCH BASIN DETAILS
SHEET 2 OF 2

	NAME	DATE	ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION
DESIGN	MRC	12/96	
DRAWN	CGS	12/96	
CHECKED	SDW	12/96	DETAIL AJ
STANLEY CONSULTANTS, INC. 3945 EAST CAMELBACK ROAD, SUITE 120 PHOENIX, ARIZONA 85018 • (602) 955-6600			
ROUTE 202L	LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR		DWG NO. G-5.27

SURVEY NO. | FIELD PLANS | REVISIONS | LOCATION | DATE

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

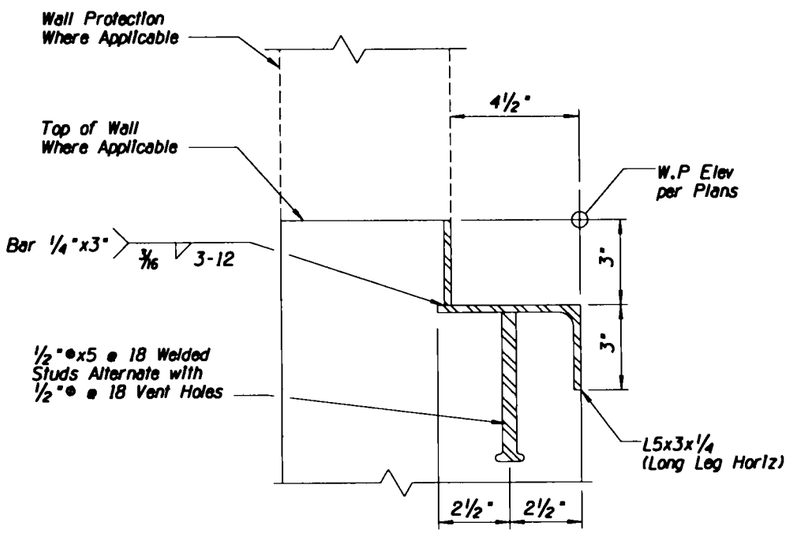
VIEW NAME: /13194/RM3G5-30.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

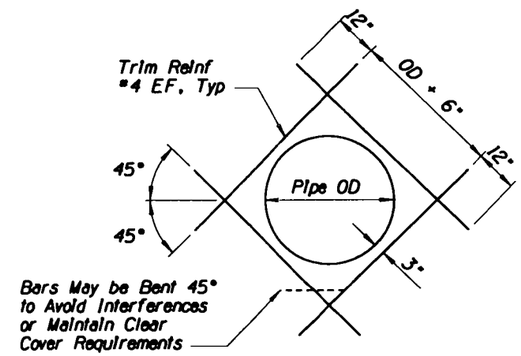
TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

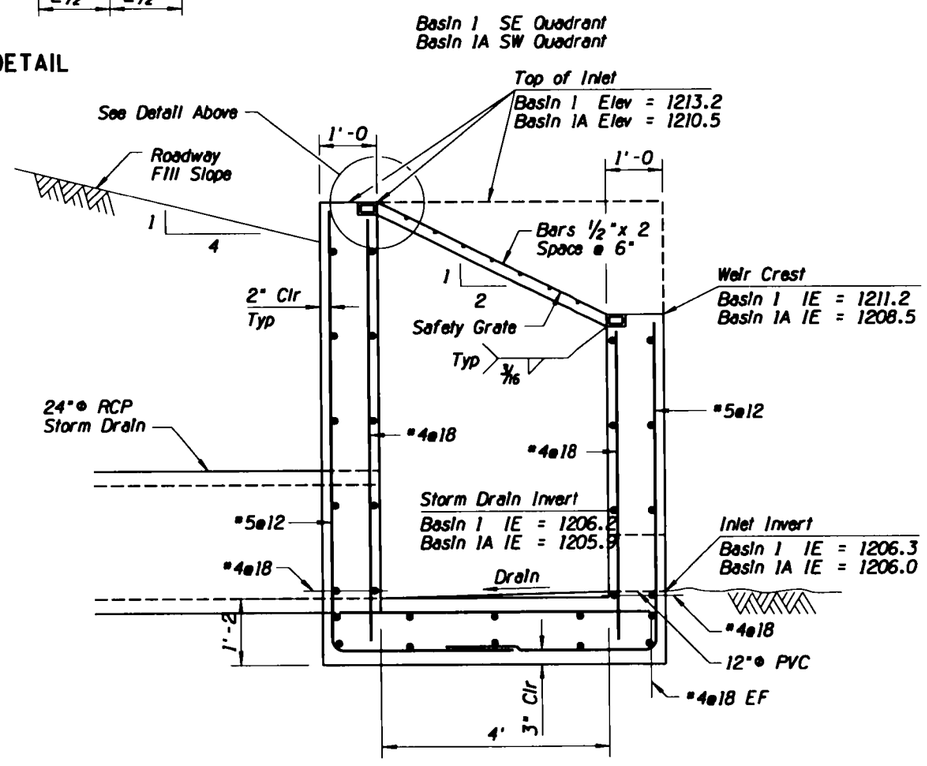
202L MA 013



DETAIL

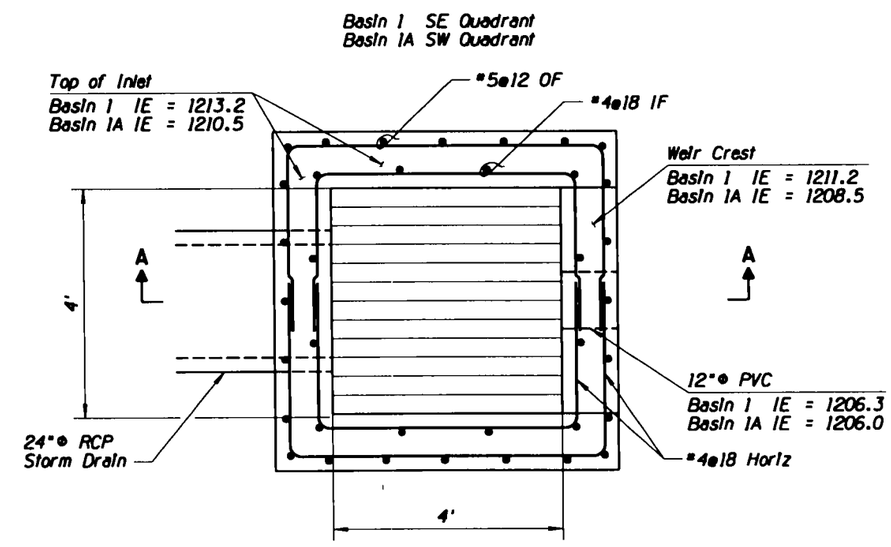


TYPICAL WALL PENETRATION



Adjust Reinforcing to Clear Openings by
Bundling In Pairs 3" from Each Side of Pipe

SECTION A-A



PLAN

DETAIL AL

DETENTION BASIN INLETS

	NAME	DATE
DESIGN	JRM/KAS	12/96
DRAWN	CGS	12/96
CHECKED	SDW	12/96

STANLEY CONSULTANTS, INC.
7501 EAST CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85016 • (602) 955-0600

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DETAIL AL

ROUTE 202L | LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR | DWG NO. G-5.29

SURVEY NO.	FINISHED PLANS	REVISIONS	LOCATION	DATE

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM3G5-29.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

EXHIBIT II

HEC-1 Schematic Diagram

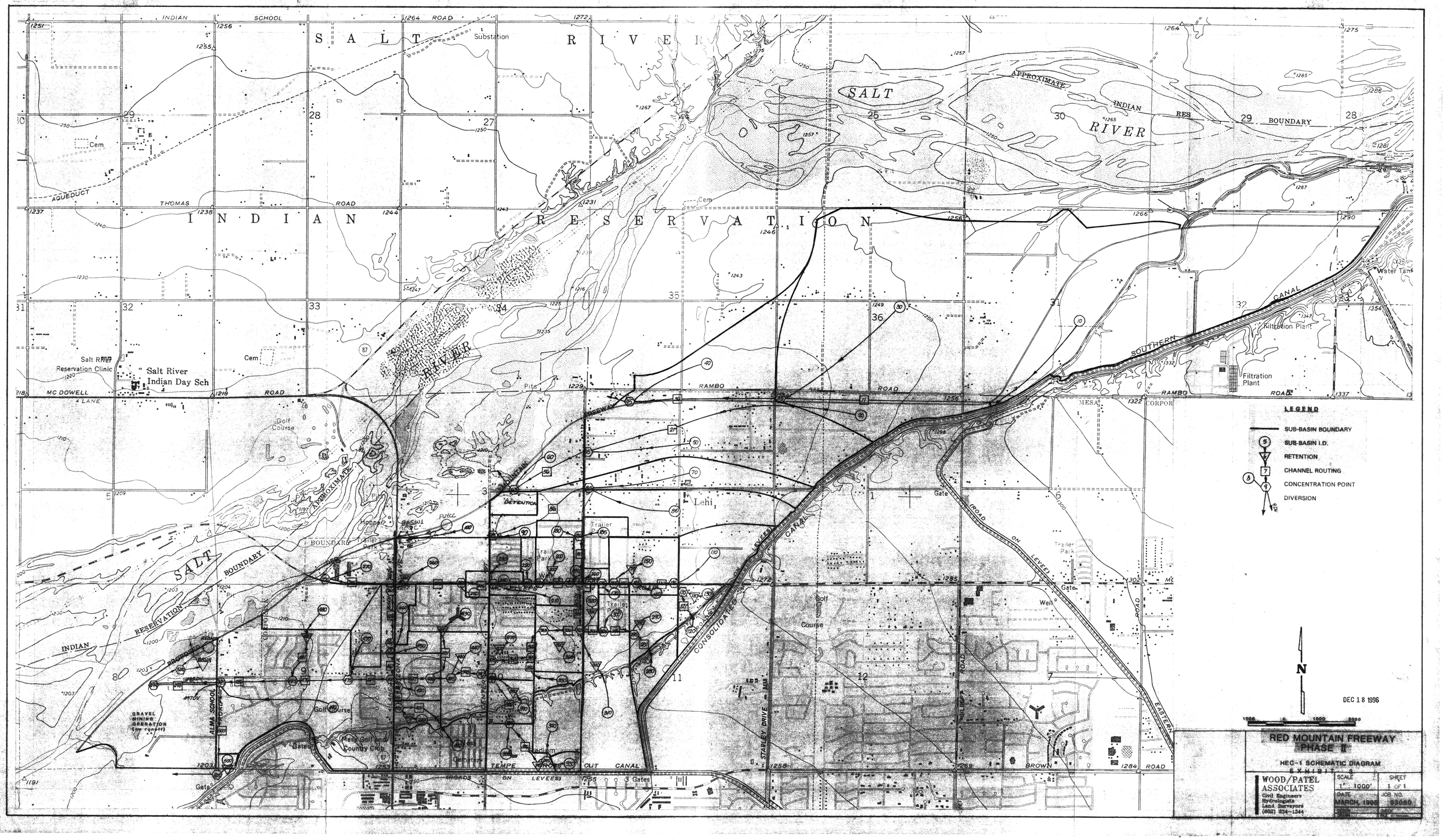
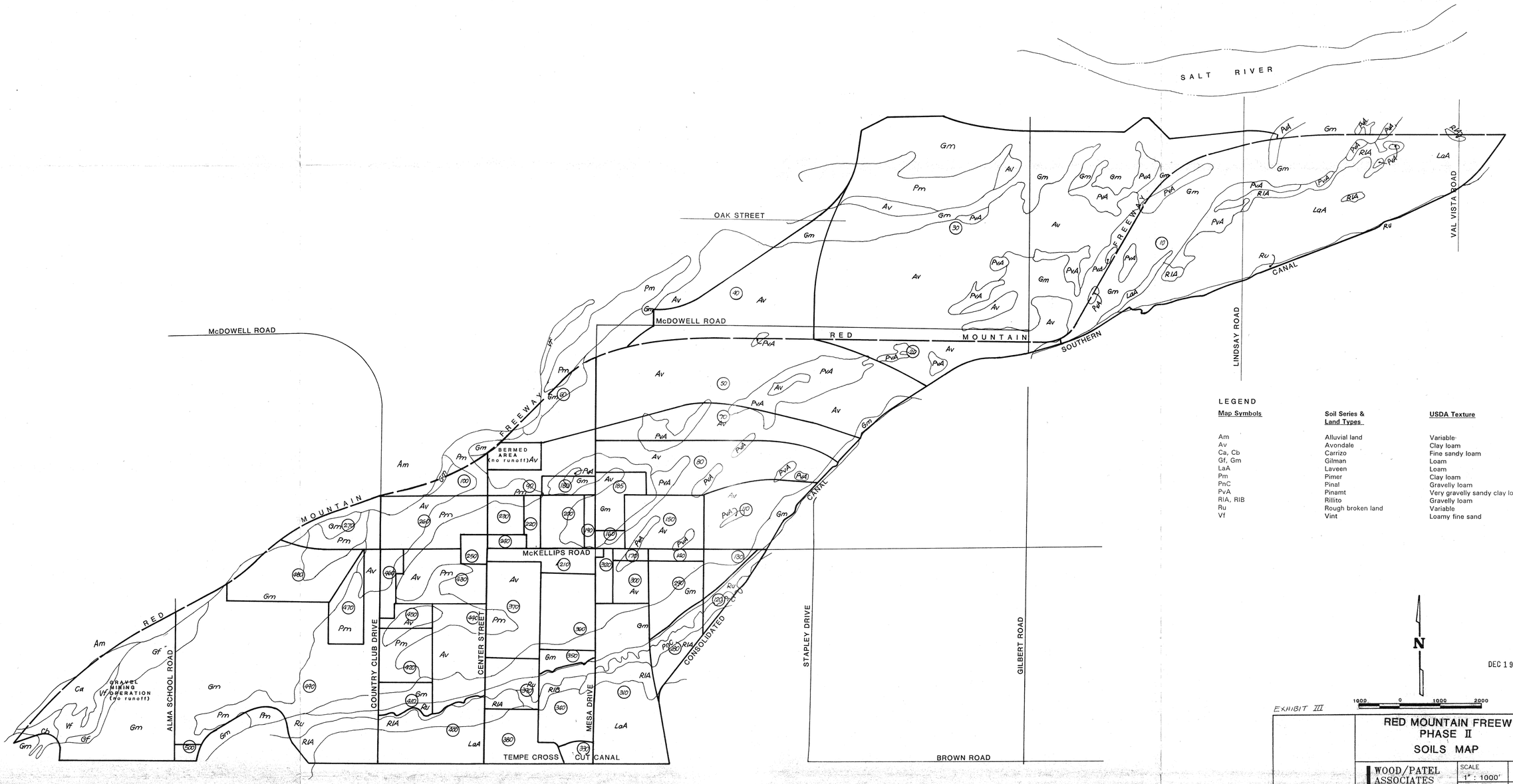

SALT RIVER INDIAN RESERVATION
SALT RIVER INDIAN RES BOUNDARY
APPROXIMATE
INDIAN SCHOOL ROAD
THOMAS ROAD
MC DOWELL ROAD
RAMBO ROAD
BROWN ROAD
ROAD ON LEVEES
EASTERN
STARLEY DRIVE
ALMA SCHOOL
CONSOLIDATED CANAL
SOUTHERN CANAL
TEMPE CUT CANAL
Lehi
Salt River Reservation Clinic
Salt River Indian Day Sch
Substation
Cem
Golf Course
Filtration Plant
Water Tank
Well
Gate
Trailer Park
Stadium
Mesa Golf and Country Club
GRAVEL MINING OPERATION
DETENTION
Hopper
Pits
LEGEND
SUB-BASIN BOUNDARY
SUB-BASIN I.D.
RETENTION
CHANNEL ROUTING
CONCENTRATION POINT
DIVERSION
N
DEC 18 1996
RED MOUNTAIN FREEWAY PHASE II
HEC-1 SCHEMATIC DIAGRAM
EXHIBIT 2
WOOD/PATEL ASSOCIATES
Civil Engineers
Hydrologists
Land Surveyors
(602) 234-1344
SCALE 1" = 1000'
SHEET 1 OF 1
DATE MARCH, 1996
JOB NO. 93085

EXHIBIT III

Soils Map



LEGEND

Map Symbols	Soil Series & Land Types	USDA Texture
Am	Alluvial land	Variable
Av	Avondale	Clay loam
Ca, Cb	Carrizo	Fine sandy loam
Gf, Gm	Gilman	Loam
LaA	Laveen	Loam
Pm	Pimer	Clay loam
PnC	Pinal	Gravelly loam
PvA	Pinamt	Very gravelly sandy clay loam
RlA, RlB	Rillito	Gravelly loam
Ru	Rough broken land	Variable
Vf	Vint	Loamy fine sand

DEC 19 1996

EXHIBIT III

RED MOUNTAIN FREEWAY PHASE II
SOILS MAP

WOOD/PATEL ASSOCIATES
Civil Engineers
Hydrologists
Land Surveyors
(602) 234-1344

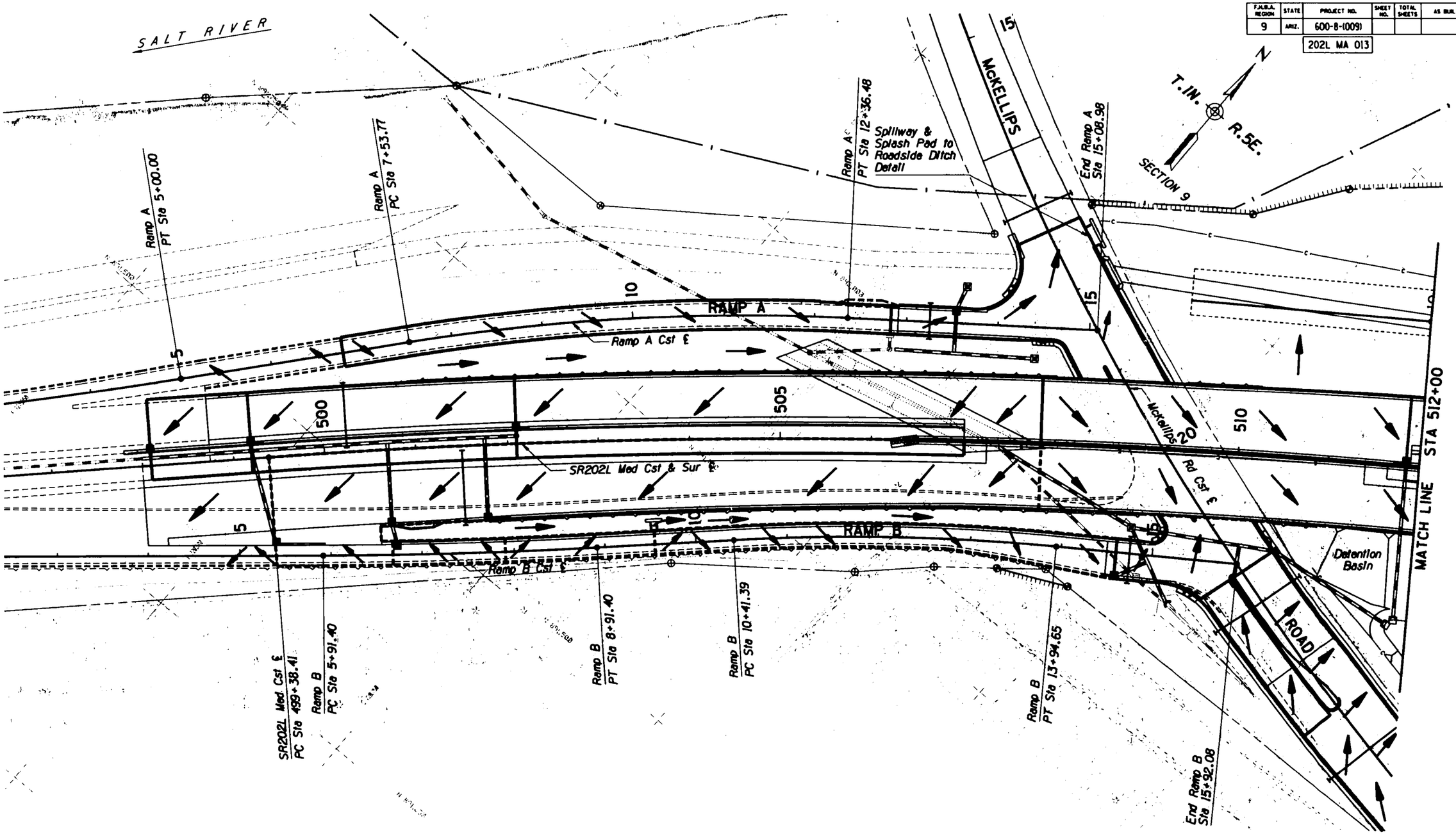
SCALE	SHEET
1" : 1000'	1 OF 1
DATE MARCH, 1995	JOB NO. 93080
DESIGN / DRAWN	CHECK / FILE

EXHIBIT IV

Roadway Drainage Area Map

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



NOTE:
Dashed Line Indicates Eastbound & Median Contributing Drainage Area Boundaries

	NAME	DATE
DESIGN	JRM	9/96
DRAWN	CGS	9/96
CHECKED	SDW	9/96

STANLEY CONSULTANTS, INC.
2575 E. CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85016 • (602) 381-4200

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PLAN
SR202L
STA 497+00 TO STA 512+00

ROUTE 202L | LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR | DWG NO. D-1.2

DATE	LOCATION	REVISIONS	PROJECT NO.	SURVEY NO.

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

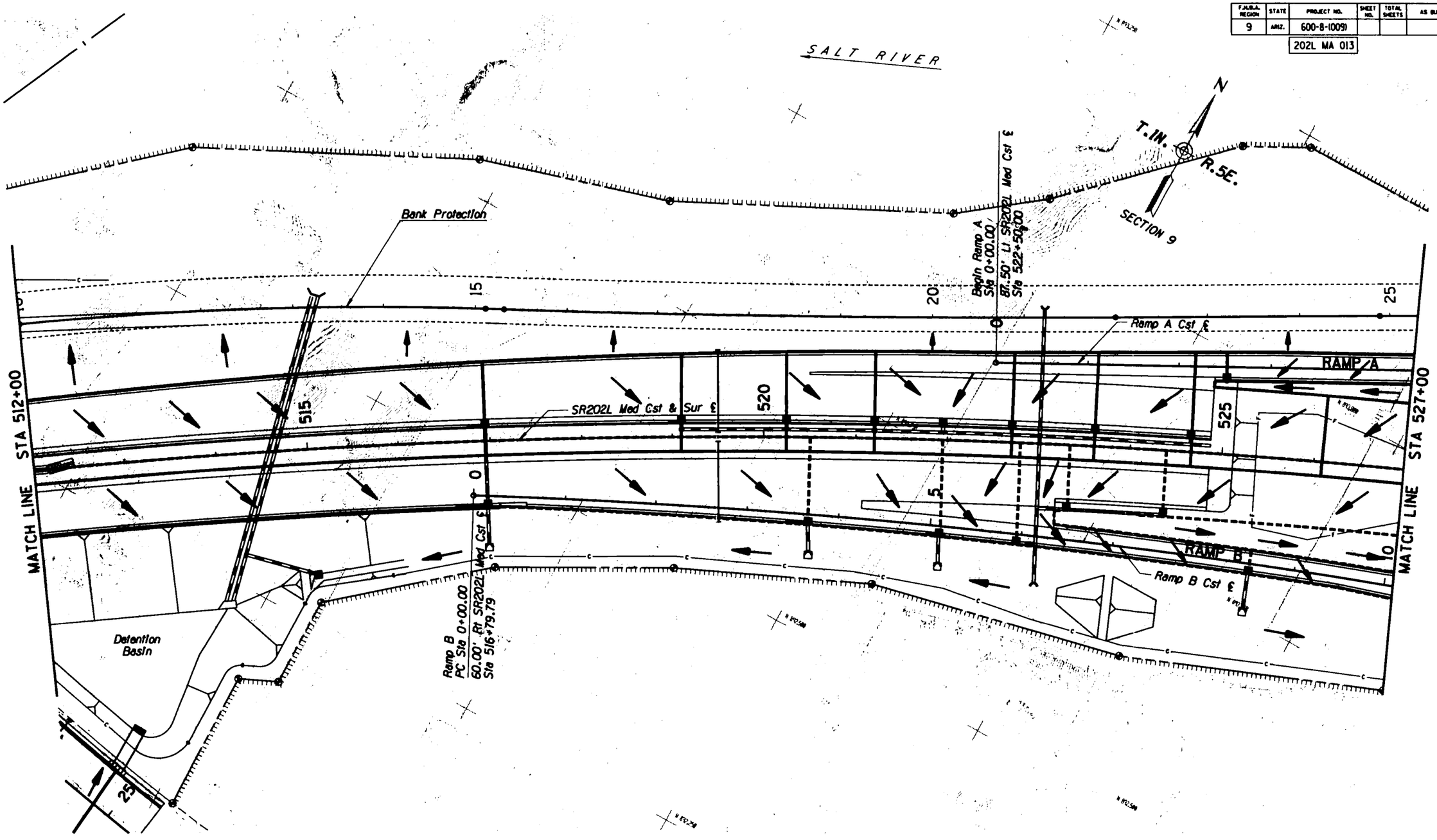
VIEW NAME: /13194/RM3DRN03.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



	NAME	DATE
DESIGN	JRM	9/96
DRAWN	CGS	9/96
CHECKED	SDW	9/96

STANLEY CONSULTANTS, INC.
5555 EAST CHANDLER BLVD., SUITE 120
PHOENIX, ARIZONA 85054 • (602) 897-0900

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PLAN
SR202L
STA 512+00 TO STA 527+00

ROUTE 202L

LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.3

DATE	LOCATION	REVISIONS	FINISHED PLANS	SURVEY NO.

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM3DRN04.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

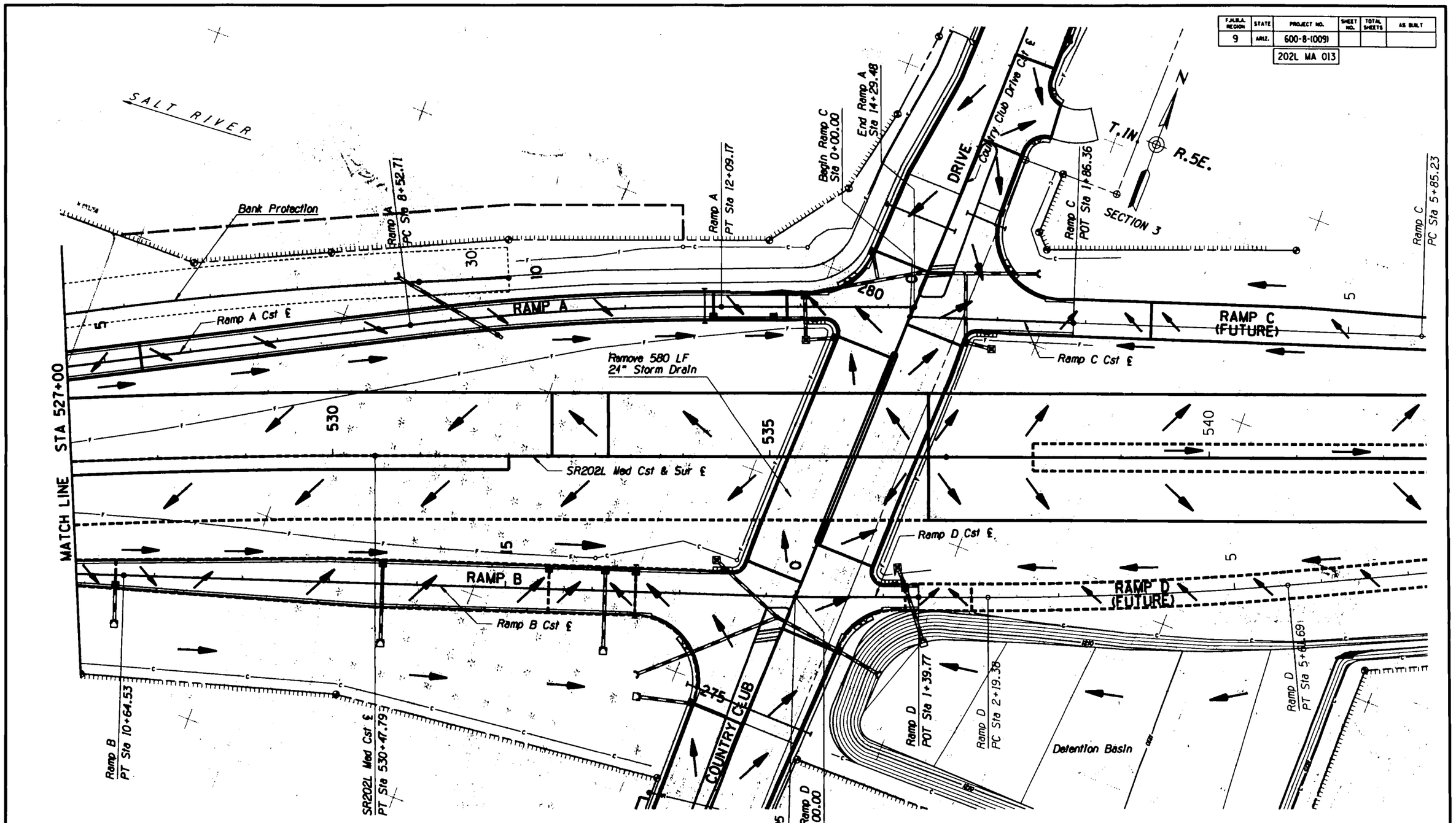
TRACS NO. H3878 01C

600-8-(009)

___ OF ___

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-B-(009)			

202L MA 013



	NAME	DATE
DESIGN	JRM	9/96
DRAWN	CGS	9/96
CHECKED	SDW	9/96

STANLEY CONSULTANTS, INC.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PLAN
SR202L
STA 527+00 TO STA 542+00

ROUTE 202L

LOCATION RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.4

SURVEY NO. | FINISHED PLANS | RE-FILMED | LOCATION | DATE

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM3DRN05.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

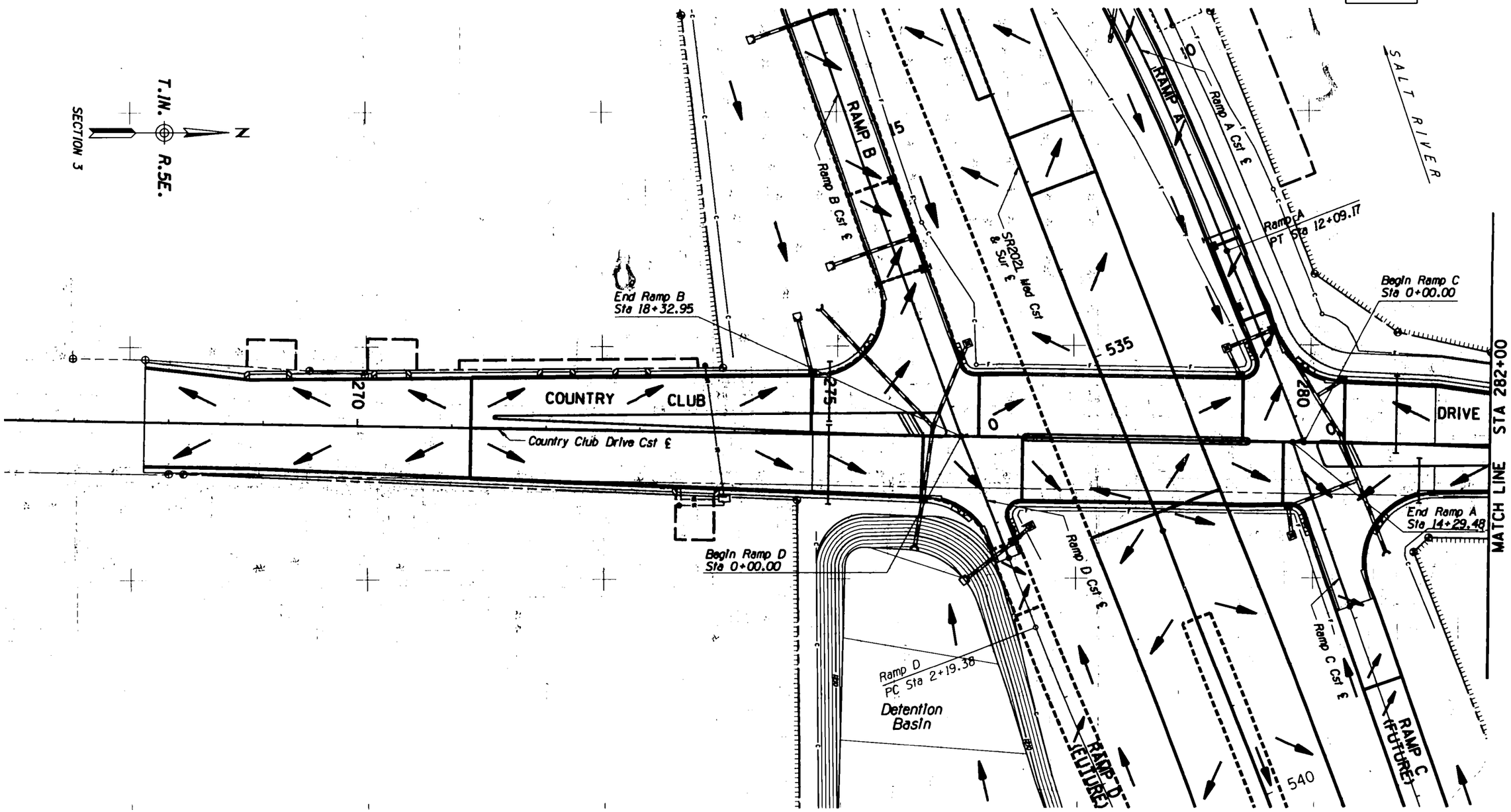
TRACS NO. H3878 01C

600-B-(009)

___ OF ___

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



	NAME	DATE
DESIGN	JRM	9/96
DRAWN	CGS	9/96
CHECKED	SDW	9/96

STANLEY CONSULTANTS, INC.
[redacted] EAST CAMELBACK ROAD, SUITE 120
PHOENIX, ARIZONA 85014 • (602) 263-8200

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PLAN
COUNTRY CLUB DRIVE
STA 266+00 TO STA 282+00

ROUTE: 202L
LOCATION: RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.5

DATE	LOCATION	REVISIONS	BY	APPR

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

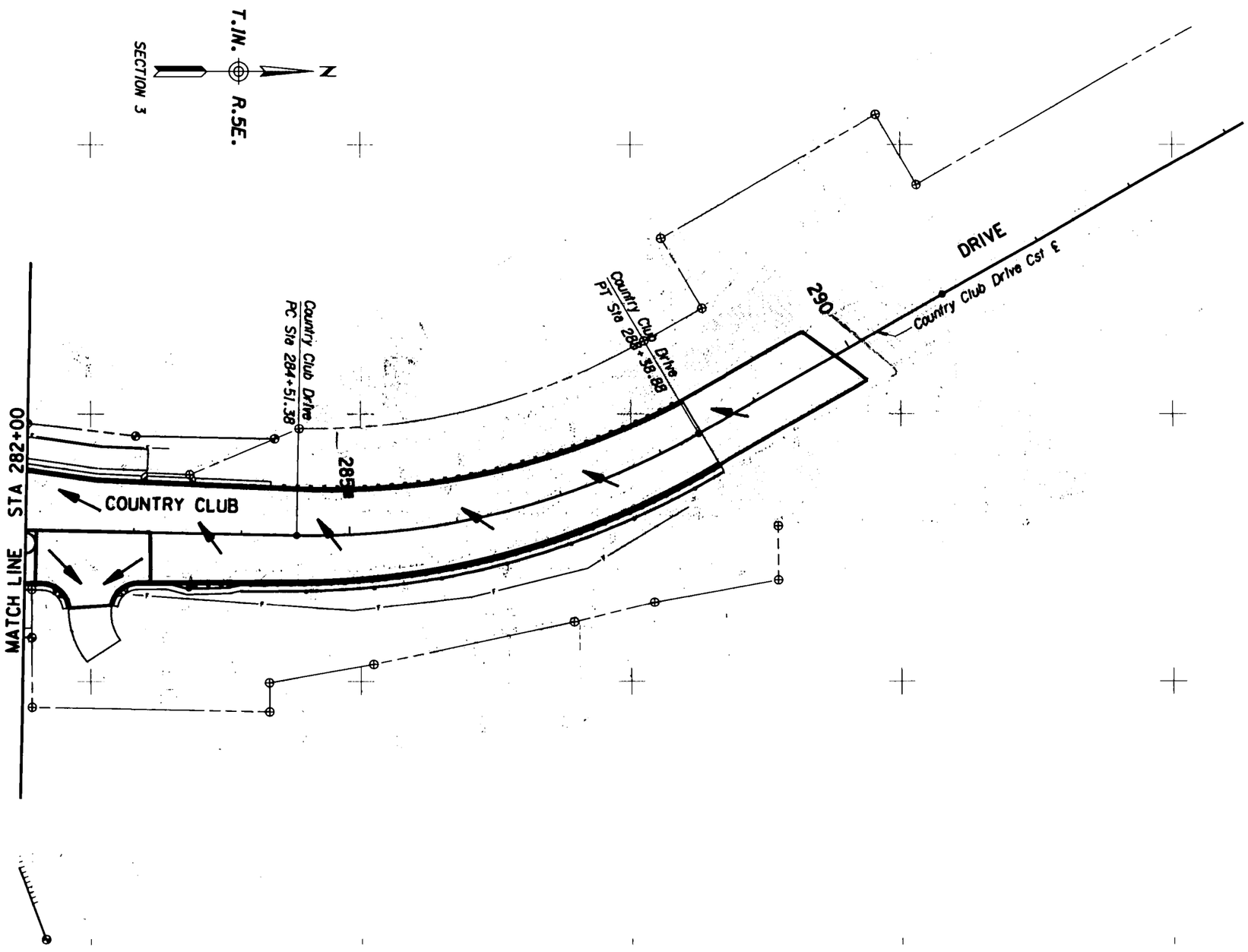
VIEW NAME: /13194/RM30RN08.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C | 600-8-(009) | ___ OF ___

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-8-(009)			

202L MA 013



	NAME	DATE
DESIGN	JRM	9/96
DRAWN	CGS	9/96
CHECKED	SDW	9/96

STANLEY CONSULTANTS, INC.
7670 EAST CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85016 • PHONE 602-946-0660

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DRAINAGE PLAN
COUNTRY CLUB DRIVE
STA 282+00 TO STA 288+38.88

ROUTE: 202L
LOCATION: RED MTN - McKELLIPS RD TO COUNTRY CLUB DR

DWG NO. D-1.6

BUILT NO.	PROPOSED PLANS	REVISIONS	LOCATION	DATE

•••••DGN•SPECIFICATION•••••
•••••SYSTIME•••••

VIEW NAME: /13194/RM3DRN09.DGN

PRELIMINARY - NOT FOR CONSTRUCTION OR RECORDING

TRACS NO. H3878 01C

600-8-(009)

___ OF ___

APPENDIX A

Phase III HEC-1 Analysis

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              MAY   1991              *
            VERSION 4.0.1E            *
*                                      *
*  RUN DATE  12/16/96  TIME  08:12:19  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 551-1748             *
*                                      *
****************************************
```

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

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

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

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

  1           ID   RED MOUNTAIN FREEWAY DRAINAGE ANALYSIS
  2           ID   PHASE III - McKELLIPS ROAD TO COUNTRY CLUB DRIVE
  3           ID   100-YEAR, 24-HOUR STORM
  4           ID   HEC-1 HYPOTHETHICAL RAINFALL DISTRIBUTION
  5           ID   RAINFALL DEPTHS IN PH RECORD BASED ON PREFRE OUTPUT
  6           ID   CLARK UNIT HYDROGRAPH
  7           ID   GREEN-AMPT SOIL LOSS PARAMETERS
  8           ID   NORMAL DEPTH CHANNEL ROUTING
  9           ID   IN GENERAL, URBANIZED AREAS IN THE CITY OF MESA BUILT BETWEEN 1973
 10           ID   AND 1987 WERE DESIGNED TO RETAIN THE 50-YEAR, 24-HOUR RAINFALL; FROM 1987
 11           ID   TO PRESENT, THE RETENTION REQUIREMENT IS THE 100-YEAR, 2-HOUR RAINFALL.
 12           ID   DIVERSIONS ALONG MAJOR STREETS WERE ESTIMATED BASED ON AS-BUILT ROADWAY
 13           ID   AND STORM DRAIN PLANS, STORM DRAIN STUDY REPORTS, AND FIELD INSPECTION.
 14           ID   ** FLOW TAKEN ACROSS RED MOUNTAIN FREEWAY AT CP 65C **
 15           ID   FREEWAY CONTRIBUTING AREA ADDED AT MCKELLIPS AND COUNTRY CLUB DRIVE BASINS
 16           ID   FILENAME: RMP3_FWY.DAT
 17           IT      2                    720
 18           IO      5
              *DIAGRAM

 19           KK    10S
 20           KM   RUNOFF FROM SUBBASIN 10
 21           BA   .868
 22           PH                   .71    1.41    2.38    2.59    2.73    3.00    3.30    3.60
 23           LG    .47     .25    4.9     .53       1
 24           UC  5.395   5.350
 25           UA      0       3      5       8      12      20      43      75      90      96
 26           UA    100

 27           KK    11R
 28           KM   ROUTE 10S TO 35C
 29           RS     16    FLOW     -1
 30           RC   .035    .030   .035    6000   .0030
 31           RX      0       1    101     109     119     127     227     228
 32           RY    103     100     99      97      97      99     100     103

 33           KK    30S
 34           KM   RUNOFF FROM SUBBASIN 30
 35           BA   1.411
 36           LG    .48     .15    7.5     .09       1
 37           UC  5.693   4.256
 38           UA      0       3      5       8      12      20      43      75      90      96
 39           UA    100

 40           KK    35C
 41           KM   COMBINE 11C AND 30S
 42           HC      2

 43           KK    36R
 44           KM   ROUTE 35C TO 45C
 45           RS     12    FLOW     -1
 46           RC   .035    .030   .035    4800   .0025
 47           RX      0       1    101     109     169     177     277     278
 48           RY    103     100     99      97      97      99     100     103
```

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

  49          KK     40S
  50          KM   RUNOFF FROM SUBBASIN 40
  51          BA    .279
  52          LG     .50     .15     9.6     .04       0
  53          UC   3.785   4.248
  54          UA       0       3       5       8      12      20      43      75      90      96
  55          UA     100

  56          KK     45C
  57          KM   COMBINE 36R AND 40S
  58          HC       2

  59          KK     20S
  60          KM   RUNOFF FROM SUBBASIN 20
  61          BA    .108
  62          LG     .14     .15     8.5     .09      14
  63          UC    .603    .830
  64          UA       0       5      16      30      65      77      84      90      94      97
  65          UA     100

  66          KK     21R
  67          KM   ROUTE 20S TO 55C
  68          RS      60    FLOW      -1
  69          RC    .040    .040    .040    5800   .0022
  70          RX       0       1     101     102     352     353     503     504
  71          RY     103     100      99      98      98      99      99     110

  72          KK     50S
  73          KM   RUNOFF FROM SUBBASIN 50
  74          BA    .489
  75          LG     .14     .15     8.5     .08      14
  76          UC    .840    .670
  77          UA       0       5      16      30      65      77      84      90      94      97
  78          UA     100

  79          KK     55C
  80          KM   COMBINE 21R AND 50S
  81          HC       2

  82          KK     56R
  83          KM   ROUTE 55C TO 65C
  84          RS      12    FLOW      -1
  85          RC    .040    .040    .040    3000   .0037
  86          RX       0       1     101     102     352     353     503     504
  87          RY     103     100      99      98      98      99      99     110

  88          KK     60S
  89          KM   RUNOFF FROM SUBBASIN 60
  90          BA    .115
  91          LG      .2     .16     7.0     .13      29
  92          UC    .344    .247
  93          UA       0       5      16      30      65      77      84      90      94      97
  94          UA     100
```

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

  95          KK     65C
  96          KM   COMBINE 56R AND 60S
  97          KM   CONCENTRATED RUNOFF ASSUMED TO BE ROUTED TO THE SALT RIVER
  98          HC       2

  99          KK     70S
 100          KM   RUNOFF FROM SUBBASIN 70
 101          BA    .164
 102          LG     .14     .15     7.8     .11      14
 103          UC    .690    .831
 104          UA       0       5      16      30      65      77      84      90      94      97
 105          UA     100

 106          KK     80S
 107          KM   RUNOFF FROM SUBBASIN 80
 108          BA    .202
 109          LG     .13     .15     8.1     .09      15
 110          UC    .630    .595
 111          UA       0       5      16      30      65      77      84      90      94      97
 112          UA     100

 113          KK     85C
 114          KM   COMBINE 70S AND 80S
 115          HC       2

 116          KK     86R
 117          KM   ROUTE 85C TO 95C
 118          RS      27    FLOW      -1
 119          RC    .040    .040    .040    2900   .0017
 120          RX       0       1     101     102     352     353     503     504
 121          RY     103     100      99      98      98      99      99     110

 122          KK     90S
 123          KM   RUNOFF FROM SUBBASIN 90
 124          BA    .068
 125          LG     .26     .15     8.5     .07      12
 126          UC    .524    .478
 127          UA       0       5      16      30      65      77      84      90      94      97
 128          UA     100

 129          KK     95C
 130          KM   COMBINE 86R AND 90S
 131          KM   RUNOFF ASSUMED TO BE COLLECTED IN A FUTURE DETENTION BASIN AT THE
 132          KM   RED MTN. FWY AND CENTER STREET
 133          HC       2

 134          KK    100S
 135          KM   RUNOFF FROM SUBBASIN 100
 136          KM   AREA REDUCED BY FWYCC SUBBASIN AREA
 137          BA    .039
 138          LG     .45     .21     6.5     .13       8
 139          UC   2.474   3.387
 140          UA       0       3       5       8      12      20      43      75      90      96
 141          UA     100
```

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

 142          KK   FWYCC
 143          KM   RUNOFF FROM FREEWAY SUBBASIN (MAINLINE AND COUNTRY CLUB RAMP D)
 144          KM   RED MTN FREEWAY FROM CENTER STREET TO COUNTRY CLUB DRIVE
 145          BA    .034
 146          LG    .072     .15     7.8     .13    56.3
 147          UC    .179    .227
 148          UA       0       5      16      30      65      77      84      90      94      97
 149          UA     100

 150          KK    100C
 151          KM   COMBINE 100S AND FWYCC
 152          HC       2

 153          KK  BASIN1
 154          KM       RESERVOIR ROUTE OF DETENTION BASIN AT S.E. COUNTRY CLUB DRIVE USING 12"
 155          KM       OUTLET PIPE ORIFICE FLOW.  INLET ASSUMED TO BE ORIFICE CONTROL SECTION
 156          KM       DUE TO INLET CONFIGURATION AND 24" STORM DRAIN CONNECTION.
 157          KO       3
 158          RS       1    STOR      -1       0
 159          SA       0   0.028   0.915   2.182   2.880   2.880
 160          SE  1206.3    1207    1209    1211    1213    1215
 161          SL  1207.3   0.785    0.62     0.5
 162          SS  1211.2       4     3.2     1.5

 163          KK  FWYCCA
 164          KM   RUNOFF FROM FREEWAY SUBBASIN (MAINLINE AND COUNTRY CLUB RAMP B)
 165          KM   RED MTN FREEWAY FROM 522+80 TO COUNTRY CLUB DRIVE
 166          BA    .009
 167          LG    .082     .15     7.0     .10    36.1
 168          UC    .116    .144
 169          UA       0       5      16      30      65      77      84      90      94      97
 170          UA     100

 171          KK  BASN1A
 172          KM       RESERVOIR ROUTE OF DETENTION BASIN AT S.W. COUNTRY CLUB DRIVE USING 12"
 173          KM       OUTLET PIPE ORIFICE FLOW.  INLET ASSUMED TO BE ORIFICE CONTROL SECTION
 174          KM       DUE TO INLET CONFIGURATION AND 24" STORM DRAIN CONNECTION.
 175          KO       3
 176          RS       1    STOR      -1       0
 177          SA    0.01   0.400   0.600   0.800   1.090   1.260   1.450
 178          SE    1206    1207    1208    1209    1210    1211    1212
 179          SL    1207   0.785    0.62     0.5
 180          SS  1208.5       4     3.2     1.5

 181          KK    110S
 182          KM   RUNOFF FROM SUBBASIN 110
 183          BA    .130
 184          LG     .36     .15     7.8     .09       7
 185          UC   2.822   2.997
 186          UA       0       3       5       8      12      20      43      75      90      96
 187          UA     100
```

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

 188          KK    120S
 189          KM   RUNOFF FROM SUBBASIN 120
 190          BA    .030
 191          LG     .12     .25     4.2     .50      34
 192          UC    .107    .026
 193          UA       0       5      16      30      65      77      84      90      94      97
 194          UA     100

 195          KK    121R
 196          KM   ROUTE 120S TO 135C
 197          RS       2    FLOW      -1
 198          RC    .030    .016    .030    1250   .0152
 199          RX       0     0.1      30    30.1      74    74.1     104   104.1
 200          RY     102     100      99    98.7    98.7      99     100     102

 201          KK    130S
 202          KM   RUNOFF FROM SUBBASIN 130
 203          BA    .028
 204          LG     .12     .19     6.7     .15      32
 205          UC    .214    .209
 206          UA       0       5      16      30      65      77      84      90      94      97
 207          UA     100

 208          KK   130RT
 209          KM   UNKNOWN STORM RETENTION IN SUBBASIN 130
 210          RS       1    STOR       0
 211          SV       0       3       3
 212          SE      99     100     105
 213          SS     100     100    2.63     1.5

 214          KK    135C
 215          KM   COMBINE 121R AND 130RT
 216          HC       2

 217          KK    136C
 218          KM   COMBINE 135C AND 110S
 219          HC       2

 220          KK    137R
 221          KM   ROUTE 136C WEST ON MCKELLIPS ROAD
 222          RS       5    FLOW      -1
 223          RC    .030    .016    .030    1400   .0026
 224          RX       0     0.1      50    50.1     118   118.1     168     169
 225          RY     102    99.5      99    98.6    98.6      99    99.5     102

 226          KK    140S
 227          KM   RUNOFF FROM SUBBASIN 140
 228          BA    .015
 229          LG     .07     .15     9.6     .04      85
 230          UC    .126    .151
 231          UA       0       5      16      30      65      77      84      90      94      97
 232          UA     100
```

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

 233          KK   145C
 234          KM   COMBINE 137R AND 140S
 235          HC      2

 236          KK   146R
 237          KM   ROUTE 145C TO 155C
 238          RS      2    FLOW     -1
 239          RC   .030    .016    .030     500   .0008
 240          RX      0     0.1      50    50.1     118   118.1     168     169
 241          RY    102    99.5      99    98.6    98.6      99    99.5     102

 242          KK   150S
 243          KM   RUNOFF FROM SUBBASIN 150
 244          BA   .084
 245          LG    .11     .15     7.8     .09      43
 246          UC   .305    .259
 247          UA      0       5      16      30      65      77      84      90      94      97
 248          UA    100

 249          KK   150RT
 250          KM   FIELD-ESTIMATED RETENTION IN SUBBASIN 150
 251          RS      1    STOR       0
 252          SV      0       3       3
 253          SE   97.5     100     105
 254          SS    100     200    2.63     1.5

 255          KK   155C
 256          KM   COMBINE 146R AND 150S
 257          HC      2

 258          KK   170S
 259          KM   RUNOFF FROM SUBBASIN 170
 260          BA   .007
 261          LG    .07     .16     7.0     .11      85
 262          UC   .105    .125
 263          UA      0       5      16      30      65      77      84      90      94      97
 264          UA    100

 265          KK   175C
 266          KM   COMBINE 155C AND 170S
 267          HC      2

 268          KK   176R
 269          KM   ROUTE 175C TO 165C
 270          RS      2    FLOW     -1
 271          RC   .030    .016    .030     650   .0011
 272          RX      0     0.1      50    50.1     118   118.1     168     169
 273          RY    102    99.5      99    98.6    98.6      99    99.5     102
```

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

 274          KK    160S
 275          KM   RUNOFF FROM SUBBASIN 160
 276          BA    .014
 277          LG     .10     .16     7.0     .13      54
 278          UC    .146    .154
 279          UA       0       5      16      30      65      77      84      90      94      97
 280          UA     100

 281          KK    180S
 282          KM   RUNOFF FROM SUBBASIN 180
 283          BA    .028
 284          LG     .12     .15     7.1     .13      35
 285          UC    .244    .228
 286          UA       0       5      16      30      65      77      84      90      94      97
 287          UA     100

 288          KK    185S
 289          KM   RUNOFF FROM SUBBASIN 185
 290          BA    .056
 291          LG     .12     .25     5.5     .25      35
 292          UC    .240    .147
 293          UA       0       5      16      30      65      77      84      90      94      97
 294          UA     100

 295          KK    186C
 296          KM   COMBINE 180S AND 185S
 297          HC       2

 298          KK    187R
 299          KM   ROUTE 186C TO 165C
 300          RS       5    FLOW      -1
 301          RC    .016    .030    .016    1350   .0004
 302          RX       0     0.1      50    50.1     114   114.1     164     165
 303          RY     102    99.5      99    98.6    98.6      99    99.5     102

 304          KK    165C
 305          KM   COMBINE 176R, 160S, AND 187R
 306          HC       3    .390

 307          KK   165DV
 308          KM   DIVERT 44 PERCENT OF FLOW SOUTH ON MESA DRIVE
 309          DT   165DV
 310          DI       0    2000
 311          DQ       0     880

 312          KK    190S
 313          KM   RUNOFF FROM SUBBASIN 190
 314          BA    .012
 315          LG     .10     .25     5.2     .27      47
 316          UC    .197    .280
 317          UA       0       5      16      30      65      77      84      90      94      97
 318          UA     100
```

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

 319          KK    195C
 320          KM   COMBINE 165C AND 190S
 321          HC       2

 322          KK    196R
 323          KM   ROUTE 195C TO 205C
 324          RS       3    FLOW      -1
 325          RC    .030    .016    .030    1000   .0015
 326          RX       0     0.1      50    50.1     118   118.1     168     169
 327          RY     102    99.5      99    98.6    98.6      99    99.5     102

 328          KK    200S
 329          KM   RUNOFF FROM SUBBASIN 200
 330          BA    .048
 331          LG     .10     .15     7.8     .10      54
 332          UC    .226    .198
 333          UA       0       5      16      30      65      77      84      90      94      97
 334          UA     100

 335          KK   200RT
 336          KM   UNKNOWN STORM RETENTION IN SUBBASIN 200
 337          RS       1    STOR       0
 338          SV       0       6       6
 339          SE    95.5     100     105
 340          SS     100     450    2.63     1.5

 341          KK    205C
 342          KM   COMBINE 196R AND 200S
 343          HC       2

 344          KK    220S
 345          KM   RUNOFF FROM SUBBASIN 220
 346          BA    .019
 347          LG     .10     .15     9.6     .05      54
 348          UC    .206    .238
 349          UA       0       5      16      30      65      77      84      90      94      97
 350          UA     100

 351          KK    225C
 352          KM   COMBINE 205C AND 220S
 353          HC       2

 354          KK    226R
 355          KM   ROUTE 225C TO 245C
 356          RS       2    FLOW      -1
 357          RC    .030    .016    .030     950   .0021
 358          RX       0     0.1      50    50.1     118   118.1     168     169
 359          RY     102    99.5      99    98.6    98.6      99    99.5     102
```

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

 360          KK    210S
 361          KM   RUNOFF FROM SUBBASIN 210
 362          BA    .046
 363          LG     .08     .15     9.6     .04      75
 364          UC    .234    .281
 365          UA       0       5      16      30      65      77      84      90      94      97
 366          UA     100

 367          KK    230S
 368          KM   RUNOFF FROM SUBBASIN 230
 369          BA    .029
 370          LG     .10     .15     9.6     .05      54
 371          UC    .220    .214
 372          UA       0       5      16      30      65      77      84      90      94      97
 373          UA     100

 374          KK    240S
 375          KM   RUNOFF FROM SUBBASIN 240
 376          BA    .012
 377          LG     .07     .15     9.6     .04      85
 378          UC    .117    .131
 379          UA       0       5      16      30      65      77      84      90      94      97
 380          UA     100

 381          KK    245C
 382          KM   COMBINE 226R, 210S, 230S, AND 240S
 383          HC       4

 384          KK    246R
 385          KM   ROUTE 245BC TO 255C
 386          RS       1    FLOW      -1
 387          RC    .030    .016    .030     600   .0035
 388          RX       0     0.1      50    50.1     118   118.1     168     169
 389          RY     102    99.5      99    98.6    98.6      99    99.5     102

 390          KK    250S
 391          KM   RUNOFF FROM SUBBASIN 250
 392          BA    .018
 393          LG     .07     .15     9.6     .04      85
 394          UC    .107    .082
 395          UA       0       5      16      30      65      77      84      90      94      97
 396          UA     100

 397          KK    255C
 398          KM   COMBINE 246R AND 250S
 399          HC       2

 400          KK    256R
 401          KM   ROUTE 255C TO 265C
 402          RS       5    FLOW      -1
 403          RC    .030    .016    .030    2000   .0019
 404          RX       0     0.1      50    50.1     118   118.1     168     169
 405          RY     102    99.5      99    98.6    98.6      99    99.5     102
```

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

 406          KK   260S
 407          KM   RUNOFF FROM SUBBASIN 260
 408          BA   .114
 409          LG    .09     .15     9.6     .05      56
 410          UC   .297    .250
 411          UA      0       5      16      30      65      77      84      90      94      97
 412          UA    100

 413          KK   260RT
 414          KM   50-YEAR, 24-HOUR RETENTION IN SUBBASIN 260
 415          RS      1    STOR       0
 416          SV      0      16      16
 417          SE     96     100     105
 418          SS    100     420    2.63     1.5

 419          KK   265C
 420          KM   COMBINE 256R AND 260RT
 421          HC      2

 422          KK   265DV
 423          KM   DIVERT 70 PERCENT OF FLOW SOUTH ON COUNTRY CLUB DRIVE
 424          DT   265DV
 425          DI      0    2000
 426          DQ      0    1400

 427          KK   266R
 428          KM   ROUTE 265C TO 275C
 429          RS     10    FLOW      -1
 430          RC   .030    .016    .030    2450   .0065
 431          RX      0     0.1      50    50.1     118   118.1     168     169
 432          RY    102    99.5      99    98.6    98.6      99    99.5     102

 433          KK   270S
 434          KM   RUNOFF FROM SUBBASIN 270
 435          KM   AREA REDUCED BY FWYCC SUBBASIN AREA
 436          BA   .056
 437          LG    .09     .15     7.1     .11      41
 438          UC   .203    .155
 439          UA      0       5      16      30      65      77      84      90      94      97
 440          UA    100

 441          KK   274C1
 442          KM   COMBINE 266R AND 270S
 443          HC      2

 444          KK   FWYMC
 445          KM   RUNOFF FROM CONTRIBUTING FREEWAY AREAS TO MCKELLIPS BASIN
 446          BA   .012
 447          LG   .068     .15     7.0     .10      64
 448          UC   .069    .074
 449          UA      0       5      16      30      65      77      84      90      94      97
 450          UA    100
```

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

 451          KK   274C2
 452          KM   COMBINE 274C1 AND FWYMC
 453          HC       2

 454          KK  BASIN2
 455          KM       RESERVOIR ROUTE OF OUTFALL DETENTION BASIN AT McKELLIPS ROAD
 456          KM       2-48" OUTLET PIPES W/ 10-YR SALT RIVER TAILWATER CONDITIONS
 457          KO       3
 458          RS       1    STOR      -1       0
 459          SA       0   0.061   0.413   0.606
 460          SE    1200    1201    1202    1206
 461          SQ       0      20      40      80     160     200
 462          SE    1200 1202.53 1202.62 1202.97 1204.38 1205.45
 463          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

   19        10S
               V
               V
   27        11R
               .
               .
   33          .         30S
               .           .
               .           .
   40        35C............
               V
               V
   43        36R
               .
               .
   49          .         40S
               .           .
               .           .
   56        45C............
               .
               .
   59          .         20S
               .           V
               .           V
   66          .         21R
               .           .
               .           .
   72          .           .         50S
               .           .           .
               .           .           .
   79          .         55C............
               .           V
               .           V
   82          .         56R
               .           .
               .           .
   88          .           .         60S
               .           .           .
               .           .           .
   95          .         65C............
               .           .
               .           .
   99          .           .         70S
               .           .           .
               .           .           .
  106          .           .           .         80S
               .           .           .           .
               .           .           .           .
  113          .           .         85C............
               .           .           V
               .           .           V
  116          .           .         86R
               .           .           .
               .           .           .
  122          .           .           .         90S
               .           .           .           .
               .           .           .           .
  129          .           .         95C............
               .           .           .
```

```
134     .       .       .       100S
        .       .       .         .
        .       .       .         .
142     .       .       .         .       FWYCC
        .       .       .         .         .
        .       .       .         .         .
150     .       .       .       100C............
        .       .       .         V
        .       .       .         V
153     .       .       .     BASIN1
        .       .       .         .
        .       .       .         .
163     .       .       .         .       FWYCCA
        .       .       .         .           V
        .       .       .         .           V
171     .       .       .         .       BASN1A
        .       .       .         .           .
        .       .       .         .           .
181     .       .       .         .           .       110S
        .       .       .         .           .         .
        .       .       .         .           .         .
188     .       .       .         .           .         .       120S
        .       .       .         .           .         .         V
        .       .       .         .           .         .         V
195     .       .       .         .           .         .       121R
        .       .       .         .           .         .         .
        .       .       .         .           .         .         .
201     .       .       .         .           .         .         .       130S
        .       .       .         .           .         .         .         V
        .       .       .         .           .         .         .         V
208     .       .       .         .           .         .         .     130RT
        .       .       .         .           .         .         .       .
        .       .       .         .           .         .         .       .
214     .       .       .         .           .         .       135C............
        .       .       .         .           .         .         .
        .       .       .         .           .         .         .
217     .       .       .         .           .       136C............
        .       .       .         .           .         V
        .       .       .         .           .         V
220     .       .       .         .           .       137R
        .       .       .         .           .         .
        .       .       .         .           .         .
226     .       .       .         .           .         .       140S
        .       .       .         .           .         .         .
        .       .       .         .           .         .         .
233     .       .       .         .           .       145C............
        .       .       .         .           .         V
        .       .       .         .           .         V
236     .       .       .         .           .       146R
        .       .       .         .           .         .
        .       .       .         .           .         .
242     .       .       .         .           .         .       150S
        .       .       .         .           .         .         V
        .       .       .         .           .         .         V
249     .       .       .         .           .         .     150RT
        .       .       .         .           .         .         .
        .       .       .         .           .         .         .
255     .       .       .         .           .       155C............
        .       .       .         .           .         .
        .       .       .         .           .         .
258     .       .       .         .           .         .       170S
        .       .       .         .           .         .         .
        .       .       .         .           .         .         .
265     .       .       .         .           .       175C............
        .       .       .         .           .         V
```

```
                 .         .         .         .         .         V
268              .         .         .         .         .       176R
                 .         .         .         .         .         .
                 .         .         .         .         .         .
274              .         .         .         .         .         .       160S
                 .         .         .         .         .         .         .
                 .         .         .         .         .         .         .
281              .         .         .         .         .         .         .       180S
                 .         .         .         .         .         .         .         .
                 .         .         .         .         .         .         .         .
288              .         .         .         .         .         .         .         .         185S
                 .         .         .         .         .         .         .         .           .
                 .         .         .         .         .         .         .         .           .
295              .         .         .         .         .         .         .         .       186C............
                 .         .         .         .         .         .         .         .           V
                 .         .         .         .         .         .         .         .           V
298              .         .         .         .         .         .         .         .       187R
                 .         .         .         .         .         .         .         .         .
                 .         .         .         .         .         .         .         .         .
304              .         .         .         .         .       165C.......................
                 .         .         .         .         .         .
                 .         .         .         .         .         .
309              .         .         .         .         .         .-------->   165DV
307              .         .         .         .         .      165DV
                 .         .         .         .         .         .
                 .         .         .         .         .         .
312              .         .         .         .         .         .       190S
                 .         .         .         .         .         .         .
                 .         .         .         .         .         .         .
319              .         .         .         .         .       195C............
                 .         .         .         .         .         V
                 .         .         .         .         .         V
322              .         .         .         .         .       196R
                 .         .         .         .         .         .
                 .         .         .         .         .         .
328              .         .         .         .         .         .       200S
                 .         .         .         .         .         .         V
                 .         .         .         .         .         .         V
335              .         .         .         .         .         .      200RT
                 .         .         .         .         .         .         .
                 .         .         .         .         .         .         .
341              .         .         .         .         .       205C............
                 .         .         .         .         .         .
                 .         .         .         .         .         .
344              .         .         .         .         .         .       220S
                 .         .         .         .         .         .         .
                 .         .         .         .         .         .         .
351              .         .         .         .         .       225C............
                 .         .         .         .         .         V
                 .         .         .         .         .         V
354              .         .         .         .         .       226R
                 .         .         .         .         .         .
                 .         .         .         .         .         .
360              .         .         .         .         .         .       210S
                 .         .         .         .         .         .         .
                 .         .         .         .         .         .         .
367              .         .         .         .         .         .         .       230S
                 .         .         .         .         .         .         .         .
                 .         .         .         .         .         .         .         .
374              .         .         .         .         .         .         .         .         240S
                 .         .         .         .         .         .         .         .           .
                 .         .         .         .         .         .         .         .           .
381              .         .         .         .         .       245C.......................................
                 .         .         .         .         .         V
                 .         .         .         .         .         V
384              .         .         .         .         .       246R
```

```
                .         .         .         .         .         .
                .         .         .         .         .         .
390             .         .         .         .         .         .        250S
                .         .         .         .         .         .          .
                .         .         .         .         .         .          .
397             .         .         .         .         .      255C............
                .         .         .         .         .         V
                .         .         .         .         .         V
400             .         .         .         .         .      256R
                .         .         .         .         .         .
                .         .         .         .         .         .
406             .         .         .         .         .         .        260S
                .         .         .         .         .         .          V
                .         .         .         .         .         .          V
413             .         .         .         .         .         .       260RT
                .         .         .         .         .         .          .
                .         .         .         .         .         .          .
419             .         .         .         .         .      265C............
                .         .         .         .         .         .
                .         .         .         .         .         .
424             .         .         .         .         .         .-------->   265DV
422             .         .         .         .         .     265DV
                .         .         .         .         .         V
                .         .         .         .         .         V
427             .         .         .         .         .      266R
                .         .         .         .         .         .
                .         .         .         .         .         .
433             .         .         .         .         .         .        270S
                .         .         .         .         .         .          .
                .         .         .         .         .         .          .
441             .         .         .         .         .     274C1............
                .         .         .         .         .         .
                .         .         .         .         .         .
444             .         .         .         .         .         .       FWYMC
                .         .         .         .         .         .          .
                .         .         .         .         .         .          .
451             .         .         .         .         .     274C2............
                .         .         .         .         .         V
                .         .         .         .         .         V
454             .         .         .         .         .    BASIN2
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              MAY   1991              *
            VERSION 4.0.1E             *
*                                      *
*  RUN DATE  12/16/96  TIME  08:12:19  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 551-1748             *
*                                      *
****************************************
```

RED MOUNTAIN FREEWAY DRAINAGE ANALYSIS
PHASE III - McKELLIPS ROAD TO COUNTRY CLUB DRIVE
100-YEAR, 24-HOUR STORM
HEC-1 HYPOTHETHICAL RAINFALL DISTRIBUTION
RAINFALL DEPTHS IN PH RECORD BASED ON PREFRE OUTPUT
CLARK UNIT HYDROGRAPH
GREEN-AMPT SOIL LOSS PARAMETERS
NORMAL DEPTH CHANNEL ROUTING
IN GENERAL, URBANIZED AREAS IN THE CITY OF MESA BUILT BETWEEN 1973
AND 1987 WERE DESIGNED TO RETAIN THE 50-YEAR, 24-HOUR RAINFALL; FROM 1987
TO PRESENT, THE RETENTION REQUIREMENT IS THE 100-YEAR, 2-HOUR RAINFALL.
DIVERSIONS ALONG MAJOR STREETS WERE ESTIMATED BASED ON AS-BUILT ROADWAY
AND STORM DRAIN PLANS, STORM DRAIN STUDY REPORTS, AND FIELD INSPECTION.
** FLOW TAKEN ACROSS RED MOUNTAIN FREEWAY AT CP 65C **
FREEWAY CONTRIBUTING AREA ADDED AT MCKELLIPS AND COUNTRY CLUB DRIVE BASINS
FILENAME: RMP3_FWY.DAT

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

    IT          HYDROGRAPH TIME DATA
                       NMIN          2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        720  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1    0  ENDING DATE
                     NDTIME       2358  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL    0.03 HOURS
                      TOTAL TIME BASE   23.97 HOURS

         ENGLISH UNITS
              DRAINAGE AREA         SQUARE MILES
              PRECIPITATION DEPTH   INCHES
              LENGTH, ELEVATION     FEET
              FLOW                  CUBIC FEET PER SECOND
              STORAGE VOLUME        ACRE-FEET
              SURFACE AREA          ACRES
              TEMPERATURE           DEGREES FAHRENHEIT
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          *            *
 153 KK   *    BASIN1  *
          *            *
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157 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          3  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

              HYDROGRAPH ROUTING DATA

158 RS          STORAGE ROUTING
                      NSTPS          1  NUMBER OF SUBREACHES
                       ITYP       STOR  TYPE OF INITIAL CONDITION
                     RSVRIC      -1.00  INITIAL CONDITION
                          X       0.00 WORKING R AND D COEFFICIENT

159 SA               AREA        0.0       0.0       0.9       2.2       2.9       2.9

160 SE          ELEVATION     1206.30   1207.00   1209.00   1211.00   1213.00   1215.00

161 SL          LOW-LEVEL OUTLET
                      ELEVL     1207.30  ELEVATION AT CENTER OF OUTLET
                      CAREA        0.79  CROSS-SECTIONAL AREA
                       COQL        0.62  COEFFICIENT
                       EXPL        0.50  EXPONENT OF HEAD

162 SS          SPILLWAY
                       CREL     1211.20  SPILLWAY CREST ELEVATION
                      SPWID        4.00  SPILLWAY WIDTH
                       COQW        3.20  WEIR COEFFICIENT
                       EXPW        1.50  EXPONENT OF HEAD

                                                  ***

                                    COMPUTED STORAGE-ELEVATION DATA

          STORAGE       0.00      0.01      0.74      3.75      8.79     14.55
        ELEVATION    1206.30   1207.00   1209.00   1211.00   1213.00   1215.00

                                    COMPUTED OUTFLOW-ELEVATION DATA

          OUTFLOW       0.00      0.00      2.77      3.05      3.39      3.82      4.37      5.11      6.14      7.71
        ELEVATION    1206.30   1207.30   1207.80   1207.91   1208.05   1208.26   1208.55   1209.01   1209.78   1211.20

          OUTFLOW       7.95      8.92     11.14     15.15     21.46     30.58     43.04     59.36     80.06    105.65
        ELEVATION    1211.26   1211.39   1211.59   1211.86   1212.20   1212.62   1213.10   1213.66   1214.30   1215.00

                                  COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE       0.00      0.01      0.02      0.10      0.13      0.17      0.25      0.40      0.74      0.75
          OUTFLOW       0.00      0.00      0.00      2.77      3.05      3.39      3.82      4.37      5.09      5.11
        ELEVATION    1206.30   1207.00   1207.30   1207.80   1207.91   1208.05   1208.26   1208.55   1209.00   1209.01

          STORAGE       1.61      3.75      4.19      4.32      4.61      5.08      5.74      6.61      7.72      8.79
          OUTFLOW       6.14      7.51      7.71      7.95      8.91     11.14     15.15     21.46     30.58     40.23
        ELEVATION    1209.78   1211.00   1211.20   1211.26   1211.39   1211.59   1211.86   1212.20   1212.62   1213.00

          STORAGE       9.10     10.71     12.53     14.55
          OUTFLOW      43.04     59.36     80.06    105.65
        ELEVATION    1213.10   1213.66   1214.30   1215.00

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                     HYDROGRAPH AT STATION   BASIN1

PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
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  (CFS)      (HR)                 6-HR       24-HR       72-HR     23.97-HR
     8.     15.93      (CFS)       8.          4.          4.          4.
                     (INCHES)    0.959       1.975       1.975       1.975
                      (AC-FT)       4.          8.          8.          8.

PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
  (AC-FT)      (HR)                 6-HR       24-HR       72-HR     23.97-HR
     4.     15.87                    4.          2.          2.          2.

 PEAK STAGE    TIME                         MAXIMUM AVERAGE STAGE
   (FEET)      (HR)                 6-HR       24-HR       72-HR     23.97-HR
  1211.14     15.93              1211.02     1209.03     1209.03     1209.03

                       CUMULATIVE AREA =    0.07 SQ MI


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          *            *
171 KK    *   BASN1A   *
          *            *
          **************

175 KO         OUTPUT CONTROL VARIABLES
                     IPRNT          3  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

            HYDROGRAPH ROUTING DATA

176 RS         STORAGE ROUTING
                     NSTPS          1  NUMBER OF SUBREACHES
                      ITYP       STOR  TYPE OF INITIAL CONDITION
                    RSVRIC      -1.00  INITIAL CONDITION
                         X       0.00 WORKING R AND D COEFFICIENT

177 SA              AREA        0.0       0.4       0.6       0.8       1.1       1.3       1.5

178 SE         ELEVATION     1206.00   1207.00   1208.00   1209.00   1210.00   1211.00   1212.00

179 SL         LOW-LEVEL OUTLET
                     ELEVL     1207.00  ELEVATION AT CENTER OF OUTLET
                     CAREA        0.79  CROSS-SECTIONAL AREA
                      COQL        0.62  COEFFICIENT
                      EXPL        0.50  EXPONENT OF HEAD

180 SS         SPILLWAY
                      CREL     1208.50  SPILLWAY CREST ELEVATION
                     SPWID        4.00  SPILLWAY WIDTH
                      COQW        3.20  WEIR COEFFICIENT
                      EXPW        1.50  EXPONENT OF HEAD

                                                   ***

                                          COMPUTED STORAGE-ELEVATION DATA

          STORAGE       0.00      0.16      0.65      1.35      2.29      3.47      4.82
        ELEVATION    1206.00   1207.00   1208.00   1209.00   1210.00   1211.00   1212.00

                                          COMPUTED OUTFLOW-ELEVATION DATA

          OUTFLOW       0.00      0.00      2.70      2.87      3.08      3.32      3.59      3.92      4.30      4.78
```

ELEVATION	1206.00	1207.00	1207.48	1207.54	1207.62	1207.72	1207.85	1208.01	1208.22	1208.50
OUTFLOW	5.12	6.18	8.40	12.21	18.05	26.33	37.49	51.95	70.16	92.54
ELEVATION	1208.57	1208.69	1208.88	1209.14	1209.45	1209.84	1210.28	1210.79	1211.36	1212.00

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	0.16	0.37	0.40	0.44	0.50	0.56	0.65	0.79	0.98
OUTFLOW	0.00	0.00	2.70	2.87	3.08	3.32	3.59	3.90	4.30	4.78
ELEVATION	1206.00	1207.00	1207.48	1207.54	1207.62	1207.72	1207.85	1208.00	1208.22	1208.50
STORAGE	1.03	1.12	1.26	1.35	1.46	1.74	2.12	2.29	2.61	3.21
OUTFLOW	5.12	6.17	8.40	10.05	12.21	18.05	26.33	30.28	37.49	51.95
ELEVATION	1208.57	1208.69	1208.88	1209.00	1209.14	1209.45	1209.84	1210.00	1210.28	1210.79
STORAGE	3.47	3.94	4.82							
OUTFLOW	58.40	70.16	92.54							
ELEVATION	1211.00	1211.36	1212.00							

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HYDROGRAPH AT STATION BASN1A

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	23.97-HR
5.	12.57	(CFS)	2.	1.	1.	1.
		(INCHES)	2.383	2.637	2.637	2.637
		(AC-FT)	1.	1.	1.	1.

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	23.97-HR
1.	12.57	0.	0.	0.	0.

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	23.97-HR
1208.47	12.57	1207.56	1207.15	1207.15	1207.15

CUMULATIVE AREA = 0.01 SQ MI

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          *            *
454 KK    *   BASIN2   *
          *            *
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457 KO        OUTPUT CONTROL VARIABLES
                    IPRNT          3  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

            HYDROGRAPH ROUTING DATA

458 RS        STORAGE ROUTING
                    NSTPS          1  NUMBER OF SUBREACHES
                     ITYP       STOR  TYPE OF INITIAL CONDITION
                   RSVRIC      -1.00  INITIAL CONDITION
                        X       0.00 WORKING R AND D COEFFICIENT

459 SA            AREA        0.0      0.1      0.4      0.6
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460 SE	ELEVATION	1200.00	1201.00	1202.00	1206.00		
461 SQ	DISCHARGE	0.	20.	40.	80.	160.	200.
462 SE	ELEVATION	1200.00	1202.53	1202.62	1202.97	1204.38	1205.45

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COMPUTED STORAGE-ELEVATION DATA

STORAGE	0.00	0.02	0.23	2.26
ELEVATION	1200.00	1201.00	1202.00	1206.00

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	0.02	0.23	0.46	0.50	0.65	1.34	1.93	2.26
OUTFLOW	0.00	7.91	15.81	20.00	40.00	80.00	160.00	200.00	220.56
ELEVATION	1200.00	1201.00	1202.00	1202.53	1202.62	1202.97	1204.38	1205.45	1206.00

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

HYDROGRAPH AT STATION BASIN2

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	23.97-HR
176.	12.23	(CFS)	43.	13.	13.	13.
		(INCHES)	0.528	0.623	0.623	0.623
		(AC-FT)	21.	25.	25.	25.

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	23.97-HR
2.	12.23	0.	0.	0.	0.

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	23.97-HR
1204.82	12.23	1202.23	1200.80	1200.80	1200.80

CUMULATIVE AREA = 0.76 SQ MI

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	10S	90.	16.40	68.	20.	20.	0.87		
ROUTED TO	11R	90.	16.83	68.	20.	20.	0.87	98.72	16.83
HYDROGRAPH AT	30S	280.	16.60	202.	59.	59.	1.41		
2 COMBINED AT	35C	368.	16.67	269.	79.	79.	2.28		
ROUTED TO	36R	368.	16.93	269.	78.	78.	2.28	98.68	16.93
HYDROGRAPH AT	40S	66.	15.27	45.	13.	13.	0.28		
2 COMBINED AT	45C	417.	16.87	305.	92.	92.	2.56		
HYDROGRAPH AT	20S	111.	12.50	26.	7.	7.	0.11		
ROUTED TO	21R	103.	13.80	26.	7.	7.	0.11	98.32	13.80
HYDROGRAPH AT	50S	542.	12.57	118.	31.	31.	0.49		
2 COMBINED AT	55C	544.	12.57	143.	37.	37.	0.60		
ROUTED TO	56R	536.	12.83	143.	37.	37.	0.60	98.91	12.83
HYDROGRAPH AT	60S	252.	12.23	28.	8.	8.	0.12		
2 COMBINED AT	65C	592.	12.77	171.	45.	45.	0.71		
HYDROGRAPH AT	70S	162.	12.53	38.	10.	10.	0.16		
HYDROGRAPH AT	80S	253.	12.43	49.	13.	13.	0.20		
2 COMBINED AT	85C	414.	12.47	87.	23.	23.	0.37		
ROUTED TO	86R	408.	12.87	87.	23.	23.	0.37	98.98	12.87
HYDROGRAPH AT	90S	100.	12.37	16.	4.	4.	0.07		
2 COMBINED AT	95C	462.	12.83	103.	27.	27.	0.43		
HYDROGRAPH AT	100S	11.	14.20	6.	2.	2.	0.04		
HYDROGRAPH AT	FWYCC	86.	12.13	9.	3.	3.	0.03		
2 COMBINED AT	100C	87.	12.13	15.	5.	5.	0.07		
ROUTED TO	BASIN1	8.	15.93	8.	4.	4.	0.07	1211.14	15.93
HYDROGRAPH AT	FWYCCA	29.	12.10	2.	1.	1.	0.01		
ROUTED TO	BASN1A	5.	12.57	2.	1.	1.	0.01	1208.47	12.57
HYDROGRAPH AT	110S	42.	14.43	24.	7.	7.	0.13		
HYDROGRAPH AT	120S	135.	12.03	6.	2.	2.	0.03		
ROUTED TO	121R	125.	12.07	6.	2.	2.	0.03	99.13	12.07

HYDROGRAPH AT	130S	70.	12.17	7.	2.	2.	0.03		
ROUTED TO	130RT	21.	12.60	1.	0.	0.	0.03	100.28	12.60
2 COMBINED AT	135C	125.	12.07	7.	2.	2.	0.06		
2 COMBINED AT	136C	126.	12.07	29.	9.	9.	0.19		
ROUTED TO	137R	109.	12.17	29.	9.	9.	0.19	99.12	12.17
HYDROGRAPH AT	140S	48.	12.10	5.	1.	1.	0.01		
2 COMBINED AT	145C	153.	12.17	33.	10.	10.	0.20		
ROUTED TO	146R	139.	12.23	33.	10.	10.	0.20	99.42	12.23
HYDROGRAPH AT	150S	190.	12.20	22.	6.	6.	0.08		
ROUTED TO	150RT	190.	12.20	18.	5.	5.	0.08	100.48	12.60
2 COMBINED AT	155C	327.	12.23	51.	15.	15.	0.29		
HYDROGRAPH AT	170S	24.	12.10	2.	1.	1.	0.01		
2 COMBINED AT	175C	342.	12.23	52.	16.	16.	0.29		
ROUTED TO	176R	330.	12.30	52.	16.	16.	0.29	99.77	12.30
HYDROGRAPH AT	160S	43.	12.10	4.	1.	1.	0.01		
HYDROGRAPH AT	180S	68.	12.17	7.	2.	2.	0.03		
HYDROGRAPH AT	185S	156.	12.13	13.	4.	4.	0.06		
2 COMBINED AT	186C	222.	12.17	20.	5.	5.	0.08		
ROUTED TO	187R	191.	12.37	20.	5.	5.	0.08	99.91	12.37
3 COMBINED AT	165C	528.	12.33	75.	22.	22.	0.39		
DIVERSION TO	165DV	232.	12.33	33.	10.	10.	0.39		
HYDROGRAPH AT	165DV	296.	12.33	42.	12.	12.	0.39		
HYDROGRAPH AT	190S	26.	12.17	3.	1.	1.	0.01		
2 COMBINED AT	195C	316.	12.30	45.	13.	13.	0.40		
ROUTED TO	196R	303.	12.40	45.	13.	13.	0.40	99.64	12.40
HYDROGRAPH AT	200S	128.	12.17	13.	4.	4.	0.05		
ROUTED TO	200RT	34.	12.63	2.	1.	1.	0.05	100.12	12.63
2 COMBINED AT	205C	303.	12.40	47.	14.	14.	0.45		
HYDROGRAPH AT	220S	48.	12.17	5.	2.	2.	0.02		
2 COMBINED AT	225C	333.	12.40	52.	15.	15.	0.47		
ROUTED TO	226R	320.	12.47	52.	15.	15.	0.47	99.58	12.47
HYDROGRAPH AT	210S	106.	12.17	14.	4.	4.	0.05		
HYDROGRAPH AT	230S	76.	12.17	8.	2.	2.	0.03		

HYDROGRAPH AT	240S	41.	12.10	4.	1.	1.	0.01		
4 COMBINED AT	245C	438.	12.43	77.	23.	23.	0.56		
ROUTED TO	246R	433.	12.47	77.	23.	23.	0.56	99.61	12.47
HYDROGRAPH AT	250S	72.	12.07	6.	2.	2.	0.02		
2 COMBINED AT	255C	445.	12.47	82.	25.	25.	0.58		
ROUTED TO	256R	433.	12.60	82.	25.	25.	0.58	99.77	12.60
HYDROGRAPH AT	260S	268.	12.20	33.	9.	9.	0.11		
ROUTED TO	260RT	25.	13.10	4.	1.	1.	0.11	100.07	13.10
2 COMBINED AT	265C	433.	12.60	85.	26.	26.	0.69		
DIVERSION TO	265DV	303.	12.60	60.	18.	18.	0.69		
HYDROGRAPH AT	265DV	130.	12.60	26.	8.	8.	0.69		
ROUTED TO	266R	129.	12.70	26.	8.	8.	0.69	99.03	12.70
HYDROGRAPH AT	270S	166.	12.13	15.	4.	4.	0.06		
2 COMBINED AT	274C1	176.	12.13	40.	12.	12.	0.75		
HYDROGRAPH AT	FWYMC	49.	12.03	3.	1.	1.	0.01		
2 COMBINED AT	274C2	212.	12.10	43.	13.	13.	0.76		
ROUTED TO	BASIN2	176.	12.23	43.	13.	13.	0.76	1204.82	12.23

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

STANLEY CONSULTANTS

Project No. 13194 Page No.

Subject McKELLIPS ROAD BASIN
RAINFALL LOSSES / CLARK UNIT
FWYPC SWC BASIN

Computed by JRM Date 9/10/96

Checked by Date

Approved by Date

Sheet No. 1 of 2

MCKELLIPS ROAD BASIN:

PAVEMENT AREA: (1.16 + 0.93 + 3.18) = 4.77 Ac
R/W & INFIELD AREA: (0.41 + 2.22) = 2.63 Ac.
TOTAL = 7.40 Ac

BASIN AREA (A) = 0.012 sq. miles.

HIGHEST	STA 507+05	1237
	STA 507+60	1226
LOWEST	STA 512+60	1200
	L = 1225'	37'

r = 0.232 miles
L_{CA} = 700' = 0.039 miles

SLOPE = 37' / 0.232 = 159.5 '/mile

PERVIOUS = 4.77 / 7.40 = 64.4%

DESCRIPTION	AREA	IF
PAVEMENT	4.77	0.05
R/W & INFIELD	2.63	0.10

IF = (4.77 / 7.40)(0.05) + (2.63 / 7.40)(0.10) = 0.068

SMAP = 0.10 (COMPOSITE TABLE I)

IMPERVIOUS AREA < 10% ∴ S_K = 1.0

DT-ETP = 0.15 INCHES

PSF = 7.0

STANLEY CONSULTANTS

Project No. 13194 Page No.

Subject MCKELLOPS ROAD BASIN
RAINFALL LOSSES/CLARK UNIT
FWYMC SUB BASIN

Computed by JRM Date 9/10/96

Checked by Date

Approved by Date

Sheet No. 2 of 2

$T_c = 3.2(0.012)^{0.1}(0.232)^{0.25}(0.038)^{0.25}(159.5)^{-0.14}(64.46)^{-0.36}$

$T_c = 0.069$ hrs.

$R = 0.37(0.069)^{1.11}(0.232)^{0.8}(0.012)^{-0.57}$

$R = 0.074$

USE: WATER TIME FROM FEATURE -

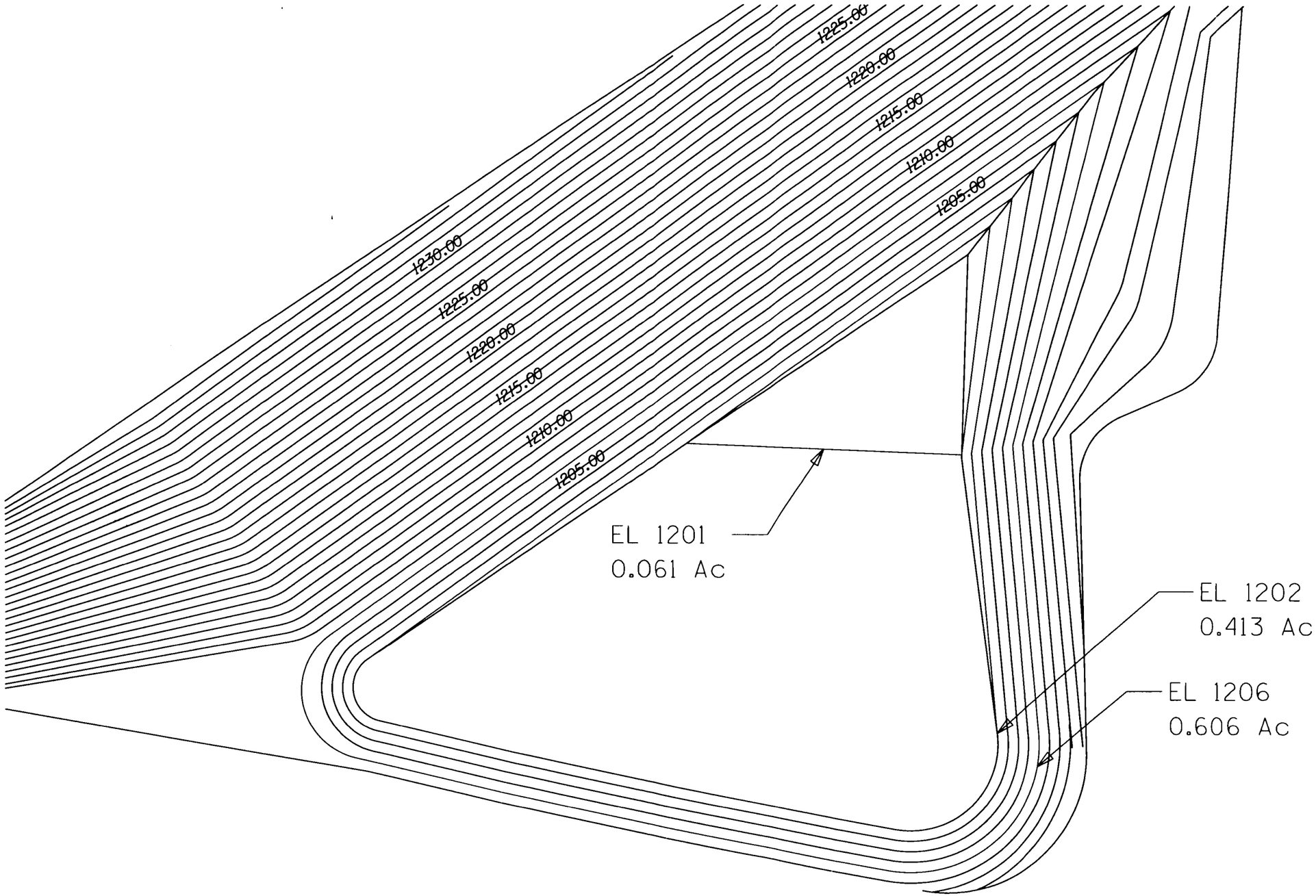
HEC-1 LOSS FEATURE:

	IA	DTHTP	PSI	XKSAT	RTIMP
LS	0.068	0.15	7.0	0.10	64.46

REDUCE SUB BASIN 2705 AREA FOR FWY:

2705 − FWYMC = 0.068 − 0.012 = 0.056 sq. mi.

SC 3004R3 795



13194
McKELLIPS ROAD
DETENTION BASIN
GRADING PLAN
9/10/96

CURRENT DATE: 09-21-1996
CURRENT TIME: 15:05:14

FILE DATE: 09-21-1996
FILE NAME: MCKELL

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	SITE DATA: OUTLET ELEV. (FT)	SITE DATA: CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1200.00	1198.50	358.00	2 RCP	4.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: MCKELL DATE: 09-21-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1202.50	0	0	0	0	0	0	0	0	1
1202.53	20	20	0	0	0	0	0	0	1
02.62	40	40	0	0	0	0	0	0	1
1202.77	60	60	0	0	0	0	0	0	1
1202.97	80	80	0	0	0	0	0	0	1
1203.24	100	100	0	0	0	0	0	0	1
1203.56	120	120	0	0	0	0	0	0	1
1203.94	140	140	0	0	0	0	0	0	1
1204.38	160	160	0	0	0	0	0	0	1
1204.93	180	180	0	0	0	0	0	0	1
1205.45	200	200	0	0	0	0	0	0	1
1230.00	611	611	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: MCKELL DATE: 09-21-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1202.50	0.00	0	0	0.00
1202.53	0.00	20	0	0.00
1202.62	0.00	40	0	0.00
1202.77	0.00	60	0	0.00
1202.97	0.00	80	0	0.00
1203.24	0.00	100	0	0.00
1203.56	0.00	120	0	0.00
1203.94	0.00	140	0	0.00
1204.38	0.00	160	0	0.00
1204.93	0.00	180	0	0.00
1205.45	0.00	200	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 0.500

CURRENT DATE: 09-21-1996 FILE DATE: 09-21-1996
CURRENT TIME: 15:05:14 FILE NAME: MCKELL

PERFORMANCE CURVE FOR CULVERT # 1 - 2 (4 BY 4) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1202.50	0.00	2.50	0-NF	0.00	0.00	0.00	0.00	0.00	4.00
20	1202.53	1.13	2.53	1-S1f	0.84	0.91	0.80	4.00	0.00	4.00
40	1202.62	1.77	2.62	1-S1f	1.21	1.31	1.59	4.00	0.00	4.00
60	1202.77	2.30	2.77	1-S1f	1.49	1.62	2.39	4.00	0.00	4.00
80	1202.97	2.75	2.97	1-S1f	1.75	1.88	3.18	4.00	0.00	4.00
100	1203.24	3.15	3.24	1-S1f	1.99	2.11	3.98	4.00	0.00	4.00
120	1203.56	3.53	3.56	1-S1f	2.22	2.33	4.77	4.00	0.00	4.00
140	1203.94	3.91	3.94	1-S1f	2.45	2.52	5.57	4.00	0.00	4.00
160	1204.38	4.31	4.38	4-FFt	2.69	2.70	6.37	4.00	0.00	4.00
180	1204.93	4.73	4.93	3-M1f	2.96	2.87	7.16	4.00	0.00	4.00
200	1205.45	5.20	5.45	3-M1f	3.26	3.02	7.96	4.00	0.00	4.00

El. inlet face invert 1200.00 ft El. outlet invert 1198.50 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

** * SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	0.00
INLET ELEVATION (FT)	1200.00
OUTLET STATION (FT)	358.00
OUTLET ELEVATION (FT)	1198.50
NUMBER OF BARRELS	2
SLOPE (V-FT/H-FT)	0.0042
CULVERT LENGTH ALONG SLOPE (FT)	358.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	4.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

CURRENT DATE: 09-21-1996 FILE DATE: 09-21-1996
CURRENT TIME: 15:05:14 FILE NAME: MCKELL

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1202.50

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	150.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	1230.00

STANLEY CONSULTANTS

Project No. 13194 Page No.

Subject COUNTRY CLUB DRIVE
RAINFALL LOSSES / CLARK UNIT
FWYCC SUB BASIN

Computed by JFH Date 9.9.96

Checked by Date

Approved by Date

Sheet No. 1 of 2

COUNTRY CLUB DETENTION BASIN: (S.E. QUADRANT)

FINISHED C.C.: (7.61 − 1.18) + 5.70	=	7.13 Ac
R/W AREA: 1.18 + 8.40	=	9.58 Ac.
RIGHT LINE C.C.: (7.46 − 1.32 − 0.97)	=	5.21 Ac.
		21.92 Ac.

CA = 0.034 sq. Miles

CENTER STREET	STA 506+00	1245
SOUTH END	STA 536+00	1206
	2800'	39'

L = 0.530 miles

L_{CA} = 1/2 L = 0.265

SLOPE S = 39/0.530 = 73.5 /mile

$$\text{RTIF} = \frac{12.34}{21.92}(100) = 56.30\%$$

DESCRIPTION	AREA	IA
PAVEMENT	12.34	0.05
R/W	9.58	0.10

IA = 0.56(0.05) + 0.44(0.10) = 0.072

URCA = 0.3 (PER NOTE TABLE IV)

WATER SHED = 1 C_k = 1.00

DT-ETA = 0.15 (CONSTANT)

PSF = 7.8

SC 3004R3 795

STANLEY CONSULTANTS

Project No. 13194 Page No.

Subject MONITOR TIME SERIES
RAINFALL LOSSES / CLARK UNIT
FWYCC SUB BASIN

Computed by JRM Date 9.9.96

Checked by Date

Approved by Date

Sheet No. 2 of 2

$T_c = 3.2 / 0.034^{0.1} (0.53)^{0.25} (0.265^{0.25} / 73.5)^{-0.14} / 56.30^{-0.36}$

$T_c = 0.179$ hrs

$R = 0.37 / 0.179^{1.11} / 0.53^{0.80} / 0.034^{-0.57}$

$R = 0.225$

USE: MEAN TIME FROM RESERVOIR

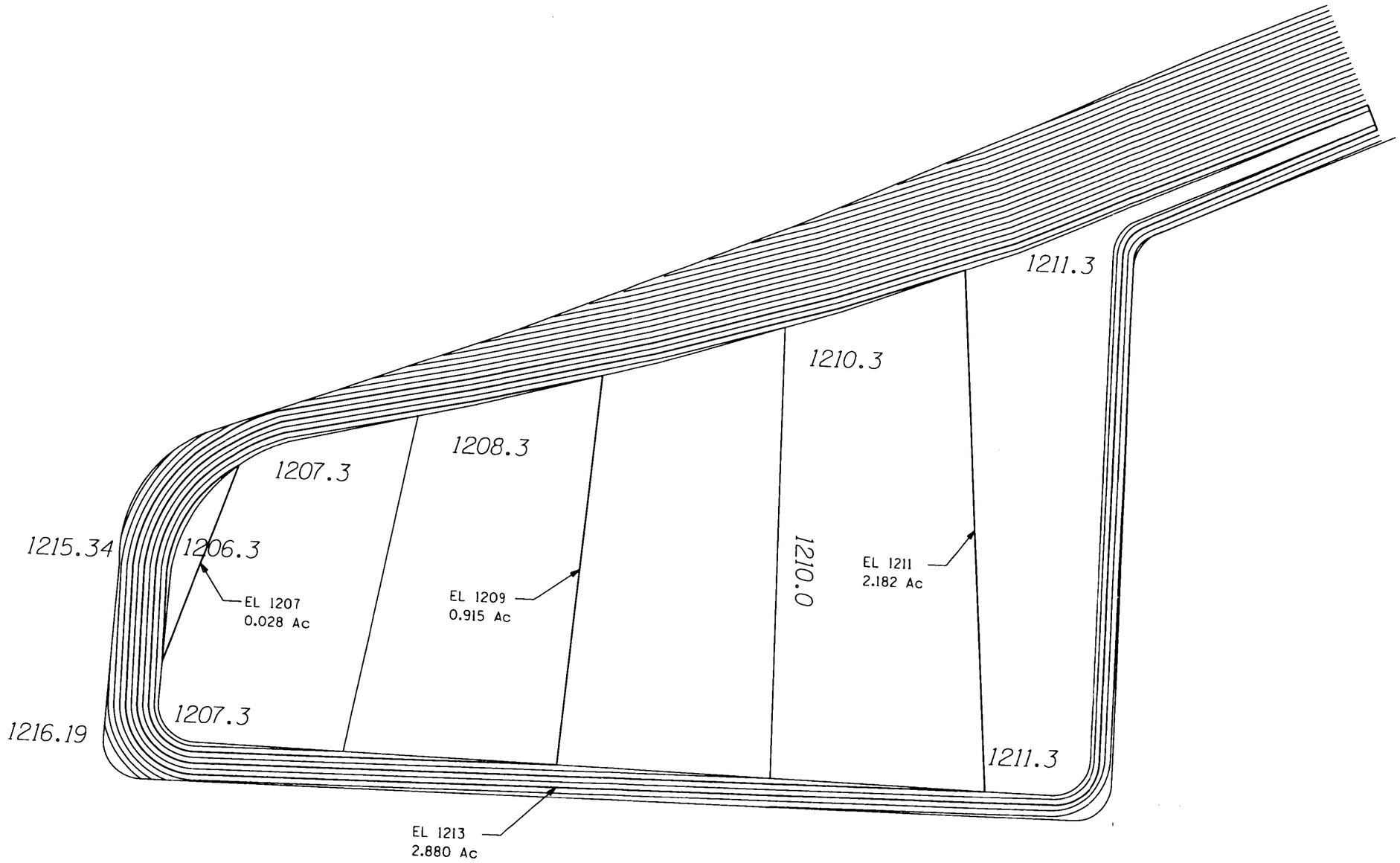
FROM LG RECORD:

	IA	INFILT	PSF	YKSF	FTMF
LG	0.072	0.15	7.8	0.13	56.30

REDUCE SUB BASIN 1005 AREA FOR FWY:

1005 − FWYCC = 0.073 − 0.034 = 0.039 sq. mi.

SC 3004R3 795



#13195
COUNTRY CLUB DRIVE
DETENTION BASIN
GRADING PLAN
9/9/96

DESIGNED BY SAW	DATE 12/15/94	SHEET NO.	PAGE NO.
CHECKED BY	DATE	OF	JOB NO. 12055
REVIEWED BY	DATE	SUBJECT: DETENTION BASINS @ COUNTRY	
APPROVED BY	DATE	CLUB DRIVE	

COUNTRY CLUB DETENTION BASIN: (S.W. QUADRANT)

MAINLINE / RAMP E.B.: 1.58 + 0.58 = 2.16 Ac
R/W AREA: 1.13 + 2.70 = 3.83 Ac

5.99 Ac

BA = 0.009 sq. miles

MAINLINE HIGH PT: STA 522+80 (±) 1222
INV ES 80 LOW PT: STA 534+00 (±) 1206
1120' 16'

L = 0.212 miles
L_{CA} = ½L = 0.106

SLOPE (S) = 16/0.212 = 75.5'/mile

RTIMP = 2.16/5.99 (100) = 36.1%

DESCRIPTION	AREA	IA (TABLE 3-1 p 3-2 ADOT)
PAVEMENT	2.16	0.05
R/W	3.83	0.10

IA = 0.361(0.05) + 0.639(0.10) = 0.082

X K SAT = 0.10 (TABLE IV, REPORT SUB-BASIN 270)

VEGATATIVE COVER = (<10%) C_k = 1.00

D THETA = 0.15 (NORMAL) (FIG 3-3 p. 3-10 ADOT)

PSIF = 7.0 (FIG 3-3 p. 3-10 ADOT)

NOTE: THE INFIELD AREA IS NOT ACTUALLY ROUTED THROUGH THE BASIN, HOWEVER, TO ACCOUNT FOR THE AREA IT IS MODELED AS SUCH. THE PEAK Q FROM THE ACTUAL DIRECT CONNECTION AT MH 80 WILL NOT COINCIDE WITH EITHER THE 72" ϕ STORM DRAIN OR THE S.W. BASIN OUTFLOW. SHOULD GIVE CONSERVATIVE BASIN OUTFLOW AND MAX. STAGE.

DESIGNED BY Stw DATE 12/15/96 SHEET NO. PAGE NO.
CHECKED BY DATE OF JOB NO. 12855
REVIEWED BY DATE SUBJECT:
APPROVED BY DATE

$$T_c = 3.2\, A^{0.1}\, L^{0.25}\, L_{CA}^{0.25}\, S^{-0.14}\, RTIMP^{-0.36}$$ (EQN 4-3, 4-3 ADOT)

$$T_c = 3.2\,(0.009)^{0.1}(0.212)^{0.25}(0.106)^{0.25}(75.5)^{-0.14}(36.1)^{-0.36} = \underline{\underline{0.116\ hrs}}$$

$$R = 0.37\,(T_c)^{1.11}\, L^{0.80}\, A^{-0.57} = 0.37(0.116)^{1.11}(0.212)^{0.80}(0.009)^{-0.57}$$

$$R = \underline{\underline{0.144}}$$

<u>USE</u>: URBAN TIME AREA RELATION

<u>HEC-1 LG RECORD</u>:

LG	0.082	0.15	7.0	0.10	36.1
	(IA)	(DTHETA)	(PSIF)	(XKSAT)	(RTIMP)

DESIGNED BY SAW DATE 12/15/74 SHEET NO. PAGE NO.
CHECKED BY DATE OF JOB NO. 12055
REVIEWED BY DATE SUBJECT:
APPROVED BY DATE

BASIN GRADING: DEPTH/AREA RELATIONSHIPS

The basin is essentially an open ditch controlled more by the roadway ditch grading than by basin contours/excavation.

The ditch will be approximated with depth/elevation area relationships. The overall storage volume will be underestimated producing conservative peak discharges from the basin.

The following represents the approximate basin/ditch storage volume modeled.

SA	0.01	0.40	0.60	0.80	1.09	1.26	1.45
SE	1206	1207	1208	1209	1210	1211	1212

SL	1207	3.14	0.62	0.5	
SS	1211	100	3.2	1.5	⇐ NOT EFFECTIVE

APPENDIX B

Catch Basin Runoff and Inlet Calculations

RED MTN. FREEWAY PHASE III
STP 600-8-(009)
ADOT RATIONAL METHOD
10-YEAR STORM
SCI Project No: 13194

SITE SPECIFIC
I-D-F CURVE PARAMETERS
(for 10-YR return frequency storm)

Computed by: SAW Date: 10/2/96
Checked by: JAM Date: 10/2/96
Approved by: _____ Date: _____

Power Curve Regression: (5 min < Tc < 60 min)

y = (10^m)*(x^b)

Reg. Coeff.	10-Year Duration Range (min) 5 to 10	10 to 15	15 to 30	30 to 60
m	-0.393	-0.427	-0.571	-0.689
b	0.317	0.291	0.204	0.169

NOTES:
1. Runoff Coefficients are area-weighted when more than one land use is present.
2. The minimum time of concentration is 10 minutes per ADOT.
3. Calculated discharges rounded to 0.1 cfs for design.
4. Inlet numbers correspond to Cst plan catch basin (CB) numbers Except where noted as end sections (ES)

Drainage Area Station to Station	Length (ft)	Width (ft)	Area (ac)	Ratio of Total Runoff Coefficient C1	C2	C3	Avg. C	Design Tc (hr)	i (in/hr)	Q (cfs)	Inlet No.	Station	Type	U/S Flowby Qc (cfs)	Inlet No.	Total Flow Qt (cfs)	Slotted Drain (ft)	Flow Spread (ft)	Intercepted Flow Qi (cfs)	CST. Phase II	III	IV	Comments
FREEWAY MAINLINE																							
498+10 - 499+20 W.B.	110	89.5	0.23	0.69	0.31		0.87	0.17	4.20	0.8	10	498+10	C-15.91	0.0	NA	0.8	0	7.90	0.8	x			
499+20 - 502+10 W.B.	290	89.5	0.60	0.69	0.31		0.87	0.17	4.20	2.2	11	499+20	C-15.91	0.1	17	2.3	10	8.30	2.3	x			
502+10 - 507+75 W.B.	565	89.5	1.16	0.69	0.31		0.87	0.17	4.20	4.3	17	502+10	C-15.91	0.0	NA	4.3	10	9.90	4.2	x			
500+69.5 - 501+75 E.B.	106	85.5	0.21	1.00			0.95	0.17	4.20	0.8	13	500+69.5	C-15.91	0.0	NA	0.8	0	3.90	0.8	x			
501+75 - 507+75 E.B.	600	82.5	1.14	1.00			0.95	0.17	4.20	4.5	16	501+75	C-15.92	0.0	NA	4.5	20	10.00	4.5	x			
507+75 - 511+85 W.B.	410	73.8	0.69	1.00			0.95	0.17	4.20	2.8	40	511+85	C-15.92	0.0	NA	2.8	15	8.80	2.8	x			
511+85 - 516+95 W.B.	510	98.8	1.16	0.69	0.31		0.87	0.17	4.20	4.3	42	516+95	C-15.91	0.0	NA	4.3	15	8.80	4.2	x			
507+75 - 516+95 E.B.	920	73.5	1.55	1.00			0.95	0.17	4.20	6.2	43	516+95	C-15.92	0.0	NA	6.2	30	10.50	6.2	x			
McKELLIPS T.I.																							
INFIELD CB																							
Ramp A	850	NA	0.79		1.00		0.70	0.17	4.18	2.3	22	Off road	C-15.80	0.0	NA	2.3	NA	NA	2.3	x			
Ramp A R/W	600	80	1.10		1.00		0.70	0.17	4.20	3.2	20	Off road	C-15.80	0.0	NA	3.2	NA	NA	3.2	x			
Ramp B	750	NA	0.35		1.00		0.70	0.17	4.17	1.0	172	Off road	C-15.80	0.8	Scupper	1.8	NA	NA	1.8	x			
Ramp B R/W	650	NA	2.12		1.00		0.70	0.20	3.85	5.7	ES 140	Off road	C-15.75	0.0	NA	5.7	NA	NA	5.7	x			Drop Inlet
McKELLIPS ROAD																							
RAMP A																							
12+83 - 13+53	70	33	0.05	1.00			0.95	0.17	4.20	0.2	21	13+53	C-15.91	0.0	NA	0.2	0	1.50	0.2	x			
RAMP B																							
5+40 - 6+73	133	NA	0.37	1.00			0.95	0.17	4.20	1.5	12	5+40	C-15.91	0.0	NA	1.5	50	7.70	1.5	x			
6+73 - 7+90	117	27	0.07	1.00			0.95	0.17	4.20	0.3	15	6+73	C-15.91	0.0	NA	0.3	0	2.00	0.3	x			

RED MTN. FREEWAY PHASE III
STP 600-8-(009)
ADOT RATIONAL METHOD
10-YEAR STORM
SCI Project No: 13194

SITE SPECIFIC
I-D-F CURVE PARAMETERS
(for 10-YR return frequency storm)

Computed by: Stu Date: 10/2/96
Checked by: JRM Date: 10/2/96
Approved by: Date:

Power Curve Regression: (5 min < Tc < 60 min)

y = (10^m)*(x^b)

Reg. Coeff.	10-Year Duration Range (min) 5 to 10	10 to 15	15 to 30	30 to 60
m	-0.393	-0.427	-0.571	-0.689
b	0.317	0.291	0.204	0.169

NOTES:
1. Runoff Coefficients are area-weighted when more than one land use is present.
2. The minimum time of concentration is 10 minutes per ADOT.
3. Calculated discharges rounded to 0.1 cfs for design.
4. Inlet numbers correspond to Cst plan catch basin (CB) numbers Except where noted as end sections (ES)

Drainage Area	Length	Width	Area	Ratio of Total Runoff Coefficient			Avg.	Design Tc	Design i	Q	Inlet			U/S Flowby Qc	U/S Flowby Inlet	Total Flow	Slotted Drain	Flow Spread	Intercepted Flow	CST. Phase			Comments
Station to Station	(ft)	(ft)	(ac)	C1	C2	C3	C	(hr)	(in/hr)	(cfs)	No.	Station	Type	(cfs)	No.	Qt (cfs)	(ft)	(ft)	Qi (cfs)	II	III	IV	
7+90 - 9+55	165	27	0.10	1.00			0.95	0.17	4.20	0.4	NA	9+55	C-15.20	0.0	NA	0.4	NA	2.10	0.4		x		Scupper to infield
9+55 - 14+60	505	NA	0.36	1.00			0.95	0.17	4.20	1.4	170	14+60	C-15.91	0.0	NA	1.4	10	10.50	1.4	x			
McKELLIPS ROAD																							
17+53 - 21+65 Lt	412	NA	0.70	1.00			0.95	0.17	4.20	2.8	NA	17+53	C-15.20	0.0	NA	2.8	NA	5.00	2.8		x		
21+65 - 25+40 Lt	375	NA	0.69	1.00			0.95	0.17	4.20	2.8	31	21+62	C-15.20	0.0	NA	2.8	NA	7.20	2.8		x		
21+65 - 23+45 Rt	180	NA	0.17	1.00			0.95	0.17	4.20	0.7	30	21+65	C-15.30	0.0	NA	0.7	NA	4.50	0.7		x		
FREEWAY MAINLINE																							
516+95 - 519+10 W.B.	215	106.2	0.52	0.69	0.31		0.87	0.17	4.20	1.9	50	519+10	C-15.91	0.0	NA	1.9	10	6.80	1.9		x		
519+10 - 520+25 W.B.	115	110.5	0.29	0.69	0.31		0.87	0.17	4.20	1.1	51	520+25	C-15.91	0.0	NA	1.1	0	5.70	1.1		x		
520+25 - 521+20 W.B.	95	112.4	0.25	0.69	0.31		0.87	0.17	4.20	0.9	52	521+20	C-15.91	0.0	NA	0.9	0	6.50	0.9		x		
521+20 - 522+70 W.B.	150	113.9	0.39	0.69	0.31		0.87	0.17	4.20	1.4	53	521+95	C-15.91	0.0	NA	1.4	0	9.00	1.4		x		CB in sump
522+70 - 523+60 W.B.	90	118	0.24	0.69	0.31		0.87	0.17	4.20	0.9	54	522+70	C-15.91	0.0	NA	0.9	0	6.50	0.9		x		
523+60 - 524+65 W.B.	105	125	0.30	0.69	0.31		0.87	0.17	4.20	1.1	55	523+60	C-15.91	0.0	NA	1.1	0	5.90	1.1		x		
524+65 - 526+15 W.B.	150	103.1	0.36	0.69	0.31		0.87	0.17	4.20	1.3	56	524+65	C-15.91	0.0	NA	1.3	0	5.60	1.3		x		
526+15 - 532+45 W.B.	630	89.5	1.29	0.69	0.31		0.87	0.17	4.20	4.7	62	526+15	C-15.91	0.0	NA	4.7	20	9.60	4.7		x		
516+95 - 520+50 E.B.	355	85.3	0.70	1.00			0.95	0.17	4.20	2.8	44	520+50	C-15.92	0.0	NA	2.8	20	9.60	2.8		x		
520+50 - 521+95 E.B.	145	107	0.36	1.00			0.95	0.17	4.20	1.4	45	521+95	C-15.92	0.0	NA	1.4	10	8.00	1.4		x		
521+95 - 522+75 E.B.	80	110	0.20	1.00			0.95	0.17	4.20	0.8	59	522+75	C-15.91	0.0	NA	0.8	0	6.10	0.8		x		
522+75 - 8+50 Ramp B	255	NA	0.27	1.00			0.95	0.17	4.20	1.1	70	8+50	C-15.91	0.0	NA	1.1	0	6.30	1.1		x		
8+50 - 10+55 Ramp B	205	31.9	0.15	1.00			0.95	0.17	4.20	0.6	71	10+55	C-15.91	0.0	NA	0.6	0	4.40	0.6		x		

RED MTN. FREEWAY PHASE III
STP 600-8-(009)
ADOT RATIONAL METHOD
10-YEAR STORM
SCI Project No: 13194

SITE SPECIFIC
I-D-F CURVE PARAMETERS
(for 10-YR return frequency storm)

Computed by: Stv Date: 10/2/96
Checked by: JRM Date: 10/2/96
Approved by: Date:

Power Curve Regression: (5 min < Tc < 60 min)

y = (10^m)*(x^b)

Reg. Coeff.	10-Year Duration Range (min) 5 to 10	10 to 15	15 to 30	30 to 60
m	-0.393	-0.427	-0.571	-0.689
b	0.317	0.291	0.204	0.169

NOTES:
1. Runoff Coefficients are area-weighted when more than one land use is present.
2. The minimum time of concentration is 10 minutes per ADOT.
3. Calculated discharges rounded to 0.1 cfs for design.
4. Inlet numbers correspond to Cst plan catch basin (CB) numbers Except where noted as end sections (ES)

Drainage Area	Length	Width	Area	Ratio of Total Runoff Coefficient			Avg.	Design Tc	Design i	Q	Inlet			U/S Flowby Qc	U/S Flowby Inlet	Total Flow	Slotted Drain	Flow Spread	Intercepted Flow	CST. Phase			Comments
Station to Station	(ft)	(ft)	(ac)	C1	C2	C3	C	(hr)	(in/hr)	(cfs)	No.	Station	Type	(cfs)	No.	Qt (cfs)	(ft)	(ft)	Qi (cfs)	II	III	IV	
523+00	640	NA	2.31	0.54	0.46		0.84	0.17	4.20	8.1		Off road	C-15.80	0.0	NA	8.1	NA	NA	8.1	x			Cross culvert
523+32 - 524+40 E.B.	108	73.5	0.18	1.00			0.95	0.17	4.20	0.7	60	523+32	C-15.91	0.0	NA	0.7	0	4.80	0.7		x		
524+40 - 536+80 E.B.	1240	73.5	2.09	1.00			0.95	0.17	4.20	8.3	61	524+40	C-15.92	0.0	NA	8.3	35	13.90	8.3		x		
532+45 - 533+15 W.B.	70	73.5	0.12	1.00			0.95	0.17	4.20	0.5	101	532+45	C-15.92	0.0	NA	0.5	0	4.60	0.5			x	
533+15 - 536+80 W.B.	365	73.5	0.62	1.00			0.95	0.17	4.20	2.5	100	533+15	C-15.91	0.0	NA	2.5	15	13.20	2.5			x	
COUNTRY CLUB T.I.																							
RAMP A																							
2+52 - 5+40	288	33	0.22	1.00			0.95	0.17	4.20	0.9	57	2+54	C-15.91	0.0	NA	0.9	0	5.00	0.9	x			
5+40 - 12+00	660	33	0.50	1.00			0.95	0.17	4.20	2.0	113	12+00	C-15.91	0.0	NA	2.0	0	4.90	1.9	x			
12+00 - 12+85	85	33	0.06	1.00			0.95	0.17	4.20	0.2	114	12+70	C-15.91	0.1	113	0.3	0	5.60	0.3	x			CB in sump
12+85 - 14+25	140	33	0.11	1.00			0.95	0.17	4.20	0.4	112	13+05	C-15.30	0.0	NA	0.4	NA	6.40	0.4	x			CB in sump
RAMP B																							
10+55 - 13+60	305	45	0.32	1.00			0.95	0.17	4.20	1.3	72	13+60	Scupper	0.0	NA	1.3	NA	6.60	1.3	x			
13+60 - 15+50	190	55	0.24	1.00			0.95	0.17	4.20	1.0	73	15+50	C-15.91	0.0	NA	1.0	0	5.60	1.0	x			
15+50 - 16+50	100	55	0.13	1.00			0.95	0.17	4.20	0.5	74	16+15	C-15.91	0.0	NA	0.5	0	2.70	0.5	x			CB in sump
16+50 - 18+00	150	55	0.19	1.00			0.95	0.17	4.20	0.8	75	16+50	C-15.91	0.0	NA	0.8	0	5.80	0.8	x			
RAMP C																							
0+00 - 2+75	275	NA	0.51	1.00			0.95	0.17	4.20	2.0	NA	2+05	C-15.91	0.1	2+75	2.1	30	8.67	2.1		x		CB in sump
2+75 - 6+58	384	NA	0.36	1.00			0.95	0.17	4.20	1.4	NA	2+75	C-15.91	0.2	NA	1.6	0	6.30	1.5		x		
RAMP D																							
0+00 - 1+25	125	31	0.09	1.00			0.95	0.17	4.20	0.4	91	1+25	C-15.91	0.0	NA	0.4	0	2.50	0.4	x			
1+25 - 2+10	85	31	0.06	1.00			0.95	0.17	4.20	0.2	93	1+50	C-15.91	0.1	2+10	0.3	0	1.90	0.3		x		CB in sump
2+10 - 8+71	661	31	0.47	1.00			0.95	0.17	4.20	1.9	92	2+10	C-15.91	0.0	NA	1.9	0	6.50	1.8		x		

RED MTN. FREEWAY PHASE III
STP 600-8-(009)
ADOT RATIONAL METHOD
10-YEAR STORM
SCI Project No: 13194

SITE SPECIFIC
I-D-F CURVE PARAMETERS
(for 10-YR return frequency storm)

Computed by: Stw Date: 10/2/96
Checked by: Jem Date: 10/2/96
Approved by: Date:

Power Curve Regression: (5 min < Tc < 60 min)

y = (10^m)*(x^b)

Reg. Coeff.	10-Year Duration Range (min) 5 to 10	10 to 15	15 to 30	30 to 60
m	-0.393	-0.427	-0.571	-0.689
b	0.317	0.291	0.204	0.169

NOTES:
1. Runoff Coefficients are area-weighted when more than one land use is present.
2. The minimum time of concentration is 10 minutes per ADOT.
3. Calculated discharges rounded to 0.1 cfs for design.
4. Inlet numbers correspond to Cst plan catch basin (CB) numbers Except where noted as end sections (ES)

Drainage Area Station to Station	Length (ft)	Width (ft)	Area (ac)	Ratio of Total Runoff Coefficient C1	C2	C3	Avg. C	Design Tc (hr)	i (in/hr)	Q (cfs)	Inlet No.	Station	Type	U/S Flowby Qc (cfs)	Inlet No.	Total Flow Qt (cfs)	Slotted Drain (ft)	Flow Spread (ft)	Intercepted Flow Qi (cfs)	CST. Phase II	III	IV	Comments
INFIELD CB																							
Ramp A	850	NA	1.22		1.00		0.70	0.18	4.10	3.5	111	Off road	C-15.80	0.0	NA	3.5	NA	NA	3.5	x			
Ramp B	1000	NA	1.13		1.00		0.70	0.22	3.72	2.9	81	Off road	C-15.80	1.3	Scupper	4.2	NA	NA	4.2	x			
Ramp B R/W	930	NA	5.41	0.21	0.79		0.75	0.19	3.99	16.2	ES 80	Off road	C-16.10	0.0	NA	16.2	NA	NA	16.2	x			
Ramp C	1000	NA	1.32		1.00		0.70	0.22	3.72	3.4	116	Off road	C-15.80	0.7	Scupper	4.1	NA	NA	4.1	x			
Ramp C R/W	2900	NA	4.73		1.00		0.70	0.42	2.62	8.7	ES 110	Off road	C-16.10	0.0	NA	8.7	NA	NA	26.2	x			
Ramp D	850	NA	1.18		1.00		0.70	0.18	4.10	3.4	90	Off road	C-15.80	0.0	NA	3.4	NA	NA	3.4	x			
Ramp D R/W											ES 81	Off road	C-16.10										On-Site Runoff
COUNTRY CLUB DRIVE																							
271+20 - 274+81 S.B.	361	63.45	0.53	1.00			0.95	0.17	4.20	2.1	76	274+81	C-15.20	0.0	NA	2.1	NA	9.72	2.1	x			LGD=1", 10' Wing
276+57 - 279+35 S.B.	125	73.5	0.21	1.00			0.95	0.17	4.20	0.8	110	279+35	C-15.20	0.0	NA	0.8	NA	7.20	0.8	x			3' Wing
280+45 - 285+00 S.B.	455	NA	0.82	1.00			0.95	0.17	4.20	3.3	115	280+43	C-15.20	1.4	120	4.7	NA	16.50	4.7	x			17' Wing
285+00 - 289+75 S.B.	475	82	0.89	1.00			0.95	0.17	4.20	3.6	120	285+00	C-15.30	0.0	NA	3.6	NA	4.36	2.1	x			EF-2
271+20 - 276+00 N.B.	480	65	0.72	1.00			0.95	0.17	4.20	2.9	80	276+00	C-15.20	0.0	NA	2.9	NA	10.30	2.9	x			17' Wing
277+05 - 279+86 N.B.	125	73.5	0.21	1.00			0.95	0.17	4.20	0.8	117	279+86	C-15.20	0.0	NA	0.8	NA	8.00	0.8	x			3' Wing

RED MTN. FREEWAY PHASE III
STP 600-8-(009)
ADOT RATIONAL METHOD
10-YEAR STORM
SCI Project No: 13194

NOTES:
1. Runoff Coefficients are area weighted when more than one land use is present
2. The minimum time of concentration is 10 minutes per ADOT
3. Calculated discharges rounded to 0.1 cfs for design
4. Inlet depths are calculated using ADOT design criteria

Variable	Description	Value
Cw	Weir Coefficient	3.00
P	Perimeter	8.3
	Perimeter Debris Factor	0.75
Co	Orifice Coefficient	0.67
A	Area of Grate (C-15.80)	4.09
	Area Debris Factor	0.50

Computed by [illegible] Date 10/2/96
Checked by [illegible] Date 10/2/96
Approved by _____ Date _____

Drainage Area Station to Station	Area (ac)	Avg. C	Design Tc (hr)	Design i (in/hr)	Q (cfs)	Inlet No.	Inlet Station	Inlet Type	U/S Flowby Qc (cfs)	U/S Flowby Inlet No.	Total Flow Qt (cfs)	Depth at Inlet (ft) Weir	Depth at Inlet (ft) Orifice	Depth at Inlet (ft) Design	Depth Control	Cst. Phase II	Cst. Phase III
McKELLIPS T.I.																	
INFIELD CB																	
Ramp A	0.79	0.70	0.17	4.18	2.3	22	Off road	C-15.80	0.0	NA	2.3	0.25	0.04	0.25	Weir		x
Ramp A R/W	1.10	0.70	0.17	4.20	3.2	20	Off road	C-15.80	0.0	NA	3.2	0.31	0.09	0.31	Weir		x
Ramp B	0.35	0.70	0.17	4.17	1.0	172	Off road	C-15.80	0.8	Scuppers	1.8	0.21	0.03	0.21	Weir		x
COUNTRY CLUB T.I.																	
INFIELD CB																	
Ramp A	1.22	0.70	0.18	4.10	3.5	111	Off road	C-15.80	0.0	NA	3.5	0.33	0.10	0.33	Weir		x
Ramp B	1.13	0.70	0.22	3.72	2.9	81	Off road	C-15.80	1.3	Scupper	4.2	0.37	0.14	0.37	Weir		x
Ramp C	1.32	0.70	0.22	3.72	3.4	116	Off road	C-15.80	0.7	Scupper	4.1	0.36	0.14	0.36	Weir		x
Ramp D	1.18	0.70	0.18	4.10	3.4	90	Off road	C-15.80	0.0	NA	3.4	0.32	0.10	0.32	Weir		x
FREEWAY MAINLINE																	
523+00	2.31	0.84	0.17	4.20	8.1		Off road	C-15.80	0.0	NA	8.1	0.57	0.55	0.57	Weir		x

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

08-31-1996

PROJECT NAME- SR202L
HIGHWAY NAME- E.B. MAINLINE
LOCATION - 500+69.5
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - SRM
CHECKER - PAGE

GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.595
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	0.920
SPREAD-Ft.--T	=	3.943
Average Velocity-V-fps	=	2.919
FLOW in Gutter-CFS--Q	=	0.898
% Flow in Gutter-CFS	=	97.583
Velocity of Flow in Gutter-fps	=	3.082
Depth at Curb Line-Inches--d	=	2.398

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	0.920
GUTTER FLOW at INLET-CFS--Q	=	0.920
Gutter Velocity at INLET-fps	=	3.358
Depth at INLET Curb Line-Inches--d	=	2.809
Frontal Flow Intercepted by GRATE--CFS	=	0.915
Lateral Flow Intercepted by GRATE--CFS	=	0.004
TOTAL Flow Intercepted by GRATE--CFS	=	0.919
% FLOW Intercepted	=	99.902
By-pass Flow--CFS	=	0.001

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-03-1996

PROJECT NAME- SR202L
HIGHWAY NAME- E.B. MAINLINE
LOCATION - 501+75
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER -
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SLOTTED DRAIN W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.358
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	4.540
SPREAD-Ft.--T	=	10.046 ✓
Average Velocity-V-fps	=	3.500
FLOW in Gutter-CFS--Q	=	2.878
% Flow in Gutter-CFS	=	63.392
Velocity of Flow in Gutter-fps	=	4.481
Depth at Curb Line-Inches--d	=	4.083 ✓

SLOTTED DRAIN--ADOT STD.--C13.60
GRATE TYPE: ADOT STD.--C15.92

Grate Length--Ft.	=	3.350
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.590
Splash-Over Velocity--FPS	=	7.350
Depth at INLET Curb Line-Inches--d	=	0.951
Local Gutter Depression-Inches	=	0.000
Length of opening: TOTAL Intercept--Ft.	=	33.304
Capture Ratio -- SLOTTED DRAIN	=	0.670
Capture Ratio -- GRATE	=	0.500

LENGTH	Efficiency	Q(S.D.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
20.000	0.808	3.670	0.835	4.505	0.035	99.22 ⇐
30.000	0.984	4.469	0.071	4.540	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-18-1996

PROJECT NAME- SR202L
HIGHWAY NAME- E.B. MAINLINE
LOCATION - 516+95
Ver 3.40: December 1995

TRACS NO.-
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SLOTTED DRAIN W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	2.060
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	6.190
SPREAD-Ft.--T	=	10.511
Average Velocity-V-fps	=	4.399
FLOW in Gutter-CFS--Q	=	3.789
% Flow in Gutter-CFS	=	61.208
Velocity of Flow in Gutter-fps	=	5.663
Depth at Curb Line-Inches--d	=	4.211

SLOTTED DRAIN--ADOT STD.--C13.60
GRATE TYPE: ADOT STD.--C15.92

Grate Length--Ft.	=	3.350
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.590
Splash-Over Velocity--FPS	=	7.350
Depth at INLET Curb Line-Inches--d	=	0.000
Local Gutter Depression-Inches	=	0.000
Length of opening: TOTAL Intercept--Ft.	=	43.483
Capture Ratio -- SLOTTED DRAIN	=	0.670
Capture Ratio -- GRATE	=	0.500

LENGTH	Efficiency	Q(S.D.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
10.000	0.375	2.323	2.607	4.930	1.260	79.65
20.000	0.670	4.148	1.688	5.836	0.354	94.28
30.000	0.878	5.438	0.743	6.180	0.010	99.85

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-18-1996

PROJECT NAME- SR202L
HIGHWAY NAME- E.B. MAINLINE / RAMP B
LOCATION - 520+50 / 3+67.57
Ver 3.40: December 1995

TRACS NO.-
DESIGNER -
CHECKER - SAW
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SLOTTED DRAIN W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.610
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	7.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	2.770
SPREAD-Ft.--T	=	9.628
Average Velocity-V-fps	=	2.304
FLOW in Gutter-CFS--Q	=	1.813
% Flow in Gutter-CFS	=	65.442
Velocity of Flow in Gutter-fps	=	2.932
Depth at Curb Line-Inches--d	=	3.967

SLOTTED DRAIN--ADOT STD.--C13.60
GRATE TYPE: ADOT STD.--C15.92

Grate Length--Ft.	=	3.350
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.590
Splash-Over Velocity--FPS	=	7.350
Depth at INLET Curb Line-Inches--d	=	0.000
Local Gutter Depression-Inches	=	0.000
Length of opening: TOTAL Intercept--Ft.	=	21.064
Capture Ratio -- SLOTTED DRAIN	=	0.670
Capture Ratio -- GRATE	=	0.500

LENGTH	Efficiency	Q(S.D.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
10.000	0.686	1.901	0.798	2.699	0.071	97.43
20.000	0.995	2.757	0.013	2.770	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-06-1996

PROJECT NAME- SR202L
HIGHWAY NAME- E.B. MAINLINE / RAMP B
LOCATION - 521+95 / 5+10
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SAW
PAGE

SLOTTED DRAIN W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.347
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	7.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	1.420
SPREAD-Ft.--T	=	8.027
Average Velocity-V-fps	=	1.618
FLOW in Gutter-CFS--Q	=	1.054
% Flow in Gutter-CFS	=	74.190
Velocity of Flow in Gutter-fps	=	2.002
Depth at Curb Line-Inches--d	=	3.525

SLOTTED DRAIN--ADOT STD.--C13.60
GRATE TYPE: ADOT STD.--C15.92

Grate Length--Ft.	=	3.350
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.590
Splash-Over Velocity--FPS	=	7.350
Depth at INLET Curb Line-Inches--d	=	3.586
Local Gutter Depression-Inches	=	0.000
Length of opening: TOTAL Intercept--Ft.	=	12.871
Capture Ratio -- SLOTTED DRAIN	=	0.670
Capture Ratio -- GRATE	=	0.500

LENGTH	Efficiency	Q(S.D.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
5.000	0.587	0.834	0.558	1.392	0.028	98.04
10.000	0.933	1.325	0.095	1.420	0.000	100.00
15.000	1.000	1.420	0.000	1.420	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-06-1996

PROJECT NAME- SR202L
HIGHWAY NAME- E.B. MAINLINE/RAMP B
LOCATION - 522+75/5+95
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SAW
PAGE

GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.347
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	7.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	0.845
SPREAD-Ft.--T	=	6.123
Average Velocity-V-fps	=	1.489
FLOW in Gutter-CFS--Q	=	0.726
% Flow in Gutter-CFS	=	85.944
Velocity of Flow in Gutter-fps	=	1.743
Depth at Curb Line-Inches--d	=	3.000

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	0.845
GUTTER FLOW at INLET-CFS--Q	=	0.817
Gutter Velocity at INLET-fps	=	1.879
Depth at INLET Curb Line-Inches--d	=	3.586
Frontal Flow Intercepted by GRATE--CFS	=	0.780
Lateral Flow Intercepted by GRATE--CFS	=	0.047
TOTAL Flow Intercepted by GRATE--CFS	=	0.827
% FLOW Intercepted	=	97.842
By-pass Flow--CFS	=	0.018

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-06-1996

PROJECT NAME- SR 202L
HIGHWAY NAME- E.B. MAINLINE/ RAMP B
LOCATION - N.A. / 8+50
Ver 3.40: December 1995

TRACS NO.-
DESIGNER -
CHECKER - PAGE

GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.520
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	7.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	1.080
SPREAD-Ft.--T	=	6.271
Average Velocity-V-fps	=	1.834
FLOW in Gutter-CFS--Q	=	0.918
% Flow in Gutter-CFS	=	85.005
Velocity of Flow in Gutter-fps	=	2.159
Depth at Curb Line-Inches--d	=	3.041

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	1.080
GUTTER FLOW at INLET-CFS--Q	=	1.037
Gutter Velocity at INLET-fps	=	2.328
Depth at INLET Curb Line-Inches--d	=	3.637
Frontal Flow Intercepted by GRATE--CFS	=	0.988
Lateral Flow Intercepted by GRATE--CFS	=	0.057
TOTAL Flow Intercepted by GRATE--CFS	=	1.045
% FLOW Intercepted	=	96.745
By-pass Flow--CFS	=	0.035

neglect.

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-06-1996

PROJECT NAME- SR202L
HIGHWAY NAME- E.B. MAINLINE/RAMP B
LOCATION - N.A. / 10+55
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SAW
PAGE

GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.698
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.018
Shoulder Width-Ft.--	=	7.500
Shoulder Slope-Ft./Ft.--Ss	=	0.018
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	0.630
SPREAD-Ft.--T	=	4.432
Average Velocity-V-fps	=	1.908
FLOW in Gutter-CFS--Q	=	0.609
% Flow in Gutter-CFS	=	96.633
Velocity of Flow in Gutter-fps	=	2.055
Depth at Curb Line-Inches--d	=	2.422

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	0.630
GUTTER FLOW at INLET-CFS--Q	=	0.630
Gutter Velocity at INLET-fps	=	2.240
Depth at INLET Curb Line-Inches--d	=	2.846
Frontal Flow Intercepted by GRATE--CFS	=	0.626
Lateral Flow Intercepted by GRATE--CFS	=	0.004
TOTAL Flow Intercepted by GRATE--CFS	=	0.630
% FLOW Intercepted	=	99.922
By-pass Flow--CFS	=	0.000

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-05-1996

PROJECT NAME- SR202L
HIGHWAY NAME- E.B. MAINLINE
LOCATION - 523+32.13
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - STW
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GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.568
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	0.730
SPREAD-Ft.--T	=	4.826
Average Velocity-V-fps	=	1.805
FLOW in Gutter-CFS--Q	=	0.683
% Flow in Gutter-CFS	=	93.629
Velocity of Flow in Gutter-fps	=	1.998
Depth at Curb Line-Inches--d	=	2.642

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	0.730
GUTTER FLOW at INLET-CFS--Q	=	0.730
Gutter Velocity at INLET-fps	=	2.155
Depth at INLET Curb Line-Inches--d	=	3.126
Frontal Flow Intercepted by GRATE--CFS	=	0.715
Lateral Flow Intercepted by GRATE--CFS	=	0.012
TOTAL Flow Intercepted by GRATE--CFS	=	0.727
% FLOW Intercepted	=	99.571
By-pass Flow--CFS	=	0.003

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-05-1996

PROJECT NAME- SR202L
HIGHWAY NAME- E.B. MAINLINE
LOCATION - 524+40
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
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SLOTTED DRAIN W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.019
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	8.350
SPREAD-Ft.--T	=	13.882
Average Velocity-V-fps	=	3.549
FLOW in Gutter-CFS--Q	=	4.042
% Flow in Gutter-CFS	=	48.409
Velocity of Flow in Gutter-fps	=	4.685
Depth at Curb Line-Inches--d	=	5.141

SLOTTED DRAIN--ADOT STD.--C13.60
GRATE TYPE: ADOT STD.--C15.92

Grate Length--Ft.	=	3.350
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.590
Splash-Over Velocity--FPS	=	7.350
Depth at INLET Curb Line-Inches--d	=	0.969
Local Gutter Depression-Inches	=	0.000
Length of opening: TOTAL Intercept--Ft.	=	42.876
Capture Ratio -- SLOTTED DRAIN	=	0.670
Capture Ratio -- GRATE	=	0.500

LENGTH	Efficiency	Q(S.D.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
20.000	0.677	5.655	1.891	7.546	0.804	90.37
25.000	0.793	6.621	1.395	8.016	0.334	96.00
30.000	0.885	7.392	0.891	8.283	0.067	99.20
35.000	0.953	7.955	0.395	8.350	0.000	99.99
40.000	0.992	8.286	0.064	8.350	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-02-1996

PROJECT NAME- SR202L
HIGHWAY NAME- W.B. MAINLINE
LOCATION - 498+10
Ver 3.40: December 1995

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GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.976
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.003
Shoulder Width-Ft.--	=	5.500
Shoulder Slope-Ft./Ft.--Ss	=	0.003
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	0.820
SPREAD-Ft.--T	=	7.924
Average Velocity-V-fps	=	2.805
FLOW in Gutter-CFS--Q	=	0.793
% Flow in Gutter-CFS	=	96.708
Velocity of Flow in Gutter-fps	=	3.190
Depth at Curb Line-Inches--d	=	2.193

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	0.820
GUTTER FLOW at INLET-CFS--Q	=	0.820
Gutter Velocity at INLET-fps	=	3.536
Depth at INLET Curb Line-Inches--d	=	2.584
Frontal Flow Intercepted by GRATE--CFS	=	0.819
Lateral Flow Intercepted by GRATE--CFS	=	0.001
TOTAL Flow Intercepted by GRATE--CFS	=	0.820
% FLOW Intercepted	=	99.998
By-pass Flow--CFS	=	0.000

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-02-1996

PROJECT NAME- SR 202L
HIGHWAY NAME- W.B. MAINLINE
LOCATION - 499+20
Ver 3.40: December 1995

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SLOTTED DRAIN W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.931
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.014
Shoulder Width-Ft.--	=	5.500
Shoulder Slope-Ft./Ft.--Ss	=	0.014
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	2.160
SPREAD-Ft.--T	=	8.348 ✓
Average Velocity-V-fps	=	3.277
FLOW in Gutter-CFS--Q	=	1.709
% Flow in Gutter-CFS	=	79.139
Velocity of Flow in Gutter-fps	=	4.108
Depth at Curb Line-Inches--d	=	2.997

SLOTTED DRAIN--ADOT STD.--C13.60
GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Splash-Over Velocity--FPS	=	7.354
Depth at INLET Curb Line-Inches--d	=	3.651
Local Gutter Depression-Inches	=	1.000
Length of opening: TOTAL Intercept--Ft.	=	18.672
Capture Ratio -- SLOTTED DRAIN	=	0.670
Capture Ratio -- GRATE	=	0.500

LENGTH	Efficiency	Q(S.D.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
10.000	0.749	1.617	0.543	2.160	0.000	100.00 ←
20.000	1.000	2.160	0.000	2.160	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-02-1996

PROJECT NAME- SR202L
HIGHWAY NAME- W.B. MAINLINE
LOCATION - 502+10
Ver 3.40: December 1995

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SLOTTED DRAIN W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.279
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	5.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	4.220
SPREAD-Ft.--T	=	9.852
Average Velocity-V-fps	=	3.369
FLOW in Gutter-CFS--Q	=	2.715
% Flow in Gutter-CFS	=	64.335
Velocity of Flow in Gutter-fps	=	4.302
Depth at Curb Line-Inches--d	=	4.029

SLOTTED DRAIN--ADOT STD.--C13.60
GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Splash-Over Velocity--FPS	=	7.354
Depth at INLET Curb Line-Inches--d	=	4.781
Local Gutter Depression-Inches	=	1.000
Length of opening: TOTAL Intercept--Ft.	=	24.013
Capture Ratio -- SLOTTED DRAIN	=	0.670
Capture Ratio -- GRATE	=	0.500

LENGTH	Efficiency	Q(S.D.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
10.000	0.621	2.619	1.535	4.155	0.065	98.45
20.000	0.960	4.051	0.169	4.220	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-18-1996

PROJECT NAME- SR 202 L
HIGHWAY NAME- W.B. MAINLINE
LOCATION - 511+85
Ver 3.40: December 1995

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SLOTTED DRAIN W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.913
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	7.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	2.780
SPREAD-Ft.--T	=	8.784
Average Velocity-V-fps	=	2.716
FLOW in Gutter-CFS--Q	=	1.943
% Flow in Gutter-CFS	=	69.888
Velocity of Flow in Gutter-fps	=	3.411
Depth at Curb Line-Inches--d	=	3.734

SLOTTED DRAIN--ADOT STD.--C13.60
GRATE TYPE: ADOT STD.--C15.92

Grate Length--Ft.	=	3.350
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.590
Splash-Over Velocity--FPS	=	7.350
Depth at INLET Curb Line-Inches--d	=	1.082
Local Gutter Depression-Inches	=	0.000
Length of opening: TOTAL Intercept--Ft.	=	23.291
Capture Ratio -- SLOTTED DRAIN	=	0.670
Capture Ratio -- GRATE	=	0.500

LENGTH	Efficiency	Q(S.D.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
10.000	0.636	1.767	0.926	2.693	0.087	96.87
15.000	0.844	2.347	0.431	2.778	0.002	99.94 USE
20.000	0.970	2.698	0.082	2.780	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-18-1996

PROJECT NAME- SR202L
HIGHWAY NAME- W.B. MAINLINE
LOCATION - 51.6+95
Ver 3.40: December 1995

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SLOTTED DRAIN W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	2.060
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	5.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	4.200
SPREAD-Ft.--T	=	8.809
Average Velocity-V-fps	=	4.082
FLOW in Gutter-CFS--Q	=	2.930
% Flow in Gutter-CFS	=	69.761
Velocity of Flow in Gutter-fps	=	5.130
Depth at Curb Line-Inches--d	=	3.741

SLOTTED DRAIN--ADOT STD.--C13.60
GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Splash-Over Velocity--FPS	=	7.354
Depth at INLET Curb Line-Inches--d	=	4.460
Local Gutter Depression-Inches	=	1.000
Length of opening: TOTAL Intercept--Ft.	=	26.703
Capture Ratio -- SLOTTED DRAIN	=	0.670
Capture Ratio -- GRATE	=	0.500

LENGTH	Efficiency	Q(S.D.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
10.000	0.570	2.395	1.748	4.143	0.057	98.65
15.000	0.773	3.249	0.951	4.200	0.000	99.99
20.000	0.917	3.851	0.349	4.200	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-18-1996

PROJECT NAME- SR202L
HIGHWAY NAME- W.B. MAINLINE
LOCATION - 519+10
Ver 3.40: December 1995

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SLOTTED DRAIN W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.194
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	5.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.001
Manning's 'N	=	0.016
Flow-CFS--Q	=	1.900
SPREAD-Ft.--T	=	6.799
Average Velocity-V-fps	=	2.843
FLOW in Gutter-CFS--Q	=	1.552
% Flow in Gutter-CFS	=	81.687
Velocity of Flow in Gutter-fps	=	3.406
Depth at Curb Line-Inches--d	=	3.188

SLOTTED DRAIN--ADOT STD.--C13.60
GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Splash-Over Velocity--FPS	=	7.354
Depth at INLET Curb Line-Inches--d	=	3.816
Local Gutter Depression-Inches	=	1.000
Length of opening: TOTAL Intercept--Ft.	=	15.261
Capture Ratio -- SLOTTED DRAIN	=	0.670
Capture Ratio -- GRATE	=	0.500

LENGTH	Efficiency	Q(S.D.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
10.000	0.853	1.621	0.279	1.900	0.000	100.00
20.000	1.000	1.900	0.000	1.900	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-05-1996

PROJECT NAME- SR 202L
HIGHWAY NAME- W.B. MAINLINE
LOCATION - 520+25
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SAW
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GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.714
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	5.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	1.070
SPREAD-Ft.--T	=	5.701
Average Velocity-V-fps	=	2.097
FLOW in Gutter-CFS--Q	=	0.948
% Flow in Gutter-CFS	=	88.597
Velocity of Flow in Gutter-fps	=	2.416
Depth at Curb Line-Inches--d	=	2.883

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	1.070
GUTTER FLOW at INLET-CFS--Q	=	1.051
Gutter Velocity at INLET-fps	=	2.603
Depth at INLET Curb Line-Inches--d	=	3.438
Frontal Flow Intercepted by GRATE--CFS	=	1.012
Lateral Flow Intercepted by GRATE--CFS	=	0.037
TOTAL Flow Intercepted by GRATE--CFS	=	1.049
% FLOW Intercepted	=	98.032
By-pass Flow--CFS	=	0.021 < 0.03 ≈ Ø

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-05-1996

PROJECT NAME- SR 202L
HIGHWAY NAME- W.B. MAINLINE
LOCATION - 521+20
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SMW
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GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.318
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	5.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	0.897
SPREAD-Ft.--T	=	6.485
Average Velocity-V-fps	=	1.446
FLOW in Gutter-CFS--Q	=	0.750
% Flow in Gutter-CFS	=	83.667
Velocity of Flow in Gutter-fps	=	1.715
Depth at Curb Line-Inches--d	=	3.100

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	0.897
GUTTER FLOW at INLET-CFS--Q	=	0.851
Gutter Velocity at INLET-fps	=	1.849
Depth at INLET Curb Line-Inches--d	=	3.710
Frontal Flow Intercepted by GRATE--CFS	=	0.808
Lateral Flow Intercepted by GRATE--CFS	=	0.061
TOTAL Flow Intercepted by GRATE--CFS	=	0.869
% FLOW Intercepted	=	96.919
By-pass Flow--CFS	=	0.028

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-05-1996

PROJECT NAME- SR 202L
HIGHWAY NAME- W.B. MAINLINE
LOCATION - 521+95
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SAW
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GRATE INLET--IN SUMP

GUTTER FLOW HYDRAULICS

GUTTER DESCRIPTION

Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	5.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Effective Perimeter--Ft.	=	7.354
Capture Ratio -- GRATE	=	0.500
Local Gutter Depression-Inches	=	1.000
Depth at INLET Curb Line-Inches--d	=	3.794
Depth at C.G. of Grate Flow--In.	=	3.728
SPREAD-Ft.--T	=	9.000
FLOW INTERCEPTED--WEIR FLOW--CFS	=	1.487
FLOW INTERCEPTED--ORIFICE FLOW--CFS	=	7.713

Q(INLET)= 1.487 cfs is Based on WEIR flow

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-05-1996

PROJECT NAME- SR202L TRACS NO.-
HIGHWAY NAME- W.B. MAINLINE DESIGNER - JRM
LOCATION - 522+70 CHECKER - SAW PAGE
Ver 3.40: December 1995

GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.309
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	5.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	0.884
SPREAD-Ft.--T	=	6.485
Average Velocity-V-fps	=	1.426
FLOW in Gutter-CFS--Q	=	0.740
% Flow in Gutter-CFS	=	83.667
Velocity of Flow in Gutter-fps	=	1.691
Depth at Curb Line-Inches--d	=	3.100

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	0.884
GUTTER FLOW at INLET-CFS--Q	=	0.840
Gutter Velocity at INLET-fps	=	1.824
Depth at INLET Curb Line-Inches--d	=	3.710
Frontal Flow Intercepted by GRATE--CFS	=	0.797
Lateral Flow Intercepted by GRATE--CFS	=	0.061
TOTAL Flow Intercepted by GRATE--CFS	=	0.858
% FLOW Intercepted	=	97.017
By-pass Flow--CFS	=	0.026

$< 0.03 \approx 0$

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-05-1996

PROJECT NAME- SR 202L
HIGHWAY NAME- W.B. MAINLINE
LOCATION - 523+60
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SAW
PAGE

GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.684
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	5.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	1.100
SPREAD-Ft.--T	=	5.865
Average Velocity-V-fps	=	2.067
FLOW in Gutter-CFS--Q	=	0.963
% Flow in Gutter-CFS	=	87.585
Velocity of Flow in Gutter-fps	=	2.397
Depth at Curb Line-Inches--d	=	2.929

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	1.100
GUTTER FLOW at INLET-CFS--Q	=	1.074
Gutter Velocity at INLET-fps	=	2.584
Depth at INLET Curb Line-Inches--d	=	3.496
Frontal Flow Intercepted by GRATE--CFS	=	1.031
Lateral Flow Intercepted by GRATE--CFS	=	0.043
TOTAL Flow Intercepted by GRATE--CFS	=	1.074
% FLOW Intercepted	=	97.626
By-pass Flow--CFS	=	0.026 <0.03 ≈ Ø

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-05-1996

PROJECT NAME- SR 202L
HIGHWAY NAME- W.B. MAINLINE
LOCATION - 524+65
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SAW
PAGE

GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.123
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	5.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	1.294
SPREAD-Ft.--T	=	5.579
Average Velocity-V-fps	=	2.618
FLOW in Gutter-CFS--Q	=	1.156
% Flow in Gutter-CFS	=	89.299
Velocity of Flow in Gutter-fps	=	2.999
Depth at Curb Line-Inches--d	=	2.850

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	1.294
GUTTER FLOW at INLET-CFS--Q	=	1.276
Gutter Velocity at INLET-fps	=	3.231
Depth at INLET Curb Line-Inches--d	=	3.396
Frontal Flow Intercepted by GRATE--CFS	=	1.232
Lateral Flow Intercepted by GRATE--CFS	=	0.035
TOTAL Flow Intercepted by GRATE--CFS	=	1.267
% FLOW Intercepted	=	97.859
By-pass Flow--CFS	=	0.028

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-05-1996

PROJECT NAME- SR202L
HIGHWAY NAME- W.B. MAINLINE
LOCATION - 526+15
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SJW
PAGE

SLOTTED DRAIN W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.749
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	5.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	4.700
SPREAD-Ft.--T	=	9.637
Average Velocity-V-fps	=	3.902
FLOW in Gutter-CFS--Q	=	3.074
% Flow in Gutter-CFS	=	65.409
Velocity of Flow in Gutter-fps	=	4.969
Depth at Curb Line-Inches--d	=	3.970

SLOTTED DRAIN--ADOT STD.--C13.60
GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Splash-Over Velocity--FPS	=	7.354
Depth at INLET Curb Line-Inches--d	=	4.715
Local Gutter Depression-Inches	=	1.000
Length of opening: TOTAL Intercept--Ft.	=	27.402
Capture Ratio -- SLOTTED DRAIN	=	0.670
Capture Ratio -- GRATE	=	0.500

LENGTH	Efficiency	Q(S.D.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
10.000	0.558	2.624	1.942	4.566	0.134	97.16
15.000	0.760	3.572	1.123	4.695	0.005	99.88
20.000	0.905	4.254	0.446	4.700	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-05-1996

PROJECT NAME- SR202L
HIGHWAY NAME- W.B. MAINLINE
LOCATION - 532+45
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SAW
PAGE

GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.933
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.004
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.004
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	0.488
SPREAD-Ft.--T	=	4.551
Average Velocity-V-fps	=	2.054
FLOW in Gutter-CFS--Q	=	0.486
% Flow in Gutter-CFS	=	99.514
Velocity of Flow in Gutter-fps	=	2.120
Depth at Curb Line-Inches--d	=	2.100

GRATE TYPE: ADOT STD.--C15.92

Grate Length--Ft.	=	3.350
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.590
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.350
Splash-Over Velocity--FPS	=	7.350
Local Gutter Depression-Inches	=	0.000
Flow-CFS--Q	=	0.488
GUTTER FLOW at INLET-CFS--Q	=	0.486
Gutter Velocity at INLET-fps	=	2.120
Depth at INLET Curb Line-Inches--d	=	2.100
Frontal Flow Intercepted by GRATE--CFS	=	0.475
Lateral Flow Intercepted by GRATE--CFS	=	0.010
TOTAL Flow Intercepted by GRATE--CFS	=	0.485
% FLOW Intercepted	=	99.300
By-pass Flow--CFS	=	0.003

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-05-1996

PROJECT NAME- SR202L
HIGHWAY NAME- W.B. MAINLINE
LOCATION - 533+15
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SAW
PAGE

SLOTTED DRAIN W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.783
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.011
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.011
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	2.460
SPREAD-Ft.--T	=	13.190
Average Velocity-V-fps	=	2.141
FLOW in Gutter-CFS--Q	=	1.495
% Flow in Gutter-CFS	=	60.789
Velocity of Flow in Gutter-fps	=	2.943
Depth at Curb Line-Inches--d	=	3.439

SLOTTED DRAIN--ADOT STD.--C13.60
GRATE TYPE: ADOT STD.--C15.92

Grate Length--Ft.	=	3.350
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.590
Splash-Over Velocity--FPS	=	7.350
Depth at INLET Curb Line-Inches--d	=	2.100
Local Gutter Depression-Inches	=	0.000
Length of opening: TOTAL Intercept--Ft.	=	23.462
Capture Ratio -- SLOTTED DRAIN	=	0.670
Capture Ratio -- GRATE	=	0.500

LENGTH	Efficiency	Q(S.D.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
5.000	0.350	0.862	1.175	2.037	0.423	82.81
10.000	0.632	1.555	0.808	2.363	0.097	96.07
15.000	0.840	2.068	0.391	2.459	0.001	99.95

ARIZONA DEPARTMENT OF TRANSPOPTATION
DRAINAGE DESIGN SECTION

09-14-1996

PROJECT NAME- SR202L
HIGHWAY NAME- McKELLIPS A
LOCATION - 13+53.43
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SAW
PAGE

GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	3.655
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.017
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.017
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	0.210
SPREAD-Ft.--T	=	1.484
Average Velocity-V-fps	=	2.862
FLOW in Gutter-CFS--Q	=	0.210
% Flow in Gutter-CFS	=	100.015
Velocity of Flow in Gutter-fps	=	2.863
Depth at Curb Line-Inches--d	=	1.187

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	0.210
GUTTER FLOW at INLET-CFS--Q	=	0.210
Gutter Velocity at INLET-fps	=	3.168
Depth at INLET Curb Line-Inches--d	=	1.382
Frontal Flow Intercepted by GRATE--CFS	=	0.210
Lateral Flow Intercepted by GRATE--CFS	=	0.000
TOTAL Flow Intercepted by GRATE--CFS	=	0.210
% FLOW Intercepted	=	100.000
By-pass Flow--CFS	=	0.000

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-01-1996

PROJECT NAME- SR 202L
HIGHWAY NAME- McKELLIPS B
LOCATION - 5+40
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER -
PAGE

(DOWNSTREAM END OF SLOTTED DRAIN)

SLOTTED DRAIN W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	2.031
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.005
Shoulder Width-Ft.--	=	6.000
Shoulder Slope-Ft./Ft.--Ss	=	0.005
Gutter Width-Ft.--W	=	1.000
Gutter Slope-Ft./Ft.--Sw	=	0.005
Gutter Depression-Inches--	=	0.056
Manning's 'N	=	0.016
Flow-CFS--Q	=	1.470
SPREAD-Ft.--T	=	18.138
Average Velocity-V-fps	=	1.920
FLOW in Gutter-CFS--Q	=	0.206
% Flow in Gutter-CFS	=	14.037
Velocity of Flow in Gutter-fps	=	2.513
Depth at Curb Line-Inches--d	=	1.013

SLOTTED DRAIN--ADOT STD.--C13.60
GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Splash-Over Velocity--FPS	=	7.354
Depth at INLET Curb Line-Inches--d	=	1.855
Local Gutter Depression-Inches	=	0.000
Length of opening: TOTAL Intercept--Ft.	=	98.045
Capture Ratio -- SLOTTED DRAIN	=	0.670
Capture Ratio -- GRATE	=	0.500

LENGTH	Efficiency	Q(S.D.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
30.000	0.482	0.708	0.279	0.987	0.483	67.13
40.000	0.611	0.898	0.230	1.128	0.342	76.70
50.000	0.723	1.063	0.182	1.245	0.225	84.6[illegible]

$Q_b < 0.3$ cfs (ADOT PREFERENCE)

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-01-1996

PROJECT NAME- SR202L
HIGHWAY NAME- McKELLIPS B
LOCATION - 5+90
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SAW
PAGE

(UPSTREAM END OF SLOTTED DRAIN)

SLOTTED DRAIN W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	2.031
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.014
Shoulder Width-Ft.--	=	6.000
Shoulder Slope-Ft./Ft.--Ss	=	0.014
Gutter Width-Ft.--W	=	1.000
Gutter Slope-Ft./Ft.--Sw	=	0.014
Gutter Depression-Inches--	=	0.165
Manning's 'N	=	0.016
Flow-CFS--Q	=	0.920
SPREAD-Ft.--T	=	7.732 close
Average Velocity-V-fps	=	2.239
FLOW in Gutter-CFS--Q	=	0.284
% Flow in Gutter-CFS	=	30.885
Velocity of Flow in Gutter-fps	=	2.858
Depth at Curb Line-Inches--d	=	1.276

SLOTTED DRAIN--ADOT STD.--C13.60
GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Splash-Over Velocity--FPS	=	7.354
Depth at INLET Curb Line-Inches--d	=	0.120
Local Gutter Depression-Inches	=	0.000
Length of opening: TOTAL Intercept--Ft.	=	42.045
Capture Ratio -- SLOTTED DRAIN	=	0.670
Capture Ratio -- GRATE	=	0.500

LENGTH	Efficiency	Q(S.D.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
30.000	0.895	0.823	0.092	0.915	0.005	99.43
40.000	0.996	0.916	0.004	0.920	0.000	100.00
50.000	1.000	0.920	0.000	0.920	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-01-1996

PROJECT NAME- SR 202L
HIGHWAY NAME- McKELLIPS B
LOCATION - 6+72.75
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER -
PAGE

GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.449
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	7.500
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	0.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	0.290
SPREAD-Ft.--T	=	1.992
Average Velocity-V-fps	=	2.193
FLOW in Gutter-CFS--Q	=	0.290
% Flow in Gutter-CFS	=	100.013
Velocity of Flow in Gutter-fps	=	2.193
Depth at Curb Line-Inches--d	=	1.593

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	0.290
GUTTER FLOW at INLET-CFS--Q	=	0.290
Gutter Velocity at INLET-fps	=	2.427
Depth at INLET Curb Line-Inches--d	=	1.855
Frontal Flow Intercepted by GRATE--CFS	=	0.290
Lateral Flow Intercepted by GRATE--CFS	=	0.000
TOTAL Flow Intercepted by GRATE--CFS	=	0.290
% FLOW Intercepted	=	100.000
By-pass Flow--CFS	=	0.000

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-01-1996

PROJECT NAME- SR202L
HIGHWAY NAME- MCKELLIPS B
LOCATION - 9+55
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - VRM
CHECKER - SAW
PAGE

CURB OPENING INLET -- ON GRADE
(SCUPPER)

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.991
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.011
Shoulder Width-Ft.--	=	7.000
Shoulder Slope-Ft./Ft.--Ss	=	0.011
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	0.165
Manning's 'N	=	0.016
Flow-CFS--Q	=	0.410
SPREAD-Ft.--T	=	2.137
Average Velocity-V-fps	=	2.694
FLOW in Gutter-CFS--Q	=	0.410
% Flow in Gutter-CFS	=	100.013
Velocity of Flow in Gutter-fps	=	2.694
Depth at Curb Line-Inches--d	=	1.709

CURB OPENING--ADOT STD. C-15.20

Flow-CFS--Q	=	0.410
Gutter Velocity at INLET-fps	=	2.694
GUTTER FLOW at INLET-CFS--Q	=	0.410
Depth at INLET Curb Line-Inches--d	=	1.709
Local Gutter Depression-Inches	=	0.000
Length of opening: TOTAL Intercept--Ft.	=	9.667
Capture Ratio -- CURB OPENING	=	0.800

LENGTH	Efficiency	Q(Captured)	Q(By-Pass)
3.083	0.499	0.205	0.205
6.583	0.872	0.358	0.052
9.583	1.000	0.410	0.000
13.583	1.000	0.410	0.000
20.583	1.000	0.410	0.000

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-14-1996

PROJECT NAME- SR202L
HIGHWAY NAME- McKELLIPS B
LOCATION - 14+60
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - DTW
PAGE

SLOTTED DRAIN W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	3.564
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.004
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.004
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	1.430
SPREAD-Ft.--T	=	10.488
Average Velocity-V-fps	=	3.573
FLOW in Gutter-CFS--Q	=	1.281
% Flow in Gutter-CFS	=	89.546
Velocity of Flow in Gutter-fps	=	4.537
Depth at Curb Line-Inches--d	=	2.355

SLOTTED DRAIN--ADOT STD.--C13.60
GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Splash-Over Velocity--FPS	=	7.354
Depth at INLET Curb Line-Inches--d	=	2.851
Local Gutter Depression-Inches	=	1.000
Length of opening: TOTAL Intercept--Ft.	=	18.213
Capture Ratio -- SLOTTED DRAIN	=	0.670
Capture Ratio -- GRATE	=	0.500

LENGTH	Efficiency	Q(S.D.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
10.000	0.762	1.089	0.341	1.430	0.000	100.00
15.000	0.956	1.367	0.063	1.430	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-11-1996

PROJECT NAME- SR202L
HIGHWAY NAME- McKELLIPS ROAD
LOCATION - 17+53
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SAW
PAGE

USE: MODIFIED CURB OPENING SPILLWAY TO DITCH

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	2.735
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.040
Shoulder Width-Ft.--	=	10.000
Shoulder Slope-Ft./Ft.--Ss	=	0.040
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.083
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	2.790
SPREAD-Ft.--T	=	5.038
Average Velocity-V-fps	=	4.694
FLOW in Gutter-CFS--Q	=	2.266
% Flow in Gutter-CFS	=	81.209
Velocity of Flow in Gutter-fps	=	5.530
Depth at Curb Line-Inches--d	=	3.458

CURB OPENING--ADOT STD. C-15.20

Flow-CFS--Q	=	2.790
Gutter Velocity at INLET-fps	=	5.530
GUTTER FLOW at INLET-CFS--Q	=	2.266
Depth at INLET Curb Line-Inches--d	=	3.458
Local Gutter Depression-Inches	=	0.000
Length of opening: TOTAL Intercept--Ft.	=	22.139 ← 22'±
Capture Ratio -- CURB OPENING	=	0.800

LENGTH	Efficiency	Q(Captured)	Q(By-Pass)
3.083	0.237	0.660	2.130
6.583	0.470	1.312	1.478
9.583	0.640	1.785	1.005
13.583	0.819	2.286	0.504
20.583	0.992	2.767	0.023

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-11-1996

PROJECT NAME- SR202L
HIGHWAY NAME- McKELLIPS ROAD
LOCATION - 21+62 LT
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SAW
PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.557
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.040
Shoulder Width-Ft.--	=	12.000
Shoulder Slope-Ft./Ft.--Ss	=	0.040
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.083
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	2.770
SPREAD-Ft.--T	=	7.165
Average Velocity-V-fps	=	2.488
FLOW in Gutter-CFS--Q	=	1.796
% Flow in Gutter-CFS	=	64.847
Velocity of Flow in Gutter-fps	=	3.098
Depth at Curb Line-Inches--d	=	4.479

CURB OPENING--ADOT STD. C-15.20

Flow-CFS--Q	=	2.770
Gutter Velocity at INLET-fps	=	3.098
GUTTER FLOW at INLET-CFS--Q	=	1.796
Depth at INLET Curb Line-Inches--d	=	4.479
Local Gutter Depression-Inches	=	0.000
Length of opening: TOTAL Intercept--Ft.	=	14.530
Capture Ratio -- CURB OPENING	=	0.800

LENGTH	Efficiency	Q(Captured)	Q(By-Pass)
3.083	0.349	0.967	1.803
6.583	0.662	1.835	0.935
9.583	0.856	2.372	0.398
13.583	0.993	2.750	0.020
20.583	1.000	2.770	0.000

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-18-1996

PROJECT NAME- SR202 L
HIGHWAY NAME- Mckellips Road
LOCATION - 21+65 Rt
Ver 3.40: December 1995

TRACS NO.-
DESIGNER -
CHECKER - SAW
PAGE

GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.548
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.040
Shoulder Width-Ft.--	=	10.000
Shoulder Slope-Ft./Ft.--Ss	=	0.040
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.042
Gutter Depression-Inches--	=	1.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	0.670
SPREAD-Ft.--T	=	4.474
Average Velocity-V-fps	=	1.660
FLOW in Gutter-CFS--Q	=	0.534
% Flow in Gutter-CFS	=	79.725
Velocity of Flow in Gutter-fps	=	1.899
Depth at Curb Line-Inches--d	=	2.188

GRATE TYPE: ADOT STD.--EF--2

Grate Length--Ft.	=	3.250
Grate Width---Ft.	=	1.500
Grate Area--Sq. Ft.	=	3.480
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	6.250
Splash-Over Velocity--FPS	=	3.558
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	0.670
GUTTER FLOW at INLET-CFS--Q	=	0.622
Gutter Velocity at INLET-fps	=	2.066
Depth at INLET Curb Line-Inches--d	=	2.805
Frontal Flow Intercepted by GRATE--CFS	=	0.561
Lateral Flow Intercepted by GRATE--CFS	=	0.058
TOTAL Flow Intercepted by GRATE--CFS	=	0.619
% FLOW Intercepted	=	92.326
By-pass Flow--CFS	=	0.051

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-11-1996

PROJECT NAME- SR202L
HIGHWAY NAME- McKELLIPS ROAD
LOCATION - 25+39
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - SRM
CHECKER - SAW
PAGE

USE: MAG STD DTL 206 (4 IN SERIES)

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.214
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.040
Shoulder Width-Ft.--	=	12.000
Shoulder Slope-Ft./Ft.--Ss	=	0.040
Gutter Width-Ft.--W	=	1.417
Gutter Slope-Ft./Ft.--Sw	=	0.059
Gutter Depression-Inches--	=	1.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	8.580
SPREAD-Ft.--T	=	13.917
Average Velocity-V-fps	=	2.204
FLOW in Gutter-CFS--Q	=	2.205
% Flow in Gutter-CFS	=	25.694
Velocity of Flow in Gutter-fps	=	2.872
Depth at Curb Line-Inches--d	=	7.000

CURB OPENING--ADOT STD. C-15.20

Flow-CFS--Q	=	8.580
Gutter Velocity at INLET-fps	=	3.129
GUTTER FLOW at INLET-CFS--Q	=	2.705
Depth at INLET Curb Line-Inches--d	=	8.819
Local Gutter Depression-Inches	=	2.000
Length of opening: TOTAL Intercept--Ft.	=	15.571
Capture Ratio -- CURB OPENING	=	0.800

LENGTH	Efficiency	Q(Captured)	Q(By-Pass)
3.083	0.328	2.812	5.768
6.583	0.628	5.389	3.191
9.583	0.821	7.044	1.536
13.583	0.975	8.369	0.211
20.583	1.000	8.580	0.000

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-05-1996

PROJECT NAME- SR202L
HIGHWAY NAME- COUNTRY CLUB A
LOCATION - 2+52.29
Ver 3.40: December 1995

TRACS NO.-
DESIGNER -
CHECKER - SAW
PAGE

GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.709
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.023
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	0.870
SPREAD-Ft.--T	=	5.034
Average Velocity-V-fps	=	2.033
FLOW in Gutter-CFS--Q	=	0.805
% Flow in Gutter-CFS	=	92.504
Velocity of Flow in Gutter-fps	=	2.273
Depth at Curb Line-Inches--d	=	2.699

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	0.870
GUTTER FLOW at INLET-CFS--Q	=	0.868
Gutter Velocity at INLET-fps	=	2.450
Depth at INLET Curb Line-Inches--d	=	3.200
Frontal Flow Intercepted by GRATE--CFS	=	0.847
Lateral Flow Intercepted by GRATE--CFS	=	0.017
TOTAL Flow Intercepted by GRATE--CFS	=	0.864
% FLOW Intercepted	=	99.253
By-pass Flow--CFS	=	0.006

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-07-1996

PROJECT NAME- SR202L TRACS NO.-
HIGHWAY NAME- COUNTRY CLUB RAMP A DESIGNER - JRM
LOCATION - 12+00 CHECKER - JAW PAGE
Ver 3.40: December 1995

GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	2.332
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.033
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.033
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	2.000
SPREAD-Ft.--T	=	4.899
Average Velocity-V-fps	=	3.985
FLOW in Gutter-CFS--Q	=	1.812
% Flow in Gutter-CFS	=	90.607
Velocity of Flow in Gutter-fps	=	4.456
Depth at Curb Line-Inches--d	=	2.952

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	2.000
GUTTER FLOW at INLET-CFS--Q	=	1.969
Gutter Velocity at INLET-fps	=	4.758
Depth at INLET Curb Line-Inches--d	=	3.486
Frontal Flow Intercepted by GRATE--CFS	=	1.891
Lateral Flow Intercepted by GRATE--CFS	=	0.039
TOTAL Flow Intercepted by GRATE--CFS	=	1.930
% FLOW Intercepted	=	96.497
By-pass Flow--CFS	=	0.070 bypass

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-07-1996

PROJECT NAME- SR 202L
HIGHWAY NAME- COUNTRY CLUB RAMP A
LOCATION - 12+70
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SAW
PAGE

GRATE INLET--IN SUMP

GUTTER FLOW HYDRAULICS

GUTTER DESCRIPTION

Roadway Cross-Slope-Ft./Ft.--Sx	=	0.005
Shoulder Width-Ft.--	=	11.500
Shoulder Slope-Ft./Ft.--Ss	=	0.005
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Effective Perimeter--Ft.	=	7.354
Capture Ratio -- GRATE	=	0.500
Local Gutter Depression-Inches	=	0.000
Depth at INLET Curb Line-Inches--d	=	2.190
Depth at C.G. of Grate Flow--In.	=	1.543
SPREAD-Ft.--T	=	5.617
Depth for WEIR FLOW, inches	=	2.190
Depth for ORIFICE FLOW, inches	=	0.001

Q(INLET) = 0.330 cfs is Based on WEIR flow

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-07-1996

PROJECT NAME- SR202L
HIGHWAY NAME- COUNTRY CLUB RAMP A
LOCATION - 13+05
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SAW
PAGE

GRATE INLET--IN SUMP

GUTTER FLOW HYDRAULICS

GUTTER DESCRIPTION

Roadway Cross-Slope-Ft./Ft.--Sx	=	0.009
Shoulder Width-Ft.--	=	7.500
Shoulder Slope-Ft./Ft.--Ss	=	0.009
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000

GRATE TYPE: ADOT STD.--EF--1

Grate Length--Ft.	=	3.250
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	4.660
Effective Perimeter--Ft.	=	7.250
Capture Ratio -- GRATE	=	0.500
Local Gutter Depression-Inches	=	0.000
Depth at INLET Curb Line-Inches--d	=	2.420
Depth at C.G. of Grate Flow--In.	=	1.752
SPREAD-Ft.--T	=	6.418
Depth for WEIR FLOW, inches	=	2.420
Depth for ORIFICE FLOW, inches	=	0.003

Q(INLET) = 0.420 cfs is Based on WEIR flow

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-07-1996

PROJECT NAME- SR202L
HIGHWAY NAME- COUNTRY CLUB B
LOCATION - 13+60
Ver 3.40: December 1995 (SCUPPER)

TRACS NO.-
DESIGNER - JRM
CHECKER - TMW
PAGE

CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.780
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	1.260
SPREAD-Ft.--T	=	6.565
Average Velocity-V-fps	=	2.184
FLOW in Gutter-CFS--Q	=	1.068
% Flow in Gutter-CFS	=	84.758
Velocity of Flow in Gutter-fps	=	2.595
Depth at Curb Line-Inches--d	=	2.976

CURB OPENING--ADOT STD. C-15.20

Flow-CFS--Q	=	1.260
Gutter Velocity at INLET-fps	=	2.595
GUTTER FLOW at INLET-CFS--Q	=	1.068
Depth at INLET Curb Line-Inches--d	=	2.976
Local Gutter Depression-Inches	=	0.000
Length of opening: TOTAL Intercept--Ft.	=	12.515
Capture Ratio -- CURB OPENING	=	0.800

LENGTH	Efficiency	Q(Captured)	Q(By-Pass)
3.083	0.399	0.503	0.757
6.583	0.739	0.931	0.329
9.583	0.927	1.168	0.092
13.583	1.000	1.260	0.000
20.583	1.000	1.260	0.000

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-07-1996

PROJECT NAME- SR 202L
HIGHWAY NAME- COUNTRY CLUB B
LOCATION - 15+50
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SAW
PAGE

GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.780
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	0.960
SPREAD-Ft.--T	=	5.555
Average Velocity-V-fps	=	2.113
FLOW in Gutter-CFS--Q	=	0.870
% Flow in Gutter-CFS	=	90.665
Velocity of Flow in Gutter-fps	=	2.410
Depth at Curb Line-Inches--d	=	2.733

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	0.960
GUTTER FLOW at INLET-CFS--Q	=	0.954
Gutter Velocity at INLET-fps	=	2.606
Depth at INLET Curb Line-Inches--d	=	3.258
Frontal Flow Intercepted by GRATE--CFS	=	0.928
Lateral Flow Intercepted by GRATE--CFS	=	0.022
TOTAL Flow Intercepted by GRATE--CFS	=	0.950
% FLOW Intercepted	=	98.962
By-pass Flow--CFS	=	0.010

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-07-1996

PROJECT NAME- SR 202L
HIGHWAY NAME- COUNTRY CLUB B
LOCATION - 16+15
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SAW
PAGE

GRATE INLET--IN SUMP

GUTTER FLOW HYDRAULICS

GUTTER DESCRIPTION

Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Effective Perimeter--Ft.	=	7.354
Capture Ratio -- GRATE	=	0.500
Local Gutter Depression-Inches	=	1.000
Depth at INLET Curb Line-Inches--d	=	2.040
Depth at C.G. of Grate Flow--In.	=	2.101
SPREAD-Ft.--T	=	2.665
Depth for WEIR FLOW, inches	=	3.040
Depth for ORIFICE FLOW, inches	=	0.003

Q(INLET) = 0.500 cfs is Based on WEIR flow

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-07-1996

PROJECT NAME- SR202L
HIGHWAY NAME- COUNTRY CLUB B
LOCATION - 16+50
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SAW
PAGE

GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.419
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	0.760
SPREAD-Ft.--T	=	5.836
Average Velocity-V-fps	=	1.562
FLOW in Gutter-CFS--Q	=	0.677
% Flow in Gutter-CFS	=	89.068
Velocity of Flow in Gutter-fps	=	1.804
Depth at Curb Line-Inches--d	=	2.801

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	0.760
GUTTER FLOW at INLET-CFS--Q	=	0.751
Gutter Velocity at INLET-fps	=	1.951
Depth at INLET Curb Line-Inches--d	=	3.348
Frontal Flow Intercepted by GRATE--CFS	=	0.727
Lateral Flow Intercepted by GRATE--CFS	=	0.026
TOTAL Flow Intercepted by GRATE--CFS	=	0.752
% FLOW Intercepted	=	98.995
By-pass Flow--CFS	=	0.008

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-24-1996

PROJECT NAME- SR202L
HIGHWAY NAME- Country Club Ramp C
LOCATION - 2+05 inlet
Ver 3.40: December 1995 1+75 hydraulics

TRACS NO.-
DESIGNER - SAW
CHECKER - PAGE

GUTTER FLOW HYDRAULICS @ 1+75 (C&G transition)
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.521
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000 ✓
Gutter Slope-Ft./Ft.--Sw	=	0.083
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	1.670
SPREAD-Ft.--T	=	8.668
Average Velocity-V-fps	=	1.902
FLOW in Gutter-CFS--Q	=	1.083
% Flow in Gutter-CFS	=	64.845
Velocity of Flow in Gutter-fps	=	2.499
Depth at Curb Line-Inches--d	=	3.600 ✓

3.6" > 3" Slotted drain must collect enough flow to reduce d to 3" by the end of the 15' C&G transition.

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-24-1996

PROJECT NAME- SR202L
HIGHWAY NAME- Country Club RAMP C
LOCATION - 2+05
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - SAW
CHECKER - PAGE

SLOTTED DRAIN W/ GRATE--IN SUMP

GUTTER FLOW HYDRAULICS

GUTTER DESCRIPTION

Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Effective Perimeter--Ft.	=	7.354
Capture Ratio -- GRATE	=	0.500
Capture Ratio -- SLOTTED DRAIN	=	0.670
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	2.120

LENGTH	Q(Slot. Dn)	Q(Grate)	d(inches)	SPREAD,Ft.
10.000	1.718	0.401	1.779	2.224
20.000	2.043	0.077	0.966	1.207
30.000	2.068	0.052	0.512	0.640

[illegible] FIND [illegible] Simply put [illegible] of [illegible] slot drain instead [illegible] of hydraulic [illegible].

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-07-1996

PROJECT NAME- SR 202L
HIGHWAY NAME- COUNTRY CLUB RAMP C
LOCATION - 2+75
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SJW
PAGE

GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.363
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	1.560
SPREAD-Ft.--T	=	6.317
Average Velocity-V-fps	=	2.863
FLOW in Gutter-CFS--Q	=	1.345
% Flow in Gutter-CFS	=	86.244
Velocity of Flow in Gutter-fps	=	3.370
Depth at Curb Line-Inches--d	=	2.916

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	1.560
GUTTER FLOW at INLET-CFS--Q	=	1.518
Gutter Velocity at INLET-fps	=	3.647
Depth at INLET Curb Line-Inches--d	=	3.498
Frontal Flow Intercepted by GRATE--CFS	=	1.457
Lateral Flow Intercepted by GRATE--CFS	=	0.048
TOTAL Flow Intercepted by GRATE--CFS	=	1.505
% FLOW Intercepted	=	96.465
By-pass Flow--CFS	=	0.055

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-07-1996

PROJECT NAME- SR 202L
HIGHWAY NAME- COUNTRY CLUB RAMP D
LOCATION - I-25
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - VRM
CHECKER -
PAGE

GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.687
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	0.350
SPREAD-Ft.--T	=	2.458
Average Velocity-V-fps	=	1.737
FLOW in Gutter-CFS--Q	=	0.350
% Flow in Gutter-CFS	=	100.012
Velocity of Flow in Gutter-fps	=	1.738
Depth at Curb Line-Inches--d	=	1.967

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	0.350
GUTTER FLOW at INLET-CFS--Q	=	0.350
Gutter Velocity at INLET-fps	=	1.923
Depth at INLET Curb Line-Inches--d	=	2.290
Frontal Flow Intercepted by GRATE--CFS	=	0.350
Lateral Flow Intercepted by GRATE--CFS	=	0.000
TOTAL Flow Intercepted by GRATE--CFS	=	0.350
% FLOW Intercepted	=	100.000
By-pass Flow--CFS	=	0.000

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-07-1996

PROJECT NAME- SR202L TRACS NO.-
HIGHWAY NAME- COUNTRY CLUB RAMP D DESIGNER - JRM
LOCATION - 1+50 CHECKER - AW PAGE
Ver 3.40: December 1995

GRATE INLET--IN SUMP

GUTTER FLOW HYDRAULICS

GUTTER DESCRIPTION

Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Effective Perimeter--Ft.	=	7.354
Capture Ratio -- GRATE	=	0.500
Local Gutter Depression-Inches	=	1.000
Depth at INLET Curb Line-Inches--d	=	1.560
Depth at C.G. of Grate Flow--In.	=	1.713
SPREAD-Ft.--T	=	1.949
Depth for WEIR FLOW, inches	=	2.560
Depth for ORIFICE FLOW, inches	=	0.001

Q(INLET) = 0.330 cfs is Based on WEIR flow

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-07-1996

PROJECT NAME- SR202L
HIGHWAY NAME- COUNTRY CLUB RAMP D
LOCATION - 2+10
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - JRM
CHECKER - SAW
PAGE

GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.778
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	9.500
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.500
Gutter Slope-Ft./Ft.--Sw	=	0.067
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	1.880
SPREAD-Ft.--T	=	6.520
Average Velocity-V-fps	=	3.293
FLOW in Gutter-CFS--Q	=	1.599
% Flow in Gutter-CFS	=	85.031
Velocity of Flow in Gutter-fps	=	3.905
Depth at Curb Line-Inches--d	=	2.965

GRATE TYPE: ADOT STD.--C15.91

Grate Length--Ft.	=	3.354
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	5.171
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	7.354
Splash-Over Velocity--FPS	=	7.354
Local Gutter Depression-Inches	=	1.000
Flow-CFS--Q	=	1.880
GUTTER FLOW at INLET-CFS--Q	=	1.814
Gutter Velocity at INLET-fps	=	4.227
Depth at INLET Curb Line-Inches--d	=	3.560
Frontal Flow Intercepted by GRATE--CFS	=	1.735
Lateral Flow Intercepted by GRATE--CFS	=	0.054
TOTAL Flow Intercepted by GRATE--CFS	=	1.789
% FLOW Intercepted	=	95.177
By-pass Flow--CFS	=	0.091

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-24-1996

PROJECT NAME- SR202 L
HIGHWAY NAME- Country Club Southbound (& North)
LOCATION - 265+25.19 East
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - SAW
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CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.629
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	10.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	1.500
Gutter Slope-Ft./Ft.--Sw	=	0.056
Gutter Depression-Inches--	=	1.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	3.270
SPREAD-Ft.--T	=	11.983
Average Velocity-V-fps	=	2.216
FLOW in Gutter-CFS--Q	=	1.117
% Flow in Gutter-CFS	=	34.158
Velocity of Flow in Gutter-fps	=	2.963
Depth at Curb Line-Inches--d	=	3.516

CURB OPENING--ADOT STD. C-15~~/20~~ MESA DBL Type E (8' curb opening)

Flow-CFS--Q	=	3.270
Gutter Velocity at INLET-fps	=	3.243
GUTTER FLOW at INLET-CFS--Q	=	1.377
Depth at INLET Curb Line-Inches--d	=	4.397
Local Gutter Depression-Inches	=	1.000
Length of opening: TOTAL Intercept--Ft.	=	14.180
Capture Ratio -- CURB OPENING	=	1.000

LENGTH	Efficiency	Q(Captured)	Q(By-Pass)
3.083	0.357	1.167	2.103
6.583	0.675	2.207	1.063
9.583	0.868	2.840	0.430
13.583	0.997	3.259	0.011
20.583	1.000	3.270	0.000

approx length of opening

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-24-1996

PROJECT NAME- SR202 L
HIGHWAY NAME- Country Club Southbound
LOCATION - 267176
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - Stw
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CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.629
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.023
Shoulder Width-Ft.--	=	12.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	1.500
Gutter Slope-Ft./Ft.--Sw	=	0.056
Gutter Depression-Inches--	=	1.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	1.800
SPREAD-Ft.--T	=	9.451
Average Velocity-V-fps	=	1.929
FLOW in Gutter-CFS--Q	=	0.770
% Flow in Gutter-CFS	=	42.774
Velocity of Flow in Gutter-fps	=	2.558
Depth at Curb Line-Inches--d	=	2.908

CURB OPENING--ADOT STD. C-15.20

Flow-CFS--Q	=	1.800
Gutter Velocity at INLET-fps	=	2.842
GUTTER FLOW at INLET-CFS--Q	=	0.978
Depth at INLET Curb Line-Inches--d	=	3.753
Local Gutter Depression-Inches	=	1.000
Length of opening: TOTAL Intercept--Ft.	=	12.420
Capture Ratio -- CURB OPENING	=	0.800

LENGTH	Efficiency	Q(Captured)	Q(By-Pass)
3.083	0.402	0.723	1.077
6.583	0.743	1.338	0.462
9.583	0.930	1.674	0.126
13.583	1.000	1.800	0.000
20.583	1.000	1.800	0.000

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-24-1996

PROJECT NAME- SR202L
HIGHWAY NAME- Country Club Southbound
LOCATION - 274+83
Ver 3.40: December 1995

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CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.749
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	12.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	1.500
Gutter Slope-Ft./Ft.--Sw	=	0.056
Gutter Depression-Inches--	=	1.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	2.110
SPREAD-Ft.--T	=	9.728
Average Velocity-V-fps	=	2.139
FLOW in Gutter-CFS--Q	=	0.879
% Flow in Gutter-CFS	=	41.646
Velocity of Flow in Gutter-fps	=	2.841
Depth at Curb Line-Inches--d	=	2.975

CURB OPENING--ADOT STD. C-15.20

Flow-CFS--Q	=	2.110
Gutter Velocity at INLET-fps	=	3.151
GUTTER FLOW at INLET-CFS--Q	=	1.113
Depth at INLET Curb Line-Inches--d	=	3.825
Local Gutter Depression-Inches	=	1.000
Length of opening: TOTAL Intercept--Ft.	=	14.171
Capture Ratio -- CURB OPENING	=	0.800

LENGTH	Efficiency	Q(Captured)	Q(By-Pass)
3.083	0.357	0.753	1.357
6.583	0.675	1.425	0.685
9.583	0.869	1.833	0.277
13.583	0.997	2.103	0.007
20.583	1.000	2.110	0.000

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-24-1996

PROJECT NAME- SR202L
HIGHWAY NAME- Country Club Southbound
LOCATION - Z791 35
Ver 3.40: December 1995

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CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.274
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	12.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.083
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	0.840
SPREAD-Ft.--T	=	7.202
Average Velocity-V-fps	=	1.302
FLOW in Gutter-CFS--Q	=	0.621
% Flow in Gutter-CFS	=	73.942
Velocity of Flow in Gutter-fps	=	1.657
Depth at Curb Line-Inches--d	=	3.248

CURB OPENING--ADOT STD. C-15.20

Flow-CFS--Q	=	0.840
Gutter Velocity at INLET-fps	=	1.657
GUTTER FLOW at INLET-CFS--Q	=	0.621
Depth at INLET Curb Line-Inches--d	=	3.248
Local Gutter Depression-Inches	=	0.000
Length of opening: TOTAL Intercept--Ft.	=	7.194
Capture Ratio -- CURB OPENING	=	0.800

LENGTH	Efficiency	Q(Captured)	Q(By-Pass)
3.083	0.635	0.533	0.307
6.583	0.988	0.830	0.010
9.583	1.000	0.840	0.000
13.583	1.000	0.840	0.000
20.583	1.000	0.840	0.000

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-24-1996

PROJECT NAME- SR202L
HIGHWAY NAME- Country Club Southbound
LOCATION - 220+45
Ver 3.40: December 1995

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CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.300	← Assumed "effective" longitudinal slope
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020	
Shoulder Width-Ft.--	=	12.000	
Shoulder Slope-Ft./Ft.--Ss	=	0.020	
Gutter Width-Ft.--W	=	2.000	
Gutter Slope-Ft./Ft.--Sw	=	0.083	
Gutter Depression-Inches--	=	2.000	
Manning's 'N	=	0.016	
Flow-CFS--Q	=	4.720	
SPREAD-Ft.--T	=	15.469	← ok
Average Velocity-V-fps	=	1.873	
FLOW in Gutter-CFS--Q	=	1.819	
% Flow in Gutter-CFS	=	38.536	
Velocity of Flow in Gutter-fps	=	2.578	
Depth at Curb Line-Inches--d	=	5.232	

CURB OPENING--ADOT STD. C-15.20

Flow-CFS--Q	=	4.720
Gutter Velocity at INLET-fps	=	2.578
GUTTER FLOW at INLET-CFS--Q	=	1.819
Depth at INLET Curb Line-Inches--d	=	5.232
Local Gutter Depression-Inches	=	0.000
Length of opening: TOTAL Intercept--Ft.	=	19.513
Capture Ratio -- CURB OPENING	=	0.800

LENGTH	Efficiency	Q(Captured)	Q(By-Pass)	
3.083	0.266	1.257	3.463	
6.583	0.523	2.470	2.250	
9.583	0.704	3.321	1.399	
13.583	0.883	4.167	0.553	
20.583	1.000	4.720	0.000	← USE

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-24-1996

PROJECT NAME- SR202L
HIGHWAY NAME- Country Club Southbound
LOCATION - 200+45
Ver 3.40: December 1995

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CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.051	- Actual longitudinal slope
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020	
Shoulder Width-Ft.--	=	12.000	
Shoulder Slope-Ft./Ft.--Ss	=	0.020	
Gutter Width-Ft.--W	=	2.000	
Gutter Slope-Ft./Ft.--Sw	=	0.083	
Gutter Depression-Inches--	=	2.000	
Manning's 'N	=	0.016	
Flow-CFS--Q	=	4.720	
SPREAD-Ft.--T	=	22.029	←
Average Velocity-V-fps	=	0.948	
FLOW in Gutter-CFS--Q	=	1.267	
% Flow in Gutter-CFS	=	26.838	
Velocity of Flow in Gutter-fps	=	1.309	
Depth at Curb Line-Inches--d	=	6.807	

CURB OPENING--ADOT STD. C-15.20

Flow-CFS--Q	=	4.720
Gutter Velocity at INLET-fps	=	1.309
GUTTER FLOW at INLET-CFS--Q	=	1.267
Depth at INLET Curb Line-Inches--d	=	6.807
Local Gutter Depression-Inches	=	0.000
Length of opening: TOTAL Intercept--Ft.	=	12.809
Capture Ratio -- CURB OPENING	=	0.800

LENGTH	Efficiency	Q(Captured)	Q(By-Pass)	
3.083	0.391	1.845	2.875	
6.583	0.727	3.432	1.288	
9.583	0.916	4.325	0.395	
13.583	1.000	4.720	0.000	
20.583	1.000	4.720	0.000	← use

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-24-1996

PROJECT NAME- SR202L TRACS NO.-
HIGHWAY NAME- Country Club Southbound DESIGNER - SAW
LOCATION - 2E5100 CHECKER - PAGE
Ver 3.40: December 1995

GRATE INLET DESIGN -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.931
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.077
Shoulder Width-Ft.--	=	12.000
Shoulder Slope-Ft./Ft.--Ss	=	0.077
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.083
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	3.570
SPREAD-Ft.--T	=	4.365
Average Velocity-V-fps	=	4.783
FLOW in Gutter-CFS--Q	=	2.897
% Flow in Gutter-CFS	=	81.137
Velocity of Flow in Gutter-fps	=	5.456
Depth at Curb Line-Inches--d	=	4.186

GRATE TYPE: ADOT STD.--EF--2

Grate Length--Ft.	=	3.250
Grate Width---Ft.	=	1.500
Grate Area--Sq. Ft.	=	3.480
Capture Ratio -- GRATE	=	0.500
Effective Perimeter--Ft.	=	6.250
Splash-Over Velocity--FPS	=	3.558
Local Gutter Depression-Inches	=	0.000
Flow-CFS--Q	=	3.570
GUTTER FLOW at INLET-CFS--Q	=	2.897
Gutter Velocity at INLET-fps	=	5.456
Depth at INLET Curb Line-Inches--d	=	4.186
Frontal Flow Intercepted by GRATE--CFS	=	1.974
Lateral Flow Intercepted by GRATE--CFS	=	0.160
TOTAL Flow Intercepted by GRATE--CFS	=	2.134
% FLOW Intercepted	=	59.765
By-pass Flow--CFS	=	1.436

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-24-1996

PROJECT NAME- SR202L
HIGHWAY NAME- County Club Northbound
LOCATION - 267+76
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - SAW
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CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.629
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	12.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.083
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	1.740
SPREAD-Ft.--T	=	8.448
Average Velocity-V-fps	=	2.070
FLOW in Gutter-CFS--Q	=	1.150
% Flow in Gutter-CFS	=	66.121
Velocity of Flow in Gutter-fps	=	2.710
Depth at Curb Line-Inches--d	=	3.548

CURB OPENING--ADOT STD. C-15.20

Flow-CFS--Q	=	1.740
Gutter Velocity at INLET-fps	=	2.710
GUTTER FLOW at INLET-CFS--Q	=	1.150
Depth at INLET Curb Line-Inches--d	=	3.548
Local Gutter Depression-Inches	=	0.000
Length of opening: TOTAL Intercept--Ft.	=	13.131
Capture Ratio -- CURB OPENING	=	0.800

LENGTH	Efficiency	Q(Captured)	Q(By-Pass)
3.083	0.382	0.665	1.075
6.583	0.714	1.243	0.497
9.583	0.905	1.575	0.165
13.583	1.000	1.740	0.000
20.583	1.000	1.740	0.000

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-24-1996

PROJECT NAME- SR202L
HIGHWAY NAME- Country Club Northbound
LOCATION - 279+83
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - SAW
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CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.176
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	12.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.083
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	0.840
SPREAD-Ft.--T	=	8.069
Average Velocity-V-fps	=	1.080
FLOW in Gutter-CFS--Q	=	0.575
% Flow in Gutter-CFS	=	68.428
Velocity of Flow in Gutter-fps	=	1.404
Depth at Curb Line-Inches--d	=	3.456

CURB OPENING--ADOT STD. C-15.20

Flow-CFS--Q	=	0.840
Gutter Velocity at INLET-fps	=	1.404
GUTTER FLOW at INLET-CFS--Q	=	0.575
Depth at INLET Curb Line-Inches--d	=	3.456
Local Gutter Depression-Inches	=	0.000
Length of opening: TOTAL Intercept--Ft.	=	6.514
Capture Ratio -- CURB OPENING	=	0.800

LENGTH	Efficiency	Q(Captured)	Q(By-Pass)
3.083	0.685	0.575	0.265
6.583	1.000	0.840	0.000
9.583	1.000	0.840	0.000
13.583	1.000	0.840	0.000
20.583	1.000	0.840	0.000

ARIZONA DEPARTMENT OF TRANSPORTATION
DRAINAGE DESIGN SECTION

09-24-1996

PROJECT NAME- SR202L
HIGHWAY NAME- County Club Northbound
LOCATION - 276 +00
Ver 3.40: December 1995

TRACS NO.-
DESIGNER - SAW
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CURB OPENING INLET -- ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.749
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	12.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.083
Gutter Depression-Inches--	=	2.000
Manning's 'N	=	0.016
Flow-CFS--Q	=	2.880
SPREAD-Ft.--T	=	10.285
Average Velocity-V-fps	=	2.432
FLOW in Gutter-CFS--Q	=	1.625
% Flow in Gutter-CFS	=	56.436
Velocity of Flow in Gutter-fps	=	3.263
Depth at Curb Line-Inches--d	=	3.988

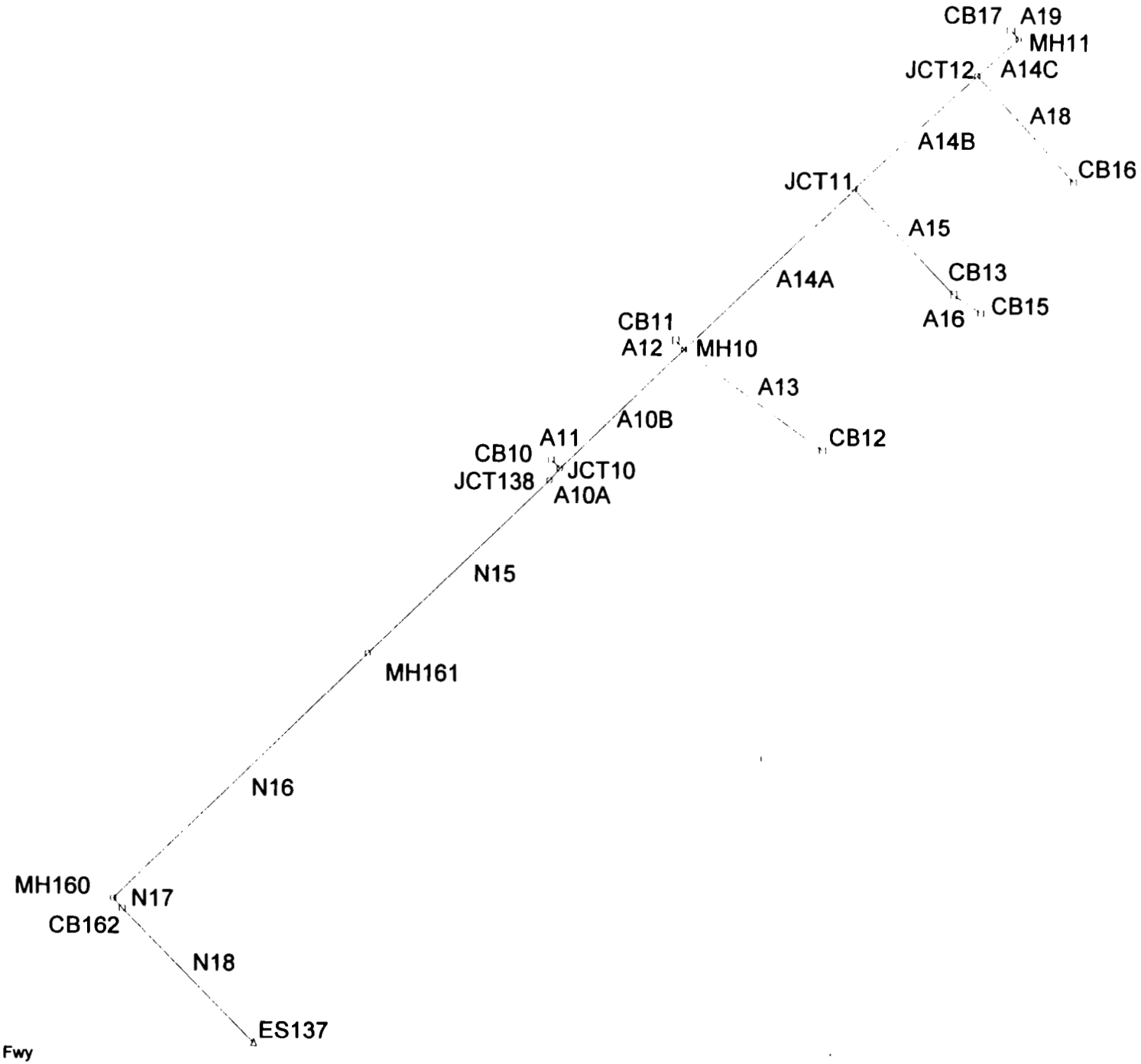
CURB OPENING--ADOT STD. C-15.20

Flow-CFS--Q	=	2.880
Gutter Velocity at INLET-fps	=	3.263
GUTTER FLOW at INLET-CFS--Q	=	1.625
Depth at INLET Curb Line-Inches--d	=	3.988
Local Gutter Depression-Inches	=	0.000
Length of opening: TOTAL Intercept--Ft.	=	18.203
Capture Ratio -- CURB OPENING	=	0.800

LENGTH	Efficiency	Q(Captured)	Q(By-Pass)
3.083	0.284	0.818	2.062
6.583	0.554	1.596	1.284
9.583	0.740	2.130	0.750
13.583	0.915	2.636	0.244
20.583	1.000	2.880	0.000

APPENDIX C

Storm Drain Hydraulic Gradeline Calculations



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Project Engineer: JRM
StormCAD v1.0
Page 1 of 1

Pipe Report

Pipe	Upstream Node	Downstream Node	Inlet Area (acres)	Weighted Roughness Coefficient	Inlet CA (acres)	Total CA (acres)	System Intensity (in/hr)	Discharge (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Roughness	Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Cover (ft)	Downstream Cover (ft)	Upstream HGL (ft)	Downstream HGL (ft)
A11	CB10	JCT10	0.23	0.865	0.20	0.20	4.20	0.84	8.00	0.165000	24 inch	0.012	99.54	1,221.13	1,219.81	1,226.13	1,225.81	3.00	4.00	1,221.45	1,221.38
A16	CB15	CB13	0.07	0.950	0.07	0.07	4.20	0.28	20.62	0.014064	24 inch	0.012	29.06	1,225.23	1,224.94	1,229.73	1,229.94	2.50	3.00	1,226.06	1,226.06
A15	CB13	JCT11	0.23	0.950	0.22	0.29	3.96	1.14	92.00	0.001957	24 inch	0.012	10.84	1,224.94	1,224.76	1,229.94	1,230.76	3.00	4.00	1,226.06	1,226.06
A18	CB16	JCT12	1.14	0.950	1.08	1.08	4.20	4.58	90.50	0.002320	24 inch	0.012	11.80	1,226.62	1,226.41	1,231.62	1,230.41	3.00	2.00	1,227.75	1,227.71
A19	CB17	MH11	1.16	0.865	1.00	1.00	4.20	4.25	8.00	0.081250	24 inch	0.012	69.85	1,227.61	1,226.96	1,232.61	1,232.96	3.00	4.00	1,228.33	1,227.90
A14C	MH11	JCT12	N/A	N/A	N/A	1.00	4.19	4.24	35.04	0.015696	24 inch	0.012	30.70	1,226.96	1,226.41	1,232.96	1,230.41	4.00	2.00	1,227.68	1,227.71
A14B	JCT12	JCT11	N/A	N/A	N/A	2.09	4.11	8.65	105.64	0.015619	24 inch	0.012	30.63	1,226.41	1,224.76	1,230.41	1,230.76	2.00	4.00	1,227.46	1,226.06
A14A	JCT11	MH10	N/A	N/A	N/A	2.37	3.60	8.62	149.62	0.015640	24 inch	0.012	30.65	1,224.76	1,222.42	1,230.76	1,228.42	4.00	4.00	1,225.81	1,224.15
A12	CB11	MH10	0.60	0.865	0.52	0.52	4.20	2.20	8.00	0.087500	24 inch	0.012	72.49	1,223.12	1,222.42	1,228.12	1,228.42	3.00	4.00	1,224.13	1,224.15
A13	CB12	MH10	0.37	0.950	0.35	0.35	4.20	1.49	108.95	0.004039	24 inch	0.012	15.57	1,222.86	1,222.42	1,227.36	1,228.42	2.50	4.00	1,224.15	1,224.15
A10B	MH10	JCT10	N/A	N/A	N/A	3.24	3.53	11.52	110.00	0.023727	24 inch	0.012	37.75	1,222.42	1,219.81	1,228.42	1,225.81	4.00	4.00	1,223.64	1,221.38
A10A	JCT10	JCT138	N/A	N/A	N/A	3.44	3.50	12.13	10.00	0.024000	24 inch	0.012	37.96	1,219.81	1,219.57	1,225.81	1,225.57	4.00	4.00	1,221.06	1,220.82
N15	JCT138	MH161	N/A	N/A	N/A	3.44	3.50	12.12	160.00	0.022062	24 inch	0.012	36.40	1,219.57	1,216.04	1,225.57	1,222.04	4.00	4.00	1,220.82	1,217.31
N16	MH161	MH160	N/A	N/A	N/A	3.44	3.46	12.00	224.00	0.012232	24 inch	0.012	27.10	1,216.04	1,213.30	1,222.04	1,218.30	4.00	3.00	1,217.28	1,214.95
N17	MH160	CB162	N/A	N/A	N/A	3.44	3.40	11.81	8.50	0.052941	24 inch	0.012	56.39	1,213.30	1,212.85	1,218.30	1,217.55	3.00	2.70	1,214.53	1,214.40
N18	CB162	ES137	0.30	0.700	0.21	3.65	3.40	12.52	119.69	0.051800	24 inch	0.012	55.78	1,212.85	1,206.65	1,217.55	1,209.65	2.70	1.00	1,214.12	1,208.65

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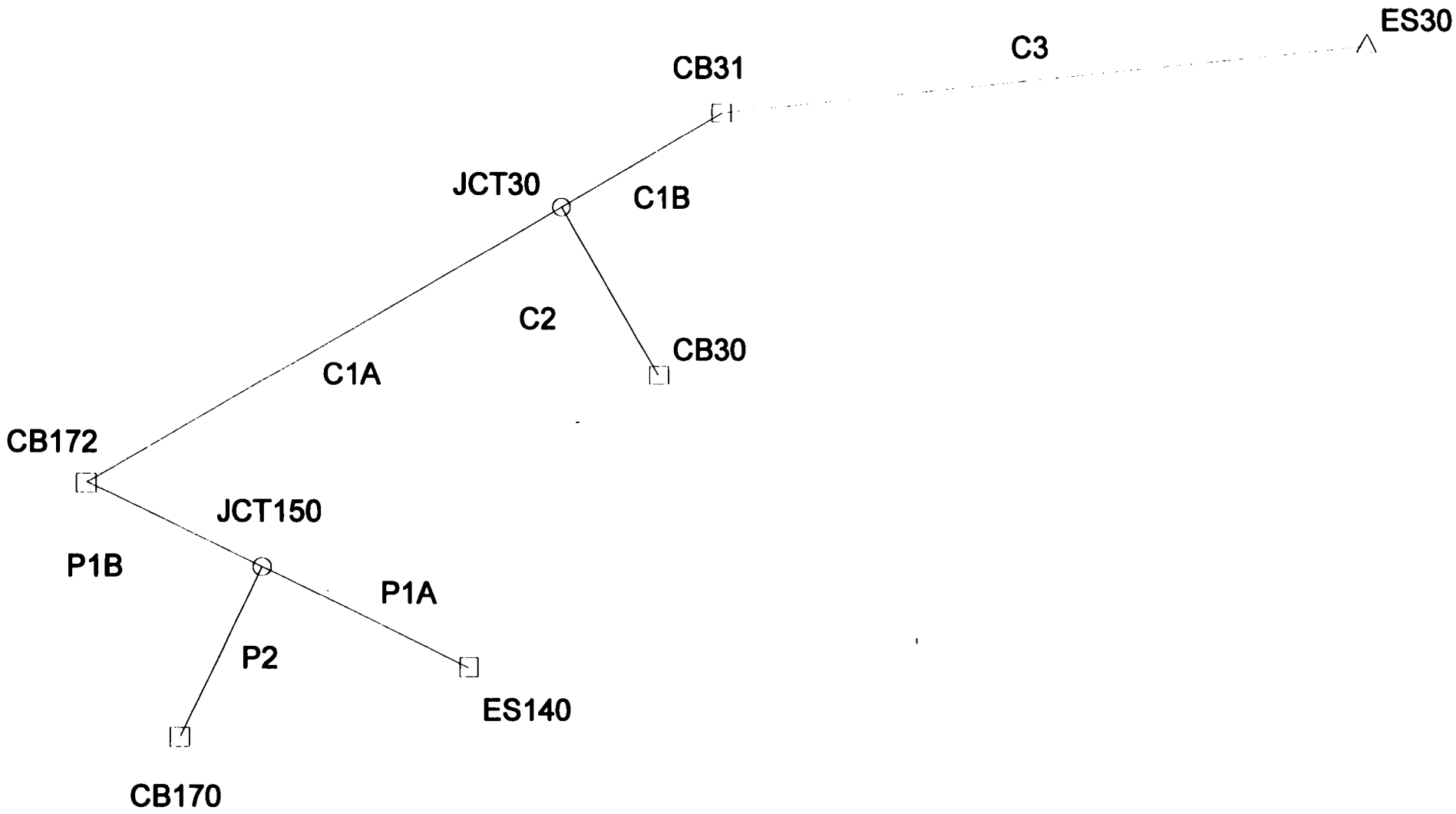
Pipe Report

Pipe	Upstream Node	Downstream Node	Inlet Area (acres)	Weighted Roughness Coefficient	Inlet CA (acres)	Total CA (acres)	System Intensity (in/hr)	Discharge (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Roughness	Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Cover (ft)	Downstream Cover (ft)	Upstream HGL (ft)	Downstream HGL (ft)
P3	CB171	MH170	0.44	0.95	0.42	0.42	4.20	1.77	18.86	0.0127	24 inch	0.012	27.64	1,206.74	1,206.50	1,211.74	1,211.50	3.00	3.00	1,207.20	1,206.86
B1	CB20	CB21	0.96	0.70	0.67	0.67	4.20	2.84	27.73	0.0162	24 inch	0.012	31.22	1,199.50	1,199.05	1,203.50	1,209.06	2.00	8.01	1,206.19	1,206.19
B2	CB21	JCT21	0.00	0.00	0.00	0.67	4.13	2.80	49.03	0.0159	24 inch	0.012	30.91	1,199.05	1,198.27	1,209.06	1,207.00	8.01	6.73	1,206.18	1,206.18
B3B	CB22	JCT21	0.79	0.70	0.55	0.55	4.17	2.33	89.39	0.0194	24 inch	0.012	34.09	1,200.00	1,198.27	1,204.00	1,207.00	2.00	6.73	1,206.19	1,206.18
B3A	JCT21	JCT20	N/A	N/A	N/A	1.22	3.90	4.82	63.62	0.0193	24 inch	0.012	34.07	1,198.27	1,197.04	1,207.00	1,211.50	6.73	12.46	1,206.16	1,206.13
P4	JCT20	MH170	N/A	N/A	N/A	1.22	3.81	4.71	6.00	0.0067	24 inch	0.012	20.01	1,197.04	1,197.00	1,211.50	1,211.50	12.46	12.50	1,206.13	1,206.13
P5	MH170	MH171	N/A	N/A	N/A	1.64	3.80	6.30	86.97	0.0057	24 inch	0.012	18.58	1,197.00	1,196.50	1,211.50	1,207.20	12.50	8.70	1,206.09	1,206.03
P6	MH171	MH172	N/A	N/A	N/A	1.64	3.71	6.14	327.44	0.0058	36 inch	0.012	55.04	1,196.50	1,194.60	1,207.20	1,210.50	7.70	12.90	1,206.03	1,206.01
P7	MH172	ES141	N/A	N/A	N/A	1.64	3.15	5.21	168.76	0.0059	36 inch	0.012	55.62	1,194.60	1,193.60	1,210.50	1,198.00	12.90	1.40	1,206.01	1,206.00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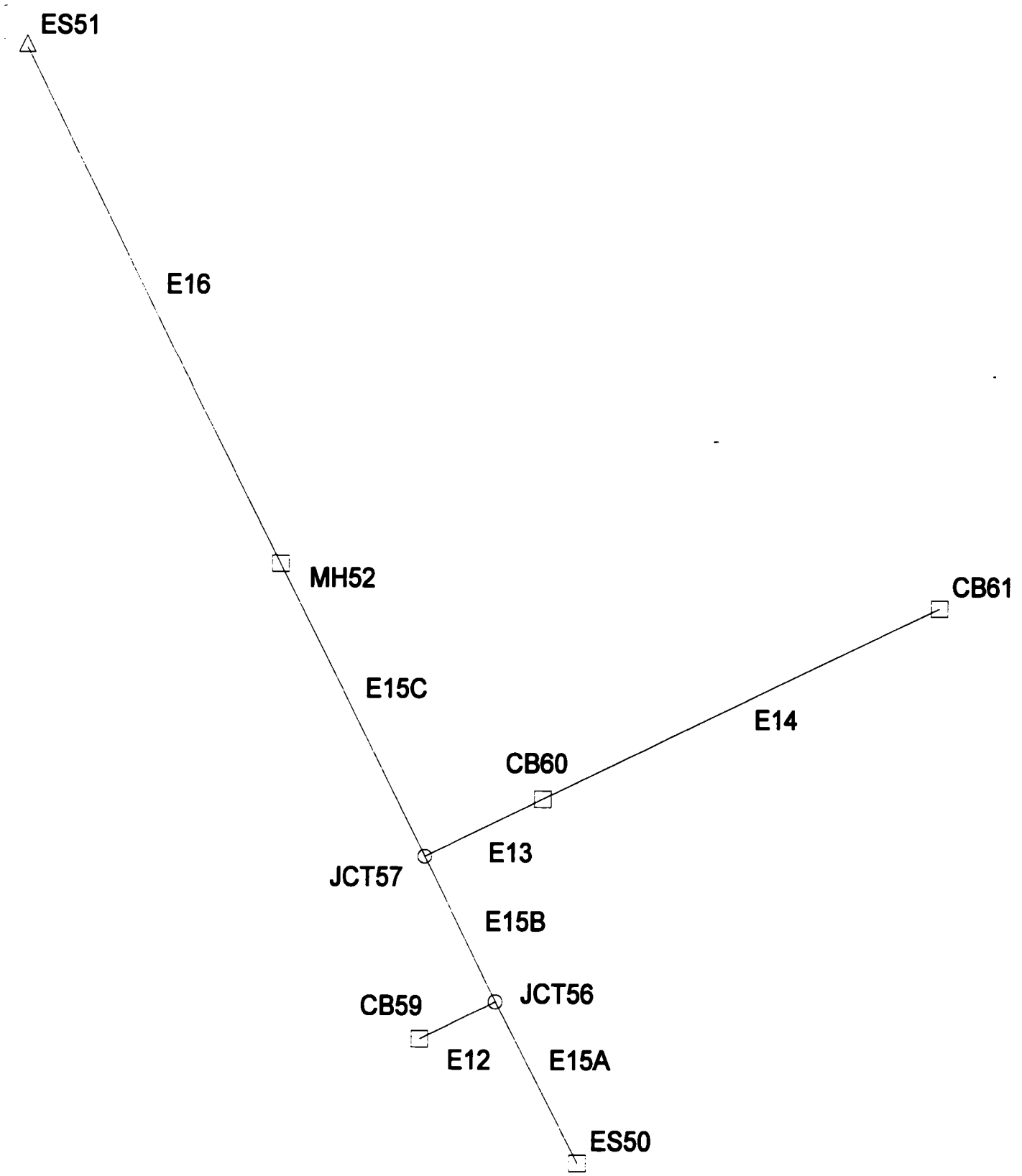
C3
CB31
JCT30
C1B
C2
CB30
C1A
CB172
JCT150
P1B
P1A
P2
ES140
CB170

Pipe Report

Pipe	Upstream Node	Downstream Node	Inlet Area (acres)	Weighted Roughness Coefficient	Inlet CA (acres)	Total CA (acres)	System Intensity (in/hr)	Discharge (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Roughness	Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Cover (ft)	Downstream Cover (ft)	Upstream HGL (ft)	Downstream HGL (ft)
C2	CB30	JCT30	0.17	0.95	0.16	0.16	4.20	0.68	42.05	0.027111	24 inch	0.012	40.35	1,205.27	1,204.13	1,209.27	1,208.00	2.00	1.87	1,205.55	1,205.43
P2	CB170	JCT150	0.36	0.95	0.34	0.34	4.20	1.45	40.81	0.020338	24 inch	0.012	34.95	1,207.47	1,206.64	1,212.47	1,210.00	3.00	1.36	1,207.89	1,207.81
P1A	ES140	JCT150	2.12	0.70	1.48	1.48	3.93	5.88	49.41	0.027120	24 inch	0.012	40.36	1,207.98	1,206.64	1,210.40	1,210.00	0.42	1.36	1,208.84	1,207.81
P1B	JCT150	CB172	N/A	N/A	N/A	1.83	3.90	7.18	41.94	0.027182	24 inch	0.012	40.40	1,206.64	1,205.50	1,210.00	1,209.00	1.36	1.50	1,207.59	1,206.83
C1A	CB172	JCT30	0.35	0.70	0.24	2.07	3.88	8.10	118.65	0.011547	24 inch	0.012	26.33	1,205.50	1,204.13	1,209.00	1,208.00	1.50	1.87	1,206.51	1,205.43
C1B	JCT30	CB31	N/A	N/A	N/A	2.23	3.82	8.60	40.60	0.011330	24 inch	0.012	26.09	1,204.13	1,203.67	1,208.00	1,206.94	1.87	1.27	1,205.18	1,205.11
C3	CB31	ES30	0.69	0.95	0.66	2.89	3.80	11.06	140.90	0.011498	24 inch	0.012	26.28	1,203.67	1,202.05	1,206.94	1,204.00	1.27	-0.05	1,204.86	1,204.05


ES51
E16
MH52
CB61
E15C
E14
CB60
E13
JCT57
E15B
CB59
JCT56
E12
E15A
ES50

Pipe Report

Pipe	Upstream Node	Downstream Node	Inlet Area (acres)	Weighted Roughness Coefficient	Inlet CA (acres)	Total CA (acres)	System Intensity (in/hr)	Discharge (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Roughness	Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Cover (ft)	Downstream Cover (ft)	Upstream HGL (ft)	Downstream HGL (ft)
E14	CB61	CB60	2.09	0.950	1.99	1.99	4.20	8.41	106.86	0.0087	24 inch	0.012	22.86	1,217.52	1,216.59	1,222.52	1,221.59	3.00	3.00	1,218.55	1,217.88
E13	CB60	JCT57	0.18	0.950	0.17	2.16	4.15	9.02	31.83	0.2234	24 inch	0.012	115.82	1,216.59	1,209.48	1,221.59	1,223.00	3.00	11.52	1,217.66	1,213.73
E12	CB59	JCT56	0.20	0.950	0.19	0.19	4.20	0.80	20.67	0.2603	24 inch	0.012	125.03	1,215.10	1,209.72	1,220.10	1,222.00	3.00	10.28	1,215.41	1,213.75
E15A	ES50	JCT56	2.31	0.834	1.93	1.93	4.20	8.16	43.60	0.0060	36 inch	0.012	55.80	1,209.48	1,209.22	1,212.48	1,222.00	0.00	9.78	1,213.75	1,213.75
E15B	JCT56	JCT57	N/A	N/A	N/A	2.12	4.12	8.78	39.28	0.0061	36 inch	0.012	56.48	1,209.22	1,208.98	1,222.00	1,223.00	9.78	11.02	1,213.73	1,213.73
E15C	JCT57	MH52	N/A	N/A	N/A	4.27	4.04	17.42	80.07	0.0060	36 inch	0.012	55.94	1,208.98	1,208.50	1,223.00	1,222.27	11.02	10.77	1,213.67	1,213.63
E16	MH52	ES51	0.00	0.000	0.00	7.63	3.91	30.11	140.30	0.0107	36 inch	0.012	74.71	1,208.50	1,207.00	1,222.27	1,211.00	10.77	1.00	1,213.34	1,213.10

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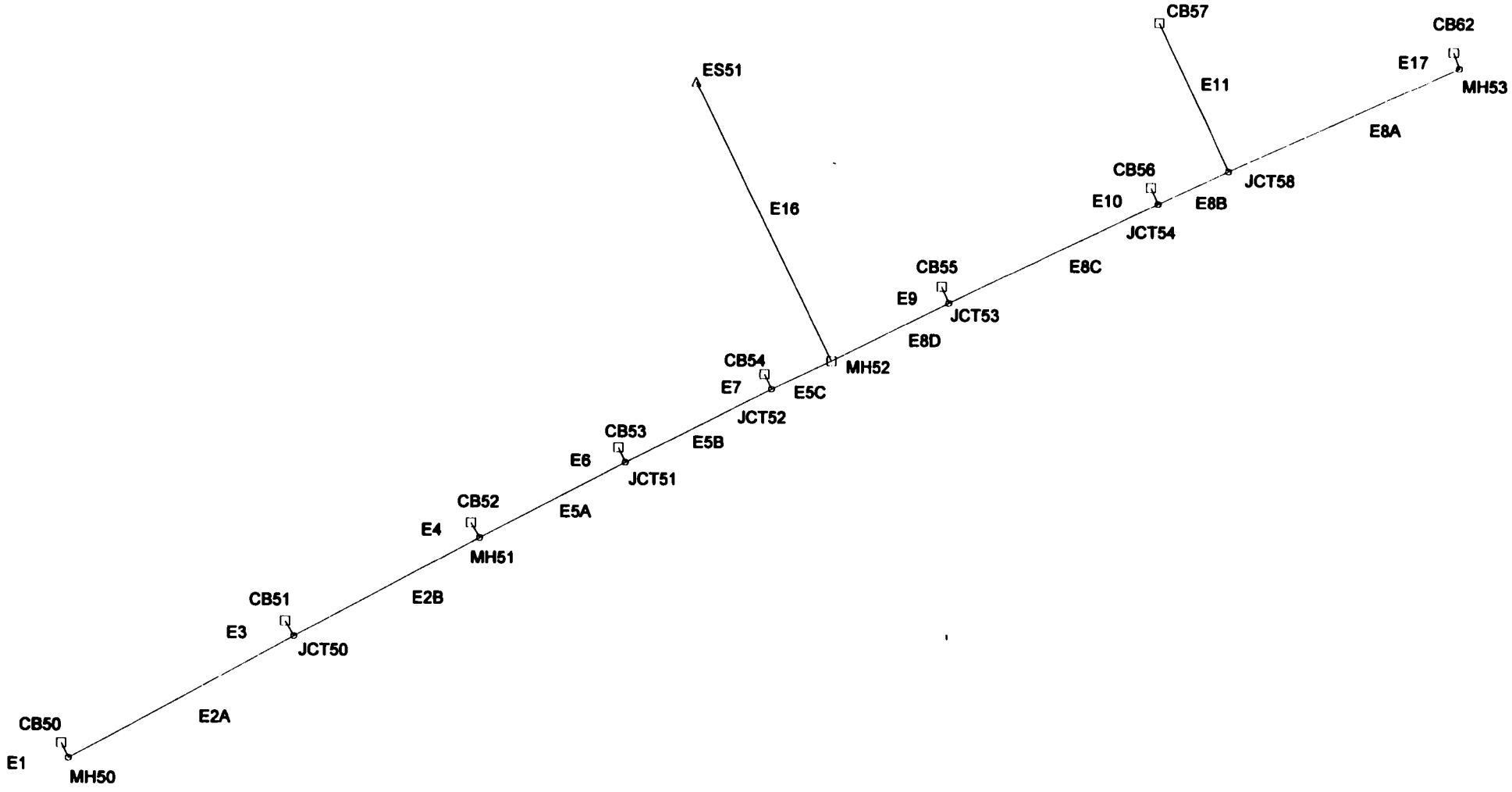

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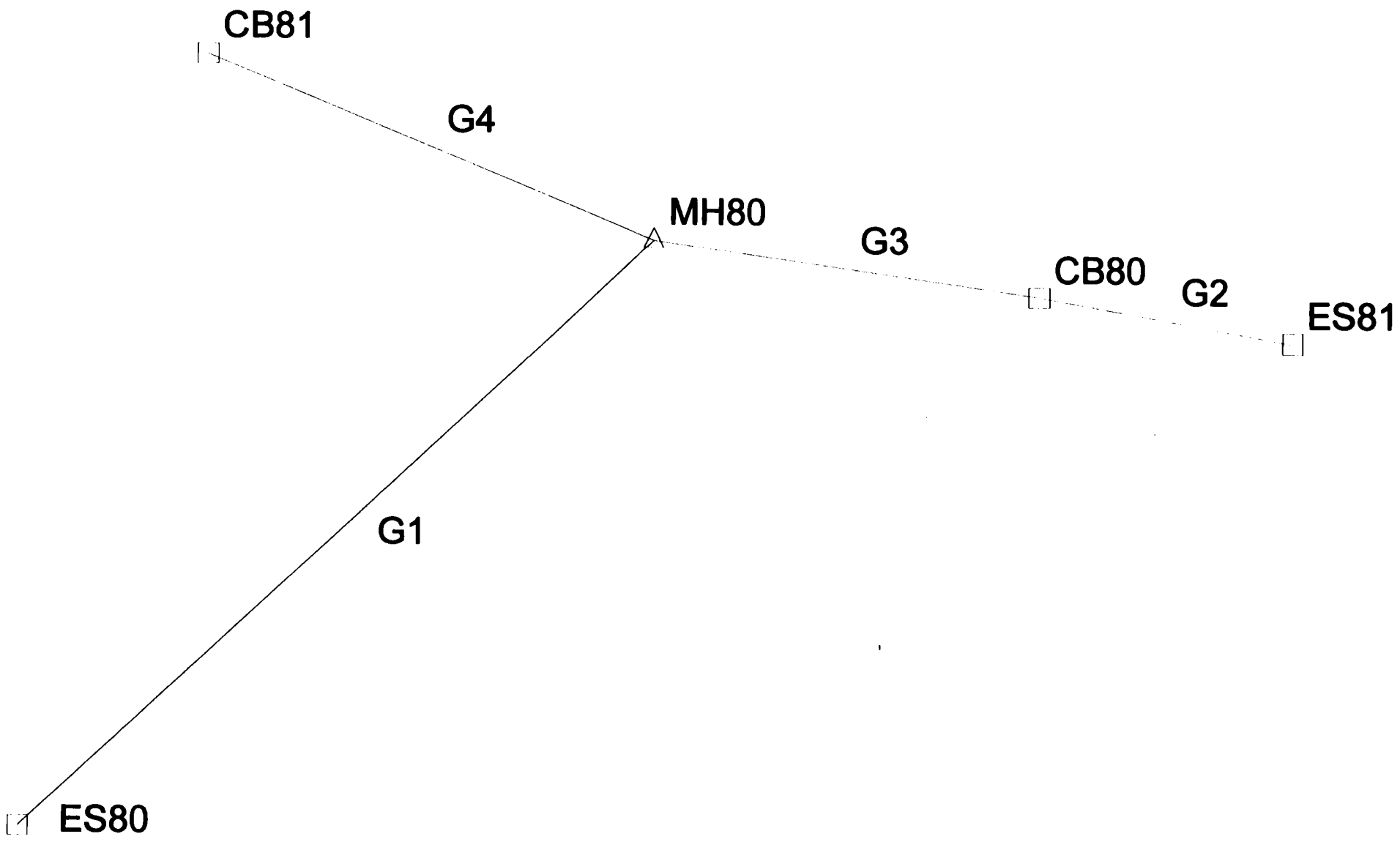
Project Engineer: JRM
StormCAD v1.0
Page 1 of 1

Pipe Report

Pipe	Upstream Node	Downstream Node	Inlet Area (acres)	Weighted Roughness Coefficient	Inlet CA (acres)	Total CA (acres)	System Intensity (in/hr)	Discharge (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Roughness	Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Cover (ft)	Downstream Cover (ft)	Upstream HGL (ft)	Downstream HGL (ft)
E7	CB54	JCT52	0.24	0.865	0.21	0.21	4.20	0.88	8.00	0.1575	24 inch	0.012	97.26	1,216.68	1,215.42	1,221.68	1,221.42	3.00	4.00	1,217.00	1,216.46
E6	CB53	JCT51	0.39	0.865	0.34	0.34	4.20	1.43	8.00	0.0975	24 inch	0.012	76.52	1,216.57	1,215.79	1,221.57	1,221.79	3.00	4.00	1,216.98	1,216.76
E4	CB52	MH51	0.25	0.865	0.22	0.22	4.20	0.92	8.00	0.0650	24 inch	0.012	62.48	1,216.69	1,216.17	1,221.69	1,222.17	3.00	4.00	1,217.02	1,216.99
E3	CB51	JCT50	0.29	0.865	0.25	0.25	4.20	1.06	8.00	0.0362	24 inch	0.012	46.66	1,217.18	1,216.89	1,222.18	1,222.89	3.00	4.00	1,217.54	1,217.61
E1	CB50	MH50	0.52	0.865	0.45	0.45	4.20	1.90	8.00	0.0650	24 inch	0.012	62.48	1,218.28	1,217.76	1,223.28	1,223.76	3.00	4.00	1,218.76	1,218.37
E2A	MH50	JCT50	N/A	N/A	N/A	0.45	4.19	1.90	115.13	0.0076	24 inch	0.012	21.30	1,217.76	1,216.89	1,223.76	1,222.89	4.00	4.00	1,218.24	1,217.61
E2B	JCT50	MH51	N/A	N/A	N/A	0.70	4.09	2.89	95.10	0.0076	24 inch	0.012	21.32	1,216.89	1,216.17	1,222.89	1,222.17	4.00	4.00	1,217.48	1,216.99
E5A	MH51	JCT51	N/A	N/A	N/A	0.92	4.02	3.72	75.09	0.0051	24 inch	0.012	17.43	1,216.17	1,215.79	1,222.17	1,221.79	4.00	4.00	1,216.85	1,216.76
E5B	JCT51	JCT52	N/A	N/A	N/A	1.25	3.97	5.02	75.08	0.0049	24 inch	0.012	17.20	1,215.79	1,215.42	1,221.79	1,221.42	4.00	4.00	1,216.58	1,216.46
E5C	JCT52	MH52	N/A	N/A	N/A	1.46	3.93	5.79	30.03	0.0050	24 inch	0.012	17.32	1,215.42	1,215.27	1,221.42	1,222.27	4.00	5.00	1,216.27	1,216.07
E9	CB55	JCT53	0.30	0.865	0.26	0.26	4.20	1.10	8.00	0.1263	24 inch	0.012	87.07	1,217.13	1,216.12	1,222.13	1,222.12	3.00	4.00	1,217.49	1,217.34
E10	CB56	JCT54	0.36	0.865	0.31	0.31	4.20	1.32	8.00	0.0600	24 inch	0.012	60.03	1,218.08	1,217.60	1,223.08	1,223.60	3.00	4.00	1,218.70	1,218.73
E11	CB57	JCT58	0.22	0.950	0.21	0.21	4.20	0.88	74.68	0.0179	24 inch	0.012	32.83	1,219.43	1,218.09	1,224.43	1,224.09	3.00	4.00	1,219.75	1,219.10
E17	CB62	MH53	1.29	0.865	1.12	1.12	4.20	4.72	8.00	0.0650	24 inch	0.012	62.48	1,220.23	1,219.71	1,225.23	1,225.71	3.00	4.00	1,220.99	1,220.70
E8A	MH53	JCT58	N/A	N/A	N/A	1.12	4.20	4.72	115.29	0.0141	24 inch	0.012	29.05	1,219.71	1,218.09	1,225.71	1,224.09	4.00	4.00	1,220.47	1,219.10
E8B	JCT58	JCT54	N/A	N/A	N/A	1.32	4.10	5.47	34.87	0.0141	24 inch	0.012	29.05	1,218.09	1,217.60	1,224.09	1,223.60	4.00	4.00	1,218.92	1,218.73
E8C	JCT54	JCT53	N/A	N/A	N/A	1.64	4.08	6.72	105.12	0.0141	24 inch	0.012	29.08	1,217.60	1,216.12	1,223.60	1,222.12	4.00	4.00	1,218.52	1,217.34
E8D	JCT53	MH52	N/A	N/A	N/A	1.90	4.02	7.68	60.07	0.0142	24 inch	0.012	29.15	1,216.12	1,215.27	1,222.12	1,222.27	4.00	5.00	1,217.11	1,215.99
E16	MH52	ES51	0.00	0.000	0.00	7.63	3.91	30.08	140.30	0.0107	36 inch	0.012	74.71	1,208.50	1,207.00	1,222.27	1,211.00	10.77	1.00	1,213.34	1,213.10



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Project Engineer: JRM
StormCAD v1.0
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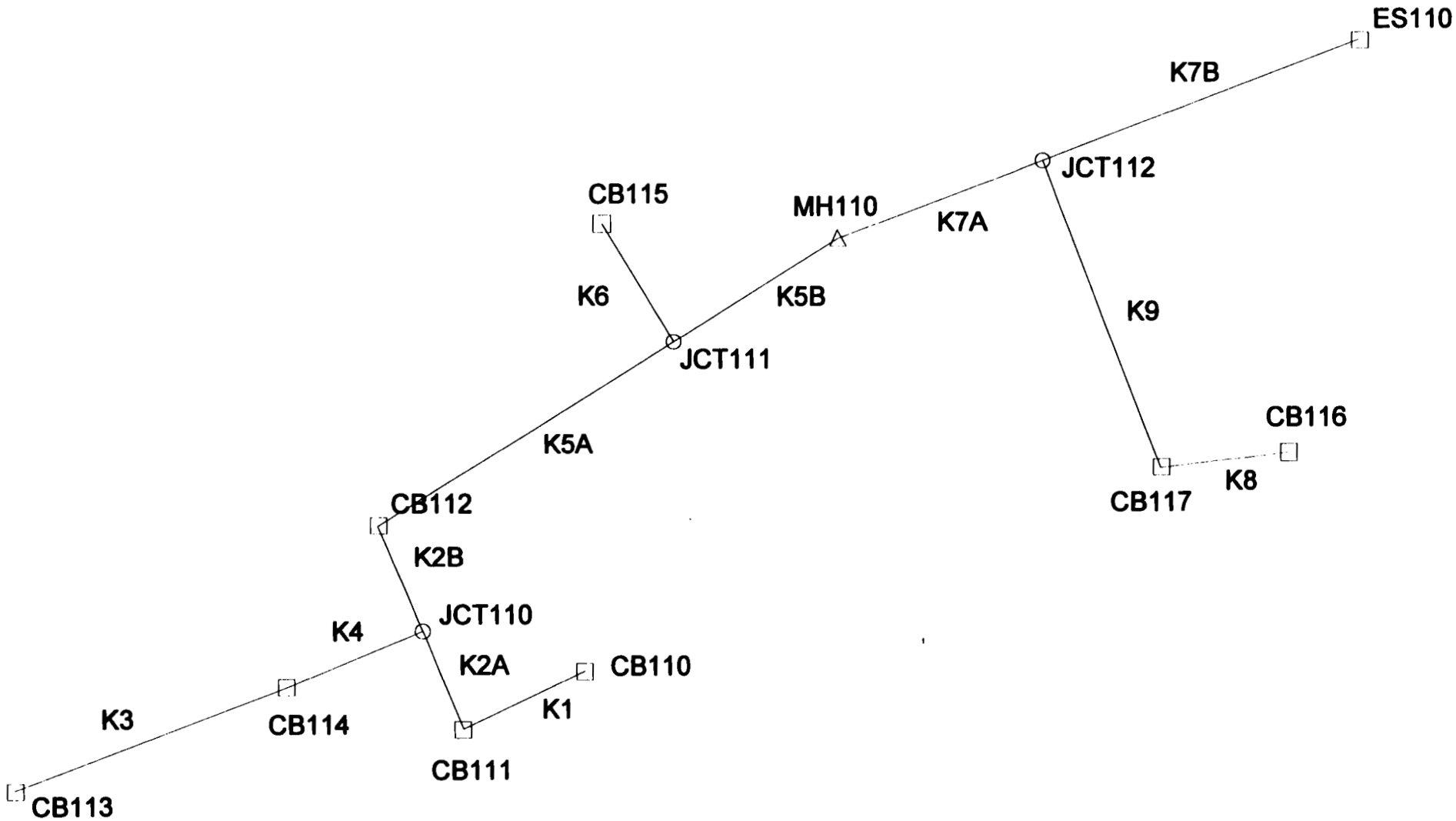
Node Report

Node	Inlet Area (acres)	Weighted Roughness Coefficient	Inlet CA (acres)	External CA (acres)	Total CA (acres)	Inlet TC (min)	External TC (min)	Upstream Flow Time (min)	System Flow Time (min)	System Intensity (in/hr)	Total Watershed (CIA) (cfs)	Discharge (cfs)	Ground Elevation (ft)	Rim Elevation (ft)	HGL In (ft)	HGL Out (ft)	Inlet Intensity (in/hr)	Inlet Discharge (cfs)
ES81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.84	0.00	26.00	1,208.30	1,208.30	1,208.30	1,208.30	6.84	0.00
CB80	0.72	0.95	0.68	0.00	0.68	10.00	0.00	0.11	10.00	4.20	2.90	28.90	1,215.41	1,215.41	1,207.92	1,207.07	4.20	2.90
ES80	4.11	0.79	3.23	0.00	3.23	10.00	0.00	0.00	10.00	4.20	13.67	13.67	1,208.00	1,208.00	1,207.63	1,207.33	4.20	13.67
CB81	1.13	0.70	0.79	0.00	0.79	13.20	0.00	0.00	13.20	3.77	3.01	3.01	1,210.50	1,210.50	1,207.11	1,207.11	3.77	3.01
MH80	N/A	N/A	N/A	N/A	4.70	N/A	0.00	13.61	13.61	3.72	17.63	N/A	1,217.28	1,217.28	1,204.60	1,204.60	N/A	N/A


ES110
K7B
JCT112
CB115
MH110
K7A
K6
K5B
K9
JCT111
CB116
K5A
K8
CB112
CB117
K2B
JCT110
K4
K2A
CB110
K3
CB114
K1
CB111
CB113

Pipe Report

Pipe	Upstream Node	Downstream Node	Inlet Area (acres)	Weighted Roughness Coefficient	Inlet CA (acres)	Total CA (acres)	System Intensity (in/hr)	Discharge (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Roughness	Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Cover (ft)	Downstream Cover (ft)	Upstream HGL (ft)	Downstream HGL (ft)
K8	CB116	CB117	1.32	0.70	0.92	0.92	3.77	3.51	31.01	0.0161	24 inch	0.012	31.12	1,206.50	1,206.00	1,210.50	1,213.33	2.00	5.33	1,207.16	1,206.88
K9	CB117	JCT112	0.21	0.95	0.20	1.12	3.75	4.25	79.66	0.0131	24 inch	0.012	28.00	1,206.00	1,204.96	1,213.33	1,214.00	5.33	7.04	1,206.72	1,206.29
K7B	ES110	JCT112	5.60	0.74	4.14	4.14	2.75	11.46	82.01	0.0340	30 inch	0.012	81.95	1,207.50	1,204.71	1,210.00	1,214.00	0.00	6.79	1,208.63	1,206.29
K7A	JCT112	MH110	N/A	N/A	N/A	5.26	2.72	14.45	53.51	0.0340	30 inch	0.012	81.94	1,204.71	1,202.89	1,214.00	1,214.54	6.79	9.15	1,205.99	1,203.66
K6	CB115	JCT111	0.82	0.95	0.78	0.78	4.20	3.30	33.66	0.1506	24 inch	0.012	95.11	1,209.30	1,204.23	1,213.30	1,214.00	2.00	7.77	1,209.93	1,205.64
K3	CB113	CB114	0.50	0.95	0.48	0.48	4.20	2.01	69.96	0.0091	24 inch	0.012	23.44	1,209.23	1,208.59	1,213.23	1,212.59	2.00	2.00	1,209.72	1,209.20
K4	CB114	JCT110	0.06	0.95	0.06	0.53	4.15	2.22	35.62	0.0761	24 inch	0.012	67.60	1,208.59	1,205.88	1,212.59	1,213.00	2.00	5.12	1,209.11	1,207.10
K1	CB110	CB111	0.21	0.95	0.20	0.20	4.20	0.84	33.01	0.1039	24 inch	0.012	79.00	1,209.43	1,206.00	1,213.43	1,210.00	2.00	2.00	1,209.75	1,207.17
K2A	CB111	JCT110	1.22	0.70	0.85	1.05	4.09	4.35	25.51	0.0047	24 inch	0.012	16.81	1,206.00	1,205.88	1,210.00	1,213.00	2.00	5.12	1,207.09	1,207.10
K2B	JCT110	CB112	N/A	N/A	N/A	1.59	4.07	6.50	27.72	0.0047	24 inch	0.012	16.78	1,205.88	1,205.75	1,213.00	1,212.64	5.12	4.89	1,206.97	1,206.97
K5A	CB112	JCT111	0.11	0.95	0.10	1.69	4.05	6.90	84.71	0.0179	24 inch	0.012	32.83	1,205.75	1,204.23	1,212.64	1,214.00	4.89	7.77	1,206.68	1,205.64
K5B	JCT111	MH110	N/A	N/A	N/A	2.47	4.00	9.96	47.13	0.0178	24 inch	0.012	32.72	1,204.23	1,203.39	1,214.00	1,214.54	7.77	9.15	1,205.36	1,204.19

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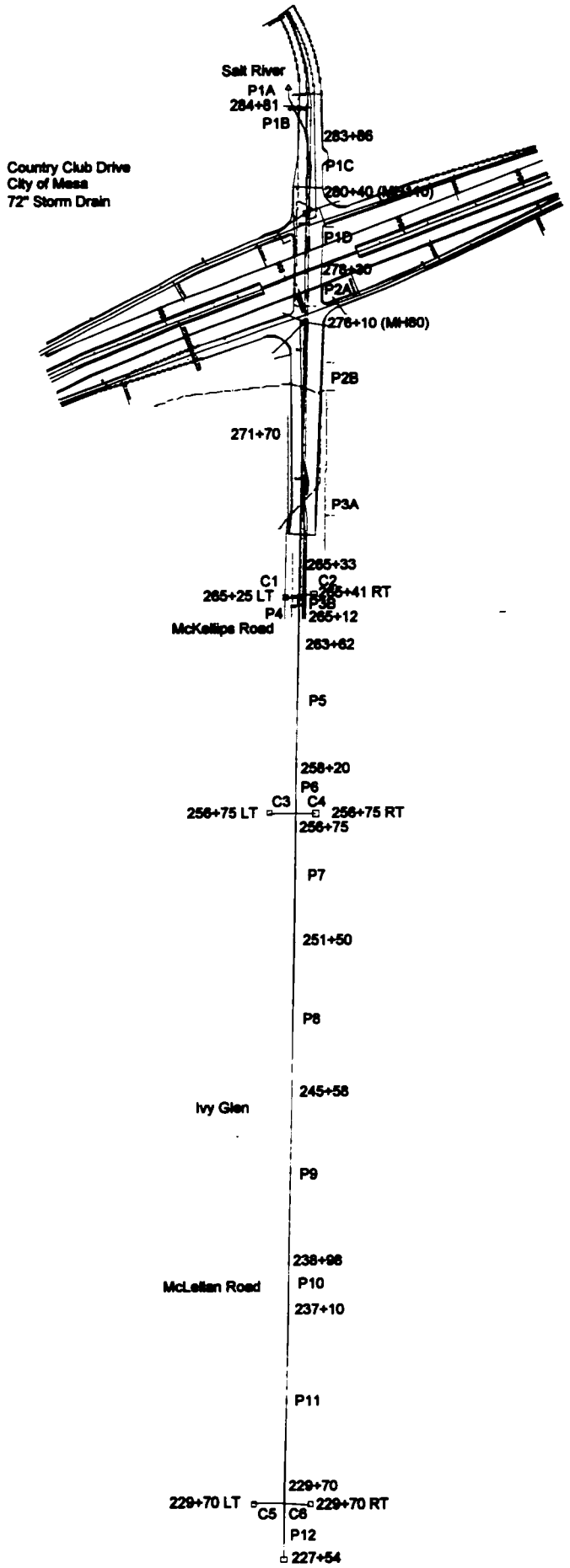

Project Title: Red Mtn Fwy
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Stanley Consultants

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Project Engineer: JRM
StormCAD v1.0

Node Report

Node	Inlet Area (acres)	Weighted Roughness Coefficient	Inlet CA (acres)	External CA (acres)	Total CA (acres)	Inlet TC (min)	External TC (min)	Upstream Flow Time (min)	System Flow Time (min)	System Intensity (in/hr)	Total Watershed (CIA) (cfs)	Known Flow (cfs)	Discharge (cfs)	Ground Elevation (ft)	Rim Elevation (ft)	HGL In (ft)	HGL Out (ft)	Inlet Intensity (in/hr)	Inlet Discharge (cfs)
265+25 LT	0.00	0.00	0.00	0.93	0.93	0.00	10.00	0.00	10.00	4.20	3.94	0.00	3.94	1,216.66	1,216.66	1,214.28	1,214.28	6.84	0.00
265+41 RT	0.00	0.00	0.00	0.93	0.93	0.00	10.00	0.00	10.00	4.20	3.94	0.00	3.94	1,216.84	1,216.84	1,213.94	1,213.94	6.84	0.00
256+75 LT	0.00	0.00	0.00	0.72	0.72	0.00	10.00	0.00	10.00	4.20	3.05	0.00	3.05	1,213.43	1,213.43	1,212.41	1,212.41	6.84	0.00
256+75 RT	0.00	0.00	0.00	0.72	0.72	0.00	10.00	0.00	10.00	4.20	3.05	0.00	3.05	1,213.43	1,213.43	1,212.36	1,212.36	6.84	0.00
229+70 LT	0.00	0.00	0.00	0.49	0.49	0.00	10.00	0.00	10.00	4.20	2.07	0.00	2.07	1,216.81	1,216.81	1,215.99	1,215.99	6.84	0.00
229+70 RT	0.00	0.00	0.00	0.49	0.49	0.00	10.00	0.00	10.00	4.20	2.07	0.00	2.07	1,216.81	1,216.81	1,215.97	1,215.97	6.84	0.00
227+54	0.00	0.00	0.00	44.22	44.22	0.00	49.00	0.00	49.00	1.81	80.68	0.00	80.68	1,220.20	1,220.20	1,216.25	1,216.25	6.84	0.00
229+70	N/A	N/A	N/A	N/A	45.20	N/A	0.00	49.71	49.71	1.79	81.50	N/A	81.50	1,217.60	1,217.60	1,215.94	1,215.92	N/A	N/A
237+10	N/A	N/A	N/A	N/A	45.20	N/A	0.00	52.12	52.12	1.72	78.21	N/A	78.21	1,217.00	1,217.00	1,214.84	1,214.77	N/A	N/A
238+98	N/A	N/A	N/A	N/A	45.20	N/A	0.00	52.84	52.84	1.69	77.22	N/A	77.22	1,217.00	1,217.00	1,214.54	1,214.53	N/A	N/A
245+58	N/A	N/A	N/A	N/A	45.20	N/A	0.00	55.10	55.10	1.63	74.12	N/A	74.12	1,215.00	1,215.00	1,213.66	1,213.64	N/A	N/A
251+50	N/A	N/A	N/A	N/A	45.20	N/A	0.00	57.22	57.22	1.56	71.23	N/A	71.23	1,215.00	1,215.00	1,212.92	1,212.91	N/A	N/A
256+75	N/A	N/A	N/A	N/A	46.64	N/A	0.00	59.24	59.24	1.50	70.66	N/A	70.66	1,214.20	1,214.20	1,212.30	1,212.29	N/A	N/A
258+20	N/A	N/A	N/A	N/A	46.64	N/A	0.00	59.78	59.78	1.49	69.89	N/A	69.89	1,214.60	1,214.60	1,212.13	1,212.11	N/A	N/A
263+62	N/A	N/A	N/A	N/A	46.64	N/A	0.00	61.84	61.84	1.46	68.62	N/A	68.62	1,217.00	1,217.00	1,211.53	1,211.48	N/A	N/A
265+12	0.00	0.00	0.00	116.50	163.14	0.00	90.00	62.49	90.00	1.14	188.29	0.00	188.29	1,217.40	1,217.40	1,211.34	1,210.79	6.84	0.00
265+33	N/A	N/A	N/A	N/A	165.00	N/A	0.00	90.05	90.05	1.14	190.34	N/A	190.34	1,217.40	1,217.40	1,210.75	1,210.72	N/A	N/A
271+70	N/A	N/A	N/A	N/A	165.00	N/A	0.00	91.63	91.63	1.13	187.41	N/A	187.41	1,220.40	1,220.40	1,209.62	1,209.59	N/A	N/A
276+10 (MH80)	1.13	0.70	0.79	0.00	165.79	10.00	0.00	92.74	92.74	1.11	186.24	13.00	199.24	1,218.20	1,218.20	1,208.85	1,208.08	4.20	3.35
278+30	N/A	N/A	N/A	N/A	165.79	N/A	0.00	93.26	93.26	1.11	185.27	N/A	198.27	1,216.60	1,216.60	1,207.66	1,207.63	N/A	N/A
280+40 (MH110)	15.18	0.83	12.60	0.00	178.39	14.50	0.00	93.78	93.78	1.10	198.30	13.00	211.30	1,216.20	1,216.20	1,207.22	1,206.29	3.60	45.68
283+86	N/A	N/A	N/A	N/A	178.39	N/A	0.00	94.48	94.48	1.09	196.90	N/A	209.90	1,216.00	1,216.00	1,205.35	1,205.35	N/A	N/A
284+81	N/A	N/A	N/A	N/A	178.39	N/A	0.00	94.68	94.68	1.09	196.50	N/A	209.50	1,216.00	1,216.00	1,204.71	1,204.71	N/A	N/A
Salt River	N/A	N/A	N/A	N/A	178.39	N/A	0.00	94.70	94.70	1.09	196.46	N/A	N/A	1,208.00	1,208.00	1,204.46	1,204.46	N/A	N/A

Pipe Report

Pipe	Upstream Node	Downstream Node	Inlet Area (acres)	Weighted Roughness Coefficient	Inlet CA (acres)	Total CA (acres)	System Intensity (in/hr)	Discharge (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Roughness	Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Cover (ft)	Downstream Cover (ft)	Upstream HGL (ft)	Downstream HGL (ft)
C1	265+25 LT	265+33	0.00	0.00	0.00	0.93	4.20	3.94	48.00	0.18833	15 inch	0.012	30.37	1,213.48	1,204.44	1,216.66	1,217.40	1.93	11.71	1,214.28	1,210.75
C2	265+41 RT	265+33	0.00	0.00	0.00	0.93	4.20	3.94	57.00	0.15439	15 inch	0.012	27.50	1,213.14	1,204.34	1,216.84	1,217.40	2.45	11.81	1,213.94	1,210.75
C3	256+75 LT	256+75	0.00	0.00	0.00	0.72	4.20	3.05	55.00	0.08091	15 inch	0.012	19.90	1,208.96	1,204.51	1,213.43	1,214.20	3.22	8.44	1,212.41	1,212.30
C4	256+75 RT	256+75	0.00	0.00	0.00	0.72	4.20	3.05	31.00	0.17355	15 inch	0.012	29.15	1,210.60	1,205.22	1,213.43	1,214.20	1.58	7.73	1,212.36	1,212.30
C5	229+70 LT	229+70	0.00	0.00	0.00	0.49	4.20	2.07	54.00	0.11519	15 inch	0.012	23.75	1,212.94	1,206.72	1,216.81	1,217.60	2.62	9.63	1,215.99	1,215.94
C6	229+70 RT	229+70	0.00	0.00	0.00	0.49	4.20	2.07	30.00	0.23000	15 inch	0.012	33.56	1,213.89	1,206.99	1,216.81	1,217.60	1.67	9.36	1,215.97	1,215.94
P12	227+54	229+70	0.00	0.00	0.00	44.22	1.81	80.68	216.00	0.00120	54 inch	0.012	73.91	1,205.10	1,204.84	1,220.20	1,217.60	10.60	8.26	1,216.25	1,215.94
P11	229+70	237+10	N/A	N/A	N/A	45.20	1.79	81.50	740.00	0.00078	54 inch	0.012	59.64	1,204.84	1,204.26	1,217.60	1,217.00	8.26	8.24	1,215.92	1,214.84
P10	237+10	238+98	N/A	N/A	N/A	45.20	1.72	78.21	188.00	0.00080	6 x 3 ft	0.012	62.96	1,204.26	1,204.11	1,217.00	1,217.00	9.74	9.89	1,214.77	1,214.54
P9	238+98	245+58	N/A	N/A	N/A	45.20	1.69	77.22	660.00	0.00076	54 inch	0.012	58.63	1,204.11	1,203.61	1,217.00	1,215.00	8.39	6.89	1,214.53	1,213.66
P8	245+58	251+50	N/A	N/A	N/A	45.20	1.63	74.12	592.00	0.00079	54 inch	0.012	60.02	1,203.61	1,203.14	1,215.00	1,215.00	6.89	7.36	1,213.64	1,212.92
P7	251+50	256+75	N/A	N/A	N/A	45.20	1.56	71.23	542.00	0.00077	54 inch	0.012	59.30	1,203.14	1,202.72	1,215.00	1,214.20	7.36	6.98	1,212.91	1,212.30
P6	256+75	258+20	N/A	N/A	N/A	46.64	1.50	70.66	145.00	0.00076	54 inch	0.012	58.67	1,202.72	1,202.61	1,214.20	1,214.60	6.98	7.49	1,212.29	1,212.13
P5	258+20	263+62	N/A	N/A	N/A	46.64	1.49	69.89	542.00	0.00094	54 inch	0.012	65.35	1,202.61	1,202.10	1,214.60	1,217.00	7.49	10.40	1,212.11	1,211.53
P4	263+62	265+12	N/A	N/A	N/A	46.64	1.46	68.62	150.00	0.00367	6 x 3 ft	0.012	134.97	1,202.10	1,201.55	1,217.00	1,217.40	11.90	12.85	1,211.48	1,211.34
P3B	265+12	265+33	0.00	0.00	0.00	163.14	1.14	188.29	21.00	0.00381	72 inch	0.012	283.16	1,201.55	1,201.47	1,217.40	1,217.40	9.85	9.93	1,210.79	1,210.75
P3A	265+33	271+70	N/A	N/A	N/A	165.00	1.14	190.34	637.00	0.00036	72 inch	0.012	87.18	1,201.47	1,201.24	1,217.40	1,220.40	9.93	13.16	1,210.72	1,209.62
P2B	271+70	276+10 (MH80)	N/A	N/A	N/A	165.00	1.13	187.41	440.00	0.00061	72 inch	0.012	113.65	1,201.24	1,200.97	1,220.40	1,218.20	13.16	11.23	1,209.59	1,208.85
P2A	276+10 (MH80)	278+30	1.13	0.70	0.79	165.79	1.11	199.24	220.00	0.00064	72 inch	0.012	115.73	1,200.97	1,200.83	1,218.20	1,216.60	11.23	9.77	1,208.08	1,207.66
P1D	278+30	280+40 (MH110)	N/A	N/A	N/A	165.79	1.11	198.27	220.00	0.00045	72 inch	0.012	97.81	1,200.83	1,200.73	1,216.60	1,216.20	9.77	9.47	1,207.63	1,207.22
P1C	280+40 (MH110)	283+86	15.18	0.83	12.60	178.39	1.10	211.30	346.00	0.00049	72 inch	0.012	101.69	1,200.73	1,200.56	1,216.20	1,216.00	9.47	9.44	1,206.29	1,205.35
P1B	283+86	284+81	N/A	N/A	N/A	178.39	1.09	209.90	110.00	0.00045	72 inch	0.012	97.81	1,200.56	1,200.51	1,216.00	1,216.00	9.44	9.49	1,205.35	1,204.71
P1A	284+81	Salt River	N/A	N/A	N/A	178.39	1.09	209.50	11.42	0.00088	72 inch	0.012	135.76	1,200.51	1,200.50	1,216.00	1,208.00	9.49	1.50	1,204.71	1,204.46

CITY OF
MESA

February 19, 1991

Mr. Dan Powell
Arizona Department of Transportation
District No. 1
2140 East Hilton
Phoenix, Arizona 85009

Subject: Project No. 91-25, Country Club Drive Widening, Permit to Construct Storm Drain in Arizona Department of Transportation Right-of-way.

Dear Mr. Powell:

In reference to our conversations with you concerning the above referenced permit, the City of Mesa agrees to allow you to drain the paved areas of the future Red Mountain Freeway Ramps and the existing Country Club Drive Right-of-way into the proposed storm drain. The existing Country Club Drive Right-of-way area should include that area from approximately 800-feet north of McKellips Rod to approximately 2100-feet north of McKellips Road. The flow from these areas should not exceed 20 cfs.

Based on this information please proceed with the processing of the permit and return it to us at your earliest convenience.

Sincerely,

Harry Kent

HARRY KENT
City Engineer

GL/rr

xc: Keith Nath
Gene Larson

Engineering
55 North Center Street • P.O. Box 1466 • Mesa, Arizona 85211-1466 • (602) 644-2251