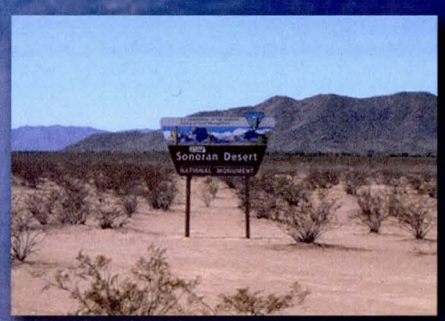
RAINBOW VALLEY
Area Drainage Master Plan

Contract FCD 2006C029

Technical Data Notebook
Hydrology Report
Volume III



Submittted to

Flood Control District of Maricopa County

Submittted by

URS

in cooperation with

Dibble Engineering

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.

October 2010

Rainbow Valley Area Drainage Master Plan:

Technical Data Notebook (TDN)

Hydrology Report

Volume 3 of 4

Prepared for:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Registered Professional Engineer (Civil)
CERTIFICATE NO. 33656
ELLIOT SILVERSTON
Date Signed 10-15-10
ARIZONA, U.S.A.
Exp Date 6-30-11

Prepared by:

URS CORPORATION

October 2010

Registered Professional Engineer (Civil)
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ARIZONA, U.S.A.
EXPIRES 9.30.2011

RVADMP Routing Reach Cross-section Summary Table - Basin A

Label	Solve For	Roughness Coefficient	Channel Slope (ft/ft)	Water Surface Elevation	Elevation Range	Discharge (ft^3/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Normal Depth (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
RCPA06	Normal Depth	0.045	0.0087	1116.89	1115.90 to 1118.25 ft	223	99.78	161.28	161.26	0.99	0.71	0.03863	2.24	0.08	1.07	0.5	Subcritical
RCPA05	Normal Depth	0.047	0.0089	1154.42	1153.80 to 1155.30 ft	447	298.14	833.65	833.65	0.62	0.43	0.05157	1.5	0.03	0.66	0.44	Subcritical
RCPA23	Normal Depth	0.05	0.0087	1156.97	1156.40 to 1158.70 ft	51	40.19	129.53	129.53	0.57	0.38	0.06118	1.27	0.03	0.59	0.4	Subcritical
RCPA25	Normal Depth	0.05	0.0089	1102.96	1102.20 to 1104.00 ft	76	47.89	112.49	112.47	0.76	0.51	0.05433	1.59	0.04	0.8	0.43	Subcritical
RCPA26	Normal Depth	0.05	0.0079	1049.39	1048.00 to 1050.30 ft	409	180.65	227.75	227.73	1.39	0.97	0.04433	2.26	0.08	1.47	0.45	Subcritical
RCPA28	Normal Depth	0.045	0.0074	1032.1	1031.20 to 1035.00 ft	304	152.49	259.43	259.42	0.9	0.62	0.04026	1.99	0.06	0.96	0.46	Subcritical
RCPA27	Normal Depth	0.05	0.0041	1016.1	1014.00 to 1020.10 ft	717	370.16	360.45	360.41	2.1	1.28	0.03998	1.94	0.06	2.16	0.34	Subcritical
RCPA30	Normal Depth	0.049	0.0046	1004.55	1001.40 to 1006.00 ft	1152	488.36	392.12	392.05	3.15	2.17	0.03557	2.36	0.09	3.24	0.37	Subcritical
RCPA52	Normal Depth	0.046	0.0051	995.89	992.70 to 997.20 ft	1558	817.2	1098.36	1098.29	3.19	2.58	0.03403	1.91	0.06	3.25	0.39	Subcritical
RCPA55	Normal Depth	0.05	0.0048	977.24	975.60 to 977.80 ft	1796	808.96	725.67	725.22	1.64	1.04	0.04194	2.22	0.08	1.72	0.37	Subcritical
RCPA56	Normal Depth	0.046	0.0046	943.02	937.40 to 948.00 ft	11309	2956.54	1281.47	1281.34	5.62	4.32	0.0259	3.83	0.23	5.85	0.44	Subcritical
RCPA51	Normal Depth	0.046	0.0057	942.99	937.40 to 949.00 ft	11236	2776.88	1310.49	1310.33	5.59	4.5	0.02591	4.05	0.25	5.85	0.49	Subcritical
RCPA57	Normal Depth	0.047	0.0019	933.76	926.60 to 939.00 ft	11267	4196.13	1522.44	1521.54	7.16	4.1	0.02566	2.69	0.11	7.28	0.29	Subcritical
RCPA60	Normal Depth	0.05	0.0054	887.33	880.00 to 895.30 ft	11277	1834.48	388.47	386.43	7.33	5.41	0.02484	6.15	0.59	7.91	0.5	Subcritical
RCPA59	Normal Depth	0.05	0.0096	916.24	912.90 to 922.30 ft	2006	478.31	276.76	276.65	3.34	2.63	0.03285	4.19	0.27	3.61	0.56	Subcritical
RCPA54	Normal Depth	0.047	0.0052	1002.34	999.90 to 1004.00 ft	829	392.67	444.03	443.44	2.44	2	0.04025	2.11	0.07	2.51	0.4	Subcritical
DRA04	Normal Depth	0.05	0.0121	1249.61	1249.30 to 1250.00 ft	43	37.29	177.86	177.85	0.31	0.21	0.07167	1.15	0.02	0.33	0.44	Subcritical
RCPA06	Normal Depth	0.05	0.0089	1117.02	1115.90 to 1118.30 ft	223	97.08	130.89	130.82	1.12	0.77	0.0456	2.3	0.08	1.21	0.47	Subcritical
RCPA22	Normal Depth	0.05	0.0079	1074.39	1072.50 to 1076.70 ft	255	100.42	106.55	106.39	1.89	1.38	0.04126	2.54	0.1	1.99	0.46	Subcritical
RCPA24	Normal Depth	0.05	0.0069	1044.48	1042.10 to 1045.90 ft	522	243.26	300.2	300.13	2.38	1.97	0.04566	2.15	0.07	2.45	0.42	Subcritical
RCPA31	Normal Depth	0.05	0.0067	1014.68	1014.00 to 1016.00 ft	251	152.29	272.99	272.98	0.68	0.38	0.05246	1.65	0.04	0.73	0.39	Subcritical
RCPA32	Normal Depth	0.05	0.0052	1001.77	1000.00 to 1002.00 ft	697	335.27	351.04	350.84	1.77	1.2	0.04286	2.08	0.07	1.84	0.37	Subcritical
RDA07	Normal Depth	0.05	0.0099	1186.68	1186.40 to 1188.80 ft	58	59.02	307.8	307.8	0.28	0.17	0.07506	0.98	0.02	0.29	0.4	Subcritical
RCPA07	Normal Depth	0.048	0.0097	1173.49	1173.00 to 1174.40 ft	40	33.43	137.33	137.32	0.49	0.32	0.05545	1.2	0.02	0.51	0.43	Subcritical
RCPA09	Normal Depth	0.046	0.0068	1175.61	1174.00 to 1176.60 ft	174	139.32	436.04	435.77	1.61	1.03	0.03704	1.25	0.02	1.63	0.39	Subcritical
RCPA08	Normal Depth	0.046	0.0089	1141.71	1140.90 to 1143.00 ft	287	158.74	345.81	345.8	0.81	0.58	0.04492	1.81	0.05	0.86	0.47	Subcritical
RDA08	Normal Depth	0.047	0.008	1146.32	1145.40 to 1147.00 ft	277	201.64	600.16	600.15	0.92	0.67	0.04725	1.37	0.03	0.95	0.42	Subcritical
RDA20	Normal Depth	0.05	0.007	1070.55	1070.00 to 1072.00 ft	21	20.03	73.27	73.26	0.55	0.36	0.06449	1.05	0.02	0.56	0.35	Subcritical
RCPA20	Normal Depth	0.049	0.0061	1064.73	1064.00 to 1065.10 ft	179	142.33	370.73	370.59	0.73	0.44	0.05249	1.26	0.02	0.75	0.36	Subcritical
RDA09	Normal Depth	0.274	0.008	1170.12	1168.50 to 1170.00 ft	42	162.52	418.29	418	1.62	0.41	1.70948	0.26	0	1.62	0.07	Subcritical
RDA64	Normal Depth	0.046	0.0076	1158.12	1157.00 to 1159.00 ft	774	423.94	816.73	816.73	1.12	0.81	0.04159	1.83	0.05	1.17	0.45	Subcritical
RCPA18	Normal Depth	0.452	0.0074	1095.92	1092.80 to 1094.60 ft	397	795.9	339.51	336.26	3.12	0.92	3.74368	0.5	0	3.12	0.06	Subcritical
RDA18	Normal Depth	0.048	0.0079	1093.08	1092.00 to 1093.40 ft	361	177.13	275.79	275.59	1.08	0.67	0.04207	2.04	0.06	1.14	0.45	Subcritical
RCPA50	Normal Depth	0.493	0.0051	959.46	954.00 to 956.00 ft	1092	1759.97	359.91	352	5.46	1.11	4.02036	0.62	0.01	5.47	0.05	Subcritical
RCPA49	Normal Depth	0.046	0.003	957.03	950.60 to 960.00 ft	10984	3343.37	1305.92	1305.8	6.43	4.66	0.02592	3.29	0.17	6.6	0.36	Subcritical
RCPA03	Normal Depth	0.048	0.0077	1231.13	1230.00 to 1232.10 ft	1492	623.77	760.77	760.76	1.13	0.7	0.03954	2.39	0.09	1.22	0.47	Subcritical
RCPA64	Normal Depth	0.048	0.0082	1154.76	1154.00 to 1155.70 ft	225	150.83	394.33	394.32	0.76	0.52	0.04926	1.49	0.03	0.79	0.43	Subcritical
RCPA33	Normal Depth	0.05	0.0046	2.03	0.00 to 6.00 ft	597	256.26	206.23	206.17	2.03	1.21	0.0389	2.33	0.08	2.12	0.37	Subcritical
RDA01A	Normal Depth	0.05	0.0081	5.01	0.00 to 6.00 ft	1575	673.28	823.03	821.6	5.01	4.52	0.0422	2.34	0.09	5.09	0.46	Subcritical
RCPA19	Normal Depth	0.05	0.0081	1.66	0.00 to 6.00 ft	519	185.94	174.38	174.33	1.66	1.13	0.0397	2.79	0.12	1.78	0.48	Subcritical

RVADMP Routing Reach Cross-section Summary Table - Basin A

Label	Solve For	Roughness Coefficient	Channel Slope (ft/ft)	Water Surface Elevation (ft)	Elevation Range	Discharge (ft^3/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Normal Depth (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
RCPA01	Normal Depth	0.05	0.0077	1218.9	1217.50 to 1221.00 ft	532	222	252.45	252.35	1.4	1	0.04429	2.4	0.09	1.49	0.45	Subcritical
RCPA11	Normal Depth	0.035	0.0082	1074.39	1074.00 to 1075.50 ft	200	113.04	362.75	362.75	0.39	0.28	0.02946	1.77	0.05	0.43	0.56	Subcritical
RCPA14	Normal Depth	0.035	0.0067	1074.53	1074.00 to 1075.50 ft	453	217.95	471.19	471.18	0.53	0.36	0.02607	2.08	0.07	0.59	0.54	Subcritical
RCPA38	Normal Depth	0.05	0.0069	1070.14	1068.80 to 1071.10 ft	320	127.05	124.96	124.85	1.34	0.87	0.04189	2.52	0.1	1.43	0.44	Subcritical
RCPA13	Normal Depth	0.048	0.0053	4.34	0.00 to 6.00 ft	420	260.4	433.88	423.76	4.34	3.71	0.04227	1.61	0.04	4.39	0.36	Subcritical
RCPA12	Normal Depth	0.05	0.004	4.33	0.00 to 6.00 ft	347	255.34	417.95	416.53	4.33	3.61	0.04392	1.36	0.03	4.36	0.31	Subcritical
RCPA39	Normal Depth	0.035	0.0061	1099.68	1099.00 to 1100.00 ft	467	228.39	471.93	471.92	0.68	0.47	0.02519	2.04	0.06	0.74	0.52	Subcritical
RCPA40	Normal Depth	0.035	0.0048	1099.64	1099.00 to 1100.00 ft	373	211.91	457.74	457.74	0.64	0.41	0.02612	1.76	0.05	0.69	0.46	Subcritical
RCPA43	Normal Depth	0.035	0.0061	1099.78	1099.00 to 1100.00 ft	619	279.86	513.71	513.7	0.78	0.55	0.02409	2.21	0.08	0.86	0.53	Subcritical
RCPA37	Normal Depth	0.035	0.0048	1100.02	1099.00 to 1100.00 ft	937	410.46	600.04	600	1.02	0.69	0.0226	2.28	0.08	1.1	0.49	Subcritical
RCPA36	Normal Depth	0.047	0.0062	1005.54	1004.60 to 1006.50 ft	245	161.31	339.99	339.98	0.94	0.64	0.04648	1.52	0.04	0.98	0.39	Subcritical
RCPA35	Normal Depth	0.035	0.0067	1004.43	1003.70 to 1005.30 ft	746	319.39	579.62	579.62	0.73	0.53	0.0242	2.34	0.08	0.82	0.55	Subcritical
RCPA47	Normal Depth	0.035	0.0067	971.87	971.00 to 972.50 ft	627	319.32	751.91	751.91	0.87	0.69	0.02601	1.96	0.06	0.93	0.53	Subcritical
RCPA48	Normal Depth	0.035	0.0071	966.66	965.70 to 968.20 ft	910	424.9	917.28	917.28	0.96	0.77	0.02494	2.14	0.07	1.03	0.55	Subcritical
RCPA63	Normal Depth	0.047	0.0064	2.02	0.00 to 5.00 ft	949	315.8	242.48	242.4	2.02	1.31	0.03261	3.01	0.14	2.16	0.46	Subcritical
RDA11	Normal Depth	0.035	0.008	1120.21	1119.50 to 1121.30 ft	180	109.53	385.09	385.09	0.71	0.6	0.03043	1.64	0.04	0.75	0.54	Subcritical
RCPA16	Normal Depth	0.035	0.0054	1048.8	1048.00 to 1049.30 ft	626	264.95	402.14	402.12	0.8	0.53	0.02315	2.36	0.09	0.88	0.51	Subcritical
RCPA34	Normal Depth	0.046	0.0064	1030.77	1029.90 to 1031.70 ft	260	157.06	302.9	302.89	0.87	0.58	0.04498	1.66	0.04	0.91	0.41	Subcritical
RDA21	Normal Depth	0.046	0.0074	1078.62	1078.00 to 1078.80 ft	126	150.6	909.07	909.07	0.62	0.37	0.04773	0.84	0.01	0.63	0.36	Subcritical
RCPA21	Normal Depth	0.048	0.0083	1109.35	1108.00 to 1110.40 ft	303	184.52	416.83	416.82	1.35	0.94	0.0425	1.64	0.04	1.39	0.44	Subcritical
RCPA65	Normal Depth	0.047	0.0083	1200.39	1198.36 to 1200.00 ft	1201	433.78	456.81	456	2.03	1.5	0.03372	2.77	0.12	2.14	0.5	Subcritical
RDA10	Normal Depth	0.05	0.007	1076.15	1074.20 to 1078.00 ft	260	110.31	119.52	119.44	1.95	1.41	0.04159	2.36	0.09	2.04	0.43	Subcritical
RCPA10	Normal Depth	0.045	0.0071	1069.26	1068.30 to 1070.70 ft	205	114	219.41	219.4	0.96	0.67	0.04105	1.8	0.05	1.01	0.44	Subcritical
RDA1B	Normal Depth	0.049	0.0083	1218.52	1217.50 to 1221.00 ft	336	168.35	276.88	276.87	1.02	0.74	0.04741	2	0.06	1.08	0.45	Subcritical
RCPA41	Normal Depth	0.05	0.0032	1030.26	1026.90 to 1031.50 ft	11005	6092.09	5485.58	5485.55	3.36	2.5	0.04091	1.81	0.05	3.41	0.3	Subcritical
RCPA42	Normal Depth	0.049	0.0024	1029.91	1026.90 to 1031.50 ft	11035	6599.83	5527.65	5527.64	3.01	2.02	0.03896	1.67	0.04	3.06	0.27	Subcritical
RCPA44	Normal Depth	0.05	0.0033	1014.39	1007.50 to 1017.00 ft	11015	3496.81	1414.25	1414.05	6.89	5.01	0.02924	3.15	0.15	7.04	0.35	Subcritical
RCPA46	Normal Depth	0.05	0.0029	989.83	982.00 to 991.00 ft	10979	4082.85	1899.33	1898.91	7.83	5.73	0.02886	2.69	0.11	7.94	0.32	Subcritical
RCPA56	Normal Depth	0.049	0.0046	943.14	937.40 to 948.00 ft	11309	3108.97	1314.29	1314.17	5.74	4.32	0.02961	3.64	0.21	5.95	0.42	Subcritical

RVADMP Routing Reach Cross-section Summary Table - Basin B

Label	Solve For	Roughness Coefficient	Channel Slope (ft/ft)	Water Surface Elevation (ft)	Elevation Range	Discharge (ft^3/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Normal Depth (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
RCPB13	Normal Depth	0.047	0.0057	1220.59	1220.00 to 1221.60 ft	567	401.31	872.26	872.26	0.59	0.33	0.05019	1.41	0.03	0.63	0.37	Subcritical
RCPB05	Normal Depth	0.049	0.006	1170.8	1170.00 to 1171.50 ft	533	373.6	787.13	787.13	0.8	0.49	0.05182	1.43	0.03	0.83	0.37	Subcritical
RCPB06	Normal Depth	0.049	0.005	1166.29	1165.30 to 1167.10 ft	260	192.41	387.02	387.01	0.99	0.61	0.04845	1.35	0.03	1.02	0.34	Subcritical
RCPB11	Normal Depth	0.054	0.0195	1150.44	1149.50 to 1151.00 ft	612	269.91	604.09	603.94	0.94	0.8	0.06081	2.27	0.08	1.02	0.6	Subcritical
RCPB09	Normal Depth	0.049	0.0047	1141.28	1136.00 to 1142.00 ft	4377	1975.93	1788.17	1788.03	5.28	3.55	0.02793	2.22	0.08	5.36	0.37	Subcritical
RCPB03	Normal Depth	0.045	0.006	1239.74	1238.00 to 1241.00 ft	2487	904.4	811.27	811.23	1.74	1.16	0.03185	2.75	0.12	1.85	0.46	Subcritical
RDB13	Normal Depth	0.047	0.0062	1210.34	1207.90 to 1211.10 ft	1519	650.37	719.29	718.8	2.44	1.71	0.03355	2.34	0.08	2.53	0.43	Subcritical
RDB17	Normal Depth	0.048	0.0073	1190.03	1189.90 to 1190.90 ft	7	11.65	106.34	106.33	0.13	0.06	0.08813	0.6	0.01	0.14	0.32	Subcritical
RCPB17	Normal Depth	0.045	0.0072	1184.34	1183.80 to 1186.00 ft	5	4.11	14.39	14.34	0.54	0.36	0.0508	1.22	0.02	0.56	0.4	Subcritical
RDB23	Normal Depth	0.045	0.0071	1160.79	1160.70 to 1161.00 ft	2	4.68	77.99	77.99	0.09	0.05	0.08935	0.43	0	0.1	0.31	Subcritical
RCPB25	Normal Depth	0.048	0.0048	1126.83	1126.00 to 1128.00 ft	284	225.85	499.31	499.31	0.83	0.46	0.04976	1.26	0.02	0.85	0.33	Subcritical
RCPB32	Normal Depth	0.045	0.0078	1154.96	1154.00 to 1156.40 ft	11	5.86	11.35	11.17	0.96	0.68	0.0415	1.88	0.05	1.02	0.46	Subcritical
RCPB31	Normal Depth	0.045	0.0048	1137.22	1136.00 to 1139.30 ft	36	21.57	34.52	34.42	1.22	0.81	0.03968	1.67	0.04	1.26	0.37	Subcritical
RCPB30	Normal Depth	0.045	0.0114	1138.15	1137.80 to 1140.60 ft	11	7.97	32.51	32.5	0.35	0.24	0.05263	1.38	0.03	0.38	0.49	Subcritical
RCPB34	Normal Depth	0.049	0.0058	1128.36	1127.10 to 1129.00 ft	157	158.3	556.37	556.31	1.26	0.82	0.04398	0.99	0.02	1.28	0.33	Subcritical
RCPB27	Normal Depth	0.047	0.0064	1131.03	1130.00 to 1132.20 ft	341	202.99	378.52	378.51	1.03	0.64	0.04201	1.68	0.04	1.07	0.4	Subcritical
RCPB23	Normal Depth	0.046	0.007	1160.57	1160.00 to 1161.00 ft	104	70.37	175.15	175.14	0.57	0.34	0.04721	1.48	0.03	0.6	0.41	Subcritical
RCPB24	Normal Depth	0.049	0.0045	1142.83	1142.00 to 1144.70 ft	252	203.02	432.42	432.42	0.83	0.47	0.05049	1.24	0.02	0.85	0.32	Subcritical
RCPB22	Normal Depth	0.046	0.0062	1154.48	1154.00 to 1155.30 ft	174	163.82	615.72	615.72	0.48	0.3	0.05399	1.06	0.02	0.49	0.36	Subcritical
RCPB54	Normal Depth	0.048	0.0047	1115.57	1114.00 to 1116.20 ft	796	542.22	931.61	931.6	1.57	1.09	0.04441	1.47	0.03	1.6	0.34	Subcritical
RCPB16	Normal Depth	0.048	0.0065	1161.27	1160.00 to 1162.00 ft	809	448.61	727.15	727.14	1.27	0.85	0.04348	1.8	0.05	1.32	0.4	Subcritical
RCPB42	Normal Depth	0.05	0.0062	1161.04	1160.40 to 1161.30 ft	144	114.87	292.97	292.93	0.64	0.38	0.05799	1.25	0.02	0.66	0.35	Subcritical
RCPB20	Normal Depth	0.035	0.0065	1127.6	1127.00 to 1130.00 ft	54	26.91	59.95	59.92	0.6	0.41	0.02589	2.01	0.06	0.66	0.53	Subcritical
RCPB21	Normal Depth	0.049	0.0062	1159.83	1158.00 to 1160.20 ft	1306	718.67	1098.74	1098.72	1.83	1.1	0.03669	1.82	0.05	1.88	0.4	Subcritical
RCPB41	Normal Depth	0.048	0.0056	1116.76	1116.00 to 1117.90 ft	311	235.95	542.23	542.22	0.76	0.42	0.04997	1.32	0.03	0.79	0.35	Subcritical
RCPB19	Normal Depth	0.049	0.0054	1126.47	1126.00 to 1128.10 ft	215	173.37	421.2	421.19	0.47	0.24	0.05736	1.24	0.02	0.5	0.34	Subcritical
RCPB50	Normal Depth	0.05	0.0027	1110.99	1110.00 to 1113.00 ft	253	248.8	470.16	470.16	0.99	0.54	0.05366	1.02	0.02	1.01	0.25	Subcritical
RCPB40	Normal Depth	0.05	0.0063	1146.25	1146.00 to 1148.00 ft	37	40.71	172.18	172.17	0.25	0.12	0.07339	0.91	0.01	0.26	0.33	Subcritical
RCPB49	Normal Depth	0.046	0.0043	1117.93	1116.00 to 1118.20 ft	183	88.77	91.39	91.13	1.93	1.28	0.03615	2.06	0.07	2	0.37	Subcritical
RCPB39	Normal Depth	0.05	0.0051	1126.53	1124.00 to 1126.90 ft	820	560.49	982.64	982.42	2.53	2.12	0.04984	1.46	0.03	2.56	0.34	Subcritical

RVADMP Routing Reach Cross-section Summary Table - Basin B

Label	Solve For	Roughness Coefficient	Channel Slope (ft/ft)	Water Surface Elevation (ft)	Elevation Range	Discharge (ft^3/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Normal Depth (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
RCPB57	Normal Depth	0.05	0.0072	1110.48	1110.00 to 1110.70 ft	126	87.95	205.39	205.38	0.48	0.26	0.05837	1.43	0.03	0.51	0.39	Subcritical
RDB30	Normal Depth	0.048	0.0082	1136.56	1136.00 to 1137.50 ft	135	84.88	198.76	198.75	0.56	0.33	0.0504	1.59	0.04	0.6	0.43	Subcritical
RCPB56	Normal Depth	0.054	0.0193	1102.45	1100.30 to 1103.10 ft	223	103.78	243.59	243.21	2.15	2	0.06295	2.15	0.07	2.22	0.58	Subcritical
RCPB26	Normal Depth	0.045	0.0032	1110.89	1110.00 to 1111.50 ft	117	94.25	173.96	173.95	0.89	0.48	0.04287	1.24	0.02	0.91	0.3	Subcritical
RCPB33	Normal Depth	0.05	0.0015	1109.3	1106.00 to 1111.00 ft	551	559.49	713.2	712.5	3.3	2.45	0.04577	0.98	0.02	3.31	0.2	Subcritical
RCPB44	Normal Depth	0.045	0.0073	1119.18	1114.00 to 1120.90 ft	275	55.6	23.95	21.57	5.18	4.06	0.02686	4.95	0.38	5.56	0.54	Subcritical
RCPB47	Normal Depth	0.055	0.0028	1084.36	1082.00 to 1092.00 ft	413	195.29	108.94	108.68	2.36	1.13	0.04508	2.11	0.07	2.43	0.28	Subcritical
RCPB04	Normal Depth	0.047	0.0057	1220.59	1220.00 to 1221.60 ft	561	398.3	869.98	869.98	0.59	0.32	0.05027	1.41	0.03	0.62	0.37	Subcritical
RCPB12	Normal Depth	0.049	0.0057	1135.32	1130.00 to 1140.00 ft	8552	2256.05	1050.44	1049.71	5.32	4.11	0.03004	3.79	0.22	5.55	0.46	Subcritical
RCPB15	Normal Depth	0.049	0.0057	1126.62	1120.00 to 1128.00 ft	8952	2672.25	1512.59	1511.98	6.62	5.07	0.02852	3.35	0.17	6.8	0.44	Subcritical
RCPB45	Normal Depth	0.049	0.0038	1127.28	1120.00 to 1128.50 ft	9132	3541.85	2166.28	2165.77	7.28	5.8	0.03128	2.58	0.1	7.38	0.36	Subcritical
RCPB46	Normal Depth	0.049	0.005	1100.29	1092.00 to 1104.00 ft	9608	2398.17	926.3	924.94	8.29	6.77	0.02868	4.01	0.25	8.54	0.44	Subcritical
RCPB35	Normal Depth	0.049	0.0037	1113.7	1112.00 to 1115.00 ft	455	361.88	633.6	633.52	1.7	1.21	0.04879	1.26	0.02	1.72	0.29	Subcritical
RCPB62	Normal Depth	0.049	0.0057	1065.13	1054.00 to 1066.00 ft	10941	3201.04	1744.3	1740.51	11.13	9.79	0.02977	3.42	0.18	11.31	0.44	Subcritical
RCPB63	Normal Depth	0.049	0.0027	1066.03	1054.00 to 1067.00 ft	10903	4511.44	2345.98	2342.19	12.03	9.93	0.02849	2.42	0.09	12.12	0.31	Subcritical
RCPB64	Normal Depth	0.049	0.0033	1058.14	1046.00 to 1059.00 ft	10898	4245.96	2383.93	2382.29	12.14	6.72	0.02043	2.57	0.1	12.25	0.34	Subcritical
RCPB07 - TSFF	Normal Depth	0.045	0.0037	1	0.00 to 5.00 ft	217	119.83	140	139.95	1	0.51	0.03808	1.81	0.05	1.05	0.35	Subcritical
RCPB05	Normal Depth	0.049	0.006	1170.8	1170.00 to 1171.50 ft	533	373.6	787.13	787.13	0.8	0.49	0.05182	1.43	0.03	0.83	0.37	Subcritical
RCPB48 - TSSW	Normal Depth	0.05	0.0044	4.37	0.00 to 6.00 ft	392	273.34	443.12	441.69	4.37	3.67	0.04358	1.43	0.03	4.41	0.32	Subcritical
RCPB61	Normal Depth	0.047	0.005	1088.5	1080.00 to 1092.00 ft	10222	1947.15	538.58	533.34	8.5	7.08	0.02486	5.25	0.43	8.93	0.48	Subcritical
RCPB38 - TSSW	Normal Depth	0.05	0.002	5	0.00 to 6.00 ft	779	669.69	820.4	818.97	5	4.09	0.04253	1.16	0.02	5.02	0.23	Subcritical
RCPB65 - TSFF	Normal Depth	0.047	0.0054	2.13	0.00 to 5.00 ft	969	343.12	253.5	253.42	2.13	1.33	0.03271	2.82	0.12	2.26	0.43	Subcritical
RCPB55 - TSFF	Normal Depth	0.045	0.0044	0.22	0.00 to 5.00 ft	18	23.08	108.85	108.84	0.22	0.1	0.06408	0.78	0.01	0.23	0.3	Subcritical
RCPB29 - TSFF	Normal Depth	0.046	0.0038	1.18	0.00 to 5.00 ft	280	146.48	157.84	157.78	1.18	0.6	0.03718	1.91	0.06	1.23	0.35	Subcritical
RCPB58 - TSFF	Normal Depth	0.046	0.0016	1.41	0.00 to 5.00 ft	242	185	180.61	180.55	1.41	0.55	0.03923	1.31	0.03	1.43	0.23	Subcritical
RCPB52 - TSFF	Normal Depth	0.045	0.0041	0.74	0.00 to 5.00 ft	135	84.74	129.57	129.54	0.74	0.37	0.04188	1.59	0.04	0.78	0.35	Subcritical
RCPB53 - TSFF	Normal Depth	0.045	0.0029	0.63	0.00 to 5.00 ft	87	71.28	125.34	125.31	0.63	0.28	0.04583	1.22	0.02	0.66	0.29	Subcritical
RCPB60 - TSFF	Normal Depth	0.047	0.0141	1.63	0.00 to 5.00 ft	935	228.53	203.3	203.24	1.63	1.3	0.03189	4.09	0.26	1.89	0.68	Subcritical
RDB16 - TSSW	Normal Depth	0.05	0.0076	4.62	0.00 to 6.00 ft	798	398.54	589.08	587.65	4.62	4.11	0.0426	2	0.06	4.68	0.43	Subcritical
RDB18	Normal Depth	0.05	0.0073	1212.58	1212.00 to 1213.70 ft	93	68.46	177.14	177.14	0.58	0.35	0.05663	1.36	0.03	0.61	0.39	Subcritical

RVADMP Routing Reach Cross-section Summary Table - Basin C

Label	Solve For	Roughness Coefficient	Channel Slope (ft/ft)	Water Surface Elevation (ft)	Elevation Range	Discharge (ft^3/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Normal Depth (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
RCPC44	Normal Depth	0.049	0.007	1238.83	1238.00 to 1240.60 ft	78	72.16	260.5	260.46	0.83	0.64	0.06014	1.08	0.02	0.85	0.36	Subcritical
RCPC38	Normal Depth	0.05	0.0072	1238.35	1236.00 to 1239.00 ft	121	123.35	511.41	510.87	2.35	2.17	0.06581	0.98	0.01	2.36	0.35	Subcritical
RDC45	Normal Depth	0.047	0.0058	1237.09	1236.00 to 1237.70 ft	19	25.09	143.8	143.65	1.09	0.55	0.04464	0.76	0.01	1.1	0.32	Subcritical
RDC42B	Normal Depth	0.035	0.0079	1.06	0.00 to 6.00 ft	24	7.54	9.74	9.24	1.06	0.8	0.02196	3.18	0.16	1.22	0.62	Subcritical
RDC46	Normal Depth	0.05	0.0068	1226.69	1226.00 to 1228.00 ft	39	31.33	86.61	86.6	0.69	0.45	0.05843	1.24	0.02	0.72	0.36	Subcritical
RCPC46	Normal Depth	0.045	0.0069	1227.61	1226.30 to 1229.00 ft	52	30.79	63.73	63.65	1.31	0.86	0.03816	1.69	0.04	1.36	0.43	Subcritical
RCPC35	Normal Depth	0.045	0.0047	1223.16	1216.00 to 1224.00 ft	2917	1425.89	1641.62	1640.61	7.16	6.43	0.03211	2.05	0.07	7.23	0.39	Subcritical
RCPC34	Normal Depth	0.05	0.0061	1211.06	1206.91 to 1213.00 ft	4863	1282.38	614.07	613.06	4.15	3.14	0.03241	3.79	0.22	4.37	0.46	Subcritical
RCPC36	Normal Depth	0.046	0.0042	1195.59	1190.00 to 1197.00 ft	4663	1981.43	1689.03	1688.45	5.59	4.68	0.03042	2.35	0.09	5.67	0.38	Subcritical
RCPC49	Normal Depth	0.05	0.0048	1186.12	1180.00 to 1187.00 ft	4544	1753.98	1256.92	1255.42	6.12	5.15	0.03549	2.59	0.1	6.22	0.39	Subcritical
RCPC48	Normal Depth	0.05	0.0034	1176.62	1172.00 to 1178.00 ft	4442	2226.54	1818.4	1817.95	4.62	3.54	0.03719	2	0.06	4.69	0.32	Subcritical
RCPC37	Normal Depth	0.047	0.0073	1188.9	1188.00 to 1189.90 ft	663	316.16	468.59	468.57	0.9	0.56	0.04097	2.1	0.07	0.97	0.45	Subcritical
RCPC33	Normal Depth	0.05	0.0057	1231.96	1228.01 to 1233.20 ft	5162	2124.02	1899.43	1899.24	3.95	3.25	0.03875	2.43	0.09	4.04	0.41	Subcritical
RCPC25	Normal Depth	0.045	0.0048	1400.43	1400.00 to 1405.00 ft	16	14.07	40.15	40.12	0.43	0.22	0.05091	1.14	0.02	0.45	0.34	Subcritical
RCPC52- TSFF	Normal Depth	0.045	0.0054	0.81	0.00 to 5.00 ft	180	93.48	132.25	132.21	0.81	0.45	0.03952	1.93	0.06	0.86	0.4	Subcritical
RCPC53- TSFF	Normal Depth	0.045	0.0016	0.69	0.00 to 5.00 ft	75	78.5	127.63	127.59	0.69	0.26	0.04728	0.96	0.01	0.7	0.21	Subcritical
RCPC47	Normal Depth	0.049	0.0038	1158.65	1151.80 to 1164.00 ft	4400	1190.17	426.19	424.77	6.85	4.16	0.0259	3.7	0.21	7.07	0.39	Subcritical
RCPC01	Normal Depth	0.045	0.021	1616.2	1615.00 to 1619.00 ft	146	31.19	32.23	32	1.2	1.08	0.03098	4.68	0.34	1.54	0.84	Subcritical
RCPC02	Normal Depth	0.045	0.022	1624.49	1624.00 to 1628.00 ft	32	11.59	27.41	27.34	0.49	0.41	0.04159	2.76	0.12	0.61	0.75	Subcritical
RCPC03	Normal Depth	0.045	0.0167	1612.93	1612.00 to 1615.00 ft	46	13.67	19.51	19.32	0.93	0.76	0.03546	3.37	0.18	1.11	0.71	Subcritical
RCPC04	Normal Depth	0.045	0.0232	1664.7	1663.00 to 1667.00 ft	101	19.32	18.24	17.74	1.7	1.6	0.03026	5.23	0.42	2.12	0.88	Subcritical
RCPC05	Normal Depth	0.045	0.0153	1613.88	1613.00 to 1616.00 ft	59	18.89	28.25	28.14	0.88	0.69	0.03616	3.12	0.15	1.03	0.67	Subcritical
RCPC06	Normal Depth	0.045	0.0127	1565.26	1564.00 to 1568.00 ft	118	30.5	28.77	28.4	1.26	0.97	0.03158	3.87	0.23	1.49	0.66	Subcritical
RCPC07	Normal Depth	0.049	0.0106	1556.4	1553.00 to 1558.00 ft	601	159.29	121.4	120.96	3.4	2.81	0.03295	3.77	0.22	3.62	0.58	Subcritical
RCPC08	Normal Depth	0.045	0.0099	1567.82	1566.00 to 1580.00 ft	397	92.6	62.13	61.83	1.82	1.35	0.02826	4.29	0.29	2.1	0.62	Subcritical
RCPC09	Normal Depth	0.045	0.0139	1550.63	1550.00 to 1553.00 ft	47	17.7	31.41	31.29	0.63	0.46	0.03933	2.66	0.11	0.74	0.62	Subcritical
RCPC10	Normal Depth	0.045	0.0055	1481.6	1480.00 to 1485.00 ft	197	64.39	46.11	45.65	1.6	0.96	0.03097	3.06	0.15	1.74	0.45	Subcritical

RVADMP Routing Reach Cross-section Summary Table - Basin C

Label	Solve For	Roughness Coefficient	Channel Slope (ft/ft)	Water Surface Elevation (ft)	Elevation Range	Discharge (ft^3/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Normal Depth (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
RCPC11	Normal Depth	0.049	0.0116	1535.41	1534.00 to 1537.00 ft	69	38.38	94.1	93.9	1.41	1.09	0.04461	1.8	0.05	1.46	0.5	Subcritical
RCPC12	Normal Depth	0.045	0.0119	1525.93	1525.00 to 1529.00 ft	66	20.75	25.01	24.65	0.93	0.68	0.03497	3.18	0.16	1.09	0.61	Subcritical
RCPC13	Normal Depth	0.045	0.0054	1481.31	1480.00 to 1485.00 ft	138	51.36	44.08	43.7	1.31	0.77	0.03322	2.69	0.11	1.42	0.44	Subcritical
RCPC14	Normal Depth	0.045	0.0056	1480.72	1480.00 to 1485.00 ft	51	26.89	40.01	39.79	0.72	0.4	0.04074	1.9	0.06	0.78	0.41	Subcritical
RCPC15	Normal Depth	0.045	0.0095	1614.12	1614.00 to 1617.00 ft	1	1.3	11.25	11.23	0.12	0.07	0.07365	0.77	0.01	0.13	0.4	Subcritical
RCPC16	Normal Depth	0.049	0.0106	1516.23	1514.00 to 1517.00 ft	189	119.48	326.49	326.09	2.23	2.07	0.05827	1.58	0.04	2.26	0.46	Subcritical
RCPC17	Normal Depth	0.045	0.0106	1506.23	1506.00 to 1510.00 ft	3	2.59	13.05	13	0.23	0.14	0.05906	1.16	0.02	0.25	0.46	Subcritical
RCPC18	Normal Depth	0.045	0.0103	1525.18	1524.00 to 1527.00 ft	99	30.51	32.02	31.78	1.18	0.85	0.03316	3.24	0.16	1.34	0.58	Subcritical
RCPC19	Normal Depth	0.05	0.0091	1496.26	1494.00 to 1497.00 ft	220	145.11	376.6	376.2	2.26	2.09	0.05874	1.52	0.04	2.3	0.43	Subcritical
RCPC20	Normal Depth	0.048	0.0056	1418.43	1415.00 to 1420.00 ft	209	86.16	79.51	77.81	3.43	1.7	0.03184	2.43	0.09	3.52	0.41	Subcritical
RCPC21	Normal Depth	0.045	0.0093	1490.65	1490.00 to 1494.00 ft	49	22.26	38.74	38.65	0.65	0.42	0.04052	2.2	0.08	0.72	0.51	Subcritical
RCPC23	Normal Depth	0.045	0.0044	1427.83	1425.00 to 1431.00 ft	308	86.71	41.98	41.24	2.83	1.74	0.02691	3.55	0.2	3.03	0.43	Subcritical
RCPC24	Normal Depth	0.045	0.0048	1400.66	1400.00 to 1405.00 ft	35	24.22	48.21	48.17	0.66	0.36	0.04412	1.45	0.03	0.69	0.36	Subcritical
RCPC26	Normal Depth	0.045	0.0056	1410.78	1410.00 to 1414.00 ft	19	10.79	17.93	17.77	0.78	0.45	0.04117	1.76	0.05	0.83	0.4	Subcritical
RCPC27	Normal Depth	0.045	0.0059	1417.96	1415.00 to 1420.00 ft	255	58.98	26.5	24.86	2.96	1.93	0.0267	4.32	0.29	3.25	0.49	Subcritical
RCPC28	Normal Depth	0.049	0.0059	1444.46	1443.00 to 1446.00 ft	118	86.34	193.53	193.47	1.46	0.95	0.04176	1.37	0.03	1.49	0.36	Subcritical
RCPC29	Normal Depth	0.048	0.0057	1444.97	1443.00 to 1446.00 ft	318	123.94	108.57	108.38	1.97	1.44	0.0381	2.57	0.1	2.07	0.42	Subcritical
RCPC30	Normal Depth	0.045	0.0055	1481.7	1480.00 to 1485.00 ft	220	69.25	46.85	46.35	1.7	1.04	0.03031	3.18	0.16	1.86	0.46	Subcritical
RCPC31	Normal Depth	0.045	0.0055	1480.98	1480.00 to 1485.00 ft	86	37.67	41.85	41.56	0.98	0.56	0.03655	2.28	0.08	1.07	0.42	Subcritical
RCPC39	Normal Depth	0.045	0.0124	1353.5	1353.00 to 1356.00 ft	19	11.08	34.77	34.75	0.5	0.36	0.0473	1.72	0.05	0.54	0.54	Subcritical
RCPC40	Normal Depth	0.045	0.0125	1306.16	1305.00 to 1310.00 ft	76	24.93	33.24	33.12	1.16	0.9	0.03491	3.05	0.14	1.3	0.62	Subcritical
RCPC41	Normal Depth	0.045	0.01111	1316.61	1316.00 to 1320.00 ft	21	10.69	25.24	25.19	0.61	0.43	0.04335	1.96	0.06	0.67	0.53	Subcritical
RCPC42	Normal Depth	0.045	0.0087	1280.42	1280.00 to 1285.00 ft	24	15.32	42.23	42.2	0.42	0.26	0.04795	1.57	0.04	0.46	0.46	Subcritical
RCPC43	Normal Depth	0.045	0.01	1264.67	1264.00 to 1268.00 ft	43	21.06	43.33	43.3	0.67	0.46	0.04174	2.04	0.06	0.73	0.52	Subcritical
RCPC45	Normal Depth	0.048	0.0097	1251.27	1250.00 to 1253.00 ft	62	33.98	73.4	73.29	1.27	0.81	0.04095	1.82	0.05	1.32	0.47	Subcritical

RVADMP Routing Reach Cross-section Summary Table - Basin D

Label	Solve For	Roughness Coefficient	Channel Slope (ft/ft)	Water Surface Elevation (ft)	Elevation Range	Discharge (ft³/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)	Normal Depth (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
RCPD38	Normal Depth	0.045	0.0039	1204.85	1200.00 to 1205.00 ft	539	343.07	508.58	507.27	4.85	2.75	0.02454	1.57	0.04	4.88	0.34	Subcritical
RCPD21	Normal Depth	0.045	0.0061	1300.02	1299.97 to 1301.19 ft	7	20.85	440.03	440.03	0.05	0.02	0.10987	0.34	0	0.05	0.27	Subcritical
RCPD20	Normal Depth	0.045	0.0063	1340.84	1340.00 to 1344.00 ft	29	16.25	28.9	28.83	0.84	0.52	0.04082	1.79	0.05	0.89	0.42	Subcritical
RCPD25	Normal Depth	0.048	0.005	1230.38	1229.80 to 1231.50 ft	402	347.38	902.57	902.57	0.58	0.33	0.05484	1.16	0.02	0.61	0.33	Subcritical
RCPD26	Normal Depth	0.05	0.0034	1208.17	1204.00 to 1209.00 ft	667	267.91	157.77	156.62	4.17	2.34	0.03195	2.49	0.1	4.27	0.34	Subcritical
RCPD22	Normal Depth	0.049	0.0058	1211.02	1208.00 to 1212.00 ft	1957	663.6	466.79	466.6	3.02	2.2	0.0338	2.95	0.14	3.15	0.44	Subcritical
RCPD35	Normal Depth	0.045	0.0055	1.61	0.00 to 5.00 ft	588	223.56	200.84	200.78	1.61	0.96	0.03148	2.63	0.11	1.72	0.44	Subcritical
RCPD34	Normal Depth	0.05	0.0058	1173.73	1169.80 to 1175.30 ft	696	338.51	396.81	395.79	3.93	3.33	0.04122	2.06	0.07	4	0.39	Subcritical
RCPD24	Normal Depth	0.049	0.005	1300.5	1300.00 to 1301.70 ft	553	460.81	1111.87	1111.87	0.5	0.25	0.05681	1.2	0.02	0.52	0.33	Subcritical
RCPD19	Normal Depth	0.045	0.0073	1341.12	1340.00 to 1343.00 ft	49	20.72	27.01	26.87	1.12	0.75	0.03625	2.36	0.09	1.21	0.47	Subcritical
RCPD18	Normal Depth	0.045	0.0073	1340.92	1340.00 to 1343.00 ft	36	17.58	28.43	28.34	0.92	0.6	0.03904	2.05	0.07	0.98	0.46	Subcritical
RCPD07	Normal Depth	0.045	0.0066	1423.19	1422.00 to 1425.00 ft	202	93.36	127.58	127.55	1.19	0.83	0.03786	2.16	0.07	1.26	0.45	Subcritical
RCPD17	Normal Depth	0.048	0.0061	1342.03	1340.00 to 1344.00 ft	178	72.43	70.84	70.69	2.03	1.41	0.03667	2.46	0.09	2.13	0.43	Subcritical
RCPD15	Normal Depth	0.045	0.005	1290.6	1290.00 to 1295.00 ft	52	32.69	58.16	58.07	0.6	0.32	0.04386	1.59	0.04	0.64	0.37	Subcritical
RCPD47	Normal Depth	0.045	0.005	1290.06	1290.00 to 1295.00 ft	1	2.89	50.77	50.76	0.06	0.02	0.10343	0.35	0	0.06	0.26	Subcritical
RCPD02	Normal Depth	0.049	0.019	1684.15	1682.00 to 1685.00 ft	289	70.44	73.17	72.92	2.15	1.94	0.03685	4.1	0.26	2.41	0.74	Subcritical
RCPD03	Normal Depth	0.045	0.0133	1639.37	1638.00 to 1643.00 ft	142	34.38	30.44	30.07	1.37	1.08	0.03066	4.13	0.27	1.64	0.68	Subcritical
RCPD04	Normal Depth	0.045	0.012	1573.97	1573.00 to 1577.00 ft	59	19.32	24.92	24.73	0.97	0.72	0.03522	3.05	0.14	1.12	0.61	Subcritical
RCPD01	Normal Depth	0.05	0.0092	1488.38	1486.00 to 1489.50 ft	653	232.34	240.31	240.04	2.38	2.02	0.04207	2.81	0.12	2.5	0.5	Subcritical
RCPD05	Normal Depth	0.045	0.0084	1462.13	1460.50 to 1465.00 ft	34	10.79	10.16	9.22	1.63	1.12	0.03465	3.15	0.15	1.79	0.51	Subcritical
RCPD11	Normal Depth	0.045	0.0073	1414.96	1414.00 to 1416.00 ft	199	94.42	146.25	146.24	0.96	0.63	0.03831	2.11	0.07	1.03	0.46	Subcritical
RCPD06	Normal Depth	0.045	0.0078	1455.99	1455.00 to 1459.00 ft	63	24.66	30.08	29.89	0.99	0.64	0.03599	2.55	0.1	1.09	0.5	Subcritical
RCPD08	Normal Depth	0.045	0.0078	1456.88	1455.00 to 1459.00 ft	203	55.31	39.18	38.81	1.88	1.31	0.02931	3.67	0.21	2.09	0.54	Subcritical
RCPD10	Normal Depth	0.045	0.005	1291.14	1290.00 to 1295.00 ft	153	65.45	65.33	65.16	1.14	0.64	0.03513	2.34	0.08	1.22	0.41	Subcritical
RCPD46	Normal Depth	0.045	0.005	1290.09	1290.00 to 1295.00 ft	2	4.39	51.17	51.16	0.09	0.04	0.089	0.46	0	0.09	0.27	Subcritical
RCPD13	Normal Depth	0.045	0.005	1291.81	1290.00 to 1295.00 ft	346	112.51	74.43	74.16	1.81	1.09	0.02997	3.08	0.15	1.96	0.44	Subcritical
RCPD33	Normal Depth	0.049	0.003	1181.29	1175.00 to 1185.00 ft	6279	1941.83	710.86	710.34	6.29	4.85	0.03142	3.23	0.16	6.46	0.34	Subcritical
RCPD42	Normal Depth	0.049	0.0047	1157.57	1150.00 to 1165.00 ft	5941	1482.22	554.4	554.02	7.57	5.9	0.02743	4.01	0.25	7.82	0.43	Subcritical
RCPD38	Normal Depth	0.05	0.0039	1204.9	1200.00 to 1205.00 ft	539	369.6	536.5	535.19	4.9	2.75	0.0293	1.46	0.03	4.93	0.31	Subcritical
RCPD09	Normal Depth	0.045	0.0048	1401.63	1400.00 to 1405.00 ft	207	87.01	82.04	81.95	1.63	1.01	0.03305	2.38	0.09	1.72	0.41	Subcritical
RCPD12	Normal Depth	0.045	0.0048	1400.27	1400.00 to 1405.00 ft	7	8.06	34.5	34.49	0.27	0.13	0.05982	0.87	0.01	0.28	0.32	Subcritical
RDD07	Normal Depth	0.045	0.0071	1422.85	1422.00 to 1425.00 ft	50	26.32	46.67	46.61	0.85	0.56	0.04028	1.9	0.06	0.91	0.45	Subcritical
RDD02	Normal Depth	0.045	0.012	1584.31	1584.00 to 1588.00 ft	8	5.14	18.17	18.1	0.31	0.2	0.05149	1.56	0.04	0.35	0.52	Subcritical
RDD03	Normal Depth	0.045	0.012	1574.61	1573.00 to 1577.00 ft	150	37.11	31.42	31.1	1.61	1.26	0.03015	4.04	0.25	1.86	0.65	Subcritical
RDD04	Normal Depth	0.049	0.0092	1487.4	1486.00 to 1489.00 ft	61	40.15	106.09	105.89	1.4	0.9	0.04033	1.52	0.04	1.44	0.44	Subcritical
RDD06	Normal Depth	0.048	0.0081	1522.13	1520.00 to 1523.00 ft	237	85.41	85.2	85.05	2.13	1.6	0.03695	2.77	0.12	2.25	0.49	Subcritical
RDD05	Normal Depth	0.049	0.005	1456.33	1453.00 to 1457.50 ft	805	334.4	279.87	279.42	3.33	2.64	0.03778	2.41	0.09	3.42	0.39	Subcritical
RDD01	Normal Depth	0.045	0.0088	1483.18	1482.00 to 1487.00 ft	169	51.93	48.23	47.88	1.18	0.8	0.03262	3.25	0.16	1.35	0.55	Subcritical

RVADMP Routing Reach Cross-section Summary Table - Basin E

Label	Solve For	Roughness Coefficient	Channel Slope (ft/ft)	Water Surface Elevation (ft)	Elevation Range	Discharge (ft^3/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Normal Depth (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
RDE16	Normal Depth	0.049	0.0061	1443.47	1440.00 to 1445.00 ft	1354	523.75	452.76	452.37	3.47	2.96	0.04073	2.59	0.1	3.58	0.42	Subcritical
RCPE28	Normal Depth	0.047	0.0059	1381.14	1380.80 to 1382.30 ft	29	34.24	166.82	166.82	0.34	0.19	0.06332	0.85	0.01	0.35	0.33	Subcritical
RCPE15	Normal Depth	0.047	0.0063	1437.75	1437.20 to 1438.70 ft	155	155.88	624.99	624.99	0.55	0.41	0.06231	0.99	0.02	0.56	0.35	Subcritical
RDE21	Normal Depth	0.047	0.0063	1406.08	1405.90 to 1407.20 ft	33	51.92	409.32	409.32	0.18	0.1	0.07795	0.64	0.01	0.18	0.31	Subcritical
RCPE27	Normal Depth	0.049	0.0062	1382.29	1382.00 to 1383.40 ft	74	91.67	473.85	473.85	0.29	0.16	0.07091	0.81	0.01	0.3	0.32	Subcritical
RCPE08	Normal Depth	0.045	0.0063	1427.85	1427.50 to 1428.00 ft	67	69.64	313.28	313.28	0.35	0.22	0.05743	0.96	0.01	0.37	0.36	Subcritical
RDE13	Normal Depth	0.045	0.006	1412.43	1412.10 to 1412.70 ft	38	46.53	258.17	258.17	0.33	0.2	0.06045	0.82	0.01	0.34	0.34	Subcritical
RCPE24	Normal Depth	0.045	0.006	1.68	0.00 to 6.00 ft	508	189.13	175.75	175.7	1.68	1.11	0.03226	2.69	0.11	1.79	0.46	Subcritical
RCPE05	Normal Depth	0.049	0.0063	1432.65	1432.00 to 1433.40 ft	467	344.2	823.3	823.29	0.65	0.38	0.05322	1.36	0.03	0.68	0.37	Subcritical
RCPE13	Normal Depth	0.045	0.0059	1.71	0.00 to 6.00 ft	524	194.69	178.11	178.06	1.71	1.13	0.03212	2.69	0.11	1.82	0.45	Subcritical
RDE05	Normal Depth	0.045	0.0056	1424.95	1424.00 to 1426.90 ft	305	190.67	365.87	365.86	0.95	0.62	0.04145	1.6	0.04	0.99	0.39	Subcritical
RCPE12	Normal Depth	0.035	0.0053	1396.29	1396.00 to 1397.40 ft	242	199.7	813.27	813.26	0.29	0.17	0.03338	1.21	0.02	0.31	0.43	Subcritical
RDE19	Normal Depth	0.05	0.0064	1408.98	1407.90 to 1409.70 ft	653	642.29	2313.08	2312.88	1.08	0.92	0.06843	1.02	0.02	1.1	0.34	Subcritical
RDE28	Normal Depth	0.048	0.0056	1390.35	1389.90 to 1391.30 ft	111	119.66	471.69	471.69	0.45	0.27	0.06155	0.93	0.01	0.46	0.32	Subcritical
RCPE19	Normal Depth	0.045	0.0068	1.44	0.00 to 6.00 ft	393	149.64	157.98	157.94	1.44	0.97	0.03352	2.63	0.11	1.55	0.48	Subcritical
RCPE18	Normal Depth	0.045	0.006	1379.66	1378.90 to 1380.00 ft	173	128.84	339.15	339.15	0.76	0.52	0.04628	1.34	0.03	0.79	0.38	Subcritical
RCPE17	Normal Depth	0.048	0.0062	1369.12	1367.90 to 1370.10 ft	418	227.88	346.58	346.57	1.22	0.75	0.04189	1.83	0.05	1.27	0.4	Subcritical
RCPE23	Normal Depth	0.049	0.006	1362.34	1361.50 to 1362.90 ft	515	385.31	906.97	906.97	0.84	0.56	0.05301	1.34	0.03	0.87	0.36	Subcritical
RCPE29	Normal Depth	0.045	0.0051	1.8	0.00 to 6.00 ft	546	211.72	185.14	185.09	1.8	1.16	0.03192	2.58	0.1	1.9	0.43	Subcritical
RCPE37	Normal Depth	0.045	0.0047	1.53	0.00 to 6.00 ft	370	163.92	164.63	164.58	1.53	0.94	0.03383	2.26	0.08	1.61	0.4	Subcritical
RCPE34	Normal Depth	0.045	0.0046	1.77	0.00 to 6.00 ft	499	205.82	182.74	182.68	1.77	1.1	0.03235	2.42	0.09	1.86	0.4	Subcritical
RCPE42	Normal Depth	0.045	0.0051	1.55	0.00 to 6.00 ft	398	167.82	166.4	166.35	1.55	0.98	0.03346	2.37	0.09	1.64	0.42	Subcritical
RCPE33	Normal Depth	0.035	0.0057	1350.7	1350.60 to 1352.00 ft	2	4.62	93.52	93.52	0.1	0.06	0.05604	0.43	0	0.1	0.34	Subcritical
RCPE32	Normal Depth	0.045	0.0059	1.44	0.00 to 6.00 ft	367	149.91	158.12	158.07	1.44	0.93	0.03387	2.45	0.09	1.53	0.44	Subcritical
RCPE53	Normal Depth	0.035	0.0059	1336.04	1336.00 to 1336.40 ft	5	14.33	408.2	408.2	0.04	0.02	0.06964	0.35	0	0.04	0.33	Subcritical
RCPE31	Normal Depth	0.047	0.0056	1318.52	1318.20 to 1318.87 ft	89	102.98	470.36	470.35	0.32	0.18	0.06444	0.86	0.01	0.33	0.33	Subcritical
RCPE30	Normal Depth	0.045	0.0049	1.91	0.00 to 6.00 ft	610	233.17	193.64	193.58	1.91	1.23	0.03141	2.62	0.11	2.02	0.42	Subcritical
RCPE38	Normal Depth	0.049	0.0051	1318.51	1317.50 to 1319.80 ft	774	615.6	1411.2	1411.2	1.01	0.7	0.05214	1.26	0.02	1.04	0.34	Subcritical
RCPE25	Normal Depth	0.035	0.006	1099.77	1099.00 to 1100.00 ft	589	271.65	507.27	507.27	0.77	0.54	0.02428	2.17	0.07	0.84	0.52	Subcritical
RCPE36	Normal Depth	0.045	0.0037	0.84	0.00 to 6.00 ft	99	68.73	113.2	113.18	0.84	0.44	0.04174	1.44	0.03	0.87	0.33	Subcritical
RCPE54	Normal Depth	0.045	0.0045	0.88	0.00 to 6.00 ft	120	73.55	116.36	116.33	0.88	0.49	0.04042	1.63	0.04	0.93	0.36	Subcritical
RCPE45	Normal Depth	0.045	0.005	1.98	0.00 to 6.00 ft	664	246.36	198.69	198.63	1.98	1.28	0.03102	2.7	0.11	2.09	0.43	Subcritical
RCPE50	Normal Depth	0.047	0.0037	2.87	0.00 to 6.00 ft	1160	501.22	374.89	374.82	2.87	1.71	0.03177	2.31	0.08	2.96	0.35	Subcritical

RVADMP Routing Reach Cross-section Summary Table - Basin E

Label	Solve For	Roughness Coefficient	Channel Slope (ft/ft)	Water Surface Elevation (ft)	Elevation Range	Discharge (ft^3/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Normal Depth (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
RCPE52	Normal Depth	0.05	0.0031	3.85	0.00 to 6.00 ft	147	119.24	187.93	186.51	3.85	2.23	0.03431	1.23	0.02	3.87	0.27	Subcritical
RCPE43	Normal Depth	0.035	0.0042	1281.36	1280.00 to 1288.00 ft	338	113.58	100.98	100.74	1.36	0.88	0.01953	2.98	0.14	1.5	0.49	Subcritical
RDE35	Normal Depth	0.045	0.0055	0.58	0.00 to 6.00 ft	59	41.41	93.36	93.34	0.58	0.32	0.04567	1.42	0.03	0.61	0.38	Subcritical
RCPE35	Normal Depth	0.045	0.0055	0.85	0.00 to 6.00 ft	123	69.66	113.82	113.8	0.85	0.5	0.04025	1.77	0.05	0.9	0.4	Subcritical
RCPE21	Normal Depth	0.047	0.0061	1421.67	1421.60 to 1421.90 ft	4	11.25	206.66	206.66	0.07	0.03	0.1053	0.36	0	0.08	0.27	Subcritical
RCPE44	Normal Depth	0.048	0.0061	1282.85	1280.00 to 1288.00 ft	1157	290.45	138.69	138.19	2.85	1.87	0.0292	3.98	0.25	3.09	0.48	Subcritical
RDE30	Normal Depth	0.045	0.0058	1.11	0.00 to 6.00 ft	212	101.16	132.98	132.94	1.11	0.69	0.03686	2.1	0.07	1.17	0.42	Subcritical
RDE31	Normal Depth	0.048	0.0056	1318.66	1318.20 to 1319.00 ft	182	169.95	535.88	535.88	0.46	0.26	0.05985	1.07	0.02	0.48	0.34	Subcritical
RCPE16	Normal Depth	0.049	0.0064	1406.51	1405.90 to 1407.20 ft	290	250.41	753.22	753.22	0.61	0.39	0.05895	1.16	0.02	0.63	0.35	Subcritical
RCPE26 -TS	Normal Depth	0.045	0.0056	0.91	0.00 to 6.00 ft	140	75.97	117.9	117.88	0.91	0.54	0.03941	1.84	0.05	0.96	0.4	Subcritical
RCPE46 -TS	Normal Depth	0.045	0.0045	1.16	0.00 to 6.00 ft	205	108.24	136.91	136.88	1.16	0.68	0.03706	1.89	0.06	1.21	0.38	Subcritical
RCPE47 -TS	Normal Depth	0.045	0.05	1.13	0.00 to 6.00 ft	651	104.49	134.84	134.81	1.13	1.27	0.03111	6.23	0.6	1.73	1.25	Supercritical
RCPE01	Normal Depth	0.048	0.0118	1628.91	1626.00 to 1630.50 ft	1241	302.43	225.51	225.29	2.91	2.54	0.0335	4.1	0.26	3.17	0.62	Subcritical
RCPE02	Normal Depth	0.049	0.0083	1549.6	1545.00 to 1551.00 ft	1978	619.35	493.51	493.04	4.6	3.96	0.03528	3.19	0.16	4.76	0.5	Subcritical
RCPE03	Normal Depth	0.047	0.0084	1508.72	1505.00 to 1510.50 ft	1848	478.13	307.43	307.28	3.72	2.67	0.02768	3.87	0.23	3.95	0.55	Subcritical
RCPE04	Normal Depth	0.049	0.009	1469.26	1468.00 to 1471.00 ft	210	134.35	338.64	338.61	1.26	1.08	0.05582	1.56	0.04	1.3	0.44	Subcritical
RCPE05	Normal Depth	0.049	0.0063	1432.65	1432.00 to 1433.40 ft	467	344.2	823.3	823.29	0.65	0.38	0.05322	1.36	0.03	0.68	0.37	Subcritical
RCPE06	Normal Depth	0.049	0.008	1469.21	1468.00 to 1470.50 ft	156	116.69	340.12	340.09	1.21	1.04	0.05953	1.34	0.03	1.23	0.4	Subcritical
RCPE07	Normal Depth	0.048	0.0074	1488.57	1486.00 to 1490.50 ft	261	91.68	83.83	83.44	2.57	1.82	0.03189	2.85	0.13	2.7	0.48	Subcritical
RCPE08	Normal Depth	0.045	0.0063	1427.85	1427.50 to 1428.00 ft	67	69.66	313.51	313.51	0.35	0.22	0.05744	0.96	0.01	0.37	0.36	Subcritical
RCPE09	Normal Depth	0.049	0.011	1529.17	1528.00 to 1530.00 ft	60	51.97	234.17	234.07	1.17	1.07	0.06962	1.15	0.02	1.19	0.43	Subcritical
RCPE10	Normal Depth	0.045	0.0071	1468.39	1468.00 to 1470.00 ft	11	10.12	41.48	41.47	0.39	0.24	0.05403	1.09	0.02	0.41	0.39	Subcritical
RCPE11	Normal Depth	0.049	0.0058	1469.45	1468.00 to 1470.50 ft	314	203.81	375.82	375.79	1.45	1.16	0.05182	1.54	0.04	1.49	0.37	Subcritical
RCPE12	Normal Depth	0.048	0.0053	1396.62	1396.00 to 1397.40 ft	242	170.69	346.29	346.07	0.62	0.35	0.05101	1.42	0.03	0.65	0.36	Subcritical
RCPE14	Normal Depth	0.048	0.0051	1488.79	1486.00 to 1490.50 ft	301	123.31	105.75	105.32	2.79	2.2	0.03814	2.44	0.09	2.88	0.4	Subcritical
RCPE22	Normal Depth	0.048	0.0056	1362.89	1362.20 to 1363.50 ft	422	357.03	974.35	974.34	0.69	0.44	0.05446	1.18	0.02	0.71	0.34	Subcritical
RCPE41	Normal Depth	0.05	0.0025	1212.84	1207.00 to 1216.00 ft	3368	1345.85	624.47	623.41	5.84	4.5	0.03412	2.5	0.1	5.94	0.3	Subcritical
RCPE48	Normal Depth	0.047	0.0033	1253.16	1250.00 to 1254.50 ft	3152	1138.77	609.55	609.25	3.16	2.22	0.03246	2.77	0.12	3.27	0.36	Subcritical
RCPE49	Normal Depth	0.049	0.0027	1243.94	1240.00 to 1246.00 ft	3424	1418.54	754.66	754.42	3.94	2.88	0.03553	2.41	0.09	4.03	0.31	Subcritical
RCPE51	Normal Depth	0.049	0.0048	1223.63	1220.00 to 1230.00 ft	3281	1448.93	1285.32	1285.26	3.63	2.82	0.03744	2.26	0.08	3.71	0.38	Subcritical
RCPE53	Normal Depth	0.045	0.0059	1336.04	1336.00 to 1336.40 ft	5	16.8	410.94	410.94	0.04	0.02	0.11589	0.3	0	0.04	0.26	Subcritical
RDE11	Normal Depth	0.047	0.0065	1488.3	1487.00 to 1490.00 ft	175	100.14	173.75	173.71	1.3	0.78	0.04026	1.75	0.05	1.35	0.41	Subcritical
RDE09	Normal Depth	0.045	0.0106	1478.61	1478.00 to 1480.50 ft	18	10.52	29.46	29.43	0.61	0.44	0.04574	1.71	0.05	0.66	0.5	Subcritical
RDE10	Normal Depth	0.049	0.0069	1479.1	1478.00 to 1480.50 ft	41	49.27	257.92	257.87	1.1	0.65	0.04877	0.83	0.01	1.11	0.34	Subcritical

RVADMP Routing Reach Cross-section Summary Table - Basin F

Label	Solve For	Roughness Coefficient	Channel Slope (ft/ft)	Water Surface Elevation (ft)	Elevation Range	Discharge (ft^3/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Normal Depth (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
RCPF06	Normal Depth	0.045	0.0059	1522.62	1521.80 to 1524.00 ft	388	213.19	350.71	350.7	0.82	0.52	0.0414	1.82	0.05	0.87	0.41	Subcritical
RCPF04	Normal Depth	0.045	0.0053	1.73	0.00 to 6.00 ft	510	198.52	179.71	179.66	1.73	1.12	0.03224	2.57	0.1	1.83	0.43	Subcritical
RCPF05	Normal Depth	0.047	0.0049	1482.38	1481.00 to 1482.90 ft	977	566.36	827.37	827.37	1.38	0.9	0.04062	1.73	0.05	1.42	0.37	Subcritical
RCPF08	Normal Depth	0.046	0.0049	1431.77	1430.60 to 1431.80 ft	655	419.85	725.23	725.16	1.17	0.71	0.04124	1.56	0.04	1.2	0.36	Subcritical
RDF11	Normal Depth	0.035	0.0046	1376.13	1375.86 to 1376.52 ft	93	121.79	893.18	893.18	0.27	0.2	0.04295	0.76	0.01	0.28	0.36	Subcritical
RDF19	Normal Depth	0.045	0.0042	1318.24	1317.30 to 1319.20 ft	516	344.26	587.33	587.33	0.94	0.56	0.04144	1.5	0.03	0.98	0.35	Subcritical
RDF18	Normal Depth	0.035	0.0048	1335.7	1335.30 to 1336.00 ft	80	83.13	445.47	445.47	0.4	0.28	0.03506	0.96	0.01	0.42	0.39	Subcritical
RCPF17	Normal Depth	0.035	0.0047	1363.69	1363.00 to 1364.00 ft	427	235.22	477.68	477.68	0.69	0.45	0.02556	1.82	0.05	0.75	0.46	Subcritical
RDF16	Normal Depth	0.035	0.0047	1354.51	1354.00 to 1355.00 ft	116	76.18	201.18	201.18	0.51	0.31	0.02828	1.52	0.04	0.54	0.44	Subcritical
RCPF16	Normal Depth	0.035	0.0047	1393.94	1393.50 to 1394.50 ft	91	64.22	188.92	188.91	0.44	0.27	0.0295	1.42	0.03	0.48	0.43	Subcritical
RCPF15	Normal Depth	0.035	0.0053	1362.19	1361.50 to 1362.50 ft	261	177.75	542.92	542.92	0.69	0.52	0.02873	1.47	0.03	0.73	0.45	Subcritical
RCPF24	Normal Depth	0.035	0.0053	1318.01	1317.00 to 1318.00 ft	481	202.35	300.03	300	1.01	0.7	0.02251	2.38	0.09	1.1	0.51	Subcritical
RCPF23	Normal Depth	0.035	0.0043	1321.44	1320.50 to 1321.50 ft	373	181.85	287.65	287.64	0.94	0.61	0.0234	2.05	0.07	1	0.45	Subcritical
RCPF22	Normal Depth	0.035	0.0043	1317.65	1317.00 to 1318.00 ft	182	108.3	230.92	230.91	0.65	0.41	0.02623	1.68	0.04	0.7	0.43	Subcritical
RDF22	Normal Depth	0.035	0.0036	1317.54	1317.00 to 1318.00 ft	116	83.71	208.53	208.53	0.54	0.31	0.02829	1.39	0.03	0.57	0.39	Subcritical
RCPF21	Normal Depth	0.035	0.004	1314.53	1313.86 to 1316.00 ft	514	300.01	589.01	589	0.67	0.41	0.02591	1.71	0.05	0.72	0.42	Subcritical
RCPF20	Normal Depth	0.035	0.0015	1292.4	1291.00 to 1292.00 ft	545	318.84	300.8	300	1.4	0.75	0.02209	1.71	0.05	1.44	0.29	Subcritical
RCPF36	Normal Depth	0.035	0.0028	1290.53	1290.00 to 1291.00 ft	97	80.6	205.52	205.52	0.53	0.28	0.02917	1.2	0.02	0.55	0.34	Subcritical
RCPF29	Normal Depth	0.035	0.0027	1290.81	1289.50 to 1290.50 ft	632	292.02	300.62	300	1.31	0.82	0.02161	2.16	0.07	1.38	0.39	Subcritical
RDF28A	Normal Depth	0.045	0.0045	0.87	0.00 to 6.00 ft	117	72.23	115.5	115.47	0.87	0.49	0.04059	1.62	0.04	0.91	0.36	Subcritical
RCPF27	Normal Depth	0.047	0.0036	2.41	0.00 to 6.00 ft	769	348.2	281.63	281.57	2.41	1.39	0.03243	2.21	0.08	2.48	0.35	Subcritical
RCPF25	Normal Depth	0.047	0.0037	2.83	0.00 to 6.00 ft	1113	483.45	365.28	365.21	2.83	1.68	0.03186	2.3	0.08	2.91	0.35	Subcritical
RCPF26	Normal Depth	0.035	0.004	1294.21	1293.50 to 1294.50 ft	205	121.03	241.7	241.69	0.71	0.44	0.02573	1.69	0.04	0.75	0.42	Subcritical
RCPF07	Normal Depth	0.048	0.0038	3.07	0.00 to 6.00 ft	1391	578.94	414.29	414.22	3.07	1.87	0.0313	2.4	0.09	3.16	0.36	Subcritical
RCPF14	Normal Depth	0.045	0.0066	0.74	0.00 to 6.00 ft	103	57.53	105.52	105.5	0.74	0.45	0.04147	1.79	0.05	0.79	0.43	Subcritical
RCPF13	Normal Depth	0.045	0.0054	0.75	0.00 to 6.00 ft	96	58.75	106.38	106.36	0.75	0.43	0.04196	1.63	0.04	0.79	0.39	Subcritical
RCPF12	Normal Depth	0.045	0.0065	0.81	0.00 to 6.00 ft	121	64.87	110.62	110.59	0.81	0.5	0.04037	1.87	0.05	0.86	0.43	Subcritical
RCPF11	Normal Depth	0.045	0.0054	1.35	0.00 to 6.00 ft	305	135.3	151.02	150.98	1.35	0.84	0.03483	2.25	0.08	1.43	0.42	Subcritical
RCPF10	Normal Depth	0.045	0.0049	1.92	0.00 to 6.00 ft	615	234.57	194.19	194.13	1.92	1.23	0.03137	2.62	0.11	2.03	0.42	Subcritical
RCPF19	Normal Depth	0.045	0.0047	1.66	0.00 to 6.00 ft	440	186.16	174.47	174.42	1.66	1.03	0.03296	2.36	0.09	1.75	0.4	Subcritical
RCPF18	Normal Depth	0.045	0.0047	1.49	0.00 to 6.00 ft	349	157.05	161.47	161.42	1.49	0.91	0.03413	2.22	0.08	1.56	0.4	Subcritical
RCPF28	Normal Depth	0.045	0.0035	0.94	0.00 to 6.00 ft	120	80.5	120.75	120.73	0.94	0.49	0.04042	1.49	0.03	0.98	0.32	Subcritical
RCPF09	Normal Depth	0.05	0.0051	2.69	0.00 to 6.00 ft	1090	433.98	337.1	337.04	2.69	1.66	0.03567	2.51	0.1	2.78	0.39	Subcritical

RVADMP Routing Reach Cross-section Summary Table - Basin G

Label	Solve For	Roughness Coefficient	Channel Slope (ft/ft)	Water Surface Elevation (ft)	Elevation Range	Discharge (ft^3/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Normal Depth (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
RCPG48	Normal Depth	0.047	0.0131	1431.39	1430.00 to 1431.10 ft	931	333.56	485.74	485	1.39	1.19	0.04174	2.79	0.12	1.51	0.59	Subcritical
RCPG44	Normal Depth	0.035	0.0159	1561.13	1560.70 to 1563.80 ft	104	45.36	161.8	161.8	0.43	0.38	0.02856	2.29	0.08	0.52	0.76	Subcritical
RCPG06	Normal Depth	0.035	0.011	1440.79	1440.00 to 1441.00 ft	423	141.73	258.25	258.25	0.79	0.66	0.02296	2.98	0.14	0.93	0.71	Subcritical
RDG08	Normal Depth	0.035	0.0088	1350.53	1350.35 to 1352.23 ft	2	2.5	28.02	28.01	0.18	0.13	0.04415	0.8	0.01	0.19	0.47	Subcritical
RCPG03	Normal Depth	0.035	0.0091	1357.81	1356.00 to 1357.96 ft	777	214.65	254.04	253.7	1.81	1.61	0.02028	3.62	0.2	2.01	0.69	Subcritical
RCPG10	Normal Depth	0.048	0.0079	1272.85	1272.04 to 1273.65 ft	283	168.84	358.93	358.93	0.81	0.56	0.04843	1.68	0.04	0.85	0.43	Subcritical
RCPG09	Normal Depth	0.035	0.0088	1271.35	1270.00 to 1271.20 ft	625	201.35	292.65	292	1.35	1.16	0.02167	3.1	0.15	1.49	0.66	Subcritical
RDG18	Normal Depth	0.035	0.007	1269.8	1269.52 to 1270.15 ft	62	68.32	528.64	528.64	0.28	0.2	0.03857	0.91	0.01	0.29	0.45	Subcritical
RCPG20	Normal Depth	0.035	0.0065	1311.4	1311.00 to 1312.00 ft	86	55.13	179.03	179.03	0.4	0.26	0.02979	1.56	0.04	0.43	0.5	Subcritical
RCPG19	Normal Depth	0.035	0.0068	1304.68	1304.00 to 1305.00 ft	247	114.35	236.1	236.1	0.68	0.48	0.02497	2.16	0.07	0.75	0.55	Subcritical
RCG26B	Normal Depth	0.045	0.0106	0.7	0.00 to 6.00 ft	118	53.54	102.65	102.62	0.7	0.49	0.04053	2.2	0.08	0.78	0.54	Subcritical
RCPG18	Normal Depth	0.449	0.0078	2	0.00 to 6.00 ft	85	250.87	200.93	200.87	2	0.4	4.26633	0.34	0	2.01	0.05	Subcritical
RCPG17	Normal Depth	0.049	0.0061	1212.28	1207.00 to 1216.00 ft	3256	995.57	618.72	617.77	5.28	4.46	0.03313	3.27	0.17	5.44	0.45	Subcritical
RCPG45	Normal Depth	0.049	0.0105	1359.1	1358.00 to 1360.70 ft	1965	847.46	1307.99	1307.99	1.1	0.8	0.04469	2.32	0.08	1.19	0.51	Subcritical
RCPG47	Normal Depth	0.035	0.0078	1231.52	1231.00 to 1232.00 ft	158	79.18	204.14	204.14	0.52	0.37	0.02685	2	0.06	0.58	0.56	Subcritical
RCPG14	Normal Depth	0.035	0.0088	1244.67	1244.23 to 1245.60 ft	47	32.21	145.53	145.52	0.44	0.34	0.03204	1.46	0.03	0.47	0.55	Subcritical
RCPG34	Normal Depth	0.035	0.0087	1204.48	1204.00 to 1205.03 ft	273	135.93	376.61	376.6	0.48	0.35	0.02734	2.01	0.06	0.54	0.59	Subcritical
RCPG12	Normal Depth	0.035	0.0079	1202.93	1202.00 to 1203.35 ft	306	132.82	278.59	278.58	0.93	0.75	0.02452	2.3	0.08	1.01	0.59	Subcritical
RCPG11	Normal Depth	0.035	0.0079	1192.4	1192.00 to 1193.40 ft	319	174.7	519.04	519.04	0.4	0.28	0.02866	1.83	0.05	0.45	0.55	Subcritical
RDG11	Normal Depth	0.035	0.0067	1185.06	1184.00 to 1186.60 ft	266	104.17	165.36	165.33	1.06	0.81	0.02252	2.55	0.1	1.16	0.57	Subcritical
RCPG07	Normal Depth	0.035	0.0127	1328.1	1328.00 to 1329.00 ft	11	11.19	120.31	120.31	0.1	0.07	0.04412	0.98	0.02	0.12	0.57	Subcritical
RDG31W	Normal Depth	0.045	0.0095	0.37	0.00 to 6.00 ft	34	23.46	77.59	77.58	0.37	0.23	0.05051	1.45	0.03	0.4	0.46	Subcritical
RCPG47	Normal Depth	0.035	0.0078	1262.54	1262.00 to 1263.80 ft	158	77.57	193.81	193.8	0.54	0.39	0.02653	2.04	0.06	0.61	0.57	Subcritical
RDG06	Normal Depth	0.035	0.0105	1456.81	1456.10 to 1457.05 ft	171	99.2	397.71	397.7	0.71	0.62	0.03039	1.72	0.05	0.75	0.61	Subcritical
RCPG04	Normal Depth	0.035	0.0088	1394.84	1393.30 to 1395.00 ft	1186	327.29	377.25	376.7	1.54	1.33	0.02016	3.62	0.2	1.74	0.69	Subcritical
RCPG08	Normal Depth	0.038	0.008	1376.97	1376.00 to 1378.00 ft	304	130.62	240.71	240.7	0.97	0.75	0.02799	2.33	0.08	1.06	0.56	Subcritical
RCPG05	Normal Depth	0.048	0.0179	1516.45	1515.63 to 1517.60 ft	222	94.76	225.07	224.86	0.82	0.68	0.04691	2.34	0.09	0.9	0.64	Subcritical
RCPG31	Normal Depth	0.035	0.0103	1323.26	1321.00 to 1322.00 ft	3843	578.76	302.54	300	2.26	2.05	0.01504	6.64	0.69	2.95	0.84	Subcritical
RCPG06 - TSF	Normal Depth	0.047	0.0073	2.75	0.00 to 6.00 ft	1458	454.58	349.11	349.04	2.75	1.92	0.0305	3.21	0.16	2.91	0.5	Subcritical
RDG31E - TSF	Normal Depth	0.046	0.011	2.4	0.00 to 6.00 ft	1340	347.17	280.9	280.84	2.4	1.84	0.02995	3.86	0.23	2.64	0.61	Subcritical
RDG07E - TSF	Normal Depth	0.045	0.0083	1.11	0.00 to 6.00 ft	254	101.28	133.04	133.01	1.11	0.76	0.03583	2.51	0.1	1.2	0.51	Subcritical
RDG47 - TSF	Normal Depth	0.045	0.0079	0.74	0.00 to 6.00 ft	114	58.01	105.86	105.83	0.74	0.48	0.04077	1.97	0.06	0.8	0.47	Subcritical
RCPG33	Normal Depth	0.049	0.003	1187.23	1180.00 to 1198.00 ft	5841	2276.88	1181.86	1181.05	7.23	5.74	0.03203	2.57	0.1	7.33	0.33	Subcritical
RDG47E - TSF	Normal Depth	0.045	0.0092	0.33	0.00 to 6.00 ft	28	20.79	74.97	74.96	0.33	0.2	0.05238	1.35	0.03	0.36	0.45	Subcritical

RVADMP Routing Reach Cross-section Summary Table - Basin H

Label	Solve For	Roughness Coefficient	Channel Slope (ft/ft)	Water Surface Elevation (ft)	Elevation Range	Discharge (ft^3/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Normal Depth (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
RDH11	Normal Depth	0.045	0.0128	4263.24	1298.90 to 1300.20 ft	0	72.6	146.95	146.88	1.66	1.27	0.03807	2.22	0.08	1.74	0.56	Subcritical
RCPH11	Normal Depth	0.048	0.0135	1296.37	1296.00 to 1297.00 ft	152	97.61	339.57	339.57	0.37	0.23	0.05703	1.56	0.04	0.41	0.51	Subcritical
RCPH35	Normal Depth	0.047	0.0111	1258.36	1256.70 to 1259.30 ft	441	209.65	420.3	420.02	1.66	1.47	0.04552	2.1	0.07	1.73	0.52	Subcritical
RCPH37	Normal Depth	0.05	0.0086	1172.23	1171.50 to 1173.00 ft	351	261.52	777.66	777.66	0.73	0.53	0.05919	1.34	0.03	0.75	0.41	Subcritical
RCPH77	Normal Depth	0.048	0.0028	1089.92	1080.00 to 1092.00 ft	10206	1709.73	245.3	240.23	9.92	6.42	0.02133	5.97	0.55	10.47	0.39	Subcritical
RCPH49	Normal Depth	0.048	0.0062	1154.75	1154.00 to 1154.80 ft	304	206.92	439.85	439.59	0.75	0.51	0.05284	1.47	0.03	0.78	0.38	Subcritical
RCPH08	Normal Depth	0.048	0.0139	1336.08	1335.10 to 1337.00 ft	472	220.37	493.7	493.7	0.98	0.76	0.04522	2.14	0.07	1.05	0.57	Subcritical
RCPH12	Normal Depth	0.05	0.0142	1301.99	1301.50 to 1302.60 ft	145	92.45	313.44	313.44	0.49	0.37	0.06113	1.57	0.04	0.53	0.51	Subcritical
RCPH14	Normal Depth	0.045	0.0096	1287.75	1286.60 to 1289.00 ft	716	324.79	577.26	577.26	1.15	0.9	0.03907	2.2	0.08	1.23	0.52	Subcritical
RDH06	Normal Depth	0.047	0.0059	1320.21	1319.40 to 1320.00 ft	106	87.75	246.53	246.1	0.81	0.63	0.05835	1.21	0.02	0.83	0.36	Subcritical
RCH15B	Normal Depth	0.048	0.0097	1343.24	1342.00 to 1344.20 ft	364	149.79	208.1	208.08	1.24	0.9	0.04172	2.43	0.09	1.34	0.5	Subcritical
RCH15A	Normal Depth	0.05	0.009	1316.33	1315.20 to 1320.00 ft	173	83.52	132.61	132.59	1.13	0.83	0.04854	2.07	0.07	1.2	0.46	Subcritical
RCPH52	Normal Depth	0.047	0.0066	1168.61	1167.30 to 1169.50 ft	1144	611.84	977.08	977.07	1.31	0.91	0.04173	1.87	0.05	1.37	0.42	Subcritical
RCPH28	Normal Depth	0.046	0.0083	1247.8	1246.80 to 1248.40 ft	415	261.85	657.43	657.42	1	0.76	0.04577	1.58	0.04	1.04	0.44	Subcritical
RCPH62	Normal Depth	0.046	0.0082	1250.78	1249.60 to 1251.00 ft	2022	979.23	1649.2	1649.2	1.18	0.87	0.04041	2.06	0.07	1.25	0.47	Subcritical
RCPH04	Normal Depth	0.048	0.0164	1401.14	1399.90 to 1401.50 ft	608	220.89	384.46	384.02	1.24	1.07	0.04327	2.75	0.12	1.35	0.64	Subcritical
RCPH32	Normal Depth	0.048	0.0081	1226.33	1225.70 to 1227.00 ft	386	279.37	810.43	810.43	0.63	0.42	0.05249	1.38	0.03	0.66	0.41	Subcritical
RCPH31	Normal Depth	0.049	0.0092	1312.08	1311.10 to 1313.10 ft	320	193.94	447.25	447.24	0.98	0.7	0.05119	1.65	0.04	1.02	0.44	Subcritical
RCPH23	Normal Depth	0.046	0.0089	1302.88	1301.30 to 1303.70 ft	2183	904.27	1273.28	1273.27	1.58	1.24	0.03817	2.41	0.09	1.67	0.51	Subcritical
RCPH01	Normal Depth	0.05	0.0124	1362.34	1361.20 to 1362.60 ft	854	329.14	474.18	474.17	1.14	0.85	0.04487	2.59	0.1	1.24	0.55	Subcritical
RCPH58	Normal Depth	0.045	0.0075	1256.9	1256.00 to 1257.20 ft	718	431.33	962.56	962.56	0.9	0.64	0.04348	1.66	0.04	0.94	0.44	Subcritical
RCPH59	Normal Depth	0.048	0.0073	1210.27	1209.76 to 1210.16 ft	244	185.03	526.37	526	0.51	0.34	0.05778	1.32	0.03	0.53	0.39	Subcritical
RCPH60	Normal Depth	0.047	0.0062	1161.44	1160.80 to 1162.10 ft	230	200.38	638.38	638.37	0.64	0.41	0.05322	1.15	0.02	0.66	0.36	Subcritical
RCPH55	Normal Depth	0.047	0.0075	1256	1254.90 to 1256.40 ft	629	337.76	596.33	596.32	1.1	0.8	0.04448	1.86	0.05	1.16	0.44	Subcritical
RCPH24	Normal Depth	0.046	0.009	1303.77	1302.80 to 1304.60 ft	722	376.05	746.54	746.53	0.97	0.69	0.0426	1.92	0.06	1.03	0.48	Subcritical
RCPH69	Normal Depth	0.046	0.0033	1136.87	1130.00 to 1139.00 ft	9021	2289.76	738.88	736.04	6.87	5.42	0.02606	3.94	0.24	7.11	0.39	Subcritical
RCPH72	Normal Depth	0.045	0.0025	1127.36	1120.00 to 1129.00 ft	9617	4083.32	2375.36	2373.38	7.36	5.77	0.02681	2.36	0.09	7.45	0.32	Subcritical
RCPH74	Normal Depth	0.046	0.0027	1100.52	1092.00 to 1105.00 ft	10178	2877.01	949.11	948.12	8.52	6.31	0.02355	3.54	0.19	8.71	0.36	Subcritical

RVADMP Routing Reach Cross-section Summary Table - Basin H

Label	Solve For	Roughness Coefficient	Channel Slope (ft/ft)	Water Surface Elevation (ft)	Elevation Range	Discharge (ft^3/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Normal Depth (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
RCPH80	Normal Depth	0.048	0.0025	1087.53	1080.00 to 1092.00 ft	10835	2469.91	522.02	518.9	7.53	4.7	0.02327	4.39	0.3	7.83	0.35	Subcritical
RCPH86	Normal Depth	0.046	0.0033	1057.37	1046.00 to 1059.00 ft	10962	3250.38	1338.74	1336.61	11.37	5.81	0.01922	3.37	0.18	11.54	0.38	Subcritical
RCH35A	Normal Depth	0.048	0.0106	1302.39	1301.60 to 1302.60 ft	505	249.34	491.93	491.64	0.79	0.58	0.04803	2.03	0.06	0.85	0.5	Subcritical
RDH59	Normal Depth	0.049	0.0073	1210.46	1209.80 to 1211.00 ft	449	335.96	899.96	899.96	0.66	0.43	0.05604	1.34	0.03	0.69	0.39	Subcritical
RCPH09 TSF	Normal Depth	0.045	0.0205	1.78	0.00 to 6.00 ft	1067	207.77	183.54	183.48	1.78	1.64	0.02898	5.14	0.41	2.19	0.85	Subcritical
RCPH10 TSF	Normal Depth	0.045	0.0138	2.07	0.00 to 6.00 ft	1172	264.42	214	213.94	2.07	1.72	0.02903	4.43	0.31	2.37	0.7	Subcritical
RCPH38 - TSW	Normal Depth	0.05	0.0108	4.62	0.00 to 6.00 ft	971	403.83	590.42	588.46	4.62	4.22	0.04276	2.4	0.09	4.71	0.51	Subcritical
RCPH39 TSF	Normal Depth	0.045	0.0061	1.21	0.00 to 6.00 ft	262	115.83	141.01	140.98	1.21	0.78	0.03566	2.26	0.08	1.29	0.44	Subcritical
RCPH41 TSFF	Normal Depth	0.045	0.0041	1.03	0.00 to 5.00 ft	240	124.88	143.49	143.44	1.03	0.54	0.03754	1.92	0.06	1.09	0.36	Subcritical
RDH39 TSFF	Normal Depth	0.047	0.0061	1.66	0.00 to 5.00 ft	634	234.09	206.02	205.96	1.66	1	0.03339	2.71	0.11	1.77	0.45	Subcritical
RCPH40 TSFF	Normal Depth	0.046	0.0151	1.27	0.00 to 5.00 ft	626	160.92	166.74	166.68	1.27	1	0.03228	3.89	0.24	1.5	0.7	Subcritical
RCPH84 TSFF	Normal Depth	0.047	0.0071	1.9	0.00 to 5.00 ft	880	285.72	229.73	229.66	1.9	1.25	0.03268	3.08	0.15	2.04	0.49	Subcritical
RCPH65 TSFF	Normal Depth	0.045	0.0073	0.77	0.00 to 5.00 ft	195	89.25	130.96	130.92	0.77	0.47	0.0389	2.18	0.07	0.85	0.47	Subcritical
RCPH02 - TSW	Normal Depth	0.05	0.0211	4.57	0.00 to 6.00 ft	1237	373.66	558.82	556.85	4.57	4.37	0.04252	3.31	0.17	4.74	0.71	Subcritical
RCPH56 - TSW	Normal Depth	0.353	0.0073	5.72	0.00 to 6.00 ft	555	1418.86	1252.7	1250.73	5.72	3.83	2.11281	0.39	0	5.73	0.06	Subcritical
RCPH57 - TSW	Normal Depth	0.05	0.0058	4.43	0.00 to 6.00 ft	512	304.6	478.62	476.66	4.43	3.78	0.04245	1.68	0.04	4.48	0.37	Subcritical
RDH01 - TSW	Normal Depth	0.05	0.0124	4.5	0.00 to 6.00 ft	841	337.24	518.08	516.12	4.5	4.12	0.04238	2.49	0.1	4.6	0.54	Subcritical
RCPH25 TSFF	Normal Depth	0.047	0.0088	1.69	0.00 to 5.00 ft	786	240.06	208.9	208.83	1.69	1.16	0.03267	3.27	0.17	1.85	0.54	Subcritical
RCPH22 - TSW	Normal Depth	0.05	0.009	4.59	0.00 to 6.00 ft	836	384.47	570.34	568.38	4.59	4.12	0.04238	2.17	0.07	4.66	0.47	Subcritical
RCPH03 TSFF	Normal Depth	0.047	0.0142	1.89	0.00 to 5.00 ft	1237	284.36	229.14	229.07	1.89	1.54	0.03138	4.35	0.29	2.18	0.69	Subcritical
RCPH63 - TSW	Normal Depth	0.05	0.0073	4.76	0.00 to 6.00 ft	1014	491.59	673.98	672.01	4.76	4.25	0.0428	2.06	0.07	4.82	0.43	Subcritical
RCPH66 - TSW	Normal Depth	0.05	0.0067	4.73	0.00 to 6.00 ft	920	470.26	654.65	652.69	4.73	4.19	0.04272	1.96	0.06	4.79	0.41	Subcritical
RCPH56 - TSW	Normal Depth	0.05	0.0073	4.41	0.00 to 6.00 ft	555	295.35	466.84	464.88	4.41	3.83	0.04214	1.88	0.05	4.47	0.42	Subcritical
RCPH71 - TSW	Normal Depth	0.05	0.0066	4.71	0.00 to 6.00 ft	882	457.1	642.44	640.47	4.71	4.16	0.04262	1.93	0.06	4.76	0.4	Subcritical
RCPH06 TSF	Normal Depth	0.045	0.0159	0.73	0.00 to 6.00 ft	156	56.54	104.81	104.79	0.73	0.58	0.03872	2.76	0.12	0.85	0.66	Subcritical
RCPH80	Normal Depth	0.049	0.0025	1089.37	1080.00 to 1092.00 ft	10835	4393.2	2101.44	2098.62	9.37	7.58	0.03108	2.47	0.09	9.47	0.3	Subcritical

RVADMP Routing Reach Cross-section Summary Table - Basin I

Label	Solve For	Roughness Coefficient	Channel Slope (ft/ft)	Water Surface Elevation (ft)	Elevation Range	Discharge (ft^3/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Normal Depth (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
RCPI03	Normal Depth	0.035	0.0141	1361.01	1360.47 to 1362.67 ft	159	69	223.28	223.27	0.54	0.47	0.02799	2.3	0.08	0.62	0.73	Subcritical
RDI03	Normal Depth	0.035	0.018	1289.24	1288.50 to 1289.50 ft	475	128.94	248.16	248.15	0.74	0.7	0.02256	3.68	0.21	0.95	0.9	Subcritical
RCPI05	Normal Depth	0.047	0.0135	1255.74	1255.10 to 1255.91 ft	360	171.89	399.44	399.43	0.64	0.47	0.04618	2.09	0.07	0.71	0.56	Subcritical
RCPI06	Normal Depth	0.035	0.0095	1177.47	1176.95 to 1177.65 ft	237	129.71	441.41	441.41	0.52	0.41	0.02888	1.83	0.05	0.57	0.59	Subcritical
RCPI07	Normal Depth	0.035	0.0108	1292.66	1292.00 to 1293.00 ft	297	110.62	232.92	232.91	0.66	0.54	0.02425	2.68	0.11	0.78	0.69	Subcritical
RCPI08	Normal Depth	0.035	0.0084	1134.89	1134.00 to 1135.00 ft	469	168.47	278.19	278.19	0.89	0.69	0.0226	2.78	0.12	1.01	0.63	Subcritical
RCPI09	Normal Depth	0.035	0.0087	1138.67	1138.00 to 1139.00 ft	273	112.56	234.58	234.57	0.67	0.51	0.02457	2.43	0.09	0.76	0.62	Subcritical
RCPI11	Normal Depth	0.035	0.0082	1100.67	1100.00 to 1101.00 ft	264	112.15	234.23	234.22	0.67	0.5	0.0247	2.35	0.09	0.76	0.6	Subcritical
RCPI10	Normal Depth	0.035	0.0072	1100.96	1100.00 to 1101.00 ft	505	188.03	291.92	291.91	0.96	0.72	0.02235	2.69	0.11	1.07	0.59	Subcritical
RCPI13	Normal Depth	0.047	0.0078	1.57	0.00 to 5.00 ft	648	215.97	197.02	196.96	1.57	1.02	0.03309	3	0.14	1.71	0.51	Subcritical
RCPI12	Normal Depth	0.035	0.0054	1057.15	1056.00 to 1057.00 ft	672	246	300.32	300	1.15	0.84	0.02142	2.73	0.12	1.27	0.53	Subcritical
RCI17B	Normal Depth	0.045	0.0085	0.76	0.00 to 6.00 ft	124	60	107.26	107.24	0.76	0.5	0.0402	2.07	0.07	0.83	0.49	Subcritical
RCPI16	Normal Depth	0.035	0.0113	1228.68	1228.00 to 1229.00 ft	319	114.55	236.27	236.27	0.68	0.56	0.02398	2.78	0.12	0.8	0.71	Subcritical
RCPI18	Normal Depth	0.035	0.0094	1165.09	1164.00 to 1165.00 ft	775	226.91	300.19	300	1.09	0.91	0.02097	3.42	0.18	1.27	0.69	Subcritical
RCPI19	Normal Depth	0.048	0.0084	1131.2	1130.00 to 1131.40 ft	672	343.53	595.03	595.03	1.2	0.9	0.04595	1.96	0.06	1.26	0.45	Subcritical
RCPI20	Normal Depth	0.035	0.008	1057.04	1056.00 to 1057.00 ft	636	211.48	300.09	300	1.04	0.82	0.02159	3.01	0.14	1.18	0.63	Subcritical
RCPI21	Normal Depth	0.048	0.0057	1034.64	1034.00 to 1034.56 ft	553	371.43	739.2	739	0.64	0.37	0.04977	1.49	0.03	0.68	0.37	Subcritical
RCPI23	Normal Depth	0.035	0.0182	1277.24	1276.25 to 1278.00 ft	423	109.47	197.56	197.54	0.99	0.95	0.02196	3.86	0.23	1.22	0.92	Subcritical
RCPI24	Normal Depth	0.035	0.0179	1234.42	1234.00 to 1235.00 ft	159	59.4	183.74	183.74	0.42	0.38	0.02681	2.68	0.11	0.53	0.83	Subcritical
RCI26B	Normal Depth	0.035	0.01	1234.17	1234.00 to 1235.00 ft	24	20.09	134.31	134.3	0.17	0.12	0.03779	1.19	0.02	0.19	0.54	Subcritical
RCPI25	Normal Depth	0.035	0.012	1199.86	1199.00 to 1200.00 ft	526	160.81	272.63	272.62	0.86	0.74	0.02221	3.27	0.17	1.03	0.75	Subcritical
RCI26A	Normal Depth	0.035	0.0093	1292.87	1292.00 to 1293.00 ft	466	161.55	273.17	273.16	0.87	0.69	0.02262	2.88	0.13	1	0.66	Subcritical
RCPI27	Normal Depth	0.035	0.0103	1148.94	1148.00 to 1149.00 ft	576	181.55	287.45	287.44	0.94	0.78	0.02191	3.17	0.16	1.09	0.7	Subcritical
RCPI28	Normal Depth	0.035	0.0091	1106.83	1106.00 to 1107.00 ft	424	152.05	266.13	266.12	0.83	0.66	0.02295	2.79	0.12	0.95	0.65	Subcritical
RCPI29	Normal Depth	0.035	0.0095	1113.94	1113.00 to 1114.00 ft	560	183.18	288.58	288.57	0.94	0.77	0.022	3.06	0.15	1.09	0.68	Subcritical
RCPI30	Normal Depth	0.035	0.0076	1060.87	1060.00 to 1061.00 ft	429	163.72	274.76	274.75	0.87	0.66	0.02291	2.62	0.11	0.98	0.6	Subcritical
RCPI31	Normal Depth	0.035	0.0083	1064.96	1064.00 to 1065.00 ft	544	188.43	292.19	292.18	0.96	0.75	0.0221	2.89	0.13	1.09	0.63	Subcritical
RCPI32	Normal Depth	0.035	0.0055	1033.01	1032.00 to 1033.00 ft	491	202.66	300.03	300	1.01	0.71	0.02244	2.42	0.09	1.1	0.52	Subcritical
RCPI33	Normal Depth	0.035	0.0066	1032.13	1031.20 to 1033.00 ft	517	285.66	751.53	751.39	0.93	0.66	0.02358	1.81	0.05	0.98	0.52	Subcritical
RCPI34	Normal Depth	0.035	0.0064	1012.16	1011.00 to 1012.00 ft	738	247.33	300.33	300	1.16	0.89	0.02112	2.98	0.14	1.3	0.58	Subcritical
RCPI35	Normal Depth	0.035	0.0054	1008.05	1007.00 to 1008.00 ft	532	213.76	300.1	300	1.05	0.74	0.02217	2.49	0.1	1.14	0.52	Subcritical
RCPI38	Normal Depth	0.035	0.0159	1239.36	1239.00 to 1240.00 ft	111	48.26	171.19	171.18	0.36	0.3	0.02849	2.3	0.08	0.44	0.76	Subcritical
RCPI39	Normal Depth	0.035	0.0115	1178.52	1178.00 to 1179.00 ft	190	78.67	203.65	203.64	0.52	0.42	0.02604	2.42	0.09	0.61	0.69	Subcritical
RCPI40	Normal Depth	0.035	0.0103	1126.7	1126.00 to 1127.00 ft	320	118.68	239.74	239.73	0.7	0.56	0.02397	2.7	0.11	0.81	0.68	Subcritical
RCPI41	Normal Depth	0.035	0.0086	1080.81	1080.00 to 1081.00 ft	396	147.7	262.84	262.83	0.81	0.63	0.02319	2.68	0.11	0.93	0.63	Subcritical
RCPI42	Normal Depth	0.035	0.0071	1034.87	1034.00 to 1035.00 ft	408	161.72	273.3	273.29	0.87	0.64	0.02308	2.52	0.1	0.97	0.58	Subcritical
RCI44B	Normal Depth	0.035	0.0232	1282.53	1282.08 to 1283.80 ft	152	60.38	248.52	248.52	0.45	0.43	0.02902	2.52	0.1	0.55	0.9	Subcritical

RVADMP Routing Reach Cross-section Summary Table - Basin I

Label	Solve For	Roughness Coefficient	Channel Slope (ft/ft)	Water Surface Elevation (ft)	Elevation Range	Discharge (ft³/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)	Normal Depth (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
RCI44A	Normal Depth	0.035	0.0118	1288.86	1288.00 to 1289.00 ft	520	160.45	272.37	272.36	0.86	0.74	0.02225	3.24	0.16	1.03	0.74	Subcritical
RCPI45	Normal Depth	0.035	0.0106	1122.92	1122.00 to 1123.00 ft	558	175.57	283.26	283.25	0.92	0.76	0.02202	3.18	0.16	1.07	0.71	Subcritical
RCPI46	Normal Depth	0.035	0.0088	1076.94	1076.00 to 1077.00 ft	536	182.45	288.07	288.06	0.94	0.75	0.02215	2.94	0.13	1.07	0.65	Subcritical
RCPI47	Normal Depth	0.035	0.0071	1036.96	1036.00 to 1037.00 ft	506	189.19	292.72	292.71	0.96	0.72	0.02234	2.67	0.11	1.07	0.59	Subcritical
RCPI43	Normal Depth	0.035	0.0047	1006.95	1006.00 to 1007.00 ft	402	185.91	290.46	290.45	0.95	0.64	0.02314	2.16	0.07	1.02	0.48	Subcritical
RCPI48	Normal Depth	0.035	0.0055	1007.01	1006.00 to 1007.00 ft	491	202.58	300.03	300	1.01	0.71	0.02244	2.42	0.09	1.1	0.52	Subcritical
RCPI49	Normal Depth	0.035	0.0052	993.28	992.00 to 993.00 ft	831	282.7	300.56	300	1.28	0.94	0.02076	2.94	0.13	1.41	0.53	Subcritical
RCPI51	Normal Depth	0.035	0.0134	1194.33	1194.00 to 1195.00 ft	88	43.63	165.69	165.68	0.33	0.26	0.02966	2.02	0.06	0.39	0.69	Subcritical
RCPI52	Normal Depth	0.035	0.0162	1204.48	1204.00 to 1205.00 ft	197	71.49	196.46	196.46	0.48	0.43	0.02589	2.76	0.12	0.6	0.81	Subcritical
RCPI53	Normal Depth	0.035	0.0107	1142.69	1142.00 to 1143.00 ft	321	117.36	238.64	238.63	0.69	0.56	0.02396	2.74	0.12	0.81	0.69	Subcritical
RCPI54	Normal Depth	0.035	0.0114	1142.61	1142.00 to 1143.00 ft	259	98.36	222.14	222.13	0.61	0.5	0.02478	2.63	0.11	0.72	0.7	Subcritical
RCPI55	Normal Depth	0.035	0.0093	1101.7	1101.00 to 1102.00 ft	308	119.78	240.66	240.65	0.7	0.55	0.02411	2.57	0.1	0.81	0.64	Subcritical
RCI58B	Normal Depth	0.048	0.0071	1031.59	1030.00 to 1033.37 ft	465	218.78	293.26	292.95	1.59	1.22	0.04311	2.13	0.07	1.66	0.43	Subcritical
RCPI56	Normal Depth	0.035	0.0086	1076.44	1076.00 to 1079.60 ft	222	116.12	343.42	343.42	0.44	0.33	0.02836	1.91	0.06	0.5	0.58	Subcritical
RCPI59	Normal Depth	0.035	0.0058	1029.32	1029.00 to 1030.00 ft	54	41.52	163.13	163.12	0.32	0.19	0.03238	1.3	0.03	0.34	0.45	Subcritical
RCI60B	Normal Depth	0.035	0.0074	1029.25	1029.00 to 1030.00 ft	41	31.72	150.63	150.62	0.25	0.16	0.03409	1.29	0.03	0.28	0.5	Subcritical
RCPI72	Normal Depth	0.035	0.0074	1029.74	1029.00 to 1030.00 ft	301	127.9	247.32	247.31	0.74	0.54	0.0242	2.35	0.09	0.82	0.58	Subcritical
RCPI71	Normal Depth	0.035	0.0032	942.36	940.21 to 945.31 ft	1301	506.84	458.6	458.56	2.15	1.57	0.01962	2.57	0.1	2.25	0.43	Subcritical
RCI58A	Normal Depth	0.035	0.0058	1019.96	1019.00 to 1020.00 ft	458	189.36	292.83	292.82	0.96	0.69	0.02268	2.42	0.09	1.06	0.53	Subcritical
RCPI64	Normal Depth	0.035	0.0062	1009.54	1008.30 to 1010.00 ft	419	216.72	492.73	492.58	1.24	0.97	0.02351	1.93	0.06	1.3	0.51	Subcritical
RCI60A	Normal Depth	0.035	0.0031	994.29	992.00 to 995.50 ft	1459	542.68	447.38	447.35	2.29	1.59	0.01868	2.69	0.11	2.4	0.43	Subcritical
RCPI66	Normal Depth	0.035	0.004	978.93	976.70 to 979.10 ft	1327	477.3	453.13	453.11	2.23	1.64	0.01891	2.78	0.12	2.35	0.48	Subcritical
RCPI67	Normal Depth	0.035	0.0052	954.19	952.50 to 956.90 ft	1300	412.64	395.23	395.21	1.69	1.27	0.01942	3.15	0.15	1.84	0.54	Subcritical
RCPI57	Normal Depth	0.035	0.0086	1070.71	1070.00 to 1071.00 ft	303	121.76	242.29	242.29	0.71	0.54	0.02417	2.49	0.1	0.81	0.62	Subcritical
RCPI04	Normal Depth	0.046	0.0128	1245.31	1244.70 to 1245.60 ft	251	148.05	466.61	466.6	0.61	0.48	0.04912	1.7	0.04	0.66	0.53	Subcritical
RCPI63	Normal Depth	0.049	0.0046	934.17	926.60 to 936.00 ft	11330	2224.91	575.85	572.68	7.57	5.94	0.02614	5.09	0.4	7.97	0.46	Subcritical
RCPI36	Normal Depth	0.05	0.003	1014.48	1007.50 to 1017.00 ft	11008	3628.43	1445.21	1445.01	6.98	5.01	0.02925	3.03	0.14	7.12	0.34	Subcritical
RCPI37	Normal Depth	0.05	0.0021	1014.91	1007.50 to 1017.50 ft	11008	4155.6	1551.1	1550.9	7.41	5.06	0.0292	2.65	0.11	7.52	0.29	Subcritical
RCPI50	Normal Depth	0.049	0.0047	989.4	982.00 to 991.00 ft	10973	3320.03	1642.32	1641.9	7.4	5.73	0.02853	3.31	0.17	7.57	0.41	Subcritical
RCPI62	Normal Depth	0.049	0.0032	989.73	982.00 to 991.00 ft	10944	3896.74	1839.94	1839.52	7.73	5.72	0.02863	2.81	0.12	7.85	0.34	Subcritical
RCPI61 - TSFF	Normal Depth	0.045	0.0056	0.82	0.00 to 5.00 ft	190	95.71	132.92	132.88	0.82	0.47	0.03909	1.99	0.06	0.88	0.41	Subcritical
RCPI59 - TSFF	Normal Depth	0.045	0.0058	0.39	0.00 to 5.00 ft	54	42.11	115.64	115.62	0.39	0.21	0.05067	1.28	0.03	0.42	0.37	Subcritical

RVADMP Routing Reach Cross-section Summary Table - Basin J

Label	Solve For	Roughness Coefficient	Channel Slope (ft/ft)	Water Surface Elevation (ft)	Elevation Range	Discharge (ft^3/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Normal Depth (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
RDJ04	Normal Depth	0.048	0.0144	1202.26	1201.80 to 1202.70 ft	72	48.33	193.15	193.15	0.46	0.35	0.05721	1.49	0.03	0.5	0.53	Subcritical
RCPJ04	Normal Depth	0.048	0.0149	1142.49	1142.00 to 1143.00 ft	142	72.58	197.57	197.56	0.49	0.35	0.05042	1.96	0.06	0.55	0.57	Subcritical
RCPJ06	Normal Depth	0.045	0.0109	0.94	0.00 to 6.00 ft	212	80.56	120.79	120.76	0.94	0.69	0.03686	2.63	0.11	1.05	0.57	Subcritical
RCPJ07	Normal Depth	0.045	0.0045	1508.31	1506.00 to 1520.00 ft	470	193.57	168.69	167.95	2.31	1.6	0.032	2.43	0.09	2.4	0.4	Subcritical
RCPJ08	Normal Depth	0.046	0.0141	1152.37	1151.70 to 1152.90 ft	132	67.92	186.59	186.59	0.67	0.52	0.04746	1.94	0.06	0.73	0.57	Subcritical
RCPJ01	Normal Depth	0.049	0.0099	1100.85	1096.70 to 1102.80 ft	5326	1097.98	543.69	543.42	4.15	3.27	0.02857	4.85	0.37	4.51	0.6	Subcritical
RCPJ10	Normal Depth	0.046	0.0092	1044.05	1043.40 to 1045.30 ft	231	123.55	263.46	263.46	0.65	0.44	0.04512	1.87	0.05	0.71	0.48	Subcritical
RCPJ11	Normal Depth	0.045	0.0045	1508.67	1506.00 to 1520.00 ft	694	259.29	195.24	194.38	2.67	1.86	0.03038	2.68	0.11	2.78	0.41	Subcritical
RCPJ12	Normal Depth	0.045	0.0092	1067.25	1066.67 to 1067.52 ft	230	143.11	390.97	390.96	0.58	0.4	0.04715	1.61	0.04	0.62	0.47	Subcritical
RCPJ13	Normal Depth	0.047	0.0081	1076.71	1075.00 to 1077.20 ft	465	187.71	228.76	228.72	1.71	1.27	0.03792	2.48	0.1	1.8	0.48	Subcritical
RCPJ15	Normal Depth	0.05	0.0028	1016.91	1014.00 to 1024.20 ft	382	189.24	130.12	129.98	2.91	1.79	0.03788	2.02	0.06	2.98	0.29	Subcritical
RCPJ16	Normal Depth	0.046	0.0033	1019.82	1016.00 to 1028.00 ft	629	225.03	120.58	120.32	3.82	2.56	0.02906	2.8	0.12	3.94	0.36	Subcritical
RCPJ17	Normal Depth	0.048	0.005	1011.36	1010.00 to 1015.60 ft	564	261.73	269.15	269.12	1.36	0.8	0.0393	2.15	0.07	1.43	0.39	Subcritical
RCPJ18	Normal Depth	0.049	0.0057	1025.52	1023.00 to 1027.00 ft	492	202.7	183.59	183.29	2.52	1.89	0.0392	2.43	0.09	2.61	0.41	Subcritical
RCPJ20	Normal Depth	0.046	0.0069	993.6	990.00 to 997.50 ft	1278	316.99	174.4	174.25	3.6	2.79	0.02709	4.03	0.25	3.86	0.53	Subcritical
RCPJ21	Normal Depth	0.045	0.0054	992.45	990.00 to 997.50 ft	417	148.73	119.74	119.64	2.45	1.76	0.03062	2.8	0.12	2.57	0.44	Subcritical
RCPJ19	Normal Depth	0.045	0.0072	997.68	997.00 to 1000.00 ft	60	34.61	71.11	71.09	0.68	0.43	0.04271	1.73	0.05	0.73	0.44	Subcritical
RCPJ23	Normal Depth	0.048	0.0101	980	974.40 to 980.90 ft	5473	793.47	240.36	237.62	5.6	4.73	0.02454	6.9	0.74	6.34	0.67	Subcritical
RCJ29D	Normal Depth	0.045	0.0157	955.56	952.25 to 973.25 ft	586	101.63	61.78	61.41	3.31	3.01	0.02595	5.77	0.52	3.83	0.79	Subcritical
RCPJ27	Normal Depth	0.047	0.0065	885.69	881.16 to 888.42 ft	1625	466.57	287.83	287.6	4.53	3.3	0.02785	3.48	0.19	4.72	0.48	Subcritical
RCPJ22	Normal Depth	0.049	0.0073	940.72	936.95 to 945.90 ft	2239	471.86	193.33	192.83	3.77	2.81	0.0285	4.75	0.35	4.12	0.53	Subcritical
RCJ29A	Normal Depth	0.048	0.0086	939.75	934.00 to 941.00 ft	5182	943.48	351.71	351.49	5.75	4.71	0.02632	5.49	0.47	6.22	0.59	Subcritical
RCJ43C	Normal Depth	0.045	0.0113	923.68	922.10 to 936.30 ft	111	36.58	45.52	45.41	1.58	1.28	0.03409	3.03	0.14	1.73	0.6	Subcritical
RCJ43B	Normal Depth	0.048	0.0119	911.65	909.95 to 918.70 ft	128	41.22	47.49	47.31	1.7	1.37	0.03719	3.11	0.15	1.85	0.59	Subcritical
RCJ29C	Normal Depth	0.046	0.0171	977.17	974.40 to 980.90 ft	1156	199.59	123.85	123.7	2.77	2.51	0.02726	5.79	0.52	3.3	0.8	Subcritical
RCPJ40	Normal Depth	0.046	0.0132	885.03	881.80 to 888.21 ft	1104	184.56	89.83	89.37	3.23	2.8	0.02589	5.98	0.56	3.78	0.73	Subcritical
RCPJ25	Normal Depth	0.366	0.0135	1038.96	1035.10 to 1038.60 ft	651	804.03	357.41	356	3.86	1.43	2.14236	0.81	0.01	3.87	0.09	Subcritical
RCPJ14	Normal Depth	0.049	0.0116	1015.79	1010.00 to 1018.00 ft	5859	1063.16	482.06	481.48	5.79	5.23	0.02969	5.51	0.47	6.26	0.65	Subcritical
RCPJ24	Normal Depth	0.045	0.0193	1021.71	1020.00 to 1027.00 ft	249	43.88	31.89	31.38	1.71	1.54	0.02771	5.68	0.5	2.21	0.85	Subcritical
RCPJ30	Normal Depth	0.045	0.02	1033.04	1030.00 to 1040.00 ft	372	48.98	23.62	22.18	3.04	2.87	0.02499	7.59	0.9	3.94	0.9	Subcritical
RCPJ53	Normal Depth	0.045	0.0201	970.65	970.00 to 975.00 ft	37	11.82	21.61	21.48	0.65	0.54	0.03828	3.13	0.15	0.8	0.74	Subcritical
RCPJ31	Normal Depth	0.045	0.0122	962.24	960.00 to 970.00 ft	460	83.95	45.6	44.94	2.24	1.81	0.02593	5.48	0.47	2.71	0.71	Subcritical
RCPJ32	Normal Depth	0.045	0.0123	961.64	960.00 to 970.00 ft	266	58	41.39	40.91	1.64	1.28	0.02862	4.59	0.33	1.96	0.68	Subcritical
RCPJ26	Normal Depth	0.045	0.0099	1001.65	1000.00 to 1013.00 ft	472	118.2	88.22	88.05	1.65	1.22	0.02926	3.99	0.25	1.9	0.61	Subcritical
RCPJ33	Normal Depth	0.045	0.0057	933.55	930.00 to 950.00 ft	1655	316.62	104.27	103.4	3.55	2.37	0.02313	5.23	0.42	3.97	0.53	Subcritical
RCPJ34	Normal Depth	0.045	0.0069	923.15	920.00 to 940.00 ft	1966	364.4	132.11	131.48	3.15	2.2	0.02351	5.4	0.45	3.6	0.57	Subcritical
RCPJ51 - TSFF	Normal Depth	0.045	0.0045	0.89	0.00 to 5.00 ft	197	105.34	135.79	135.75	0.89	0.48	0.03881	1.87	0.05	0.95	0.37	Subcritical

RVADMP Routing Reach Cross-section Summary Table - BasinX

Label	Solve For	Roughness Coefficient	Channel Slope (ft/ft)	Water Surface Elevation (ft)	Elevation Range	Discharge (ft^3/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Normal Depth (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
RCPX01	Normal Depth	0.045	0.0124	971.6	970.00 to 980.00 ft	1623	348.16	241.21	241.08	1.6	1.26	0.02857	4.66	0.34	1.94	0.68	Subcritical
RCPX03	Normal Depth	0.035	0.0177	1063.38	1060.00 to 1150.00 ft	879	114.35	72.05	71.63	3.38	3.47	0.01525	7.69	0.92	4.3	1.07	Supercritical
RCPX16	Normal Depth	0.045	0.009	1.09	0.00 to 6.00 ft	255	98.63	131.54	131.51	1.09	0.76	0.03581	2.59	0.1	1.19	0.53	Subcritical
RCPX12	Normal Depth	0.045	0.0169	0.98	0.00 to 6.00 ft	283	84.7	123.34	123.31	0.98	0.81	0.03524	3.34	0.17	1.15	0.71	Subcritical

RVADMP Routing Reach Cross-section Summary Table along the Union Pacific Railroad

Label	Solve For	Roughness Coefficient	Channel Slope (ft/ft)	Water Surface Elevation (ft)	Elevation Range	Discharge (ft^3/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Normal Depth (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
RCPE33	Normal Depth	0.045	0.0043	1359.29	1359.17 to 1362.54 ft	1	3.08	53.07	53.05	0.12	0.07	0.09229	0.33	0	0.12	0.24	Subcritical
RCPE32	Normal Depth	0.045	0.0059	1353.62	1353.15 to 1356.23 ft	29	30.21	129.73	129.7	0.47	0.31	0.05517	0.96	0.01	0.48	0.35	Subcritical
RCPE53	Normal Depth	0.045	0.0047	1345.69	1345.51 to 1348.81 ft	1	2.24	25.43	25.41	0.18	0.1	0.07923	0.45	0	0.18	0.27	Subcritical
RCPE31	Normal Depth	0.035	0.0057	1340.32	1339.92 to 1343.73 ft	54	49.2	245.69	245.63	0.4	0.29	0.03412	1.1	0.02	0.42	0.43	Subcritical
RCPE30	Normal Depth	0.035	0.0031	1332.58	1332.42 to 1336.00 ft	1	2.31	29.56	29.54	0.16	0.09	0.04968	0.43	0	0.16	0.27	Subcritical
RCPE25	Normal Depth	0.035	0.0007	1314.58	1313.48 to 1320.36 ft	49	64.91	117.84	117.58	1.1	0.55	0.02745	0.75	0.01	1.11	0.18	Subcritical
RCPE38	Normal Depth	0.045	0.0007	1322.09	1320.31 to 1328.00 ft	120	148.76	167.66	167.1	1.78	0.84	0.03965	0.81	0.01	1.79	0.15	Subcritical
RCPE36	Normal Depth	0.035	0.0038	1310.95	1309.85 to 1316.00 ft	149	84.87	154.47	154.16	1.1	0.78	0.02454	1.76	0.05	1.15	0.42	Subcritical
RCPE54	Normal Depth	0.035	0.0017	1307.02	1306.05 to 1312.00 ft	62	57.57	119.23	119.03	0.97	0.58	0.0271	1.08	0.02	0.99	0.27	Subcritical
RCPF26	Normal Depth	0.035	0.0027	1304.12	1302.85 to 1308.00 ft	202	124.15	195.99	195.65	1.27	0.84	0.02386	1.63	0.04	1.31	0.36	Subcritical
RCPF29	Normal Depth	0.047	0.0005	1299.24	1297.49 to 1300.12 ft	333	517.67	601.97	600.45	1.75	0.76	0.04399	0.64	0.01	1.76	0.12	Subcritical

Typical Sheet Flow Route (TSF)

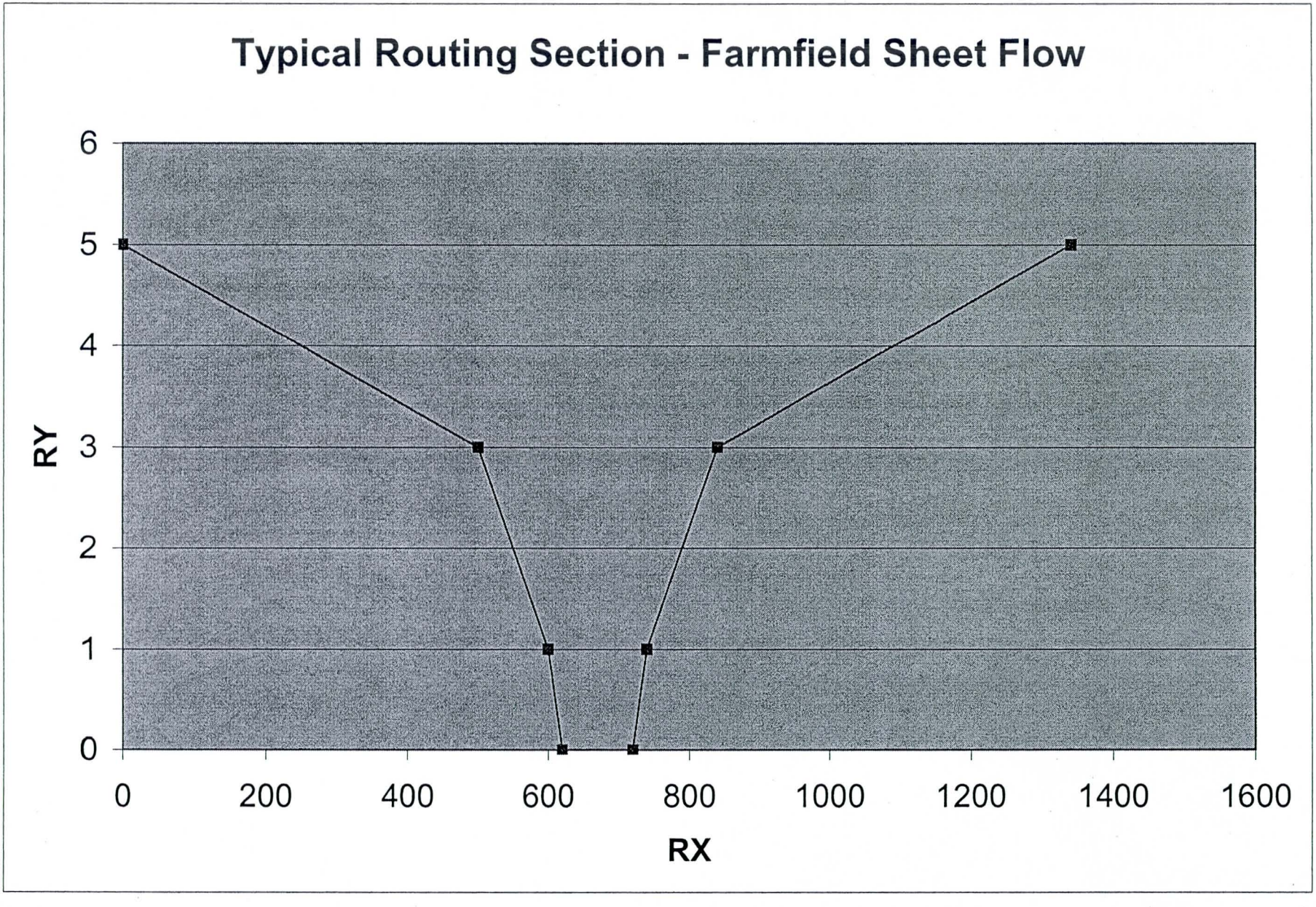
RX	0	500	700	750	800	850	1050	1550
RY	6	4	2	0	0	2	4	6

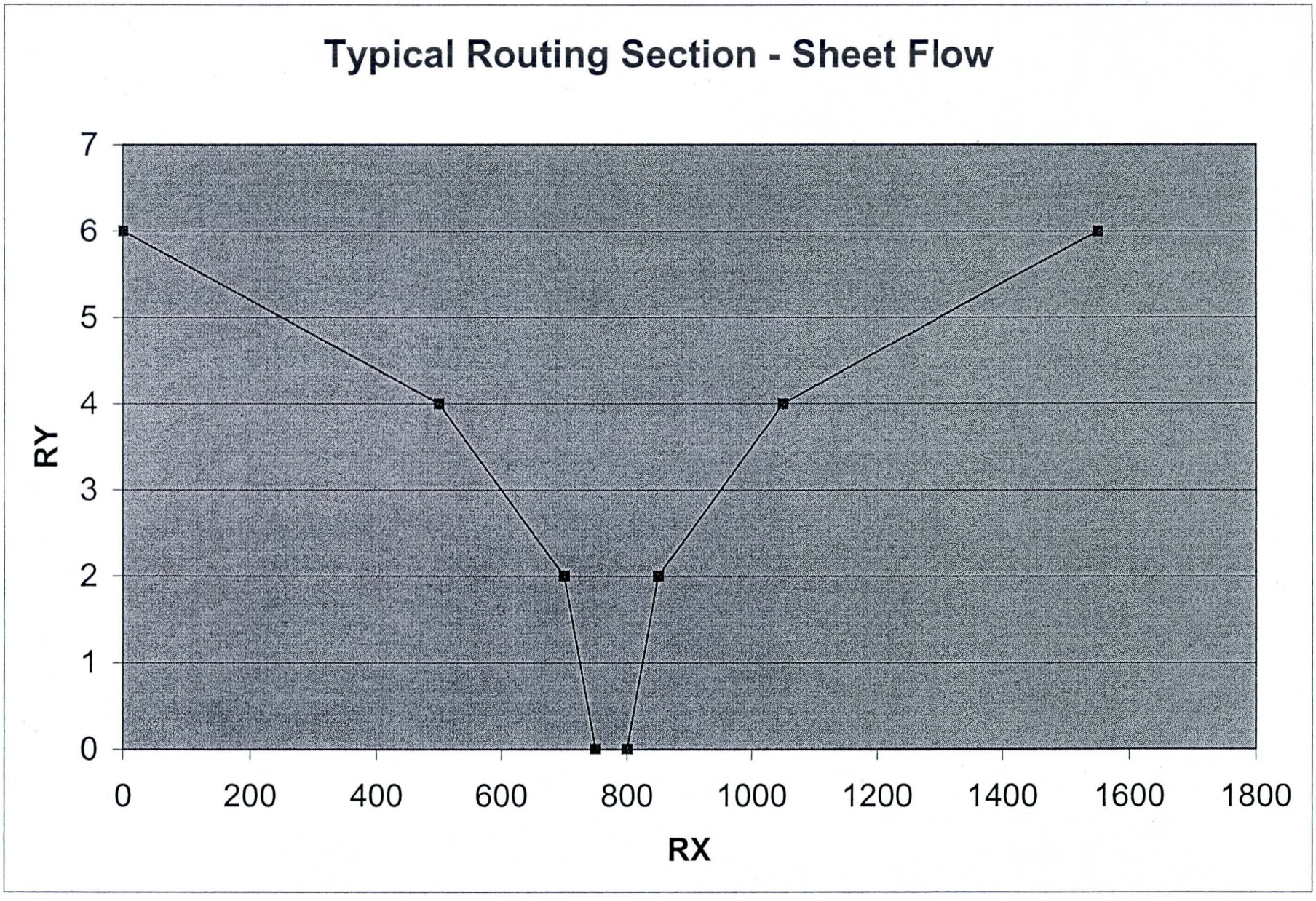
Typical Sheet Flow Farmfield (TSFF)

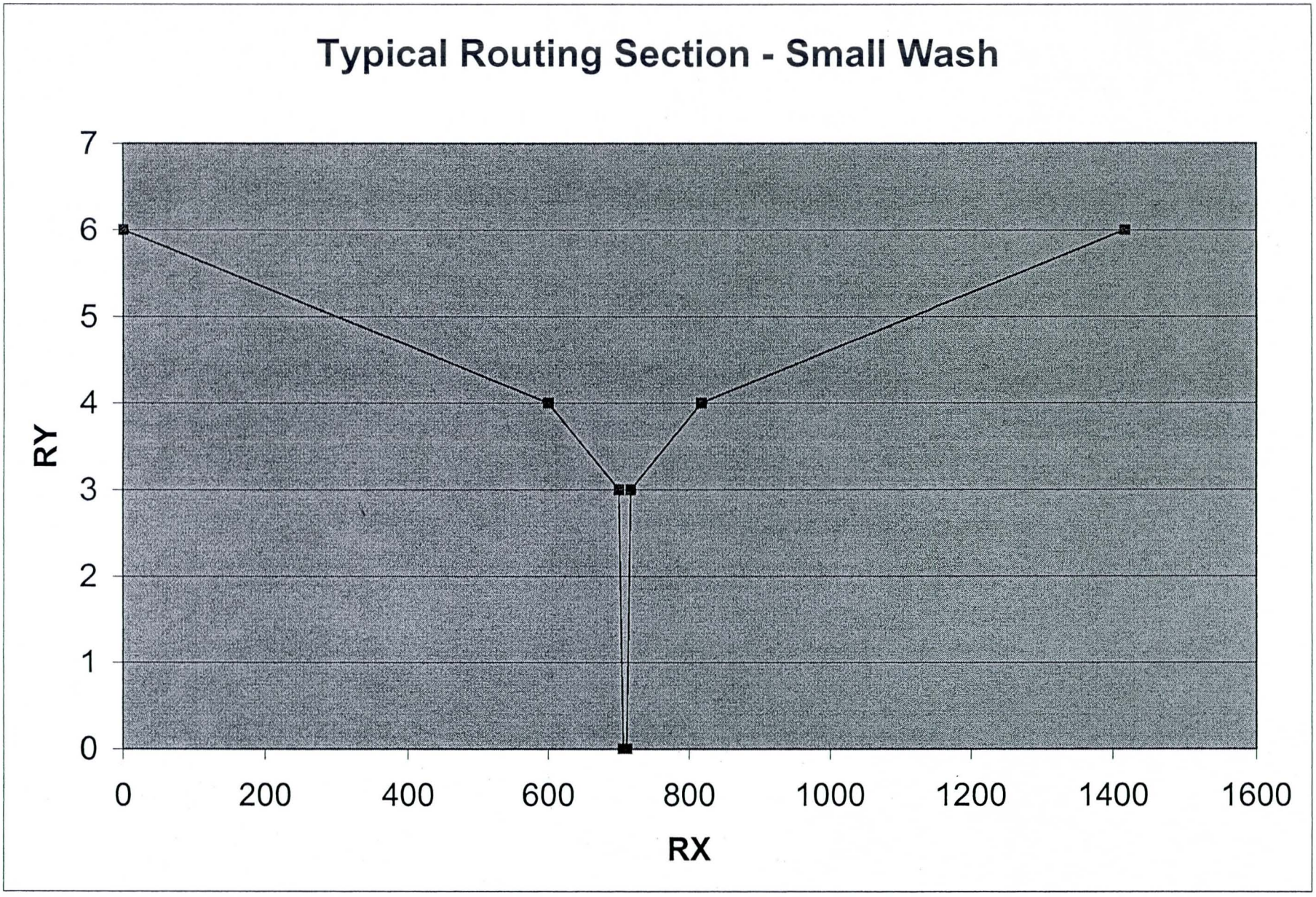
RX	0	500	600	620	720	740	840	1340
RY	5	3	1	0	0	1	3	5

Typical Sheet Flow Small Wash

RX	0	600	700	706	711	717	817	1417
RY	6	4	3	0	0	3	4	6


Typical Routing Section - Farmfield Sheet Flow
RY
6
5
4
3
2
1
0
0
200
400
600
800
1000
1200
1400
1600
RX


Typical Routing Section - Sheet Flow
RY
7
6
5
4
3
2
1
0
0
200
400
600
800
1000
1200
1400
1600
1800
RX


Typical Routing Section - Small Wash
RY
7
6
5
4
3
2
1
0
0
200
400
600
800
1000
1200
1400
1600
RX

Culvert Analysis Report
MP875.2

Comments: Existing Structure MP875.2, EEC Structure 1

Analysis Component			
Storm Event	Design	Discharge	1,495.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	1,495.00 cfs	Check Discharge	1,500.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	1,495.00 cfs	Bottom Elevation	1,506.30 ft
Depth	6.15 ft	Velocity	5.70 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-30 x 1.7 ft Box	621.41 cfs	1,516.32 ft	12.11 ft/s
Weir	Roadway	872.99 cfs	1,516.32 ft	N/A
Total	————	1,494.40 cfs	1,516.32 ft	N/A

Culvert Analysis Report
MP875.2

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,516.32	ft	Discharge	621.41	cfs
Inlet Control HW Elev.	1,513.68	ft	Tailwater Elevation	1,512.45	ft
Outlet Control HW Elev.	1,516.32	ft	Control Type	Outlet Control	
Headwater Depth/Height	5.77				

Grades					
Upstream Invert	1,506.45	ft	Downstream Invert	1,506.30	ft
Length	30.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	6.15	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	1.71	ft
Velocity Downstream	12.11	ft/s	Critical Slope	0.014902	ft/ft

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	30.00	ft
Section Size	30 x 1.7 ft		Rise	1.71	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	1,516.32	ft	Upstream Velocity Head	2.28	ft
Ke	0.50		Entrance Loss	1.14	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,513.68	ft	Flow Control	N/A	
Inlet Type	90 and 15° wingwall flares		Area Full	51.3	ft^2
K	0.06100		HDS 5 Chart	8	
M	0.75000		HDS 5 Scale	2	
C	0.04000		Equation Form	1	
Y	0.80000				

Culvert Analysis Report
MP875.2

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	872.99	cfs	Allowable HW Elevation	1,516.32	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.69	US
Low Point	1,514.40	ft	Headwater Elevation	1,516.32	ft
Discharge Coefficient (Cr)	2.69		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,512.45	ft			

Sta (ft)	Elev. (ft)
0.00	1,519.02
450.00	1,516.85
890.00	1,514.40

Culvert Analysis Report
MP875.32

Comments: Existing Culvert at MP875.32, EEC Structure 2

Analysis Component			
Storm Event	Design	Discharge	1,871.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	1,871.00 cfs	Check Discharge	2,000.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	1,871.00 cfs	Bottom Elevation	1,505.37 ft
Depth	7.47 ft	Velocity	6.79 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-36 inch Circular	76.96 cfs	1,513.81 ft	5.44 ft/s
Weir	Roadway	1,794.80 cfs	1,513.81 ft	N/A
Total	————	1,871.75 cfs	1,513.81 ft	N/A

Culvert Analysis Report
MP875.32

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	1,513.81 ft	Discharge	76.96 cfs
Inlet Control HW Elev.	1,512.84 ft	Tailwater Elevation	1,512.84 ft
Outlet Control HW Elev.	1,513.81 ft	Control Type	Outlet Control
Headwater Depth/Height	2.77		

Grades			
Upstream Invert	1,505.49 ft	Downstream Invert	1,505.37 ft
Length	24.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	7.47 ft
Slope Type	N/A	Normal Depth	N/A ft
Flow Regime	N/A	Critical Depth	2.02 ft
Velocity Downstream	5.44 ft/s	Critical Slope	0.017991 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	3.00 ft
Section Size	36 inch	Rise	3.00 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	1,513.81 ft	Upstream Velocity Head	0.46 ft
Ke	0.50	Entrance Loss	0.23 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,512.84 ft	Flow Control	N/A
Inlet Type	Headwall	Area Full	14.1 ft^2
K	0.00780	HDS 5 Chart	2
M	2.00000	HDS 5 Scale	1
C	0.03790	Equation Form	1
Y	0.69000		

Culvert Analysis Report
MP875.32

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	1,794.80	cfs	Allowable HW Elevation	1,513.81	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.88	US
Low Point	1,511.60	ft	Headwater Elevation	1,513.81	ft
Discharge Coefficient (Cr)	2.88		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,512.84	ft			

Sta (ft)	Elev. (ft)
0.00	1,513.55
215.00	1,512.57
430.00	1,511.60

Culvert Analysis Report
MP875.44

Comments: Existing Structure at MP875.44, EEC Structure 3

Overtopping Analysis

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-10 x 3.10 ft Box	311.48 cfs	1,508.79 ft	10.05 ft/s
Weir	Roadway	0.00 cfs	1,508.79 ft	N/A
Total	----------	311.46 cfs	1,508.79 ft	N/A

Culvert Analysis Report
MP875.44

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,508.79	ft	Discharge	311.48	cfs
Inlet Control HW Elev.	1,508.79	ft	Tailwater Elevation	1,505.17	ft
Outlet Control HW Elev.	1,507.94	ft	Control Type	Inlet Control	
Headwater Depth/Height	2.10				

Grades					
Upstream Invert	1,502.28	ft	Downstream Invert	1,502.13	ft
Length	30.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	3.10	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	3.10	ft
Velocity Downstream	10.05	ft/s	Critical Slope	0.011838	ft/ft

Section					
Section Shape	Box		Mannings Coefficient	0.018	
Section Material	Concrete		Span	10.00	ft
Section Size	10 x 3.10 ft		Rise	3.10	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	1,507.94	ft	Upstream Velocity Head	1.57	ft
Ke	0.50		Entrance Loss	0.78	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,508.79	ft	Flow Control	N/A	
Inlet Type	90 and 15° wingwall flares		Area Full	31.0	ft^2
K	0.06100		HDS 5 Chart	8	
M	0.75000		HDS 5 Scale	2	
C	0.04000		Equation Form	1	
Y	0.80000				

Culvert Analysis Report
MP875.44

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.00	cfs	Allowable HW Elevation	1,508.79	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.50	US
Low Point	1,508.79	ft	Headwater Elevation	N/A	ft
Discharge Coefficient (Cr)	2.50		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,505.17	ft			

Sta (ft)	Elev. (ft)
0.00	1,510.59
225.00	1,509.69
450.00	1,508.79

Culvert Analysis Report
MP875.69

Comments: Existing Culvert at MP 875.69, EEC Structure 4

Analysis Component			
Storm Event	Design	Discharge	300.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	300.00 cfs	Check Discharge	300.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	300.00 cfs	Bottom Elevation	1,496.76 ft
Depth	3.24 ft	Velocity	4.64 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-24 inch Circular	54.35 cfs	1,503.72 ft	8.65 ft/s
Weir	Roadway	245.79 cfs	1,503.72 ft	N/A
Total	————	300.14 cfs	1,503.72 ft	N/A

Culvert Analysis Report
MP875.69

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,503.72	ft	Discharge	54.35	cfs
Inlet Control HW Elev.	1,501.09	ft	Tailwater Elevation	1,500.00	ft
Outlet Control HW Elev.	1,503.72	ft	Control Type	Outlet Control	
Headwater Depth/Height	3.42				

Grades					
Upstream Invert	1,496.88	ft	Downstream Invert	1,496.76	ft
Length	24.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	3.24	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	1.81	ft
Velocity Downstream	8.65	ft/s	Critical Slope	0.071876	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.031	
Section Material	CMP		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	1,503.72	ft	Upstream Velocity Head	1.16	ft
Ke	0.50		Entrance Loss	0.58	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,501.09	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	6.3	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP875.69

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	245.79	cfs	Allowable HW Elevation	1,503.72	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.64	US
Low Point	1,502.76	ft	Headwater Elevation	1,503.72	ft
Discharge Coefficient (Cr)	2.64		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,500.00	ft			

Sta (ft)	Elev. (ft)
0.00	1,515.13
450.00	1,503.51
660.00	1,502.76

Culvert Analysis Report
MP876.09

Comments: UPRR New Culvert at MP876.09, EEC Structure 5

Analysis Component			
Storm Event	Design	Discharge	300.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	300.00 cfs	Check Discharge	350.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	300.00 cfs	Bottom Elevation	1,489.20 ft
Depth	3.41 ft	Velocity	4.27 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	3-48 inch Circular	300.03 cfs	1,494.81 ft	8.77 ft/s
Weir	Roadway	0.00 cfs	1,494.81 ft	N/A
Total	————	300.03 cfs	1,494.81 ft	N/A

Culvert Analysis Report
MP876.09

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,494.81	ft	Discharge	300.03	cfs
Inlet Control HW Elev.	1,494.75	ft	Tailwater Elevation	1,492.61	ft
Outlet Control HW Elev.	1,494.81	ft	Control Type	Outlet Control	
Headwater Depth/Height	1.30				

Grades					
Upstream Invert	1,489.60	ft	Downstream Invert	1,489.20	ft
Length	80.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	S1		Depth, Downstream	3.41	ft
Slope Type	Steep		Normal Depth	2.99	ft
Flow Regime	Subcritical		Critical Depth	3.03	ft
Velocity Downstream	8.77	ft/s	Critical Slope	0.004853	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	CMP		Span	4.00	ft
Section Size	48 inch		Rise	4.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	1,494.81	ft	Upstream Velocity Head	1.37	ft
Ke	0.50		Entrance Loss	0.68	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,494.75	ft	Flow Control	Transition	
Inlet Type	Headwall		Area Full	37.7	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP876.09

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.00	cfs	Allowable HW Elevation	1,494.81	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.50	US
Low Point	1,495.92	ft	Headwater Elevation	N/A	ft
Discharge Coefficient (Cr)	2.50		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,492.61	ft			

Sta (ft)	Elev. (ft)
0.00	1,497.91
170.00	1,497.18
660.00	1,495.92

Culvert Analysis Report
MP876.64

Comments: UPRR New Culvert at MP876.64, EEC Structure 6

Analysis Component			
Storm Event	Design	Discharge	300.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	300.00 cfs	Check Discharge	450.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	300.00 cfs	Bottom Elevation	1,474.60 ft
Depth	3.32 ft	Velocity	4.26 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	3-48 inch Circular	300.00 cfs	1,480.23 ft	8.98 ft/s
Weir	Roadway	0.00 cfs	1,480.23 ft	N/A
Total	————	300.00 cfs	1,480.23 ft	N/A

Culvert Analysis Report
MP876.64

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,480.23	ft	Discharge	300.00	cfs
Inlet Control HW Elev.	1,480.15	ft	Tailwater Elevation	1,477.92	ft
Outlet Control HW Elev.	1,480.23	ft	Control Type	Outlet Control	
Headwater Depth/Height	1.31				

Grades					
Upstream Invert	1,475.00	ft	Downstream Invert	1,474.60	ft
Length	60.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	S1		Depth, Downstream	3.32	ft
Slope Type	Steep		Normal Depth	2.99	ft
Flow Regime	Subcritical		Critical Depth	3.03	ft
Velocity Downstream	8.98	ft/s	Critical Slope	0.004853	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	CMP		Span	4.00	ft
Section Size	48 inch		Rise	4.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	1,480.23	ft	Upstream Velocity Head	1.40	ft
Ke	0.50		Entrance Loss	0.70	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,480.15	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	37.7	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP876.64

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.00	cfs	Allowable HW Elevation	1,480.23	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.50	US
Low Point	1,481.17	ft	Headwater Elevation	N/A	ft
Discharge Coefficient (Cr)	2.50		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,477.92	ft			

Sta (ft)	Elev. (ft)
0.00	1,485.99
560.00	1,482.93
1,150.00	1,481.17

Culvert Analysis Report
MP876.78

Comments: UPRR New Culvert at MP876.78, EEC Structure 7

Analysis Component			
Storm Event	Design	Discharge	1,500.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	1,500.00 cfs	Check Discharge	1,800.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	1,500.00 cfs	Bottom Elevation	1,470.90 ft
Depth	5.47 ft	Velocity	6.87 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	3-60 inch Circular	659.45 cfs	1,480.15 ft	15.84 ft/s
Weir	Roadway	841.68 cfs	1,480.15 ft	N/A
Total	————	1,501.13 cfs	1,480.15 ft	N/A

Culvert Analysis Report
MP876.78

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,480.15	ft	Discharge	659.45	cfs
Inlet Control HW Elev.	1,480.15	ft	Tailwater Elevation	1,476.37	ft
Outlet Control HW Elev.	1,479.75	ft	Control Type	Inlet Control	
Headwater Depth/Height	1.63				

Grades					
Upstream Invert	1,472.00	ft	Downstream Invert	1,470.90	ft
Length	60.00	ft	Constructed Slope	0.018333	ft/ft

Hydraulic Profile					
Profile	CompositePressureProfileS1		Depth, Downstream	3.33	ft
Slope Type	N/A		Normal Depth	2.72	ft
Flow Regime	Subcritical		Critical Depth	4.21	ft
Velocity Downstream	15.84	ft/s	Critical Slope	0.005806	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	CMP		Span	5.00	ft
Section Size	60 inch		Rise	5.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	1,479.75	ft	Upstream Velocity Head	2.41	ft
Ke	0.50		Entrance Loss	1.08	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,480.15	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	58.9	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP876.78

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	841.68	cfs	Allowable HW Elevation	1,480.15	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.60	US
Low Point	1,479.19	ft	Headwater Elevation	1,480.15	ft
Discharge Coefficient (Cr)	2.60		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,476.37	ft			

Sta (ft)	Elev. (ft)
0.00	1,482.93
453.00	1,481.17
2,437.00	1,479.19

Culvert Analysis Report
MP877.11

Comments: UPRR New Culvert at MP877.11, EEC Structure 8

Analysis Component			
Storm Event	Design	Discharge	300.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	300.00 cfs	Check Discharge	400.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	300.00 cfs	Bottom Elevation	1,461.78 ft
Depth	3.32 ft	Velocity	4.26 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	3-48 inch Circular	300.04 cfs	1,467.33 ft	8.97 ft/s
Weir	Roadway	0.00 cfs	1,467.33 ft	N/A
Total	————	300.04 cfs	1,467.33 ft	N/A

Culvert Analysis Report
MP877.11

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,467.33	ft	Discharge	300.04	cfs
Inlet Control HW Elev.	1,467.25	ft	Tailwater Elevation	1,465.10	ft
Outlet Control HW Elev.	1,467.33	ft	Control Type	Outlet Control	
Headwater Depth/Height	1.31				

Grades					
Upstream Invert	1,462.10	ft	Downstream Invert	1,461.78	ft
Length	65.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	S1		Depth, Downstream	3.32	ft
Slope Type	Steep		Normal Depth	2.99	ft
Flow Regime	Subcritical		Critical Depth	3.03	ft
Velocity Downstream	8.97	ft/s	Critical Slope	0.004853	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	CMP		Span	4.00	ft
Section Size	48 inch		Rise	4.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	1,467.33	ft	Upstream Velocity Head	1.42	ft
Ke	0.50		Entrance Loss	0.71	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,467.25	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	37.7	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP877.11

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.00	cfs	Allowable HW Elevation	1,467.33	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.50	US
Low Point	1,468.85	ft	Headwater Elevation	N/A	ft
Discharge Coefficient (Cr)	2.50		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,465.10	ft			

Sta (ft)	Elev. (ft)
0.00	1,481.17
2,010.00	1,479.19
2,463.00	1,468.85

Culvert Analysis Report
MP877.34

Comments: UPRR New Culvert MP877.34, EEC Structure 9

Analysis Component			
Storm Event	Design	Discharge	400.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	400.00 cfs	Check Discharge	700.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	400.00 cfs	Bottom Elevation	1,454.68 ft
Depth	2.64 ft	Velocity	4.27 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	5-60 inch Circular	400.09 cfs	1,459.03 ft	7.60 ft/s
Weir	Roadway	0.00 cfs	1,459.03 ft	N/A
Total	————	400.09 cfs	1,459.03 ft	N/A

Culvert Analysis Report
MP877.34

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	1,459.03 ft	Discharge	400.09 cfs
Inlet Control HW Elev.	1,458.65 ft	Tailwater Elevation	1,457.32 ft
Outlet Control HW Elev.	1,459.03 ft	Control Type	Entrance Control
Headwater Depth/Height	0.81		

Grades			
Upstream Invert	1,455.00 ft	Downstream Invert	1,454.68 ft
Length	65.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	CompositeS1S2	Depth, Downstream	2.64 ft
Slope Type	Steep	Normal Depth	2.20 ft
Flow Regime	N/A	Critical Depth	2.53 ft
Velocity Downstream	7.60 ft/s	Critical Slope	0.003077 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.012
Section Material	CMP	Span	5.00 ft
Section Size	60 inch	Rise	5.00 ft
Number Sections	5		

Outlet Control Properties			
Outlet Control HW Elev.	1,459.03 ft	Upstream Velocity Head	1.00 ft
Ke	0.50	Entrance Loss	0.50 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,458.65 ft	Flow Control	N/A
Inlet Type	Headwall	Area Full	98.2 ft^2
K	0.00780	HDS 5 Chart	2
M	2.00000	HDS 5 Scale	1
C	0.03790	Equation Form	1
Y	0.69000		

Culvert Analysis Report
MP877.34

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.00	cfs	Allowable HW Elevation	1,459.03	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.50	US
Low Point	1,462.54	ft	Headwater Elevation	N/A	ft
Discharge Coefficient (Cr)	2.50		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,457.32	ft			

Sta (ft)	Elev. (ft)
0.00	1,478.19
2,010.00	1,468.85
3,265.00	1,462.54

Culvert Analysis Report
MP877.77

Comments: UPRR New Culvert MP877.77, EEC Structure 10

Analysis Component			
Storm Event	Design	Discharge	1,500.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	1,500.00 cfs	Check Discharge	2,000.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	1,500.00 cfs	Bottom Elevation	1,439.40 ft
Depth	5.05 ft	Velocity	7.77 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-60 inch Circular	462.50 cfs	1,449.30 ft	11.78 ft/s
Weir	Roadway	1,038.08 cfs	1,449.30 ft	N/A
Total	----------	1,500.58 cfs	1,449.30 ft	N/A

Culvert Analysis Report
MP877.77

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	1,449.30 ft	Discharge	462.50 cfs
Inlet Control HW Elev.	1,448.30 ft	Tailwater Elevation	1,444.45 ft
Outlet Control HW Elev.	1,449.30 ft	Control Type	Outlet Control
Headwater Depth/Height	1.94		

Grades			
Upstream Invert	1,439.60 ft	Downstream Invert	1,439.40 ft
Length	60.00 ft	Constructed Slope	0.003333 ft/ft

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	5.05 ft
Slope Type	N/A	Normal Depth	N/A ft
Flow Regime	N/A	Critical Depth	4.30 ft
Velocity Downstream	11.78 ft/s	Critical Slope	0.024923 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	5.00 ft
Section Size	60 inch	Rise	5.00 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	1,449.30 ft	Upstream Velocity Head	2.16 ft
Ke	0.50	Entrance Loss	1.08 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,448.30 ft	Flow Control	N/A
Inlet Type	Headwall	Area Full	39.3 ft^2
K	0.00780	HDS 5 Chart	2
M	2.00000	HDS 5 Scale	1
C	0.03790	Equation Form	1
Y	0.69000		

Culvert Analysis Report
MP877.77

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	1,038.08	cfs	Allowable HW Elevation	1,449.30	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.71	US
Low Point	1,447.09	ft	Headwater Elevation	1,449.30	ft
Discharge Coefficient (Cr)	2.71		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,444.45	ft			

Sta (ft)	Elev. (ft)
0.00	1,468.85
1,255.00	1,462.54
3,566.00	1,447.09

Culvert Analysis Report
MP878.34

Comments: UPRR New Structure at MP878.34, EEC Structure 11

Analysis Component			
Storm Event	Design	Discharge	4,000.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	4,000.00 cfs	Check Discharge	5,000.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.

Discharge	4,000.00 cfs	Bottom Elevation	1,417.95 ft
Depth	7.49 ft	Velocity	5.94 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-30 x 2.5 ft Box	1,914.53 cfs	1,429.54 ft	12.76 ft/s
Weir	Roadway	2,084.44 cfs	1,429.54 ft	N/A
Total	————	3,998.97 cfs	1,429.54 ft	N/A

Culvert Analysis Report
MP878.34

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	1,429.54 ft	Discharge	1,914.53 cfs
Inlet Control HW Elev.	1,426.61 ft	Tailwater Elevation	1,425.44 ft
Outlet Control HW Elev.	1,429.54 ft	Control Type	Outlet Control
Headwater Depth/Height	4.58		

Grades			
Upstream Invert	1,418.10 ft	Downstream Invert	1,417.95 ft
Length	30.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	7.49 ft
Slope Type	N/A	Normal Depth	N/A ft
Flow Regime	N/A	Critical Depth	2.50 ft
Velocity Downstream	12.76 ft/s	Critical Slope	0.010303 ft/ft

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	30.00 ft
Section Size	30 x 2.5 ft	Rise	2.50 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	1,429.54 ft	Upstream Velocity Head	2.53 ft
Ke	0.50	Entrance Loss	1.27 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,426.61 ft	Flow Control	N/A
Inlet Type	90 and 15° wingwall flares	Area Full	150.0 ft²
K	0.06100	HDS 5 Chart	8
M	0.75000	HDS 5 Scale	2
C	0.04000	Equation Form	1
Y	0.80000		

Culvert Analysis Report
MP878.34

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	2,084.44	cfs	Allowable HW Elevation	1,429.54	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.76	US
Low Point	1,426.62	ft	Headwater Elevation	1,429.54	ft
Discharge Coefficient (Cr)	2.76		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,425.44	ft			

Sta (ft)	Elev. (ft)
0.00	1,462.54
2,311.00	1,447.09
5,300.00	1,426.62

Culvert Analysis Report
MP878.42

Comments: Existing Structure MP878.42, EEC Structure 12

Analysis Component			
Storm Event	Design	Discharge	1,500.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	1,500.00 cfs	Check Discharge	2,000.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	1,500.00 cfs	Bottom Elevation	1,417.52 ft
Depth	6.31 ft	Velocity	6.39 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-12 x 5.6 ft Box	741.55 cfs	1,426.98 ft	11.04 ft/s
Weir	Roadway	759.23 cfs	1,426.98 ft	N/A
Total	----------	1,500.79 cfs	1,426.98 ft	N/A

Culvert Analysis Report
MP878.42

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,426.98	ft	Discharge	741.55	cfs
Inlet Control HW Elev.	1,426.98	ft	Tailwater Elevation	1,423.83	ft
Outlet Control HW Elev.	1,426.89	ft	Control Type	Inlet Control	
Headwater Depth/Height	1.67				

Grades					
Upstream Invert	1,417.64	ft	Downstream Invert	1,417.52	ft
Length	30.00	ft	Constructed Slope	0.004000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	6.31	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	4.91	ft
Velocity Downstream	11.04	ft/s	Critical Slope	0.006166	ft/ft

Section					
Section Shape	Box		Mannings Coefficient	0.018	
Section Material	Concrete		Span	12.00	ft
Section Size	12 x 5.6 ft		Rise	5.60	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	1,426.89	ft	Upstream Velocity Head	1.89	ft
Ke	0.50		Entrance Loss	0.95	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,426.98	ft	Flow Control	N/A	
Inlet Type	90 and 15° wingwall flares		Area Full	67.2	ft²
K	0.06100		HDS 5 Chart	8	
M	0.75000		HDS 5 Scale	2	
C	0.04000		Equation Form	1	
Y	0.80000				

Culvert Analysis Report
MP878.42

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	759.23	cfs	Allowable HW Elevation	1,426.98	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.69	US
Low Point	1,425.69	ft	Headwater Elevation	1,426.98	ft
Discharge Coefficient (Cr)	2.69		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,423.83	ft			

Sta (ft)	Elev. (ft)
0.00	1,447.09
2,989.00	1,426.62
3,360.00	1,425.69

Culvert Analysis Report
MP878.77

Comments: Existing Structure MP878.77, EEC Structure 13

Analysis Component			
Storm Event	Design	Discharge	1,500.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	1,500.00 cfs	Check Discharge	2,000.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	1,500.00 cfs	Bottom Elevation	1,417.29 ft
Depth	6.21 ft	Velocity	6.38 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-13 x 5 ft Box	646.37 cfs	1,425.97 ft	9.94 ft/s
Weir	Roadway	851.46 cfs	1,425.97 ft	N/A
Total	————	1,497.83 cfs	1,425.97 ft	N/A

Culvert Analysis Report
MP878.77

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	1,425.97 ft	Discharge	646.37 cfs
Inlet Control HW Elev.	1,425.35 ft	Tailwater Elevation	1,423.50 ft
Outlet Control HW Elev.	1,425.97 ft	Control Type	Outlet Control
Headwater Depth/Height	1.71		

Grades			
Upstream Invert	1,417.41 ft	Downstream Invert	1,417.29 ft
Length	24.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	6.21 ft
Slope Type	N/A	Normal Depth	N/A ft
Flow Regime	N/A	Critical Depth	4.25 ft
Velocity Downstream	9.94 ft/s	Critical Slope	0.005701 ft/ft

Section			
Section Shape	Box	Mannings Coefficient	0.018
Section Material	Concrete	Span	13.00 ft
Section Size	13 x 5 ft	Rise	5.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	1,425.97 ft	Upstream Velocity Head	1.54 ft
Ke	0.50	Entrance Loss	0.77 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,425.35 ft	Flow Control	N/A
Inlet Type	90 and 15° wingwall flares	Area Full	65.0 ft²
K	0.06100	HDS 5 Chart	8
M	0.75000	HDS 5 Scale	2
C	0.04000	Equation Form	1
Y	0.80000		

Culvert Analysis Report
MP878.77

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	851.46	cfs	Allowable HW Elevation	1,425.97	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.60	US
Low Point	1,425.62	ft	Headwater Elevation	1,425.97	ft
Discharge Coefficient (Cr)	2.60		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,423.50	ft			

Sta (ft)	Elev. (ft)
0.00	1,426.62
379.00	1,425.69
2,233.00	1,425.62

Culvert Analysis Report
MP878.92

Comments: UPRR New Structure at MP878.92, EEC Structure 14

Analysis Component			
Storm Event	Design	Discharge	1,200.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	1,200.00 cfs	Check Discharge	1,500.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	1,200.00 cfs	Bottom Elevation	1,418.95 ft
Depth	4.38 ft	Velocity	5.77 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-30 x 1.8 ft Box	508.56 cfs	1,425.88 ft	9.42 ft/s
Weir	Roadway	691.80 cfs	1,425.88 ft	N/A
Total	----------	1,200.36 cfs	1,425.88 ft	N/A

Culvert Analysis Report
MP878.92

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,425.88	ft	Discharge	508.56	cfs
Inlet Control HW Elev.	1,424.08	ft	Tailwater Elevation	1,423.33	ft
Outlet Control HW Elev.	1,425.88	ft	Control Type	Outlet Control	
Headwater Depth/Height	3.77				

Grades					
Upstream Invert	1,419.10	ft	Downstream Invert	1,418.95	ft
Length	30.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	4.38	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	1.80	ft
Velocity Downstream	9.42	ft/s	Critical Slope	0.016188	ft/ft

Section					
Section Shape	Box		Mannings Coefficient	0.018	
Section Material	Concrete		Span	30.00	ft
Section Size	30 x 1.8 ft		Rise	1.80	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	1,425.88	ft	Upstream Velocity Head	1.38	ft
Ke	0.50		Entrance Loss	0.69	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,424.08	ft	Flow Control	N/A	
Inlet Type	90 and 15° wingwall flares		Area Full	54.0	ft^2
K	0.06100		HDS 5 Chart	8	
M	0.75000		HDS 5 Scale	2	
C	0.04000		Equation Form	1	
Y	0.80000				

Culvert Analysis Report
MP878.92

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	691.80	cfs	Allowable HW Elevation	1,425.88	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.59	US
Low Point	1,425.62	ft	Headwater Elevation	1,425.88	ft
Discharge Coefficient (Cr)	2.59		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,423.33	ft			

Sta (ft)	Elev. (ft)
0.00	1,425.69
1,854.00	1,425.62
2,670.00	1,425.77

Culvert Analysis Report
MP879.14

Comments: UPRR New Culvert at MP879.14, EEC Structure 15

Analysis Component			
Storm Event	Design	Discharge	400.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	400.00 cfs	Check Discharge	600.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	400.00 cfs	Bottom Elevation	1,416.75 ft
Depth	3.78 ft	Velocity	4.58 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-48 inch Circular	309.00 cfs	1,425.58 ft	12.57 ft/s
Weir	Roadway	91.01 cfs	1,425.58 ft	N/A
Total	————	400.01 cfs	1,425.58 ft	N/A

Culvert Analysis Report
MP879.14

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,425.58	ft	Discharge	309.00	cfs
Inlet Control HW Elev.	1,425.58	ft	Tailwater Elevation	1,420.53	ft
Outlet Control HW Elev.	1,424.82	ft	Control Type	Inlet Control	
Headwater Depth/Height	2.12				

Grades					
Upstream Invert	1,417.10	ft	Downstream Invert	1,416.75	ft
Length	70.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	3.78	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	3.63	ft
Velocity Downstream	12.57	ft/s	Critical Slope	0.008626	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	CMP		Span	4.00	ft
Section Size	48 inch		Rise	4.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	1,424.82	ft	Upstream Velocity Head	2.35	ft
Ke	0.50		Entrance Loss	1.17	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,425.58	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	25.1	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP879.14

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	91.01	cfs	Allowable HW Elevation	1,425.58	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.56	US
Low Point	1,425.00	ft	Headwater Elevation	1,425.58	ft
Discharge Coefficient (Cr)	2.56		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,420.53	ft			

Sta (ft)	Elev. (ft)
0.00	1,425.62
815.00	1,425.77
1,118.00	1,425.00

Culvert Analysis Report
MP879.78

Comments: UPRR New Culvert at MP879.78, EEC Structure 16

Analysis Component			
Storm Event	Design	Discharge	4,000.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	4,000.00 cfs	Check Discharge	5,000.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	4,000.00 cfs	Bottom Elevation	1,408.20 ft
Depth	8.02 ft	Velocity	8.04 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	4-60 inch Circular	798.97 cfs	1,418.93 ft	10.17 ft/s
Culvert-2	2-60 inch Circular	346.07 cfs	1,418.93 ft	8.81 ft/s
Weir	Roadway	2,853.37 cfs	1,418.93 ft	N/A
Total	————	3,998.40 cfs	1,418.93 ft	N/A

Culvert Analysis Report
MP879.78

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	1,418.93 ft	Discharge	798.97 cfs
Inlet Control HW Elev.	1,416.22 ft	Tailwater Elevation	1,416.22 ft
Outlet Control HW Elev.	1,418.93 ft	Control Type	Outlet Control
Headwater Depth/Height	2.09		

Grades			
Upstream Invert	1,408.50 ft	Downstream Invert	1,408.20 ft
Length	60.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	8.02 ft
Slope Type	N/A	Normal Depth	4.10 ft
Flow Regime	N/A	Critical Depth	4.03 ft
Velocity Downstream	10.17 ft/s	Critical Slope	0.005159 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.012
Section Material	CMP	Span	5.00 ft
Section Size	60 inch	Rise	5.00 ft
Number Sections	4		

Outlet Control Properties			
Outlet Control HW Elev.	1,418.93 ft	Upstream Velocity Head	1.61 ft
Ke	0.50	Entrance Loss	0.80 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,416.22 ft	Flow Control	N/A
Inlet Type	Headwall	Area Full	78.5 ft^2
K	0.00780	HDS 5 Chart	2
M	2.00000	HDS 5 Scale	1
C	0.03790	Equation Form	1
Y	0.69000		

Culvert Analysis Report
MP879.78

Component:Culvert-2

Culvert Summary					
Computed Headwater Elevation	1,418.93	ft	Discharge	346.07	cfs
Inlet Control HW Elev.	1,416.22	ft	Tailwater Elevation	1,416.22	ft
Outlet Control HW Elev.	1,418.93	ft	Control Type	Outlet Control	
Headwater Depth/Height	2.09				

Grades					
Upstream Invert	1,408.50	ft	Downstream Invert	1,408.20	ft
Length	60.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	8.02	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	3.77	ft
Velocity Downstream	8.81	ft/s	Critical Slope	0.017870	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	5.00	ft
Section Size	60 inch		Rise	5.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	1,418.93	ft	Upstream Velocity Head	1.21	ft
Ke	0.50		Entrance Loss	0.60	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,416.22	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	39.3	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP879.78

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	2,853.37	cfs	Allowable HW Elevation	1,418.93	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.71	US
Low Point	1,416.72	ft	Headwater Elevation	1,418.93	ft
Discharge Coefficient (Cr)	2.71		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,416.22	ft			

Sta (ft)	Elev. (ft)
0.00	1,425.77
1,118.00	1,425.00
4,509.00	1,416.72

Culvert Analysis Report
MP880.08

Comments: Existing Structure at MP880.08, EEC Structure 17

Analysis Component			
Storm Event	Design	Discharge	2,500.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	2,500.00 cfs	Check Discharge	3,000.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	2,500.00 cfs	Bottom Elevation	1,404.81 ft
Depth	7.41 ft	Velocity	7.24 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-17 x 3.2 ft Box	156.36 cfs	1,412.43 ft	2.87 ft/s
Weir	Roadway	2,339.70 cfs	1,412.43 ft	N/A
Total	----------	2,496.06 cfs	1,412.43 ft	N/A

Culvert Analysis Report
MP880.08

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,412.43	ft	Discharge	156.36	cfs
Inlet Control HW Elev.	1,412.22	ft	Tailwater Elevation	1,412.22	ft
Outlet Control HW Elev.	1,412.43	ft	Control Type	Outlet Control	
Headwater Depth/Height	2.34				

Grades					
Upstream Invert	1,404.93	ft	Downstream Invert	1,404.81	ft
Length	24.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	7.41	ft
Slope Type	N/A		Normal Depth	1.40	ft
Flow Regime	N/A		Critical Depth	1.38	ft
Velocity Downstream	2.87	ft/s	Critical Slope	0.005183	ft/ft

Section					
Section Shape	Box		Mannings Coefficient	0.018	
Section Material	Concrete		Span	17.00	ft
Section Size	17 x 3.2 ft		Rise	3.20	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	1,412.43	ft	Upstream Velocity Head	0.13	ft
Ke	0.50		Entrance Loss	0.06	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,412.22	ft	Flow Control	N/A	
Inlet Type	90 and 15° wingwall flares		Area Full	54.4	ft²
K	0.06100		HDS 5 Chart	8	
M	0.75000		HDS 5 Scale	2	
C	0.04000		Equation Form	1	
Y	0.80000				

Culvert Analysis Report
MP880.08

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	2,339.70	cfs	Allowable HW Elevation	1,412.43	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.40	US
Low Point	1,410.52	ft	Headwater Elevation	1,412.43	ft
Discharge Coefficient (Cr)	2.69		Submergence Factor (Kt)	0.89	
Tailwater Elevation	1,412.22	ft			

Sta (ft)	Elev. (ft)
0.00	1,425.00
1,583.00	1,416.72
4,974.00	1,410.52

Culvert Analysis Report
MP880.29

Comments: UPRR New Culvert at MP880.29, EEC Structure 18

Analysis Component			
Storm Event	Design	Discharge	2,500.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	2,500.00 cfs	Check Discharge	3,000.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	2,500.00 cfs	Bottom Elevation	1,396.90 ft
Depth	7.32 ft	Velocity	7.23 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	3-72 inch Circular	982.31 cfs	1,407.65 ft	11.58 ft/s
Weir	Roadway	1,516.75 cfs	1,407.65 ft	N/A
Total	————	2,499.06 cfs	1,407.65 ft	N/A

Culvert Analysis Report
MP880.29

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,407.65	ft	Discharge	982.31	cfs
Inlet Control HW Elev.	1,406.41	ft	Tailwater Elevation	1,404.22	ft
Outlet Control HW Elev.	1,407.65	ft	Control Type	Outlet Control	
Headwater Depth/Height	1.74				

Grades					
Upstream Invert	1,397.20	ft	Downstream Invert	1,396.90	ft
Length	60.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	7.32	ft
Slope Type	N/A		Normal Depth	4.97	ft
Flow Regime	N/A		Critical Depth	4.93	ft
Velocity Downstream	11.58	ft/s	Critical Slope	0.005079	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	CMP		Span	6.00	ft
Section Size	72 inch		Rise	6.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	1,407.65	ft	Upstream Velocity Head	2.08	ft
Ke	0.50		Entrance Loss	1.04	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,406.41	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	84.8	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP880.29

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	1,516.75	cfs	Allowable HW Elevation	1,407.65	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.71	US
Low Point	1,405.43	ft	Headwater Elevation	1,407.65	ft
Discharge Coefficient (Cr)	2.71		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,404.22	ft			

Sta (ft)	Elev. (ft)
0.00	1,416.72
1,583.00	1,410.52
2,680.00	1,405.43

Culvert Analysis Report
MP882.15

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	195.93	cfs	Allowable HW Elevation	1,370.63	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.60	US
Low Point	1,369.73	ft	Headwater Elevation	1,370.63	ft
Discharge Coefficient (Cr)	2.60		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,366.20	ft			

Sta (ft)	Elev. (ft)
0.00	1,377.86
1,263.00	1,372.76
2,096.00	1,369.73

Culvert Analysis Report
MP882.37

Comments: Existing Culvert at MP882.37, EEC Structure 26

Analysis Component			
Storm Event	Design	Discharge	400.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	400.00 cfs	Check Discharge	600.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	400.00 cfs	Bottom Elevation	1,356.82 ft
Depth	3.60 ft	Velocity	4.56 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-58 x 36 inch Arch	294.47 cfs	1,365.54 ft	12.96 ft/s
Weir	Roadway	105.74 cfs	1,365.54 ft	N/A
Total	————	400.21 cfs	1,365.54 ft	N/A

Culvert Analysis Report
MP882.37

omponent:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,365.54	ft	Discharge	294.47	cfs
Inlet Control HW Elev.	1,365.15	ft	Tailwater Elevation	1,360.42	ft
Outlet Control HW Elev.	1,365.54	ft	Control Type	Outlet Control	
Headwater Depth/Height	2.87				

Grades					
Upstream Invert	1,356.94	ft	Downstream Invert	1,356.82	ft
Length	24.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	3.60	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	2.79	ft
Velocity Downstream	12.96	ft/s	Critical Slope	0.043143	ft/ft

Section					
Section Shape	Arch		Mannings Coefficient	0.024	
Section Material	Aluminum Alloy CR 3x1 Corrugations Historic		Span	4.83	ft
Section Size	58 x 36 inch		Rise	3.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	1,365.54	ft	Upstream Velocity Head	2.61	ft
Ke	0.50		Entrance Loss	1.31	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,365.15	ft	Flow Control	N/A	
Inlet Type	18 inch CR structural plate, No bevels		Area Full	22.7	ft^2
K	0.00880		HDS 5 Chart	35	
M	2.00000		HDS 5 Scale	2	
C	0.03680		Equation Form	1	
Y	0.68000				

Culvert Analysis Report
MP882.37

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	105.74	cfs	Allowable HW Elevation	1,365.54	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.57	US
Low Point	1,364.87	ft	Headwater Elevation	1,365.54	ft
Discharge Coefficient (Cr)	2.57		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,360.42	ft			

Sta (ft)	Elev. (ft)
0.00	1,372.76
833.00	1,369.73
2,354.00	1,364.87

Culvert Analysis Report
MP882.66

Comments: UPRR New Culvert at MP882.66, EEC Structure 27

Analysis Component			
Storm Event	Design	Discharge	400.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	400.00 cfs	Check Discharge	600.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	400.00 cfs	Bottom Elevation	1,352.70 ft
Depth	3.21 ft	Velocity	4.48 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	3-60 inch Circular	400.06 cfs	1,358.49 ft	9.97 ft/s
Weir	Roadway	0.00 cfs	1,358.49 ft	N/A
Total	————	400.06 cfs	1,358.49 ft	N/A

Culvert Analysis Report
MP882.66

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,358.49	ft	Discharge	400.06	cfs
Inlet Control HW Elev.	1,358.11	ft	Tailwater Elevation	1,355.91	ft
Outlet Control HW Elev.	1,358.49	ft	Control Type	Entrance Control	
Headwater Depth/Height	1.10				

Grades					
Upstream Invert	1,353.00	ft	Downstream Invert	1,352.70	ft
Length	75.00	ft	Constructed Slope	0.004000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	3.22	ft
Slope Type	Steep		Normal Depth	3.22	ft
Flow Regime	Supercritical		Critical Depth	3.31	ft
Velocity Downstream	9.97	ft/s	Critical Slope	0.003719	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	CMP		Span	5.00	ft
Section Size	60 inch		Rise	5.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	1,358.49	ft	Upstream Velocity Head	1.46	ft
Ke	0.50		Entrance Loss	0.73	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,358.11	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	58.9	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP882.66

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.00	cfs	Allowable HW Elevation	1,358.49	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.50	US
Low Point	1,359.58	ft	Headwater Elevation	N/A	ft
Discharge Coefficient (Cr)	2.50		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,355.91	ft			

Sta (ft)	Elev. (ft)
0.00	1,369.73
1,521.00	1,364.87
2,979.00	1,359.58

Culvert Analysis Report
MP882.91

Comments: Existing Structure at MP882.91, EEC Structure 28

Analysis Component			
Storm Event	Design	Discharge	1,000.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	1,000.00 cfs	Check Discharge	1,500.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	1,000.00 cfs	Bottom Elevation	1,348.54 ft
Depth	5.26 ft	Velocity	5.76 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1- 12 x 2.3 ft Box	245.96 cfs	1,355.94 ft	8.91 ft/s
Weir	Roadway	753.52 cfs	1,355.94 ft	N/A
Total	————	999.48 cfs	1,355.94 ft	N/A

Culvert Analysis Report
MP882.91

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,355.94	ft	Discharge	245.96	cfs
Inlet Control HW Elev.	1,353.80	ft	Tailwater Elevation	1,353.80	ft
Outlet Control HW Elev.	1,355.94	ft	Control Type	Outlet Control	
Headwater Depth/Height	3.17				

Grades					
Upstream Invert	1,348.66	ft	Downstream Invert	1,348.54	ft
Length	24.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	5.26	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	2.30	ft
Velocity Downstream	8.91	ft/s	Critical Slope	0.012220	ft/ft

Section					
Section Shape	Box		Mannings Coefficient	0.018	
Section Material	Concrete		Span	12.00	ft
Section Size	12 x 2.3 ft		Rise	2.30	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	1,355.94	ft	Upstream Velocity Head	1.23	ft
Ke	0.50		Entrance Loss	0.62	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,353.80	ft	Flow Control	N/A	
Inlet Type	90 and 15° wingwall flares		Area Full	27.6	ft²
K	0.06100		HDS 5 Chart	8	
M	0.75000		HDS 5 Scale	2	
C	0.04000		Equation Form	1	
Y	0.80000				

Culvert Analysis Report
MP882.91

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	753.52	cfs	Allowable HW Elevation	1,355.94	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.68	US
Low Point	1,354.16	ft	Headwater Elevation	1,355.94	ft
Discharge Coefficient (Cr)	2.68		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,353.80	ft			

Sta (ft)	Elev. (ft)
0.00	1,364.87
1,458.00	1,359.58
2,474.00	1,354.16

Culvert Analysis Report
MP883.25

Comments: UPRR New Culvert at MP883.25, EEC Structure 29

Analysis Component			
Storm Event	Design	Discharge	1,200.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	1,200.00 cfs	Check Discharge	1,500.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	1,200.00 cfs	Bottom Elevation	1,338.00 ft
Depth	5.44 ft	Velocity	6.00 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	3-60 inch Circular	701.04 cfs	1,347.26 ft	11.90 ft/s
Weir	Roadway	499.42 cfs	1,347.26 ft	N/A
Total	————	1,200.46 cfs	1,347.26 ft	N/A

Culvert Analysis Report
MP883.25

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,347.26	ft	Discharge	701.04	cfs
Inlet Control HW Elev.	1,347.20	ft	Tailwater Elevation	1,343.44	ft
Outlet Control HW Elev.	1,347.26	ft	Control Type	Outlet Control	
Headwater Depth/Height	1.77				

Grades					
Upstream Invert	1,338.40	ft	Downstream Invert	1,338.00	ft
Length	75.00	ft	Constructed Slope	0.005333	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	5.44	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	4.31	ft
Velocity Downstream	11.90	ft/s	Critical Slope	0.006327	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	CMP		Span	5.00	ft
Section Size	60 inch		Rise	5.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	1,347.26	ft	Upstream Velocity Head	2.20	ft
Ke	0.50		Entrance Loss	1.10	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,347.20	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	58.9	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP883.25

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	499.42	cfs	Allowable HW Elevation	1,347.26	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.64	US
Low Point	1,345.83	ft	Headwater Elevation	1,347.26	ft
Discharge Coefficient (Cr)	2.64		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,343.44	ft			

Sta (ft)	Elev. (ft)
0.00	1,359.58
1,016.00	1,354.16
2,847.00	1,345.83

Culvert Analysis Report
MP883.46

Comments: UPRR New Structure at MP883.46, EEC Structure 30

Analysis Component			
Storm Event	Design	Discharge	2,000.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	2,000.00 cfs	Check Discharge	2,500.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	2,000.00 cfs	Bottom Elevation	1,334.60 ft
Depth	4.25 ft	Velocity	6.12 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	3-20 x 2.3 ft Box	1,567.83 cfs	1,342.29 ft	11.36 ft/s
Weir	Roadway	431.64 cfs	1,342.29 ft	N/A
Total	————	1,999.47 cfs	1,342.29 ft	N/A

Culvert Analysis Report
MP883.46

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	1,342.29 ft	Discharge	1,567.83 cfs
Inlet Control HW Elev.	1,341.60 ft	Tailwater Elevation	1,338.85 ft
Outlet Control HW Elev.	1,342.29 ft	Control Type	Outlet Control
Headwater Depth/Height	3.34		

Grades			
Upstream Invert	1,334.60 ft	Downstream Invert	1,334.50 ft
Length	24.00 ft	Constructed Slope	0.004167 ft/ft

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	4.35 ft
Slope Type	N/A	Normal Depth	N/A ft
Flow Regime	N/A	Critical Depth	2.30 ft
Velocity Downstream	11.36 ft/s	Critical Slope	0.018176 ft/ft

Section			
Section Shape	Box	Mannings Coefficient	0.018
Section Material	Concrete	Span	20.00 ft
Section Size	20 x 2.3 ft	Rise	2.30 ft
Number Sections	3		

Outlet Control Properties			
Outlet Control HW Elev.	1,342.29 ft	Upstream Velocity Head	2.01 ft
Ke	0.50	Entrance Loss	1.00 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,341.60 ft	Flow Control	N/A
Inlet Type	90 and 15° wingwall flares	Area Full	138.0 ft²
K	0.06100	HDS 5 Chart	8
M	0.75000	HDS 5 Scale	2
C	0.04000	Equation Form	1
Y	0.80000		

Culvert Analysis Report
MP883.46

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	431.64	cfs	Allowable HW Elevation	1,342.29	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.64	US
Low Point	1,340.97	ft	Headwater Elevation	1,342.29	ft
Discharge Coefficient (Cr)	2.64		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,338.85	ft			

Sta (ft)	Elev. (ft)
0.00	1,354.16
1,831.00	1,345.83
2,954.00	1,340.97

Culvert Analysis Report
MP884

Comments: UPRR New Culvert at MP844, EEC Structure 31

Analysis Component			
Storm Event	Design	Discharge	2,000.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	2,000.00 cfs	Check Discharge	2,500.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	2,000.00 cfs	Bottom Elevation	1,322.30 ft
Depth	6.60 ft	Velocity	6.82 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	3-72 inch Circular	1,025.96 cfs	1,332.67 ft	12.10 ft/s
Weir	Roadway	974.84 cfs	1,332.68 ft	N/A
Total	————	2,000.80 cfs	1,332.67 ft	N/A

Culvert Analysis Report
MP884

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	1,332.55 ft	Discharge	1,025.96 cfs
Inlet Control HW Elev.	1,332.17 ft	Tailwater Elevation	1,328.90 ft
Outlet Control HW Elev.	1,332.55 ft	Control Type	Outlet Control
Headwater Depth/Height	1.67		

Grades			
Upstream Invert	1,322.50 ft	Downstream Invert	1,322.30 ft
Length	65.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	6.60 ft
Slope Type	N/A	Normal Depth	5.28 ft
Flow Regime	N/A	Critical Depth	5.02 ft
Velocity Downstream	12.10 ft/s	Critical Slope	0.005365 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.012
Section Material	CMP	Span	6.00 ft
Section Size	72 inch	Rise	6.00 ft
Number Sections	3		

Outlet Control Properties			
Outlet Control HW Elev.	1,332.55 ft	Upstream Velocity Head	2.27 ft
Ke	0.50	Entrance Loss	1.14 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,332.17 ft	Flow Control	N/A
Inlet Type	Headwall	Area Full	84.8 ft^2
K	0.00780	HDS 5 Chart	2
M	2.00000	HDS 5 Scale	1
C	0.03790	Equation Form	1
Y	0.69000		

Culvert Analysis Report
MP884

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	974.84	cfs	Allowable HW Elevation	1,332.68	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.67	US
Low Point	1,330.99	ft	Headwater Elevation	1,332.67	ft
Discharge Coefficient (Cr)	2.67		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,328.90	ft			

Sta (ft)	Elev. (ft)
0.00	1,345.83
1,123.00	1,340.97
3,923.00	1,330.99

Culvert Analysis Report
MP884.39

Comments: UPRR New Culvert at MP844.39, EEC Structure 32

Analysis Component			
Storm Event	Design	Discharge	1,000.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	1,000.00 cfs	Check Discharge	1,500.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	1,000.00 cfs	Bottom Elevation	1,314.90 ft
Depth	4.76 ft	Velocity	5.68 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	3-72 inch Circular	999.95 cfs	1,324.69 ft	13.32 ft/s
Weir	Roadway	0.00 cfs	1,324.69 ft	N/A
Total	————	999.95 cfs	1,324.69 ft	N/A

Culvert Analysis Report
MP884.39

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	1,324.69 ft	Discharge	999.95 cfs
Inlet Control HW Elev.	1,324.69 ft	Tailwater Elevation	1,319.66 ft
Outlet Control HW Elev.	1,324.36 ft	Control Type	Inlet Control
Headwater Depth/Height	1.57		

Grades			
Upstream Invert	1,315.30 ft	Downstream Invert	1,314.98 ft
Length	65.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	M2	Depth, Downstream	4.96 ft
Slope Type	Mild	Normal Depth	5.08 ft
Flow Regime	Subcritical	Critical Depth	4.96 ft
Velocity Downstream	13.32 ft/s	Critical Slope	0.005191 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.012
Section Material	CMP	Span	6.00 ft
Section Size	72 inch	Rise	6.00 ft
Number Sections	3		

Outlet Control Properties			
Outlet Control HW Elev.	1,324.36 ft	Upstream Velocity Head	2.67 ft
Ke	0.50	Entrance Loss	1.33 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,324.69 ft	Flow Control	N/A
Inlet Type	Headwall	Area Full	84.8 ft^2
K	0.00780	HDS 5 Chart	2
M	2.00000	HDS 5 Scale	1
C	0.03790	Equation Form	1
Y	0.69000		

Culvert Analysis Report
MP884.39

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.00	cfs	Allowable HW Elevation	1,324.69	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.50	US
Low Point	1,324.82	ft	Headwater Elevation	N/A	ft
Discharge Coefficient (Cr)	2.50		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,319.66	ft			

Sta (ft)	Elev. (ft)
0.00	1,340.97
2,184.00	1,330.99
4,984.00	1,324.82

Culvert Analysis Report
MP884.5

Comments: UPRR New Structure at MP884.5, EEC Structure 33

Analysis Component			
Storm Event	Design	Discharge	3,000.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	3,000.00 cfs	Check Discharge	3,500.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	3,000.00 cfs	Bottom Elevation	1,315.90 ft
Depth	5.44 ft	Velocity	7.00 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	3-30 x 1.7 ft Box	1,762.13 cfs	1,324.72 ft	11.45 ft/s
Weir	Roadway	1,238.84 cfs	1,324.72 ft	N/A
Total	----------	3,000.96 cfs	1,324.72 ft	N/A

Culvert Analysis Report
MP884.5

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,324.72	ft	Discharge	1,762.13	cfs
Inlet Control HW Elev.	1,322.71	ft	Tailwater Elevation	1,321.34	ft
Outlet Control HW Elev.	1,324.72	ft	Control Type	Outlet Control	
Headwater Depth/Height	5.04				

Grades					
Upstream Invert	1,316.10	ft	Downstream Invert	1,315.98	ft
Length	24.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	5.36	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	1.71	ft
Velocity Downstream	11.45	ft/s	Critical Slope	0.013314	ft/ft

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	30.00	ft
Section Size	30 x 1.7 ft		Rise	1.71	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	1,324.72	ft	Upstream Velocity Head	2.04	ft
Ke	0.50		Entrance Loss	1.02	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,322.71	ft	Flow Control	N/A	
Inlet Type	90 and 15° wingwall flares		Area Full	153.9	ft²
K	0.06100		HDS 5 Chart	8	
M	0.75000		HDS 5 Scale	2	
C	0.04000		Equation Form	1	
Y	0.80000				

Culvert Analysis Report
MP884.5

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	1,238.84	cfs	Allowable HW Elevation	1,324.72	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.68	US
Low Point	1,322.88	ft	Headwater Elevation	1,324.72	ft
Discharge Coefficient (Cr)	2.68		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,321.34	ft			

Sta (ft)	Elev. (ft)
0.00	1,330.99
2,800.00	1,324.82
3,354.00	1,322.88

Culvert Analysis Report
MP884.73

Comments: UPRR New Culvert at MP884.73, EEC Structure 34

Analysis Component			
Storm Event	Design	Discharge	500.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	500.00 cfs	Check Discharge	700.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.

Discharge	500.00 cfs	Bottom Elevation	1,311.80 ft
Depth	4.17 ft	Velocity	4.85 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-48 inch Circular	267.95 cfs	1,319.16 ft	10.66 ft/s
Weir	Roadway	232.34 cfs	1,319.16 ft	N/A
Total	————	500.28 cfs	1,319.16 ft	N/A

Culvert Analysis Report
MP884.73

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	1,319.16 ft	Discharge	267.95 cfs
Inlet Control HW Elev.	1,319.16 ft	Tailwater Elevation	1,315.97 ft
Outlet Control HW Elev.	1,319.07 ft	Control Type	Inlet Control
Headwater Depth/Height	1.76		

Grades			
Upstream Invert	1,312.10 ft	Downstream Invert	1,311.80 ft
Length	60.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	4.17 ft
Slope Type	N/A	Normal Depth	N/A ft
Flow Regime	N/A	Critical Depth	3.45 ft
Velocity Downstream	10.66 ft/s	Critical Slope	0.006831 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.012
Section Material	CMP	Span	4.00 ft
Section Size	48 inch	Rise	4.00 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	1,319.07 ft	Upstream Velocity Head	1.77 ft
Ke	0.50	Entrance Loss	0.88 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,319.16 ft	Flow Control	N/A
Inlet Type	Headwall	Area Full	25.1 ft^2
K	0.00780	HDS 5 Chart	2
M	2.00000	HDS 5 Scale	1
C	0.03790	Equation Form	1
Y	0.69000		

Culvert Analysis Report
MP880.45

Comments: Existing Structure at MP880.45, EEC Structure 19

Analysis Component			
Storm Event	Design	Discharge	400.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	400.00 cfs	Check Discharge	600.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	400.00 cfs	Bottom Elevation	1,397.13 ft
Depth	3.43 ft	Velocity	4.53 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-12 x 1.8 ft Box	198.72 cfs	1,402.95 ft	9.20 ft/s
Weir	Roadway	201.56 cfs	1,402.95 ft	N/A
Total	----------	400.29 cfs	1,402.95 ft	N/A

Culvert Analysis Report
MP880.45

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,402.95	ft	Discharge	198.72	cfs
Inlet Control HW Elev.	1,402.07	ft	Tailwater Elevation	1,400.56	ft
Outlet Control HW Elev.	1,402.95	ft	Control Type	Outlet Control	
Headwater Depth/Height	3.17				

Grades					
Upstream Invert	1,397.25	ft	Downstream Invert	1,397.13	ft
Length	24.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	3.43	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	1.80	ft
Velocity Downstream	9.20	ft/s	Critical Slope	0.017222	ft/ft

Section					
Section Shape	Box		Mannings Coefficient	0.018	
Section Material	Concrete		Span	12.00	ft
Section Size	12 x 1.8 ft		Rise	1.80	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	1,402.95	ft	Upstream Velocity Head	1.32	ft
Ke	0.50		Entrance Loss	0.66	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,402.07	ft	Flow Control	N/A	
Inlet Type	90 and 15° wingwall flares		Area Full	21.6	ft^2
K	0.06100		HDS 5 Chart	8	
M	0.75000		HDS 5 Scale	2	
C	0.04000		Equation Form	1	
Y	0.80000				

Culvert Analysis Report
MP880.45

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	201.56	cfs	Allowable HW Elevation	1,402.95	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.60	US
Low Point	1,402.00	ft	Headwater Elevation	1,402.95	ft
Discharge Coefficient (Cr)	2.60		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,400.56	ft			

Sta (ft)	Elev. (ft)
0.00	1,410.52
1,097.00	1,405.43
1,955.00	1,402.00

Culvert Analysis Report
MP880.88

Comments: UPRR New Culvert at MP880.88, EEC Structure 20

Analysis Component			
Storm Event	Design	Discharge	2,500.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	2,500.00 cfs	Check Discharge	3,000.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	2,500.00 cfs	Bottom Elevation	1,386.50 ft
Depth	7.14 ft	Velocity	7.21 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-60 inch Circular	444.66 cfs	1,397.00 ft	11.32 ft/s
Culvert-2	2-60 inch Circular	385.20 cfs	1,397.00 ft	9.81 ft/s
Weir	Roadway	1,669.14 cfs	1,397.00 ft	N/A
Total	————	2,499.01 cfs	1,397.00 ft	N/A

Culvert Analysis Report
MP880.88

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,397.00	ft	Discharge	444.66	cfs
Inlet Control HW Elev.	1,395.20	ft	Tailwater Elevation	1,393.64	ft
Outlet Control HW Elev.	1,397.00	ft	Control Type	Outlet Control	
Headwater Depth/Height	2.02				

Grades					
Upstream Invert	1,386.90	ft	Downstream Invert	1,386.60	ft
Length	60.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	7.04	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	4.23	ft
Velocity Downstream	11.32	ft/s	Critical Slope	0.005895	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	CMP		Span	5.00	ft
Section Size	60 inch		Rise	5.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	1,397.00	ft	Upstream Velocity Head	1.99	ft
Ke	0.50		Entrance Loss	1.00	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,395.20	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	39.3	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP880.88

Component:Culvert-2

Culvert Summary					
Computed Headwater Elevation	1,397.00	ft	Discharge	385.20	cfs
Inlet Control HW Elev.	1,393.98	ft	Tailwater Elevation	1,393.64	ft
Outlet Control HW Elev.	1,397.00	ft	Control Type	Outlet Control	
Headwater Depth/Height	2.02				

Grades					
Upstream Invert	1,386.90	ft	Downstream Invert	1,386.60	ft
Length	60.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	7.04	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	3.97	ft
Velocity Downstream	9.81	ft/s	Critical Slope	0.019824	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	5.00	ft
Section Size	60 inch		Rise	5.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	1,397.00	ft	Upstream Velocity Head	1.50	ft
Ke	0.50		Entrance Loss	0.75	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,393.98	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	39.3	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP880.88

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	1,669.14	cfs	Allowable HW Elevation	1,397.00	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.69	US
Low Point	1,395.04	ft	Headwater Elevation	1,397.00	ft
Discharge Coefficient (Cr)	2.69		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,393.64	ft			

Sta (ft)	Elev. (ft)
0.00	1,405.43
858.00	1,402.00
3,118.00	1,395.04

Culvert Analysis Report
MP881.2

Comments: UPRR New Culvert at MP881.2, EEC Structure 21

Analysis Component			
Storm Event	Design	Discharge	1,500.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	1,500.00 cfs	Check Discharge	1,800.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	1,500.00 cfs	Bottom Elevation	1,381.70 ft
Depth	6.03 ft	Velocity	6.36 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	3-60 inch Circular	717.39 cfs	1,391.65 ft	12.18 ft/s
Weir	Roadway	783.44 cfs	1,391.65 ft	N/A
Total	————	1,500.83 cfs	1,391.65 ft	N/A

Culvert Analysis Report
MP881.2

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,391.65	ft	Discharge	717.39	cfs
Inlet Control HW Elev.	1,391.16	ft	Tailwater Elevation	1,387.73	ft
Outlet Control HW Elev.	1,391.65	ft	Control Type	Outlet Control	
Headwater Depth/Height	1.91				

Grades					
Upstream Invert	1,382.10	ft	Downstream Invert	1,381.70	ft
Length	65.00	ft	Constructed Slope	0.006154	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	6.03	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	4.35	ft
Velocity Downstream	12.18	ft/s	Critical Slope	0.006549	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	CMP		Span	5.00	ft
Section Size	60 inch		Rise	5.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	1,391.65	ft	Upstream Velocity Head	2.31	ft
Ke	0.50		Entrance Loss	1.15	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,391.16	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	58.9	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP881.2

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	783.44	cfs	Allowable HW Elevation	1,391.65	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.63	US
Low Point	1,390.41	ft	Headwater Elevation	1,391.65	ft
Discharge Coefficient (Cr)	2.63		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,387.73	ft			

Sta (ft)	Elev. (ft)
0.00	1,402.00
1,639.00	1,395.04
3,899.00	1,390.41

Culvert Analysis Report
MP881.45

Comments: UPRR New Culvert at MP881.45, EEC Structure 22

Analysis Component			
Storm Event	Design	Discharge	1,000.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	1,000.00 cfs	Check Discharge	1,500.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	1,000.00 cfs	Bottom Elevation	1,377.80 ft
Depth	5.26 ft	Velocity	5.76 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	3-48 inch Circular	425.29 cfs	1,386.52 ft	11.28 ft/s
Weir	Roadway	575.25 cfs	1,386.52 ft	N/A
Total	----------	1,000.55 cfs	1,386.52 ft	N/A

Culvert Analysis Report
MP881.45

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	1,386.52 ft	Discharge	425.29 cfs
Inlet Control HW Elev.	1,385.67 ft	Tailwater Elevation	1,383.06 ft
Outlet Control HW Elev.	1,386.52 ft	Control Type	Outlet Control
Headwater Depth/Height	2.11		

Grades			
Upstream Invert	1,378.10 ft	Downstream Invert	1,377.80 ft
Length	60.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	5.26 ft
Slope Type	N/A	Normal Depth	N/A ft
Flow Regime	N/A	Critical Depth	3.53 ft
Velocity Downstream	11.28 ft/s	Critical Slope	0.007453 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.012
Section Material	CMP	Span	4.00 ft
Section Size	48 inch	Rise	4.00 ft
Number Sections	3		

Outlet Control Properties			
Outlet Control HW Elev.	1,386.52 ft	Upstream Velocity Head	1.98 ft
Ke	0.50	Entrance Loss	0.99 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,385.67 ft	Flow Control	N/A
Inlet Type	Headwall	Area Full	37.7 ft^2
K	0.00780	HDS 5 Chart	2
M	2.00000	HDS 5 Scale	1
C	0.03790	Equation Form	1
Y	0.69000		

Culvert Analysis Report
MP881.45

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	575.25	cfs	Allowable HW Elevation	1,386.52	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.64	US
Low Point	1,385.11	ft	Headwater Elevation	1,386.52	ft
Discharge Coefficient (Cr)	2.64		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,383.06	ft			

Sta (ft)	Elev. (ft)
0.00	1,395.04
1,639.00	1,390.41
3,011.00	1,385.11

Culvert Analysis Report
MP881.75

Comments: UPRR New Culvert at MP881.75, EEC Structure 23

Analysis Component			
Storm Event	Design	Discharge	600.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	600.00 cfs	Check Discharge	800.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	600.00 cfs	Bottom Elevation	1,371.20 ft
Depth	4.16 ft	Velocity	5.04 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	3-48 inch Circular	414.17 cfs	1,378.82 ft	10.99 ft/s
Weir	Roadway	186.07 cfs	1,378.83 ft	N/A
Total	————	600.25 cfs	1,378.82 ft	N/A

Culvert Analysis Report
MP881.75

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,378.83	ft	Discharge	414.17	cfs
Inlet Control HW Elev.	1,378.83	ft	Tailwater Elevation	1,375.36	ft
Outlet Control HW Elev.	1,378.68	ft	Control Type	Inlet Control	
Headwater Depth/Height	1.83				

Grades					
Upstream Invert	1,371.50	ft	Downstream Invert	1,371.20	ft
Length	65.00	ft	Constructed Slope	0.004615	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	4.16	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	3.49	ft
Velocity Downstream	10.99	ft/s	Critical Slope	0.007148	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	CMP		Span	4.00	ft
Section Size	48 inch		Rise	4.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	1,378.68	ft	Upstream Velocity Head	1.88	ft
Ke	0.50		Entrance Loss	0.94	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,378.83	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	37.7	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP881.75

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	186.07	cfs	Allowable HW Elevation	1,378.83	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.60	US
Low Point	1,377.86	ft	Headwater Elevation	1,378.83	ft
Discharge Coefficient (Cr)	2.60		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,375.36	ft			

Sta (ft)	Elev. (ft)
0.00	1,390.41
1,372.00	1,385.11
2,974.00	1,377.86

Culvert Analysis Report
MP881.99

Comments: UPRR New Culvert at MP881.00, EEC Structure 23

Analysis Component			
Storm Event	Design	Discharge	600.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	600.00 cfs	Check Discharge	800.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	600.00 cfs	Bottom Elevation	1,363.60 ft
Depth	4.16 ft	Velocity	5.04 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-72 inch Circular	599.96 cfs	1,372.30 ft	12.93 ft/s
Weir	Roadway	0.00 cfs	1,372.30 ft	N/A
Total	————	599.96 cfs	1,372.30 ft	N/A

Culvert Analysis Report
MP881.99

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	1,372.30 ft	Discharge	599.96 cfs
Inlet Control HW Elev.	1,372.29 ft	Tailwater Elevation	1,367.76 ft
Outlet Control HW Elev.	1,372.30 ft	Control Type	Entrance Control
Headwater Depth/Height	1.40		

Grades			
Upstream Invert	1,363.90 ft	Downstream Invert	1,363.60 ft
Length	60.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	4.59 ft
Slope Type	Steep	Normal Depth	4.56 ft
Flow Regime	Supercritical	Critical Depth	4.73 ft
Velocity Downstream	12.93 ft/s	Critical Slope	0.004602 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.012
Section Material	CMP	Span	6.00 ft
Section Size	72 inch	Rise	6.00 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	1,372.30 ft	Upstream Velocity Head	2.44 ft
Ke	0.50	Entrance Loss	1.22 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,372.29 ft	Flow Control	N/A
Inlet Type	Headwall	Area Full	56.5 ft^2
K	0.00780	HDS 5 Chart	2
M	2.00000	HDS 5 Scale	1
C	0.03790	Equation Form	1
Y	0.69000		

Culvert Analysis Report
MP881.99

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.00	cfs	Allowable HW Elevation	1,372.30	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.50	US
Low Point	1,372.76	ft	Headwater Elevation	N/A	ft
Discharge Coefficient (Cr)	2.50		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,367.76	ft			

Sta (ft)	Elev. (ft)
0.00	1,385.11
1,602.00	1,377.86
2,865.00	1,372.76

Culvert Analysis Report
MP882.15

Comments: Existing Culvert at MP882.15, EEC Structure 25

Analysis Component			
Storm Event	Design	Discharge	500.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	500.00 cfs	Check Discharge	600.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	500.00 cfs	Bottom Elevation	1,362.21 ft
Depth	3.99 ft	Velocity	4.83 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-48 inch Circular	304.24 cfs	1,370.63 ft	12.11 ft/s
Weir	Roadway	195.93 cfs	1,370.63 ft	N/A
Total	————	500.17 cfs	1,370.63 ft	N/A

Culvert Analysis Report
MP882.15

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,370.63	ft	Discharge	304.24	cfs
Inlet Control HW Elev.	1,370.63	ft	Tailwater Elevation	1,366.20	ft
Outlet Control HW Elev.	1,370.53	ft	Control Type	Inlet Control	
Headwater Depth/Height	2.08				

Grades					
Upstream Invert	1,362.33	ft	Downstream Invert	1,362.21	ft
Length	24.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	3.99	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	3.61	ft
Velocity Downstream	12.11	ft/s	Critical Slope	0.033565	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	4.00	ft
Section Size	48 inch		Rise	4.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	1,370.53	ft	Upstream Velocity Head	2.28	ft
Ke	0.50		Entrance Loss	1.14	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,370.63	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	25.1	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP884.73

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	232.34	cfs	Allowable HW Elevation	1,319.16	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.61	US
Low Point	1,318.14	ft	Headwater Elevation	1,319.16	ft
Discharge Coefficient (Cr)	2.61		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,315.97	ft			

Sta (ft)	Elev. (ft)
0.00	1,324.82
554.00	1,322.88
1,697.00	1,318.14

Culvert Analysis Report
MP884.97

Comments: UPRR New Culvert at MP884.97, EEC Structure 35

Analysis Component			
Storm Event	Design	Discharge	600.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	600.00 cfs	Check Discharge	750.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	600.00 cfs	Bottom Elevation	1,306.30 ft
Depth	4.16 ft	Velocity	5.04 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	3-48 inch Circular	415.71 cfs	1,313.96 ft	11.03 ft/s
Weir	Roadway	184.50 cfs	1,313.96 ft	N/A
Total	————	600.21 cfs	1,313.96 ft	N/A

Culvert Analysis Report
MP884.97

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,313.96	ft	Discharge	415.71	cfs
Inlet Control HW Elev.	1,313.96	ft	Tailwater Elevation	1,310.46	ft
Outlet Control HW Elev.	1,313.77	ft	Control Type	Inlet Control	
Headwater Depth/Height	1.84				

Grades					
Upstream Invert	1,306.60	ft	Downstream Invert	1,306.30	ft
Length	60.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	4.16	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	3.50	ft
Velocity Downstream	11.03	ft/s	Critical Slope	0.007189	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	CMP		Span	4.00	ft
Section Size	48 inch		Rise	4.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	1,313.77	ft	Upstream Velocity Head	1.89	ft
Ke	0.50		Entrance Loss	0.94	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,313.96	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	37.7	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP884.97

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	184.50	cfs	Allowable HW Elevation	1,313.96	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.59	US
Low Point	1,313.07	ft	Headwater Elevation	1,313.96	ft
Discharge Coefficient (Cr)	2.59		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,310.46	ft			

Sta (ft)	Elev. (ft)
0.00	1,322.88
1,143.00	1,318.14
2,513.00	1,313.07

Culvert Analysis Report
MP885.29

Comments: UPRR New Culvert at MP885.29, EEC Structure 36

Analysis Component			
Storm Event	Design	Discharge	1,000.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	1,000.00 cfs	Check Discharge	1,500.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	1,000.00 cfs	Bottom Elevation	1,301.80 ft
Depth	5.26 ft	Velocity	5.76 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	3-48 inch Circular	369.68 cfs	1,309.68 ft	9.81 ft/s
Weir	Roadway	629.67 cfs	1,309.68 ft	N/A
Total	————	999.35 cfs	1,309.68 ft	N/A

Culvert Analysis Report
MP885.29

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,309.68	ft	Discharge	369.68	cfs
Inlet Control HW Elev.	1,308.49	ft	Tailwater Elevation	1,307.06	ft
Outlet Control HW Elev.	1,309.68	ft	Control Type	Outlet Control	
Headwater Depth/Height	1.89				

Grades					
Upstream Invert	1,302.10	ft	Downstream Invert	1,301.80	ft
Length	60.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	5.26	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	3.34	ft
Velocity Downstream	9.81	ft/s	Critical Slope	0.006085	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	CMP		Span	4.00	ft
Section Size	48 inch		Rise	4.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	1,309.68	ft	Upstream Velocity Head	1.49	ft
Ke	0.50		Entrance Loss	0.75	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,308.49	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	37.7	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP885.29

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	629.67	cfs	Allowable HW Elevation	1,309.68	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.63	US
Low Point	1,308.40	ft	Headwater Elevation	1,309.68	ft
Discharge Coefficient (Cr)	2.63		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,307.06	ft			

Sta (ft)	Elev. (ft)
0.00	1,318.14
1,370.00	1,313.07
3,085.00	1,308.40

Culvert Analysis Report
MP885.53

Comments: UPRR New Culvert at MP885.53, EEC Structure 37

Analysis Component			
Storm Event	Design	Discharge	1,000.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	1,000.00 cfs	Check Discharge	1,500.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	1,000.00 cfs	Bottom Elevation	1,298.50 ft
Depth	5.26 ft	Velocity	5.76 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-48 inch Circular	132.96 cfs	1,306.81 ft	10.58 ft/s
Weir	Roadway	867.85 cfs	1,306.81 ft	N/A
Total	————	1,000.81 cfs	1,306.81 ft	N/A

Culvert Analysis Report
MP885.53

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,306.81	ft	Discharge	132.96	cfs
Inlet Control HW Elev.	1,305.79	ft	Tailwater Elevation	1,303.76	ft
Outlet Control HW Elev.	1,306.81	ft	Control Type	Outlet Control	
Headwater Depth/Height	2.00				

Grades					
Upstream Invert	1,298.80	ft	Downstream Invert	1,298.50	ft
Length	60.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	5.26	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	3.44	ft
Velocity Downstream	10.58	ft/s	Critical Slope	0.006755	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	CMP		Span	4.00	ft
Section Size	48 inch		Rise	4.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	1,306.81	ft	Upstream Velocity Head	1.74	ft
Ke	0.50		Entrance Loss	0.87	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,305.79	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	12.6	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP885.53

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	867.85	cfs	Allowable HW Elevation	1,306.81	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.63	US
Low Point	1,305.53	ft	Headwater Elevation	1,306.81	ft
Discharge Coefficient (Cr)	2.63		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,303.76	ft			

Sta (ft)	Elev. (ft)
0.00	1,313.07
1,715.00	1,308.40
3,168.00	1,305.53

Culvert Analysis Report
MP885.82

Comments: UPRR New Culvert at MP885.82, EEC Structure 38

Analysis Component			
Storm Event	Design	Discharge	4,000.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	4,000.00 cfs	Check Discharge	4,500.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	4,000.00 cfs	Bottom Elevation	1,297.18 ft
Depth	5.43 ft	Velocity	7.24 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	4-20 x 2.1ft Box	1,839.26 cfs	1,305.67 ft	11.00 ft/s
Weir	Roadway	2,163.10 cfs	1,305.67 ft	N/A
Total	----------	4,002.36 cfs	1,305.67 ft	N/A

Culvert Analysis Report
MP885.82

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,305.67	ft	Discharge	1,839.26	cfs
Inlet Control HW Elev.	1,303.81	ft	Tailwater Elevation	1,302.61	ft
Outlet Control HW Elev.	1,305.67	ft	Control Type	Outlet Control	
Headwater Depth/Height	4.01				

Grades					
Upstream Invert	1,297.30	ft	Downstream Invert	1,297.18	ft
Length	24.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	5.43	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	2.09	ft
Velocity Downstream	11.00	ft/s	Critical Slope	0.009972	ft/ft

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	20.00	ft
Section Size	20 x 2.1ft		Rise	2.09	ft
Number Sections	4				

Outlet Control Properties					
Outlet Control HW Elev.	1,305.67	ft	Upstream Velocity Head	1.88	ft
Ke	0.50		Entrance Loss	0.94	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,303.81	ft	Flow Control	N/A	
Inlet Type	90 and 15° wingwall flares		Area Full	167.2	ft²
K	0.06100		HDS 5 Chart	8	
M	0.75000		HDS 5 Scale	2	
C	0.04000		Equation Form	1	
Y	0.80000				

Culvert Analysis Report
MP885.82

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	2,163.10	cfs	Allowable HW Elevation	1,305.67	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.66	US
Low Point	1,304.30	ft	Headwater Elevation	1,305.67	ft
Discharge Coefficient (Cr)	2.66		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,302.61	ft			

Sta (ft)	Elev. (ft)
0.00	1,308.40
1,453.00	1,305.53
2,685.00	1,304.30

Culvert Analysis Report
MP885.98

Comments: UPRR existing culvert at MP 885.98, EEC Structure 39

Analysis Component			
Storm Event	Design	Discharge	1,500.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	1,500.00 cfs	Check Discharge	2,500.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	1,500.00 cfs	Bottom Elevation	1,298.53 ft
Depth	5.86 ft	Velocity	6.34 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-17 x 3 ft Box	230.64 cfs	1,304.89 ft	4.52 ft/s
Weir	Roadway	1,267.21 cfs	1,304.89 ft	N/A
Total	————	1,497.85 cfs	1,304.89 ft	N/A

Culvert Analysis Report
MP885.98

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,304.89	ft	Discharge	230.64	cfs
Inlet Control HW Elev.	1,304.39	ft	Tailwater Elevation	1,304.39	ft
Outlet Control HW Elev.	1,304.89	ft	Control Type	Outlet Control	
Headwater Depth/Height	2.08				

Grades					
Upstream Invert	1,298.65	ft	Downstream Invert	1,298.53	ft
Length	24.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	5.86	ft
Slope Type	N/A		Normal Depth	1.45	ft
Flow Regime	N/A		Critical Depth	1.79	ft
Velocity Downstream	4.52	ft/s	Critical Slope	0.002617	ft/ft

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	17.00	ft
Section Size	17 x 3 ft		Rise	3.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	1,304.89	ft	Upstream Velocity Head	0.32	ft
Ke	0.50		Entrance Loss	0.16	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,304.39	ft	Flow Control	N/A	
Inlet Type	45° wingwall flare, d=0.0430		Area Full	51.0	ft^2
K	0.51000		HDS 5 Chart	9	
M	0.66700		HDS 5 Scale	1	
C	0.03090		Equation Form	2	
Y	0.80000				

Culvert Analysis Report
MP885.98

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	1,267.21	cfs	Allowable HW Elevation	1,304.89	ft
Roadway Width	0.00	ft	Overtopping Coefficient	3.09	US
Low Point	1,304.30	ft	Headwater Elevation	1,304.89	ft
Discharge Coefficient (Cr)	3.09		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,304.39	ft			

Sta (ft)	Elev. (ft)
0.00	1,305.53
1,232.00	1,304.30
2,087.00	1,304.45

Culvert Analysis Report
MP886.22

Comments: UPRR New Culvert at MP886.22, EEC Structure 40

Analysis Component			
Storm Event	Design	Discharge	1,000.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	1,000.00 cfs	Check Discharge	1,500.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	1,000.00 cfs	Bottom Elevation	1,298.10 ft
Depth	4.91 ft	Velocity	5.71 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	4-48 inch Circular	388.48 cfs	1,304.64 ft	7.73 ft/s
Weir	Roadway	612.91 cfs	1,304.64 ft	N/A
Total	————	1,001.39 cfs	1,304.64 ft	N/A

Culvert Analysis Report
MP886.22

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,304.64	ft	Discharge	388.48	cfs
Inlet Control HW Elev.	1,303.40	ft	Tailwater Elevation	1,303.01	ft
Outlet Control HW Elev.	1,304.64	ft	Control Type	Outlet Control	
Headwater Depth/Height	1.56				

Grades					
Upstream Invert	1,298.40	ft	Downstream Invert	1,298.10	ft
Length	60.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	4.91	ft
Slope Type	N/A		Normal Depth	2.92	ft
Flow Regime	N/A		Critical Depth	2.99	ft
Velocity Downstream	7.73	ft/s	Critical Slope	0.004731	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	CMP		Span	4.00	ft
Section Size	48 inch		Rise	4.00	ft
Number Sections	4				

Outlet Control Properties					
Outlet Control HW Elev.	1,304.64	ft	Upstream Velocity Head	0.93	ft
Ke	0.50		Entrance Loss	0.46	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,303.40	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	50.3	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP886.22

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	612.91	cfs	Allowable HW Elevation	1,304.64	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.60	US
Low Point	1,304.30	ft	Headwater Elevation	1,304.64	ft
Discharge Coefficient (Cr)	2.60		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,303.01	ft			

Sta (ft)	Elev. (ft)
0.00	1,304.30
855.00	1,304.45
2,055.00	1,304.40

Culvert Analysis Report
MP886.57

Comments: UPRR New Culvert at MP 886.57, EEC Structure 41

Analysis Component			
Storm Event	Design	Discharge	500.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	500.00 cfs	Check Discharge	1,000.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-60 inch Circular	308.33 cfs	1,302.54 ft	11.01 ft/s
Weir	Roadway	191.23 cfs	1,302.54 ft	N/A
Total	----------	499.56 cfs	1,302.54 ft	N/A

Culvert Analysis Report
MP886.57

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	1,302.54 ft	Discharge	308.33 cfs
Inlet Control HW Elev.	1,302.18 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev.	1,302.54 ft	Control Type	Entrance Control
Headwater Depth/Height	1.21		

Grades			
Upstream Invert	1,296.50 ft	Downstream Invert	1,296.20 ft
Length	60.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	3.36 ft
Slope Type	Steep	Normal Depth	3.30 ft
Flow Regime	Supercritical	Critical Depth	3.56 ft
Velocity Downstream	11.01 ft/s	Critical Slope	0.004076 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.012
Section Material	CMP	Span	5.00 ft
Section Size	60 inch	Rise	5.00 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	1,302.54 ft	Upstream Velocity Head	1.65 ft
Ke	0.50	Entrance Loss	0.83 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,302.18 ft	Flow Control	N/A
Inlet Type	Headwall	Area Full	39.3 ft^2
K	0.00780	HDS 5 Chart	2
M	2.00000	HDS 5 Scale	1
C	0.03790	Equation Form	1
Y	0.69000		

Culvert Analysis Report
MP886.57

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	191.23	cfs	Allowable HW Elevation	1,302.54	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.57	US
Low Point	1,301.94	ft	Headwater Elevation	1,302.54	ft
Discharge Coefficient (Cr)	2.57		Submergence Factor (Kt)	1.00	
Tailwater Elevation	-9,999.00	ft			

Sta (ft)	Elev. (ft)
0.00	1,304.45
1,200.00	1,304.40
3,080.00	1,301.94

Culvert Analysis Report
MP886.81

Comments: UPRR New Culvert at MP886.81, EEC Structure 42

Analysis Component			
Storm Event	Design	Discharge	400.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	400.00 cfs	Check Discharge	800.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	400.00 cfs	Bottom Elevation	1,259.50 ft
Depth	4.29 ft	Velocity	4.62 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-36 inch Circular	71.55 cfs	1,301.74 ft	10.74 ft/s
Weir	Roadway	329.09 cfs	1,301.75 ft	N/A
Total	————	400.63 cfs	1,301.74 ft	N/A

Culvert Analysis Report
MP886.81

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,301.75	ft	Discharge	71.55	cfs
Inlet Control HW Elev.	1,301.75	ft	Tailwater Elevation	1,263.79	ft
Outlet Control HW Elev.	1,301.32	ft	Control Type	Inlet Control	
Headwater Depth/Height	1.98				

Grades					
Upstream Invert	1,295.80	ft	Downstream Invert	1,295.50	ft
Length	60.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	2.68	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	2.68	ft
Velocity Downstream	10.74	ft/s	Critical Slope	0.008694	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	CMP		Span	3.00	ft
Section Size	36 inch		Rise	3.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	1,301.32	ft	Upstream Velocity Head	1.59	ft
Ke	0.50		Entrance Loss	0.80	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,301.75	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	7.1	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP886.81

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	329.09	cfs	Allowable HW Elevation	1,301.75	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.56	US
Low Point	1,301.21	ft	Headwater Elevation	1,301.75	ft
Discharge Coefficient (Cr)	2.56		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,263.79	ft			

Sta (ft)	Elev. (ft)
0.00	1,304.40
1,880.00	1,301.94
3,146.00	1,301.21

Culvert Analysis Report
MP886.95

Comments: UPRR New Culvert at MP886.95, EEC Structure 43

Analysis Component			
Storm Event	Design	Discharge	600.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	600.00 cfs	Check Discharge	1,500.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	600.00 cfs	Bottom Elevation	1,294.20 ft
Depth	3.95 ft	Velocity	5.47 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	3-48 inch Circular	364.46 cfs	1,301.49 ft	10.91 ft/s
Weir	Roadway	236.56 cfs	1,301.49 ft	N/A
Total	————	601.02 cfs	1,301.49 ft	N/A

Culvert Analysis Report
MP886.95

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	1,301.49 ft	Discharge	364.46 cfs
Inlet Control HW Elev.	1,301.49 ft	Tailwater Elevation	1,298.15 ft
Outlet Control HW Elev.	1,301.23 ft	Control Type	Inlet Control
Headwater Depth/Height	1.57		

Grades			
Upstream Invert	1,295.20 ft	Downstream Invert	1,294.90 ft
Length	60.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	M2	Depth, Downstream	3.32 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	3.32 ft
Velocity Downstream	10.91 ft/s	Critical Slope	0.005975 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.012
Section Material	CMP	Span	4.00 ft
Section Size	48 inch	Rise	4.00 ft
Number Sections	3		

Outlet Control Properties			
Outlet Control HW Elev.	1,301.23 ft	Upstream Velocity Head	1.65 ft
Ke	0.50	Entrance Loss	0.82 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,301.49 ft	Flow Control	N/A
Inlet Type	Headwall	Area Full	37.7 ft^2
K	0.00780	HDS 5 Chart	2
M	2.00000	HDS 5 Scale	1
C	0.03790	Equation Form	1
Y	0.69000		

Culvert Analysis Report
MP886.95

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	236.56	cfs	Allowable HW Elevation	1,301.49	ft
Roadway Width	0.00	ft	Overtopping Coefficient	3.09	US
Low Point	1,301.21	ft	Headwater Elevation	1,301.49	ft
Discharge Coefficient (Cr)	3.09		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,298.15	ft			

Sta (ft)	Elev. (ft)
0.00	1,301.94
1,266.00	1,301.21
1,944.00	1,301.42

Culvert Analysis Report
MP887.19

Comments: UPRR New Culvert at MP887.19, EEC Structure 44

Analysis Component			
Storm Event	Design	Discharge	300.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	300.00 cfs	Check Discharge	600.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	300.00 cfs	Bottom Elevation	1,294.70 ft
Depth	3.65 ft	Velocity	4.67 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-36 inch Circular	64.36 cfs	1,300.76 ft	9.11 ft/s
Weir	Roadway	235.64 cfs	1,300.76 ft	N/A
Total	————	300.00 cfs	1,300.76 ft	N/A

Culvert Analysis Report
MP887.19

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,300.76	ft	Discharge	64.36	cfs
Inlet Control HW Elev.	1,300.20	ft	Tailwater Elevation	1,298.35	ft
Outlet Control HW Elev.	1,300.76	ft	Control Type	Outlet Control	
Headwater Depth/Height	1.92				

Grades					
Upstream Invert	1,295.00	ft	Downstream Invert	1,294.70	ft
Length	60.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	3.65	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	2.58	ft
Velocity Downstream	9.11	ft/s	Critical Slope	0.007367	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	CMP		Span	3.00	ft
Section Size	36 inch		Rise	3.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	1,300.76	ft	Upstream Velocity Head	1.29	ft
Ke	0.50		Entrance Loss	0.64	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,300.20	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	7.1	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP887.19

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	235.64	cfs	Allowable HW Elevation	1,300.76	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.56	US
Low Point	1,300.20	ft	Headwater Elevation	1,300.76	ft
Discharge Coefficient (Cr)	2.56		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,298.35	ft			

Sta (ft)	Elev. (ft)
0.00	1,301.21
678.00	1,301.42
2,040.00	1,300.20

Culvert Analysis Report
MP887.32

Comments: UPRR New Culvert at MP887.32, EEC Structure 45

Analysis Component			
Storm Event	Design	Discharge	400.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	400.00 cfs	Check Discharge	800.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	400.00 cfs	Bottom Elevation	1,292.20 ft
Depth	3.59 ft	Velocity	4.98 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-48 inch Circular	255.55 cfs	1,299.87 ft	11.26 ft/s
Weir	Roadway	144.81 cfs	1,299.87 ft	N/A
Total	————	400.36 cfs	1,299.87 ft	N/A

Culvert Analysis Report
MP887.32

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	1,299.87	ft	Discharge	255.55	cfs
Inlet Control HW Elev.	1,299.87	ft	Tailwater Elevation	1,295.79	ft
Outlet Control HW Elev.	1,299.48	ft	Control Type	Inlet Control	
Headwater Depth/Height	1.67				

Grades					
Upstream Invert	1,293.20	ft	Downstream Invert	1,292.90	ft
Length	60.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	M2		Depth, Downstream	3.39	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	3.39	ft
Velocity Downstream	11.26	ft/s	Critical Slope	0.006385	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	CMP		Span	4.00	ft
Section Size	48 inch		Rise	4.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	1,299.48	ft	Upstream Velocity Head	1.73	ft
Ke	0.50		Entrance Loss	0.87	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,299.87	ft	Flow Control	N/A	
Inlet Type	Headwall		Area Full	25.1	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Culvert Analysis Report
MP887.32

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	144.81	cfs	Allowable HW Elevation	1,299.87	ft
Roadway Width	18.00	ft	Overtopping Coefficient	2.55	US
Low Point	1,299.38	ft	Headwater Elevation	1,299.87	ft
Discharge Coefficient (Cr)	2.55		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,295.79	ft			

Sta (ft)	Elev. (ft)
0.00	1,301.42
1,362.00	1,300.20
2,150.00	1,299.38

D.6 STORAGE ROUTING DATA

UPRR Structure
MP875.2

EEC Structure 1
CPC 13

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1506.45	0	0	0
1507	22	0	22
1507.5	56	0	56
1508	103	0	103
1508.5	154	0	154
1509	204	0	204
1509.5	254	14	268
1510	301	44	345
1510.5	346	82	428
1511	389	124	513
1511.5	430	253	683
1512	468	482	950
1512.5	506	832	1338
1513	541	1334	1875

DI	0	22	103	204	345	513	950	1875
DQ	0	22	103	204	301	389	468	541

UPRR Structure
MP875.32 EEC Structure 2
CPC31

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1505.49	0	0	0
1506	2	0	2
1506.5	9	0	9
1507	19	0	19
1507.5	33	5	38
1508	48	28	76
1508.5	64	75	139
1509	81	140	221
1509.5	96	223	319
1510	109	325	434
1510.5	120	454	574
1511	132	526	658
1511.5	142	722	864
1512	172	924	1096

DI	0	2	19	76	221	434	658	1096
DQ	0	2	19	48	81	109	132	172

UPRR Structure
MP875.44 EEC Structure 3
CPC14

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1502.28	0	0	0
1502.5	3	0	3
1503	15	0	15
1503.5	34	0	34
1504	57	0	57
1504.5	84	0	84
1505	113	0	113
1505.5	145	10	155
1506	180	35	215
1506.5	208	72	280
1507	233	123	356
1507.5	257	188	445
1508	280	176	456
1508.5	300	346	646
1509	324	726	1050
1509.5	436	1354	1790
1510	759	2248	3007

DI	0	15	57	113	215	356	456	1050
DQ	0	15	57	113	180	233	280	324

UPRR Structure
MP875.69 EEC Structure 4
CPC10

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1496.88	0	0	0
1497	1	0	1
1497.5	3	0	3
1498	8	0	8
1498.5	15	0	15
1499	23	0	23
1499.5	29	1	30
1500	35	17	52
1500.5	40	50	90
1501	44	98	142
1501.5	48	123	171
1502	52	219	271
1502.5	55	422	477
1503	66	768	834
1503.5	179	1288	1467

DI	0	8	23	52	142	271	834	1467
DQ	0	8	23	35	44	52	66	179

UPRR Structure
MP876.09 EEC Structure 5
CPC30

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1489.4	0	0	0
1489.5	0	0	0
1490	11	0	11
1490.5	24	0	24
1491	38	0	38
1491.5	53	0	53
1492	83	0	83
1492.5	115	0	115
1493	151	0	151
1493.5	190	6	196
1494	230	23	252
1494.5	272	50	322
1495	312	89	401
1495.5	343	155	498
1496	381	263	644
1496.5	485	351	836
1497	792	672	1464

DI	0	38	83	151	252	401	644	1464
DQ	0	38	83	151	230	312	381	792

UPRR Structure
MP876.64 EEC Structure 6
CPC29

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1474	0	0	0
1474.5	0	0	0
1475	0	0	0
1475.5	14	2	15
1476	27	11	38
1476.5	41	34	74
1477	59	74	133
1477.5	89	141	230
1478	122	229	351
1478.5	159	334	493
1479	198	458	656
1479.5	238	600	838
1480	280	759	1040
1480.5	317	543	860
1481	349	853	1202
1481.5	397	1425	1822
1482	585	2285	2870

DI	0	38	133	351	656	1040	1202	2870
DQ	0	27	59	122	198	280	349	585

UPRR Structure
MP876.78 EEC Structure 7
CPC28

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1472	0	0	0
1472.5	15	0	15
1473	29	0	29
1473.5	44	0	44
1474	68	5	73
1474.5	102	41	142
1475	143	102	245
1475.5	188	184	372
1476	237	286	523
1476.5	289	406	696
1477	344	544	888
1477.5	401	700	1101
1478	458	873	1331
1478.5	515	651	1165
1479	570	786	1356
1479.5	661	1323	1984
1480	1200	2169	3369

DI	0	29	73	245	523	888	1331	1356	3369
DQ	0	29	68	143	237	344	458	570	1200

UPRR Structure
MP877.11 EEC Structure 8
CPC27

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1462	0	0	0
1462.5	11	0	11
1463	24	0	24
1463.5	38	0	38
1464	54	0	54
1464.5	79	6	85
1465	115	36	151
1465.5	151	88	239
1466	190	164	354
1466.5	230	207	437
1467	270	363	633
1467.5	309	644	954
1468	342	1077	1419
1468.5	370	1685	2055
1469	395	2434	2829
1469.5	435	3392	3828

DI	0	24	54	151	354	633	1419	2829
DQ	0	24	54	115	190	270	342	395

UPRR Structure
MP877.34 EEC Structure 9
CPC20

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1454.8	0	0	0
1455	0	0	0
1455.5	19	0	19
1456	38	0	38
1456.5	66	0	66
1457	112	0	112
1457.5	170	0	170
1458	237	11	248
1458.5	313	39	352
1459	395	85	480
1459.5	482	153	635
1460	574	164	738
1460.5	669	410	1079
1461	763	819	1583
1461.5	858	1438	2296
1462	951	2307	3258
1462.5	1018	3464	4482
1463	1103	4892	5995

DI	0	38	112	248	480	738	1583	3258	5995
DQ	0	38	112	237	395	574	763	951	1103

UPRR Structure
MP877.77

EEC Structure 10
CPC26

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1439.6	0	0	0
1440	9	0	9
1440.5	21	0	21
1441	33	0	33
1441.5	44	0	44
1442	63	0	63
1442.5	89	0	89
1443	118	0	118
1443.5	150	6	156
1444	184	29	213
1444.5	219	69	288
1445	254	115	369
1445.5	288	180	469
1446	319	463	782
1446.5	348	1049	1397
1447	377	2000	2377
1447.5	416	3438	3854
1448	530	5346	5876
1448.5	775	7764	8539

DI	0	33	63	118	213	369	782	2377	5876
DQ	0	33	63	118	184	254	319	377	530

UPRR Structure
MP878.77 EEC Structure 13
CPC25

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1417.41	0	0	0
1418	22	0	22
1418.5	40	0	40
1419	65	0	65
1419.5	98	0	98
1420	136	1	137
1420.5	178	3	181
1421	223	6	229
1421.5	271	11	282
1422	321	29	351
1422.5	374	64	438
1423	429	121	550
1423.5	486	204	690
1424	535	307	842
1424.5	576	457	1032
1425	616	654	1270
1425.5	667	894	1562
1426	1625	1181	2806
1426.5		1516	1516

DI	0	65	137	229	351	550	842	1270	2806
DQ	0	65	136	223	321	429	535	616	1625

UPRR Structure
MP878.92 EEC Structure 14
CPD09

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1419.1	0	0	0
1419.5	26	0	26
1420.0	63	0	63
1420.5	121	0	121
1421.0	191	0	191
1421.5	257	0	257
1422.0	310	0	310
1422.5	358	0	358
1423.0	404	0	404
1423.5	447	0	447
1424.0	487	0	487
1424.5	526	1	527
1425.0	563	5	568
1425.5	598	13	611
1426.0	1750	25	1775

DI	0	63	191	310	404	487	568	1775
DQ	0	63	191	310	404	487	563	1750

UPRR Structure
MP879.14 EEC Structure 15
CPD12

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1417.1	0	0	0
1417.5	9		9
1418.0	20	0	20
1418.5	30	0	30
1419.0	41	0	41
1419.5	55	0	55
1420.0	78	0	78
1420.5	101	0	101
1421.0	127	0	127
1421.5	153	3	156
1422.0	180	9	189
1422.5	206	18	223
1423.0	226	30	256
1423.5	246	41	287
1424.0	263	53	315
1424.5	279	96	375
1425.0	295	175	470
1425.5	371	295	666
1426.0	1050	463	1513
1426.5	2800	688	3488

DI	0	41	78	127	189	256	315	470	1513
DQ	0	41	78	127	180	226	263	295	1050

UPRR Structure
MP879.78 EEC Structure 16
CPD13

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1408.5	0	0	0
1409.0	21	0	21
1409.5	42	0	42
1410.0	79	0	79
1410.5	135	0	135
1411.0	205	0	205
1411.5	286	0	286
1412.0	377	0	377
1412.5	475	0	475
1413.0	580	0	580
1413.5	689	1	690
1414.0	800	13	813
1414.5	909	43	952
1415.0	1017	85	1101
1415.5	1116	134	1250
1416.0	1193	316	1509
1416.5	1264	656	1920
1417.0	1348	1205	2553
1417.5	1586	2011	3597
1418.0	2088	3067	5155
1418.5	2925	4617	7542

DI	0	580	813	1101	1509	2553	5155
DQ	0	580	800	1017	1193	1348	2088

UPRR Structure
MP880.08 EEC Structure 17
CPD46

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1404.93	0	0	0
1405	3	0	3
1405.5	25	0	25
1406	47	0	47
1406.5	83	0	83
1407	125	0	125
1407.5	175	4	179
1408	230	22	251
1408.5	289	55	345
1409	348	73	421
1409.5	389	219	608
1410	431	514	945
1410.5	477	994	1471
1411	591	1667	2258
1411.5	950	2559	3509
1412	1700	3682	5382
1412.5	2575	5055	7630
1413	3067	6696	9762

DI	0	47	125	251	421	945	2258	5382	9762
DQ	0	47	125	230	348	431	591	1700	3067

UPRR Structure
MP880.29

EEC Structure 18
CPD10

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1397.2	0	0	0
1397.5	9	0	9
1398.0	25	0	25
1398.5	40	0	40
1399.0	62	0	62
1399.5	98	0	98
1400.0	141	0	141
1400.5	192	0	192
1401.0	247	0	247
1401.5	308	0	308
1402.0	374	0	374
1402.5	443	0	443
1403.0	515	0	515
1403.5	588	3	591
1404.0	663	15	678
1404.5	738	41	779
1405.0	812	91	902
1405.5	886	277	1163
1406.0	992	650	1642
1406.5	1229	1218	2447
1407.0	1663	2096	3759

DI	0	515	678	902	1642	3759
DQ	0	515	663	812	992	1663

UPRR Structure
MP880.45 EEC Structure 19
CPD47

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1397.25	0	0	0
1397.5	9	0	9
1398	26	0	26
1398.5	44	0	44
1399	70	0	70
1399.5	101	0	101
1400	123	7	130
1400.5	145	26	171
1401	163	45	208
1401.5	180	116	296
1402	197	281	478
1402.5	250	575	825
1403	428	1034	1462
1403.5	810	1680	2490
1404		2538	2538

DI	0	101	130	208	478	1462	2490
DQ	0	101	123	163	197	428	810

UPRR Structure
MP880.88 EEC Structure 20
CPD15

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1386.9	0	0	0
1387	3	0	3
1387.5	20	0	20
1388	37	0	37
1388.5	59	0	59
1389	98	0	98
1389.5	147	0	147
1390	202	0	202
1390.5	264	0	264
1391	331	2	333
1391.5	401	13	415
1392	474	31	504
1392.5	547	77	624
1393	619	197	816
1393.5	688	412	1100
1394	750	749	1499
1394.5	800	1259	2059
1395	847	1972	2819
1395.5	936	2902	3838
1396	1193	4134	5327
1396.5	1700	5607	7307

DI	0	264	415	624	1100	2059	3838	7307
DQ	0	264	401	547	688	800	936	1700

UPRR Structure
MP881.2 EEC Structure 21
CPD17

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1382.1	0	0	0
1382.5	12	0	12
1383	26	0	26
1383.5	41	0	41
1384	62	0	62
1384.5	95	0	95
1385	134	0	134
1385.5	179	0	179
1386	227	0	227
1386.5	279	0	279
1387	333	0	333
1387.5	390	0	390
1388	447	5	452
1388.5	503	23	527
1389	558	82	640
1389.5	602	177	780
1390	639	350	989
1390.5	684	702	1385
1391	828	1254	2082
1391.5	1300	2037	3337
1392	2117	3085	5201

DI	0	390	527	780	1385	3337	5201
DQ	0	390	503	602	684	1300	2117

UPRR Structure
MP881.45 EEC Structure 22
CPD18

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1378.1	0	0	0
1378.5	11	0	11
1379	24	0	24
1379.5	38	0	38
1380	53	0	53
1380.5	83	0	83
1381	115	0	115
1381.5	151	0	151
1382	190	8	198
1382.5	230	31	261
1383	270	63	333
1383.5	309	167	476
1384	342	431	773
1384.5	369	900	1269
1385	394	1623	2017
1385.5	444	2647	3091
1386	617	4004	4621
1386.5	980	5727	6707
1387	1583	7850	9433

DI	0	151.0	261.0	476	1269	3091	6707
DQ	0	151.0	230.0	309	369	444	980

UPRR Structure
MP881.75 EEC Structure 23
CPD19

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1371.5	0	0	0
1372	14	0	14
1372.5	27	0	27
1373	41	0	41
1373.5	59	0	59
1374	89	0	89
1374.5	122	0	122
1375	159	0	159
1375.5	198	5	202
1376	238	24	262
1376.5	280	65	344
1377	317	132	449
1377.5	349	181	530
1378	385	348	733
1378.5	421	711	1132
1379	700	1329	2029

DI	0	159	262	449	733	2029
DQ	0	0	24	132	348	1329

UPRR Structure
MP881.99 EEC Structure 24
CPD20

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1363.9	0	0	0
1364	2	0	2
1364.5	15	0	15
1365	27	0	27
1365.5	40	0	40
1366	55	0	55
1366.5	83	0	83
1367	114	0	114
1367.5	149	0	149
1368	189	0	189
1368.5	232	7	239
1369	277	28	305
1369.5	324	62	386
1370	373	112	484
1370.5	422	136	558
1371	472	237	709
1371.5	522	505	1026
1372	571	959	1529
1372.5	615	1626	2241
1373	656	2536	3192
1373.5	788	3731	4518
1374	1100	5177	6277
1374.5	1663	6982	8644
1375		9122	9122

DI	0	189	305	484	709	1529	3192	6277	8644
DQ	0	189	277	373	472	571	656	1100	1663

UPRR Structure
MP882.15 EEC Structure 25
CPD21

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1362.33	0	0	0
1362.5	4	0	4
1363	15	0	15
1363.5	26	0	26
1364	37	0	37
1364.5	48	6	54
1365	68	23	92
1365.5	91	53	144
1366	116	82	198
1366.5	142	140	282
1367	168	260	428
1367.5	194	454	648
1368	216	735	951
1368.5	236	1100	1336
1369	257	1417	1674
1369.5	278	2193	2471
1370	299	3160	3459

DI	0	37	92	198	428	951	1674	3459
DQ	0	37	68	116	168	216	257	299

UPRR Structure
MP882.37 EEC Structure 26
CPE33

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1356.94	0	0	0
1357	2	0	2
1357.5	15	0	15
1358	29	0	29
1358.5	43	0	43
1359	63	0	63
1359.5	88	0	88
1360	113	0	113
1360.5	139	0	139
1361	162	0	162
1361.5	182	1	183
1362	203	12	214
1362.5	219	36	255
1363	236	75	310
1363.5	252	135	387
1364	267	160	427
1364.5	282	314	596
1365	297	627	924
1365.5	388	1176	1564
1366	675	2045	2720

DI	0	162	214	310	427	924	2720
DQ	0	162	203	236	267	297	675

UPRR Structure
MP882.66 EEC Structure 27
CPE32

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1353	0	0	0
1353.5	15	0	15
1354	29	0	29
1354.5	44	0	44
1355	68	0	68
1355.5	102	0	102
1356	143	0	143
1356.5	188	0	188
1357	237	0	237
1357.5	289	0	289
1358	344	0	345
1358.5	401	43	444
1359	459	246	705
1359.5	523	697	1219
1360	600	1469	2069
1360.5	814	2577	3392

DI	0	345	705	2069	3392
DQ	0	345	459	600	814

UPRR Structure
MP882.91 EEC Structure 28
CPE53

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1348.66	0	0	0
1349	12	0	12
1349.5	29	0	29
1350	47	0	47
1350.5	76	0	76
1351	108	10	118
1351.5	144	36	180
1352	171	62	233
1352.5	196	152	348
1353	217	441	659
1353.5	238	1000	1239
1354	264	1883	2146
1354.5	294	3151	3445
1355	404	4930	5334
1355.5	638	7186	7823

DI	0	76	180	348	1239	3445	7823
DQ	0	76	144	196	238	294	638

UPRR Structure
MP883.25 EEC Structure 29
CPE31

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1338.4	0	0	0
1339	17	0	17
1339.5	32	0	32
1340	47	0	47
1340.5	75	0	75
1341	110	11	121
1341.5	151	36	187
1342	197	72	269
1342.5	247	226	473
1343	300	543	843
1343.5	356	1070	1426
1344	412	1851	2263
1344.5	469	2926	3395
1345	526	4349	4875
1345.5	576	6182	6758
1346	626	8472	9099
1346.5	729	11245	11973
1347	993	14525	15518
1347.5	1430	18309	19739
1348	2083	22778	24861

DI	0	75	187	473	1426	3395	6758	11973	19739
DQ	0	75	151	247	356	469	576	729	1430

UPRR Structure
MP883.46 EEC Structure 30
CPE30

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1334.6	0	0	0
1335	35	0	35
1335.5	106	0	106
1336	217	0	217
1336.5	353	0	353
1337	513	0	513
1337.5	668	0	668
1338	795	0	795
1338.5	916	0	916
1339	1030	0	1030
1339.5	1138	27	1165
1340	1257	112	1368
1340.5	1338	243	1581
1341	1433	366	1800
1341.5	1557	758	2315
1342	1789	1442	3231
1342.5	2190	2438	4628
1343	2817	3792	6609
1343.5	3717	5547	9264

DI	0	1030	1368	1800	3231	6609
DQ	0	1030	1257	1433	1789	2817

UPRR Structure
MP884 EEC Structure 31
CPE38

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1322.5	0	0	0
1323	15	0	15
1323.5	31	0	31
1324	46	0	46
1324.5	76	0	76
1325	115	0	115
1325.5	160	0	160
1326	213	0	213
1326.5	271	0	271
1327	334	3	338
1327.5	401	18	420
1328	471	44	516
1328.5	544	82	626
1329	618	86	705
1329.5	693	183	875
1330	768	437	1204
1330.5	841	906	1747
1331	914	1651	2564
1331.5	1011	2705	3716
1332	1275	4217	5492
1332.5	1788	6127	7914

DI	0	271	420	626	875	1747	3716	7914
DQ	0	271	401	544	693	841	1011	1788

UPRR Structure
MP884.39 EEC Structure 32
CPE25

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1315.3	0	0	0
1315.5	6	0	6
1316	21	0	21
1316.5	37	0	37
1317	55	0	55
1317.5	91	0	91
1318	132	0	132
1318.5	181	0	181
1319	236	0	236
1319.5	295	0	295
1320	361	7	368
1320.5	429	29	458
1321	500	66	566
1321.5	574	119	693
1322	648	124	773
1322.5	723	276	999
1323	797	625	1422
1323.5	871	1224	2094
1324	931	2101	3032
1324.5	981	3416	4398
1325	1040	5212	6251
1325.5	1231	7490	8721

DI	0	295	458	693	999	2094	4398	8721
DQ	0	295	429	574	723	871	981	1231

Combined 32&33 Rating table

UPRR Structure
MP884.5 EEC Structure 33
CPE25

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1316.1	0	0	0
1316.5	54	0	54
1317	155	5	160
1317.5	294	23	317
1318	456	55	511
1318.5	603	104	707
1319	747	113	860
1319.5	886	256	1142
1320	1017	597	1615
1320.5	1143	1185	2327
1321	1264	2051	3315
1321.5	1378	3443	4822
1322	1489	5303	6792
1322.5	1594	7681	9275
1323	1698	10628	12326
1323.5	1855	14206	16060
1324	2158	18441	20599
1324.5	2325	23372	25697

DI	0	54	317	707	1142	2327	4822	9275	16060
DQ	0	54	294	603	886	1143	1378	1594	1855

UPRR Structure
MP884.73 EEC Structure 34
CPE36

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1309.74	0	1	1
1310	0	1	1
1310.5	0	10	10
1311	0	27	27
1311.5	0	54	54
1312	0	92	92
1312.5	9	143	152
1313	20	250	270
1313.5	30	486	516
1314	41	876	918
1314.5	55	1452	1506
1315	78	2241	2319
1315.5	101	3273	3373
1316	127	4573	4700
1316.5	153	6166	6319
1317	180	8085	8265
1317.5	207	10364	10571
1318	231	12882	13113
1318.5	269	16037	16306
1319	415	19608	20023

DI	1	92	270	918	2319	4700	8265	13113	20023
DQ	0	0	20	41	78	127	180	231	415

UPRR Structure
MP884.97 EEC Structure 35
CPE54

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1306.6	0	0	0
1307	11	0	11
1307.5	24	0	24
1308	38	0	38
1308.5	53	3	56
1309	83	16	99
1309.5	115	46	161
1310	151	81	232
1310.5	190	229	418
1311	230	532	762
1311.5	270	1035	1306
1312	309	1786	2095
1312.5	342	2830	3173
1313	375	4216	4591
1313.5	428	5968	6396
1314	625	8183	8808
1314.5	1010	10824	11834

DI	0	38	99	232	762	2095	4591	8808
DQ	0	38	83	151	230	309	375	625

UPRR Structure
MP885.29 EEC Structure 36
CPF26

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1302.1	0	0	0
1302.5	11	0	11
1303	24	0	24
1303.5	38	0	38
1304	53	0	53
1304.5	83	5	88
1305	115	38	153
1305.5	151	96	246
1306	190	176	365
1306.5	230	200	430
1307	270	364	634
1307.5	309	688	998
1308	342	1216	1558
1308.5	382	1981	2363
1309	488	3056	3545
1309.5	820	4430	5250
1310	1438	6131	7569

DI	0	53	153	365	634	1558	3545	7569
DQ	0	53	115	190	270	342	488	1438

UPRR Structure

MP884.39 EEC Structure 32
CPE25

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1315.3	0	0	0
1315.5	6	0	6
1316	21	0	21
1316.5	37	0	37
1317	55	0	55
1317.5	91	0	91
1318	132	0	132
1318.5	181	0	181
1319	236	0	236
1319.5	295	0	295
1320	361	7	368
1320.5	429	29	458
1321	500	66	566
1321.5	574	119	693
1322	648	124	773
1322.5	723	276	999
1323	797	625	1422
1323.5	871	1224	2094
1324	931	2101	3032
1324.5	981	3416	4398
1325	1040	5212	6251
1325.5	1231	7490	8721
1326	1750	10278	

UPRR Structure

MP884.5 EEC Structure 33
CPE25

Water Surface Elev. (ft)	Culvert/Weir Q (cfs)	Bypass Flow Q (cfs)	Total Q (cfs)
1316.1	0	0	0
1316.5	54	0	54
1317	155	5	160
1317.5	294	23	317
1318	456	55	511
1318.5	603	104	707
1319	747	113	860
1319.5	886	256	1142
1320	1017	597	1615
1320.5	1143	1185	2327
1321	1264	2051	3315
1321.5	1378	3443	4822
1322	1489	5303	6792
1322.5	1594	7681	9275
1323	1698	10628	12326
1323.5	1855	14206	16060
1324	2158	18441	20599
1324.5	2325	23372	25697

Total Culvert Weir Flow, combined	Total Q (combined)
21	21
91	91
210	215
385	408
588	644
784	888
983	1096
1181	1437
1378	1982
1572	2785
1764	3881
1952	5514
2138	7565
2316	10274
2495	13748
2725	18155
3090	23631
3306	30095

DI	0	21	215	644	1096	1982	3881	7565	13748	23631
DQ	0	21	210	588	983	1378	1764	2138	2495	3090

Worksheet for MP875.2, EEC#1

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00450	ft/ft
Normal Depth	1.09	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1514.40
0+11	1512.35
0+52	1514.00
0+67	1509.07
0+81	1508.91
0+86	1510.45
8+40	1520.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1514.40)	(8+40, 1520.00)	0.035

Results

Discharge	44.10	ft^3/s
Elevation Range	1508.91 to 1520.00 ft	
Flow Area	17.38	ft^2
Wetted Perimeter	20.68	ft
Top Width	20.37	ft
Normal Depth	1.09	ft
Critical Depth	0.72	ft
Critical Slope	0.02184	ft/ft
Velocity	2.54	ft/s
Velocity Head	0.10	ft
Specific Energy	1.19	ft

Worksheet for MP875.2, EEC#1

Results

Froude Number	0.48	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.09	ft
Critical Depth	0.72	ft
Channel Slope	0.00450	ft/ft
Critical Slope	0.02184	ft/ft

Worksheet for MP875.32, EEC#2

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00410	ft/ft
Normal Depth	1.04	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1511.60
0+12	1509.99
0+53	1510.68
0+59	1507.81
0+80	1506.96
0+93	1511.34
11+00	1520.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1511.60)	(11+00, 1520.00)	0.035

Results

Discharge	27.81	ft^3/s
Elevation Range	1506.96 to 1520.00 ft	
Flow Area	14.56	ft^2
Wetted Perimeter	24.71	ft
Top Width	24.48	ft
Normal Depth	1.04	ft
Critical Depth	0.76	ft
Critical Slope	0.02488	ft/ft
Velocity	1.91	ft/s
Velocity Head	0.06	ft
Specific Energy	1.10	ft

Worksheet for MP875.32, EEC#2

Results

Froude Number	0.44	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.04	ft
Critical Depth	0.76	ft
Channel Slope	0.00410	ft/ft
Critical Slope	0.02488	ft/ft

Worksheet for MP875.44, EEC#3

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00390	ft/ft
Normal Depth	3.13	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1508.79
0+11	1507.50
0+49	1508.75
0+59	1505.15
0+71	1504.87
0+80	1507.65
4+65	1510.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1508.79)	(4+65, 1510.00)	0.035

Results

Discharge	176.49	ft^3/s
Elevation Range	1504.87 to 1510.00 ft	
Flow Area	77.72	ft^2
Wetted Perimeter	106.68	ft
Top Width	105.72	ft
Normal Depth	3.13	ft
Critical Depth	1.77	ft
Critical Slope	0.01523	ft/ft
Velocity	2.27	ft/s
Velocity Head	0.08	ft
Specific Energy	3.21	ft

Worksheet for MP875.44, EEC#3

Results

Froude Number	0.47	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.13	ft
Critical Depth	1.77	ft
Channel Slope	0.00390	ft/ft
Critical Slope	0.01523	ft/ft

Worksheet for MP875.69, EEC#4

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00390	ft/ft
Normal Depth	1.79	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1503.51
0+13	1501.87
0+50	1503.13
0+58	1499.21
0+74	1499.67
0+81	1501.18
8+80	1510.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1503.51)	(8+80, 1510.00)	0.035

Results

Discharge	98.16	ft^3/s
Elevation Range	1499.21 to 1510.00 ft	
Flow Area	32.33	ft^2
Wetted Perimeter	26.38	ft
Top Width	25.82	ft
Normal Depth	1.79	ft
Critical Depth	1.22	ft
Critical Slope	0.01926	ft/ft
Velocity	3.04	ft/s
Velocity Head	0.14	ft
Specific Energy	1.93	ft

Worksheet for MP875.69, EEC#4

Results

Froude Number	0.48	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.79	ft
Critical Depth	1.22	ft
Channel Slope	0.00390	ft/ft
Critical Slope	0.01926	ft/ft

Worksheet for MP876.09, EEC #5

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00500	ft/ft
Normal Depth	1.16	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1495.69
0+15	1494.84
0+48	1496.28
0+58	1492.84
0+64	1493.16
0+75	1495.99
7+00	1500.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1495.69)	(7+00, 1500.00)	0.035

Results

Discharge	22.50	ft^3/s
Elevation Range	1492.84 to 1500.00 ft	
Flow Area	9.33	ft^2
Wetted Perimeter	12.95	ft
Top Width	12.64	ft
Normal Depth	1.16	ft
Critical Depth	0.82	ft
Critical Slope	0.02269	ft/ft
Velocity	2.41	ft/s
Velocity Head	0.09	ft
Specific Energy	1.25	ft

Worksheet for MP876.09, EEC #5

Results

Froude Number	0.50	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.16	ft
Critical Depth	0.82	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.02269	ft/ft

Worksheet for MP876.64, EEC #6

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00520	ft/ft
Normal Depth	1.97	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1481.13
0+20	1480.95
0+47	1481.94
0+54	1475.03
0+78	1477.06
0+88	1480.76
1+71	1480.00
6+71	1485.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1481.13)	(6+71, 1485.00)	0.035

Results

Discharge	73.76	ft^3/s
Elevation Range	1475.03 to 1485.00 ft	
Flow Area	24.91	ft^2
Wetted Perimeter	26.18	ft
Top Width	25.29	ft
Normal Depth	1.97	ft
Critical Depth	1.52	ft
Critical Slope	0.02047	ft/ft
Velocity	2.96	ft/s
Velocity Head	0.14	ft

Worksheet for MP876.64, EEC #6

Results

Specific Energy	2.11	ft
Froude Number	0.53	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.97	ft
Critical Depth	1.52	ft
Channel Slope	0.00520	ft/ft
Critical Slope	0.02047	ft/ft

Worksheet for MP876.78, EEC #7

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00500	ft/ft
Normal Depth	1.43	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1478.71
0+21	1479.09
0+48	1478.83
0+51	1473.60
0+77	1474.04
0+87	1478.06
4+17	1480.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1478.71)	(4+17, 1480.00)	0.035

Results

Discharge	106.26	ft^3/s
Elevation Range	1473.60 to 1480.00 ft	
Flow Area	33.27	ft^2
Wetted Perimeter	30.31	ft
Top Width	29.28	ft
Normal Depth	1.43	ft
Critical Depth	1.02	ft
Critical Slope	0.02018	ft/ft
Velocity	3.19	ft/s
Velocity Head	0.16	ft
Specific Energy	1.59	ft

Worksheet for MP876.78, EEC #7

Results

Froude Number	0.53	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.43	ft
Critical Depth	1.02	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.02018	ft/ft

Worksheet for MP877.11, EEC #8

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00510	ft/ft
Normal Depth	0.82	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1468.75
0+20	1469.10
0+58	1469.76
0+67	1464.31
0+84	1464.18
0+99	1466.07
4+70	1470.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1468.75)	(4+70, 1470.00)	0.035

Results

Discharge	35.74	ft^3/s
Elevation Range	1464.18 to 1470.00 ft	
Flow Area	15.90	ft^2
Wetted Perimeter	24.89	ft
Top Width	24.65	ft
Normal Depth	0.82	ft
Critical Depth	0.55	ft
Critical Slope	0.02380	ft/ft
Velocity	2.25	ft/s
Velocity Head	0.08	ft
Specific Energy	0.90	ft

Worksheet for MP877.11, EEC #8

Results

Froude Number	0.49	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.82	ft
Critical Depth	0.55	ft
Channel Slope	0.00510	ft/ft
Critical Slope	0.02380	ft/ft

Worksheet for MP877.34, EEC#9

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00660	ft/ft
Normal Depth	3.61	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1462.29
0+15	1460.57
0+53	1463.13
0+68	1462.51
0+94	1457.39
1+02	1457.54
1+13	1459.65
1+90	1460.00
6+52	1465.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1462.29)	(6+52, 1465.00)	0.035

Results

Discharge	819.28	ft^3/s
Elevation Range	1457.39 to 1465.00 ft	
Flow Area	226.68	ft^2
Wetted Perimeter	217.46	ft
Top Width	216.86	ft
Normal Depth	3.61	ft
Critical Depth	3.23	ft
Critical Slope	0.01790	ft/ft
Velocity	3.61	ft/s

Worksheet for MP877.34, EEC#9

Results

Velocity Head		0.20	ft
Specific Energy		3.81	ft
Froude Number		0.62	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.61	ft
Critical Depth	3.23	ft
Channel Slope	0.00660	ft/ft
Critical Slope	0.01790	ft/ft

Worksheet for MP877.77, EEC#10

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00660	ft/ft
Normal Depth	3.00	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1447.17
0+12	1445.74
0+56	1446.78
0+68	1445.23
0+84	1445.86
0+95	1443.00
1+03	1443.21
1+15	1444.96
10+00	1450.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1447.17)	(10+00, 1450.00)	0.035

Results

Discharge	463.05	ft^3/s
Elevation Range	1443.00 to 1450.00 ft	
Flow Area	169.66	ft^2
Wetted Perimeter	249.34	ft
Top Width	248.76	ft
Normal Depth	3.00	ft
Critical Depth	2.70	ft
Critical Slope	0.02030	ft/ft
Velocity	2.73	ft/s

Worksheet for MP877.77, EEC#10

Results

Velocity Head		0.12	ft
Specific Energy		3.12	ft
Froude Number		0.58	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.00	ft
Critical Depth	2.70	ft
Channel Slope	0.00660	ft/ft
Critical Slope	0.02030	ft/ft

Worksheet for MP878.34, EEC#11

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00230	ft/ft
Normal Depth	3.93	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1427.47
0+11	1425.86
0+53	1425.50
0+97	1425.80
1+07	1422.21
1+15	1422.07
1+25	1423.45
6+60	1430.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1427.47)	(6+60, 1430.00)	0.035

Results

Discharge	851.81	ft^3/s
Elevation Range	1422.07 to 1430.00 ft	
Flow Area	377.70	ft^2
Wetted Perimeter	323.99	ft
Top Width	323.24	ft
Normal Depth	3.93	ft
Critical Depth	2.90	ft
Critical Slope	0.01794	ft/ft
Velocity	2.26	ft/s
Velocity Head	0.08	ft

Worksheet for MP878.34, EEC#11

Results

Specific Energy		4.01	ft
Froude Number		0.37	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.93	ft
Critical Depth	2.90	ft
Channel Slope	0.00230	ft/ft
Critical Slope	0.01794	ft/ft

Worksheet for MP878,42, EEC#12

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00001	ft/ft
Normal Depth	7.19	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1426.54
0+11	1424.70
0+44	1424.25
0+51	1418.81
0+73	1419.18
0+86	1422.02
7+60	1430.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1426.54)	(7+60, 1430.00)	0.035

Results

Discharge	230.97	ft^3/s
Elevation Range	1418.81 to 1430.00 ft	
Flow Area	979.93	ft^2
Wetted Perimeter	421.24	ft
Top Width	418.93	ft
Normal Depth	7.19	ft
Critical Depth	1.62	ft
Critical Slope	0.01717	ft/ft
Velocity	0.24	ft/s
Velocity Head	0.00	ft
Specific Energy	7.19	ft

Worksheet for MP878,42, EEC#12

Results

Froude Number	0.03	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	7.19	ft
Critical Depth	1.62	ft
Channel Slope	0.00001	ft/ft
Critical Slope	0.01717	ft/ft

Worksheet for MP878.77, EEC#13

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00015	ft/ft
Normal Depth	6.18	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1426.58
0+13	1424.26
0+45	1423.53
0+59	1419.42
0+62	1419.32
0+67	1420.98
8+00	1430.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1426.58)	(8+00, 1430.00)	0.035

Results

Discharge	894.45	ft^3/s
Elevation Range	1419.32 to 1430.00 ft	
Flow Area	987.28	ft^2
Wetted Perimeter	429.27	ft
Top Width	428.26	ft
Normal Depth	6.18	ft
Critical Depth	3.36	ft
Critical Slope	0.01794	ft/ft
Velocity	0.91	ft/s
Velocity Head	0.01	ft
Specific Energy	6.19	ft

Worksheet for MP878.77, EEC#13

Results

Froude Number	0.11	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	6.18	ft
Critical Depth	3.36	ft
Channel Slope	0.00015	ft/ft
Critical Slope	0.01794	ft/ft

Worksheet for MP878.92, EEC#14

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00030	ft/ft
Normal Depth	3.47	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1426.46
0+12	1424.98
0+44	1425.27
0+72	1424.29
0+83	1422.03
0+90	1422.31
1+02	1424.15
7+40	1430.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1426.46)	(7+40, 1430.00)	0.035

Results

Discharge	139.34	ft^3/s
Elevation Range	1422.03 to 1430.00 ft	
Flow Area	208.93	ft^2
Wetted Perimeter	241.88	ft
Top Width	241.45	ft
Normal Depth	3.47	ft
Critical Depth	1.70	ft
Critical Slope	0.01813	ft/ft
Velocity	0.67	ft/s
Velocity Head	0.01	ft

Worksheet for MP878.92, EEC#14

Results

Specific Energy		3.48	ft
Froude Number		0.13	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.47	ft
Critical Depth	1.70	ft
Channel Slope	0.00030	ft/ft
Critical Slope	0.01813	ft/ft

Worksheet for MP879.14, EEC#15

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00024	ft/ft
Normal Depth	4.90	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1426.11
0+24	1423.62
0+36	1424.42
0+57	1427.33
0+75	1427.43
0+92	1420.60
1+00	1421.01
1+15	1423.42
7+70	1430.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1426.11)	(7+70, 1430.00)	0.035

Results

Discharge	294.67	ft^3/s
Elevation Range	1420.60 to 1430.00 ft	
Flow Area	371.05	ft^2
Wetted Perimeter	281.52	ft
Top Width	280.16	ft
Normal Depth	4.90	ft
Critical Depth	2.59	ft
Critical Slope	0.01593	ft/ft
Velocity	0.79	ft/s

Worksheet for MP879.14, EEC#15

Results

Velocity Head		0.01	ft
Specific Energy		4.91	ft
Froude Number		0.12	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	4.90	ft
Critical Depth	2.59	ft
Channel Slope	0.00024	ft/ft
Critical Slope	0.01593	ft/ft

Worksheet for MP879.78, EEC#16

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00430	ft/ft
Normal Depth	3.73	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1417.80
0+14	1416.23
0+43	1417.42
0+74	1417.85
0+92	1413.65
1+03	1413.27
1+15	1414.97
8+00	1420.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1417.80)	(8+00, 1420.00)	0.035

Results

Discharge	1205.32	ft^3/s
Elevation Range	1413.27 to 1420.00 ft	
Flow Area	388.01	ft^2
Wetted Perimeter	340.02	ft
Top Width	339.44	ft
Normal Depth	3.73	ft
Critical Depth	3.15	ft
Critical Slope	0.01760	ft/ft
Velocity	3.11	ft/s
Velocity Head	0.15	ft

Worksheet for MP879.78, EEC#16

Results

Specific Energy		3.88	ft
Froude Number		0.51	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.73	ft
Critical Depth	3.15	ft
Channel Slope	0.00430	ft/ft
Critical Slope	0.01760	ft/ft

Worksheet for MP880.08, EEC#17

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00460	ft/ft
Normal Depth	2.97	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1410.91
0+11	1409.10
0+42	1408.79
0+69	1409.75
0+80	1407.03
0+88	1407.29
1+00	1408.76
11+50	1420.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1410.91)	(11+50, 1420.00)	0.035

Results

Discharge	514.13	ft^3/s
Elevation Range	1407.03 to 1420.00 ft	
Flow Area	190.82	ft^2
Wetted Perimeter	210.83	ft
Top Width	210.31	ft
Normal Depth	2.97	ft
Critical Depth	2.54	ft
Critical Slope	0.02037	ft/ft
Velocity	2.69	ft/s
Velocity Head	0.11	ft

Worksheet for MP880.08, EEC#17

Results

Specific Energy		3.08	ft
Froude Number		0.50	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.97	ft
Critical Depth	2.54	ft
Channel Slope	0.00460	ft/ft
Critical Slope	0.02037	ft/ft

Worksheet for MP880.29, EEC#18

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00360	ft/ft
Normal Depth	2.00	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1405.73
0+12	1404.04
0+34	1404.48
0+41	1406.32
0+70	1406.69
0+99	1408.41
1+07	1403.00
1+14	1403.33
1+21	1404.61
11+00	1410.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1405.73)	(11+00, 1410.00)	0.035

Results

Discharge	90.57	ft^3/s
Elevation Range	1403.00 to 1410.00 ft	
Flow Area	56.89	ft^2
Wetted Perimeter	119.47	ft
Top Width	118.59	ft
Normal Depth	2.00	ft
Critical Depth	1.53	ft
Critical Slope	0.02143	ft/ft

Worksheet for MP880.29, EEC#18

Results

Velocity		1.59	ft/s
Velocity Head		0.04	ft
Specific Energy		2.04	ft
Froude Number		0.41	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.00	ft
Critical Depth	1.53	ft
Channel Slope	0.00360	ft/ft
Critical Slope	0.02143	ft/ft

Worksheet for MP880.45, EEC#19

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00330	ft/ft
Normal Depth	2.63	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1402.62
0+12	1401.70
0+27	1404.22
0+57	1404.28
0+84	1399.37
0+91	1399.59
0+99	1400.78
11+00	1410.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1402.62)	(11+00, 1410.00)	0.035

Results

Discharge	281.05	ft^3/s
Elevation Range	1399.37 to 1410.00 ft	
Flow Area	132.83	ft^2
Wetted Perimeter	167.99	ft
Top Width	167.61	ft
Normal Depth	2.63	ft
Critical Depth	2.11	ft
Critical Slope	0.02046	ft/ft
Velocity	2.12	ft/s
Velocity Head	0.07	ft

Worksheet for MP880.45, EEC#19

Results

Specific Energy	2.70	ft
Froude Number	0.42	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.63	ft
Critical Depth	2.11	ft
Channel Slope	0.00330	ft/ft
Critical Slope	0.02046	ft/ft

Worksheet for MP880.88, EEC#20

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00290	ft/ft
Normal Depth	3.31	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1395.16
0+11	1393.73
0+45	1394.03
0+82	1395.04
0+94	1390.69
1+01	1390.77
1+12	1391.88
9+00	1400.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1395.16)	(9+00, 1400.00)	0.035

Results

Discharge	749.00	ft^3/s
Elevation Range	1390.69 to 1400.00 ft	
Flow Area	289.92	ft^2
Wetted Perimeter	266.21	ft
Top Width	265.54	ft
Normal Depth	3.31	ft
Critical Depth	2.57	ft
Critical Slope	0.01639	ft/ft
Velocity	2.58	ft/s
Velocity Head	0.10	ft

Worksheet for MP880.88, EEC#20

Results

Specific Energy		3.41	ft
Froude Number		0.44	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.31	ft
Critical Depth	2.57	ft
Channel Slope	0.00290	ft/ft
Critical Slope	0.01639	ft/ft

Worksheet for MP881.2, EEC#21

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00380	ft/ft
Normal Depth	1.42	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1390.35
0+13	1388.31
0+43	1388.63
0+74	1389.82
0+86	1387.62
0+94	1387.58
1+03	1389.40
16+50	1400.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1390.35)	(16+50, 1400.00)	0.035

Results

Discharge	82.44	ft^3/s
Elevation Range	1387.58 to 1400.00 ft	
Flow Area	40.58	ft^2
Wetted Perimeter	66.92	ft
Top Width	66.58	ft
Normal Depth	1.42	ft
Critical Depth	1.12	ft
Critical Slope	0.02045	ft/ft
Velocity	2.03	ft/s
Velocity Head	0.06	ft

Worksheet for MP881.2, EEC#21

Results

Specific Energy		1.48	ft
Froude Number		0.46	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.42	ft
Critical Depth	1.12	ft
Channel Slope	0.00380	ft/ft
Critical Slope	0.02045	ft/ft

Worksheet for MP881.45, EEC#22

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00450	ft/ft
Normal Depth	2.54	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1385.09
0+12	1383.49
0+47	1382.57
0+88	1383.33
1+02	1381.46
1+09	1381.51
1+19	1383.25
12+00	1390.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1385.09)	(12+00, 1390.00)	0.035

Results

Discharge	430.92	ft^3/s
Elevation Range	1381.46 to 1390.00 ft	
Flow Area	179.29	ft^2
Wetted Perimeter	231.27	ft
Top Width	230.94	ft
Normal Depth	2.54	ft
Critical Depth	2.12	ft
Critical Slope	0.02115	ft/ft
Velocity	2.40	ft/s
Velocity Head	0.09	ft

Worksheet for MP881.45, EEC#22

Results

Specific Energy	2.63	ft
Froude Number	0.48	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.54	ft
Critical Depth	2.12	ft
Channel Slope	0.00450	ft/ft
Critical Slope	0.02115	ft/ft

Worksheet for MP881.75, EEC#23

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00380	ft/ft
Normal Depth	1.94	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1377.82
0+19	1375.33
0+29	1377.64
0+54	1378.51
0+73	1379.35
0+89	1375.06
0+97	1375.19
1+09	1377.24
6+00	1380.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1377.82)	(6+00, 1380.00)	0.035

Results

Discharge	131.96	ft^3/s
Elevation Range	1375.06 to 1380.00 ft	
Flow Area	48.28	ft^2
Wetted Perimeter	46.51	ft
Top Width	45.80	ft
Normal Depth	1.94	ft
Critical Depth	1.39	ft
Critical Slope	0.01908	ft/ft
Velocity	2.73	ft/s

Worksheet for MP881.75, EEC#23

Results

Velocity Head		0.12	ft
Specific Energy		2.06	ft
Froude Number		0.47	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.94	ft
Critical Depth	1.39	ft
Channel Slope	0.00380	ft/ft
Critical Slope	0.01908	ft/ft

Worksheet for MP881.99, EEC#24

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00390	ft/ft
Normal Depth	4.00	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1373.00
0+13	1370.50
0+44	1370.53
0+63	1370.43
0+79	1373.57
0+98	1368.00
1+08	1368.12
1+20	1370.47
13+00	1380.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1373.00)	(13+00, 1380.00)	0.035

Results

Discharge	958.65	ft^3/s
Elevation Range	1368.00 to 1380.00 ft	
Flow Area	331.12	ft^2
Wetted Perimeter	291.99	ft
Top Width	290.89	ft
Normal Depth	4.00	ft
Critical Depth	3.40	ft
Critical Slope	0.01865	ft/ft
Velocity	2.90	ft/s

Worksheet for MP881.99, EEC#24

Results

Velocity Head		0.13	ft
Specific Energy		4.13	ft
Froude Number		0.48	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	4.00	ft
Critical Depth	3.40	ft
Channel Slope	0.00390	ft/ft
Critical Slope	0.01865	ft/ft

Worksheet for MP882.15, EEC#25

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00310	ft/ft
Normal Depth	5.00	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1369.87
0+19	1368.54
0+44	1368.87
0+80	1368.95
0+97	1368.04
1+07	1364.00
1+16	1364.11
1+28	1365.79
3+90	1370.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1369.87)	(3+90, 1370.00)	0.035

Results

Discharge	1417.23	ft^3/s
Elevation Range	1364.00 to 1370.00 ft	
Flow Area	464.24	ft^2
Wetted Perimeter	316.31	ft
Top Width	315.34	ft
Normal Depth	5.00	ft
Critical Depth	3.81	ft
Critical Slope	0.01621	ft/ft
Velocity	3.05	ft/s

Worksheet for MP882.15, EEC#25

Results

Velocity Head		0.14	ft
Specific Energy		5.14	ft
Froude Number		0.44	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	5.00	ft
Critical Depth	3.81	ft
Channel Slope	0.00310	ft/ft
Critical Slope	0.01621	ft/ft

Worksheet for MP882.37, EEC#26

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00380	ft/ft
Normal Depth	3.25	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1365.25
0+17	1362.57
0+25	1364.64
0+66	1365.54
0+84	1361.55
0+93	1361.25
1+05	1363.70
11+00	1370.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1365.25)	(11+00, 1370.00)	0.035

Results

Discharge	314.41	ft^3/s
Elevation Range	1361.25 to 1370.00 ft	
Flow Area	141.38	ft^2
Wetted Perimeter	181.33	ft
Top Width	180.36	ft
Normal Depth	3.25	ft
Critical Depth	2.40	ft
Critical Slope	0.01699	ft/ft
Velocity	2.22	ft/s
Velocity Head	0.08	ft

Worksheet for MP882.37, EEC#26

Results

Specific Energy		3.33	ft
Froude Number		0.44	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.25	ft
Critical Depth	2.40	ft
Channel Slope	0.00380	ft/ft
Critical Slope	0.01699	ft/ft

Worksheet for MP882.66, EEC#27

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00540	ft/ft
Normal Depth	1.13	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1359.59
0+18	1357.87
0+53	1358.99
0+95	1360.75
1+04	1358.07
1+15	1358.03
4+61	1360.00
16+00	1365.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1359.59)	(16+00, 1365.00)	0.035

Results

Discharge	245.53	ft^3/s
Elevation Range	1357.87 to 1365.00 ft	
Flow Area	121.16	ft^2
Wetted Perimeter	231.76	ft
Top Width	231.55	ft
Normal Depth	1.13	ft
Critical Depth	0.87	ft
Critical Slope	0.02433	ft/ft
Velocity	2.03	ft/s
Velocity Head	0.06	ft

Worksheet for MP882.66, EEC#27

Results

Specific Energy		1.19	ft
Froude Number		0.49	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.13	ft
Critical Depth	0.87	ft
Channel Slope	0.00540	ft/ft
Critical Slope	0.02433	ft/ft

Worksheet for MP882.91, EEC#28

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00460	ft/ft
Normal Depth	2.56	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1354.24
0+17	1352.45
0+43	1352.57
0+64	1354.42
0+82	1353.92
0+99	1350.44
1+08	1350.53
1+20	1351.89
17+00	1360.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1354.24)	(17+00, 1360.00)	0.035

Results

Discharge	441.43	ft^3/s
Elevation Range	1350.44 to 1360.00 ft	
Flow Area	195.37	ft^2
Wetted Perimeter	286.25	ft
Top Width	285.86	ft
Normal Depth	2.56	ft
Critical Depth	2.21	ft
Critical Slope	0.02171	ft/ft
Velocity	2.26	ft/s

Worksheet for MP882.91, EEC#28

Results

Velocity Head		0.08	ft
Specific Energy		2.64	ft
Froude Number		0.48	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.56	ft
Critical Depth	2.21	ft
Channel Slope	0.00460	ft/ft
Critical Slope	0.02171	ft/ft

Worksheet for MP883.25, EEC#29

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00430	ft/ft
Normal Depth	4.61	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1345.84
0+10	1344.40
0+37	1344.83
0+58	1345.43
0+77	1347.29
1+00	1343.24
1+10	1340.39
1+18	1340.45
1+29	1341.56
14+50	1350.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1345.84)	(14+50, 1350.00)	0.035

Results

Discharge	4349.34	ft^3/s
Elevation Range	1340.39 to 1350.00 ft	
Flow Area	1059.46	ft^2
Wetted Perimeter	615.20	ft
Top Width	614.53	ft
Normal Depth	4.61	ft
Critical Depth	3.82	ft
Critical Slope	0.01507	ft/ft

Worksheet for MP883.25, EEC#29

Results

Velocity		4.11	ft/s
Velocity Head		0.26	ft
Specific Energy		4.87	ft
Froude Number		0.55	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	4.61	ft
Critical Depth	3.82	ft
Channel Slope	0.00430	ft/ft
Critical Slope	0.01507	ft/ft

Worksheet for MP883.46, EEC#30

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00350	ft/ft
Normal Depth	1.94	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1341.16
0+12	1340.02
0+39	1340.75
0+67	1341.27
0+72	1339.06
1+24	1339.16
1+41	1340.49
11+00	1345.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1341.16)	(11+00, 1345.00)	0.035

Results

Discharge	366.33	ft^3/s
Elevation Range	1339.06 to 1345.00 ft	
Flow Area	173.51	ft^2
Wetted Perimeter	233.13	ft
Top Width	232.61	ft
Normal Depth	1.94	ft
Critical Depth	1.18	ft
Critical Slope	0.01791	ft/ft
Velocity	2.11	ft/s
Velocity Head	0.07	ft

Worksheet for MP883.46, EEC#30

Results

Specific Energy		2.01	ft
Froude Number		0.43	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.94	ft
Critical Depth	1.18	ft
Channel Slope	0.00350	ft/ft
Critical Slope	0.01791	ft/ft

Worksheet for MP884, EEC#31

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00280	ft/ft
Normal Depth	3.34	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1331.10
0+13	1329.64
0+38	1330.36
0+65	1331.12
0+87	1331.24
1+00	1326.71
1+10	1326.66
1+21	1328.79
14+00	1335.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1331.10)	(14+00, 1335.00)	0.035

Results

Discharge	436.79	ft^3/s
Elevation Range	1326.66 to 1335.00 ft	
Flow Area	227.30	ft^2
Wetted Perimeter	296.15	ft
Top Width	295.36	ft
Normal Depth	3.34	ft
Critical Depth	2.76	ft
Critical Slope	0.02027	ft/ft
Velocity	1.92	ft/s

Worksheet for MP884, EEC#31

Results

Velocity Head		0.06	ft
Specific Energy		3.40	ft
Froude Number		0.39	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.34	ft
Critical Depth	2.76	ft
Channel Slope	0.00280	ft/ft
Critical Slope	0.02027	ft/ft

Worksheet for MP884.39, EEC#32

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00360	ft/ft
Normal Depth	3.42	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1325.01
0+11	1323.24
0+32	1324.10
0+61	1323.68
0+77	1319.58
0+89	1319.64
1+00	1321.70
19+00	1330.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1325.01)	(19+00, 1330.00)	0.035

Results

Discharge	624.62	ft^3/s
Elevation Range	1319.58 to 1330.00 ft	
Flow Area	272.39	ft^2
Wetted Perimeter	318.90	ft
Top Width	318.27	ft
Normal Depth	3.42	ft
Critical Depth	2.89	ft
Critical Slope	0.02048	ft/ft
Velocity	2.29	ft/s
Velocity Head	0.08	ft

Worksheet for MP884.39, EEC#32

Results

Specific Energy		3.50	ft
Froude Number		0.44	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.42	ft
Critical Depth	2.89	ft
Channel Slope	0.00360	ft/ft
Critical Slope	0.02048	ft/ft

Worksheet for MP884.50, EEC#33

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00410	ft/ft
Normal Depth	5.50	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1323.06
0+15	1320.79
0+55	1320.74
0+76	1316.50
0+84	1316.71
0+95	1318.74
3+60	1320.00
27+00	1330.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1323.06)	(27+00, 1330.00)	0.035

Results

Discharge	5302.63	ft^3/s
Elevation Range	1316.50 to 1330.00 ft	
Flow Area	1380.35	ft^2
Wetted Perimeter	821.71	ft
Top Width	821.00	ft
Normal Depth	5.50	ft
Critical Depth	4.73	ft
Critical Slope	0.01641	ft/ft
Velocity	3.84	ft/s
Velocity Head	0.23	ft

Worksheet for MP884.50, EEC#33

Results

Specific Energy	5.73	ft
Froude Number	0.52	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	5.50	ft
Critical Depth	4.73	ft
Channel Slope	0.00410	ft/ft
Critical Slope	0.01641	ft/ft

Worksheet for MP884.73, EEC#34

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00370	ft/ft
Normal Depth	7.26	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1318.34
0+12	1316.81
0+40	1318.11
0+67	1312.26
0+78	1309.76
0+83	1309.74
0+91	1312.68
10+00	1320.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1318.34)	(10+00, 1320.00)	0.035

Results

Discharge	6166.00	ft^3/s
Elevation Range	1309.74 to 1320.00 ft	
Flow Area	1359.59	ft^2
Wetted Perimeter	589.26	ft
Top Width	587.92	ft
Normal Depth	7.26	ft
Critical Depth	6.18	ft
Critical Slope	0.01451	ft/ft
Velocity	4.54	ft/s
Velocity Head	0.32	ft

Worksheet for MP884.73, EEC#34

Results

Specific Energy		7.58	ft
Froude Number		0.53	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	7.26	ft
Critical Depth	6.18	ft
Channel Slope	0.00370	ft/ft
Critical Slope	0.01451	ft/ft

Worksheet for MP884.97, EEC#35

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00290	ft/ft
Normal Depth	4.02	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1313.15
0+12	1311.34
0+29	1312.19
0+53	1313.01
0+69	1307.98
0+98	1309.61
20+00	1320.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1313.15)	(20+00, 1320.00)	0.035

Results

Discharge	1785.76	ft^3/s
Elevation Range	1307.98 to 1320.00 ft	
Flow Area	647.28	ft^2
Wetted Perimeter	497.61	ft
Top Width	496.88	ft
Normal Depth	4.02	ft
Critical Depth	3.23	ft
Critical Slope	0.01765	ft/ft
Velocity	2.76	ft/s
Velocity Head	0.12	ft
Specific Energy	4.14	ft

Worksheet for MP884.97, EEC#35

Results

Froude Number	0.43	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	4.02	ft
Critical Depth	3.23	ft
Channel Slope	0.00290	ft/ft
Critical Slope	0.01765	ft/ft

Worksheet for MP885.29, EEC#36

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00190	ft/ft
Normal Depth	3.30	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1308.41
0+12	1306.92
0+45	1308.27
0+63	1304.38
0+98	1304.20
1+09	1306.10
9+00	1310.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1308.41)	(9+00, 1310.00)	0.035

Results

Discharge	688.32	ft^3/s
Elevation Range	1304.20 to 1310.00 ft	
Flow Area	364.95	ft^2
Wetted Perimeter	363.78	ft
Top Width	363.23	ft
Normal Depth	3.30	ft
Critical Depth	2.39	ft
Critical Slope	0.01829	ft/ft
Velocity	1.89	ft/s
Velocity Head	0.06	ft
Specific Energy	3.36	ft

Worksheet for MP885.29, EEC#36

Results

Froude Number	0.33	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.30	ft
Critical Depth	2.39	ft
Channel Slope	0.00190	ft/ft
Critical Slope	0.01829	ft/ft

Worksheet for Structure 38-39, MP 885.82 - MP 885.98

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00200	ft/ft
Normal Depth	1.00	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1304.50
4+50	1304.00
4+55	1303.00
6+50	1304.00
8+50	1305.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1304.50)	(8+50, 1305.00)	0.035

Results

Discharge		119.57	ft^3/s
Elevation Range	1303.00 to 1305.00 ft		
Flow Area		100.00	ft^2
Wetted Perimeter		200.10	ft
Top Width		200.00	ft
Normal Depth		1.00	ft
Critical Depth		0.62	ft
Critical Slope		0.02645	ft/ft
Velocity		1.20	ft/s
Velocity Head		0.02	ft
Specific Energy		1.02	ft
Froude Number		0.30	
Flow Type	Subcritical		

Worksheet for Structure 38-39, MP 885.82 - MP 885.98

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.00	ft
Critical Depth	0.62	ft
Channel Slope	0.00200	ft/ft
Critical Slope	0.02645	ft/ft

Worksheet for Structure 40-41, MP886.22 - MP886.57

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00200	ft/ft
Normal Depth	1.64	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1303.99
1+00	1302.36
2+00	1303.02
3+00	1303.31
4+00	1303.43
5+00	1303.94
6+00	1304.15
7+00	1304.18
8+00	1304.46
9+00	1304.64

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1303.99)	(9+00, 1304.64)	0.035

Results

Discharge	610.70	ft^3/s
Elevation Range	1302.36 to 1304.64 ft	
Flow Area	392.36	ft^2
Wetted Perimeter	528.60	ft
Top Width	528.57	ft
Normal Depth	1.64	ft
Critical Depth	1.13	ft
Critical Slope	0.02364	ft/ft

Worksheet for Structure 40-41, MP886.22 - MP886.57

Results

Velocity		1.56	ft/s
Velocity Head		0.04	ft
Specific Energy		1.68	ft
Froude Number		0.32	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.64	ft
Critical Depth	1.13	ft
Channel Slope	0.00200	ft/ft
Critical Slope	0.02364	ft/ft

Worksheet for Structure 43-44, MP886.95 - MP887-19

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00200	ft/ft
Normal Depth	1.00	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1302.00
6+00	1301.00
6+05	1300.00
7+00	1301.00
8+50	1302.00
10+50	1303.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1302.00)	(10+50, 1303.00)	0.035

Results

Discharge	59.76	ft^3/s
Elevation Range	1300.00 to 1303.00 ft	
Flow Area	50.00	ft^2
Wetted Perimeter	100.10	ft
Top Width	100.00	ft
Normal Depth	1.00	ft
Critical Depth	0.62	ft
Critical Slope	0.02647	ft/ft
Velocity	1.20	ft/s
Velocity Head	0.02	ft
Specific Energy	1.02	ft
Froude Number	0.30	

Worksheet for Structure 43-44, MP886.95 - MP887-19

Results

Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.00	ft
Critical Depth	0.62	ft
Channel Slope	0.00200	ft/ft
Critical Slope	0.02647	ft/ft

Process

1. Using USGS, maps (10' contours), ponds were hand drawn onto maps.
2. The areas were planimetered 3 times and the average was used.
3. The storage volume was calculated using the equation V=d/3(Atop+Abottom+SQRT(Atop*Abottom)).
4. The discharges from the structures were calculated using HY-8.
5. The discharges for the routes were calculated using FlowMaster.
6. Stage-Storage-Discharge cards were then created using the data.
7. Divert cards were added to ponds which required them.

CPC22 and CPC24 - Communal pond

Elevation (ft)	Trial 1	Trial 2	Trial 3	Average Area (Acres)	Depth (ft)	Volume (acre-ft)	Accumulative Volume (acre-ft)
1418.2	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1419	0.62	0.18	0.44	0.42	0.80	0.11	0.1
1420	0.62	0.80	0.71	0.71	1.00	0.56	0.7
1421	1.69	1.33	1.69	1.57	1.00	1.11	1.8
1422	2.76	2.76	2.76	2.76	1.00	2.14	3.9
1423	4.36	4.09	4.27	4.24	1.00	3.47	7.4
1424	5.52	5.43	5.69	5.55	1.00	4.88	12.3
1425	6.85	6.85	7.03	6.91	1.00	6.21	18.5
1426	9.07	9.07	8.90	9.01	1.00	7.94	26.4
1427	10.76	10.76	10.94	10.82	1.00	9.91	36.3
1428	13.52	13.88	13.61	13.67	1.00	12.22	48.5
1429	16.28	16.19	16.37	16.28	1.00	14.96	63.5

From HY-8-Sturcture 11

Elevation	1418.20	1419	1420	1421	1422	1423	1424	1425	1426	1427	1428
Dischrge	0	140	316	570	920	1338	1750	2094	2432	2786	3896

From HY-8-Sturcture 12

Elevation	1417.64	1418	1419	1420	1421	1422	1423	1424	1425	1426	1427
Dischrge	0	18	70	121	189	277	377	480	582	677	844

Stage-Storage-Discharge relationship for combined pond upstream of structure 10

SE	1417.60	1419	1420	1421	1422	1423	1424	1425	1426	1427
SV	0.0	0.5	2.4	5.9	11.4	19.5	30.7	44.8	62.5	84.3
SQ	0	210	437	759	1197	1715	2230	2676	3109	3630

CPC24

Elevation (ft)	Trial 1	Trial 2	Trial 3	Average Area (acres)	Depth (ft)	Volume (acre-ft)	Accumulative Volume (acre-ft)
1417.6	0.00	0.00	0.00	0.00	0.0	0.00	0.0
1418	0.09	0.18	0.18	0.15	0.4	0.02	0.0
1419	0.62	0.98	0.53	0.71	1.0	0.39	0.4
1420	2.05	1.87	1.78	1.90	1.0	1.26	1.7
1421	2.85	2.85	3.02	2.91	1.0	2.38	4.1
1422	3.83	4.36	3.74	3.97	1.0	3.43	7.5
1423	5.34	5.43	5.43	5.40	1.0	4.67	12.1
1424	7.03	6.85	7.38	7.09	1.0	6.22	18.4
1425	8.90	8.54	8.81	8.75	1.0	7.90	26.3
1426	10.94	10.59	11.12	10.88	1.0	9.80	36.1
1427	13.17	12.81	12.90	12.96	1.0	11.91	48.0
1428	15.57	15.21	15.75	15.51	1.0	14.21	62.2
1429	17.26	17.61	16.99	17.29	1.0	16.39	78.6
1430	20.10	19.66	19.30	19.69	1.0	18.48	97.1

CPC25

Elevation (ft)	Trial 1.00	Trial 2.00	Trial 3.00	Average Area (acres)	Depth (ft)	Volume (acre-ft)	Accumulative Volume (acre-ft)
1417.4	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1418	0.62	0.62	0.53	0.59	0.60	0.12	0.1
1419	1.60	1.42	1.60	1.54	1.00	1.03	1.1
1420	2.67	2.31	1.96	2.31	1.00	1.91	3.1
1421	3.47	3.38	3.47	3.44	1.00	2.86	5.9
1422	5.34	5.07	5.16	5.19	1.00	4.28	10.2
1423	5.60	5.87	5.60	5.69	1.00	5.44	15.6
1424	7.38	7.74	7.29	7.47	1.00	6.56	22.2
1425	8.18	8.90	8.54	8.54	1.00	8.00	30.2
1426	10.59	10.23	9.96	10.26	1.00	9.39	39.6
1427	12.28	12.45	12.10	12.28	1.00	11.25	50.8
1428	13.34	14.41	14.50	14.08	1.00	13.17	64.0
1429	15.92	15.92	16.37	16.07	1.00	15.07	79.1

From HY-8, Structure 13

Elevation	1417.41	1418	1419	1420	1421	1422	1423	1424	1425	1426
Discharge	0	32	86	140	227	323	430	529	624	709

Stage-Storage-Discharge relationship for structure 13

SE	1417.4	1418	1419	1420	1421	1422	1423	1424	1425	1426
SV	0.0	0.1	1.1	3.1	5.9	10.2	15.6	22.2	30.2	39.6
SQ	0	32	86	141	233	352	551	836	1278	1890

Elevation (ft)	Trial 1	Trial 2	Trial 3	Average	Depth [ft]	Volume (acre-ft)	Accummulative Volume (acre-ft)
1297.39	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1300	0.70	0.75	0.68	0.71	2.61	0.62	0.6
1301	2.84	2.83	2.86	2.84	1.00	1.66	2.3
1302	12.00	11.91	12.12	12.01	1.00	6.90	9.2
1303	24.05	24.04	23.89	23.99	1.00	17.66	26.8
1304	36.47	36.40	36.51	36.46	1.00	30.01	56.8
1305	49.45	49.41	49.55	49.47	1.00	42.80	99.6
1306	63.96	62.45	62.98	63.13	1.00	56.16	155.8

from HY-8, Structure 37

Elevation	1298.58	1299	1300	1301	1302	1303	1304	1305	1306
Discharge	0	17	58	98	165	232	291	348	425

from HY-8, Structure 38

Elevation	1297.39	1299	1300	1301	1302	1303	1304	1305	1306
Discharge	0	228	384	623	855	1080	1283	1886	4435

from Flowmaster, divert between structures 38 & 39

Elevation	1303	1304	1305	1306
Discharge	0	120	1273	4562

Stage-Storage-Discharge relationship for combined pond upstream of Structures 37-38

SE	1297.4	1299	1300	1301	1302	1303	1304	1305	1306
SV	0	0.4	0.6	2.3	9.2	26.8	56.8	99.6	155.8
SQ	0	245	442	721	1020	1312	1694	3507	9422

Divert after S-S-D (divert flow d/s of structure - remainder flow to pond at Structure 39)

DI	0	442	721	1020	1312	1694	3507	9422
DQ	0	442	721	1020	1312	1574	2234	4860

Elevation (ft)	Trial 1	Trial 2	Trial 3	Average	Depth [ft]	Volume (acre-ft)	Accummulative Volume (acre-ft)
1298.64	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1300	0.81	0.77	0.83	0.80	1.36	0.36	0.4
1301	5.69	5.74	5.63	5.69	1.00	2.88	3.2
1302	15.21	15.26	15.18	15.22	1.00	10.07	13.3
1303	21.90	21.82	21.88	21.87	1.00	18.44	31.7
1304	31.30	31.25	31.38	31.31	1.00	26.45	58.2
1305	39.40	39.33	39.41	39.38	1.00	35.27	93.5

from HY-8, Structure 39

Elevation	1298.64	1299	1300	1301	1302	1303	1304	1304.5
Discharge	0	23	89	158	263	355	440	572

from HY-8, Structure 40

Elevation	1298.63	1299	1300	1301	1302	1303	1304	1304.5
Discharge	0	11	40	92	135	203	269	299

from Flowmaster, divert between structures 40 & 41

Elevation	1302.36	1303	1304	1304.5
Discharge	0	39	610	1306

Stage-Storage-Discharge relationship for combined pond upstream of Structures 39-40

SE	1298.63	1299	1300	1301	1302	1303	1304	1304.5
SV	0	0.05	0.4	3.2	13.3	31.7	58.2	69.9
SQ	0	34	129	250	398	597	1319	2177

Divert after S-S-D (divert flow d/s of structure - remainder flow to pond at Structure 41)

DI	0	34	129	260	398	597	1319	2177
DQ	0	34	129	260	398	558	709	871

Elevation (ft)	Trial 1	Trial 2	Trial 3	Average	Depth [ft]	Volume (acre-ft)	Accummulative Volume (acre-ft)
1295.89	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1298	0.45	0.47	0.42	0.45	2.11	0.31	0.3
1300	0.80	0.84	0.77	0.80	2.00	1.23	1.5
1301	1.05	1.09	1.06	1.07	1.00	0.93	2.5
1302	6.58	6.49	6.72	6.60	1.00	3.44	5.9
1303	22.50	22.44	22.49	22.48	1.00	13.75	19.7

from HY-8, Structure 41

Elevation	1295.89	1297	1298	1299	1300	1301	1302	1302.5	1303
Discharge	0	31	65	111	152	182	210	378	1136

Stage-Storage-Discharge relationship for combined pond upstream of Structure 41

SE	1295.89	1297	1298	1299	1300	1301	1302	1302.5	1303
SV	0	0.1	0.3	0.7	1.5	2.5	5.9	10.5	19.7
SQ	0	31	65	111	152	182	210	378	1136

Elevation (ft)	Trial 1	Trial 2	Trial 3	Average	Depth [ft]	Volume (acre-ft)	Accummulative Volume (acre-ft)
1295.98	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1298	1.16	1.19	1.15	1.17	2.02	0.79	0.8
1300	7.38	7.44	7.32	7.38	2.00	7.65	8.4
1301	16.10	16.13	16.05	16.09	1.00	11.46	19.9
1302	28.40	28.30	28.53	28.41	1.00	21.96	41.9
1303	38.16	40.74	40.74	39.88	1.00	33.98	75.8

from HY-8, Structure 42

Elevation	1296.56	1298	1299	1300	1301	1301.5	1301.8	1302	1302.5
Discharge	0	19	33	49	69	78	360	737	942

from HY-8, Structure 43

Elevation	1295.98	1298	1299	1300	1301	1301.5	1301.8	1302	1302.5
Discharge	0	60	104	121	174	220	435	900	1559

from Flowmaster, divert between structures 43 and 44

Elevation	1300	1301	1302	1303
Discharge	0	202	723	3510

Stage-Storage-Discharge relationship for combined pond upstream of Structures 42-43

SE	1296.56	1298	1299	1300	1301	1301.5	1301.8	1302	1302.5
SV	0	0.8	3.3	8.4	19.9	27.2	33.1	41.9	58.9
SQ	0	79	137	170	243	298	795	1637	2501

Divert to pond F5

DI	0	170	445	761	1414	2360	4618
DQ	0	170	243	298	795	1637	2501

Elevation (ft)	Trial 1	Trial 2	Trial 3	Average Area (acres)	Depth [ft]	Volume (acre-ft)	Accummulative Volume (acre-ft)
1294.19	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1295	1.15	1.18	1.11	1.15	0.81	0.31	0.3
1296	3.46	3.51	3.40	3.46	1.00	2.20	2.5
1297	9.07	9.01	9.14	9.07	1.00	6.04	8.6
1298	14.67	14.72	14.58	14.66	1.00	11.75	20.3
1299	21.40	21.39	21.43	21.41	1.00	17.93	38.2
1300	27.70	27.73	21.74	25.72	1.00	23.53	61.8
1301	36.50	36.42	36.55	36.49	1.00	30.95	92.7

from HY-8, Structure 44

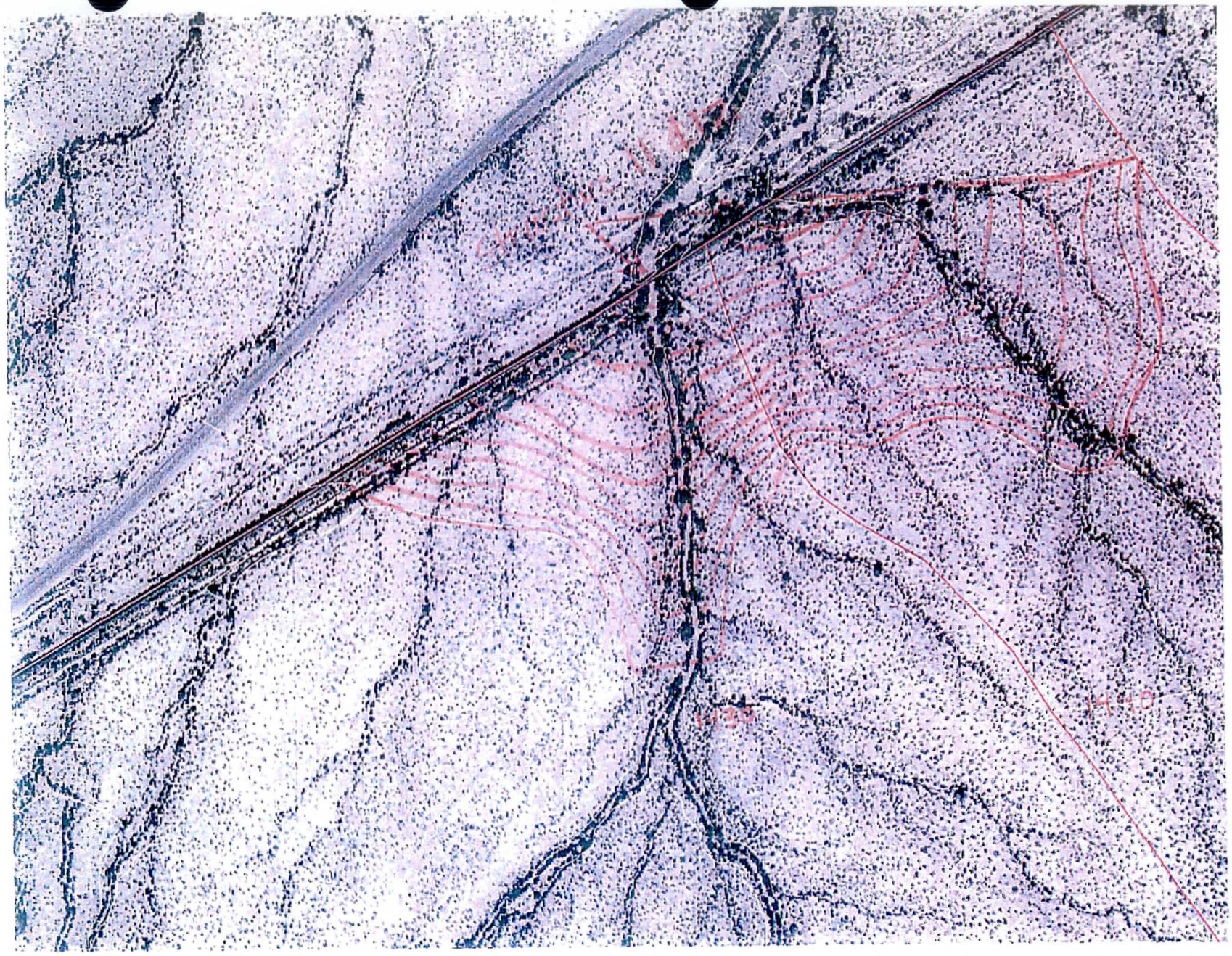
Elevation	1295.1	1296	1297	1298	1299	1300	1300.5	1301
Discharge	0	13	28	49	73	188	809	1018

from HY-8, Structure 45

Elevation	1294.3	1296	1297	1298	1299	1300	1300.5	1301
Discharge	0	47	91	131	168	296	1100	1671

Stage-Storage-Discharge relationship for combined pond upstream of Structures 44-45

SE	1294.3	1296	1297	1298	1299	1300	1300.5	1301.0
SV	0	2.5	8.6	20.3	38.2	61.8	77.3	92.7
SQ	0	60	119	180	241	484	1909	2689



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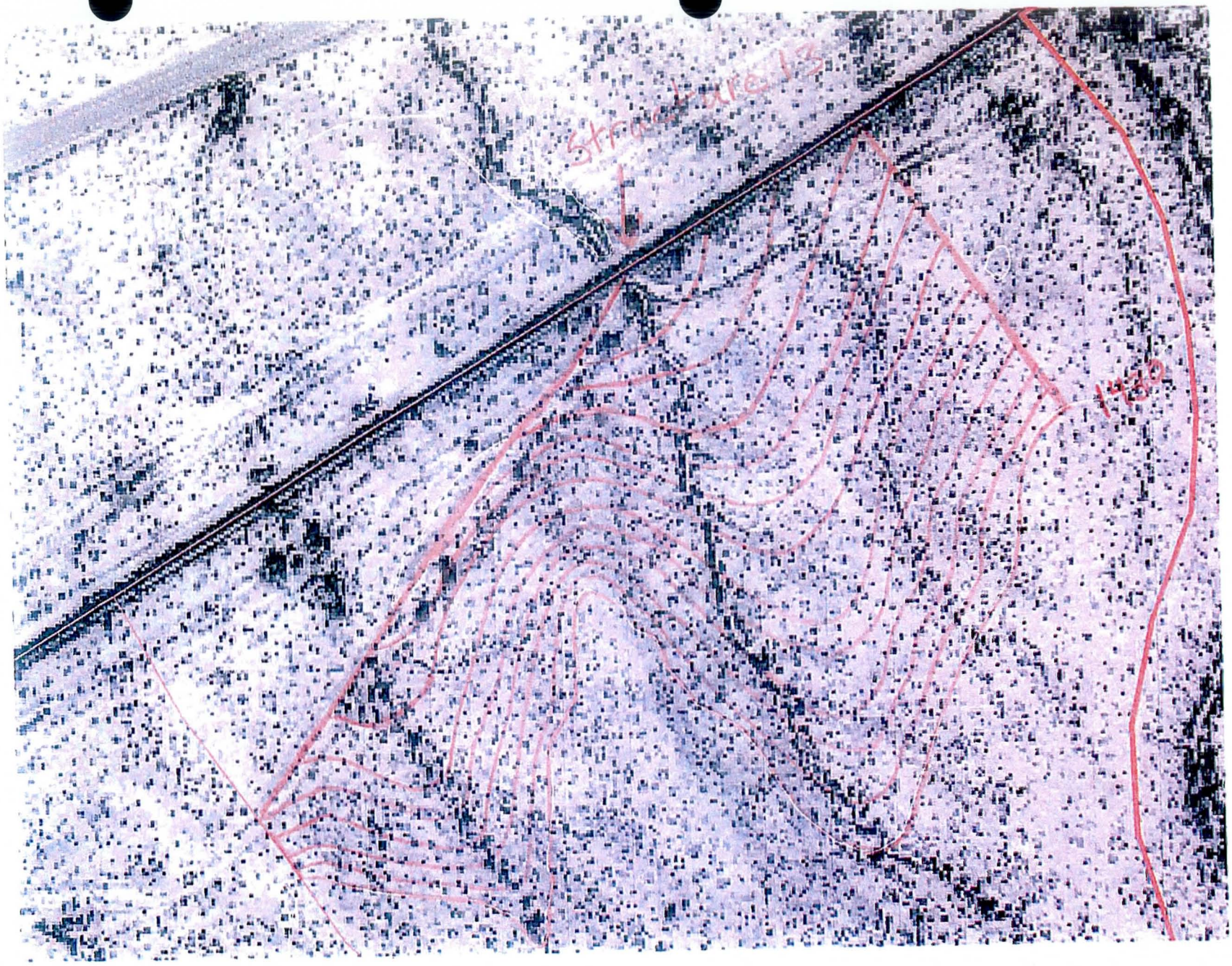

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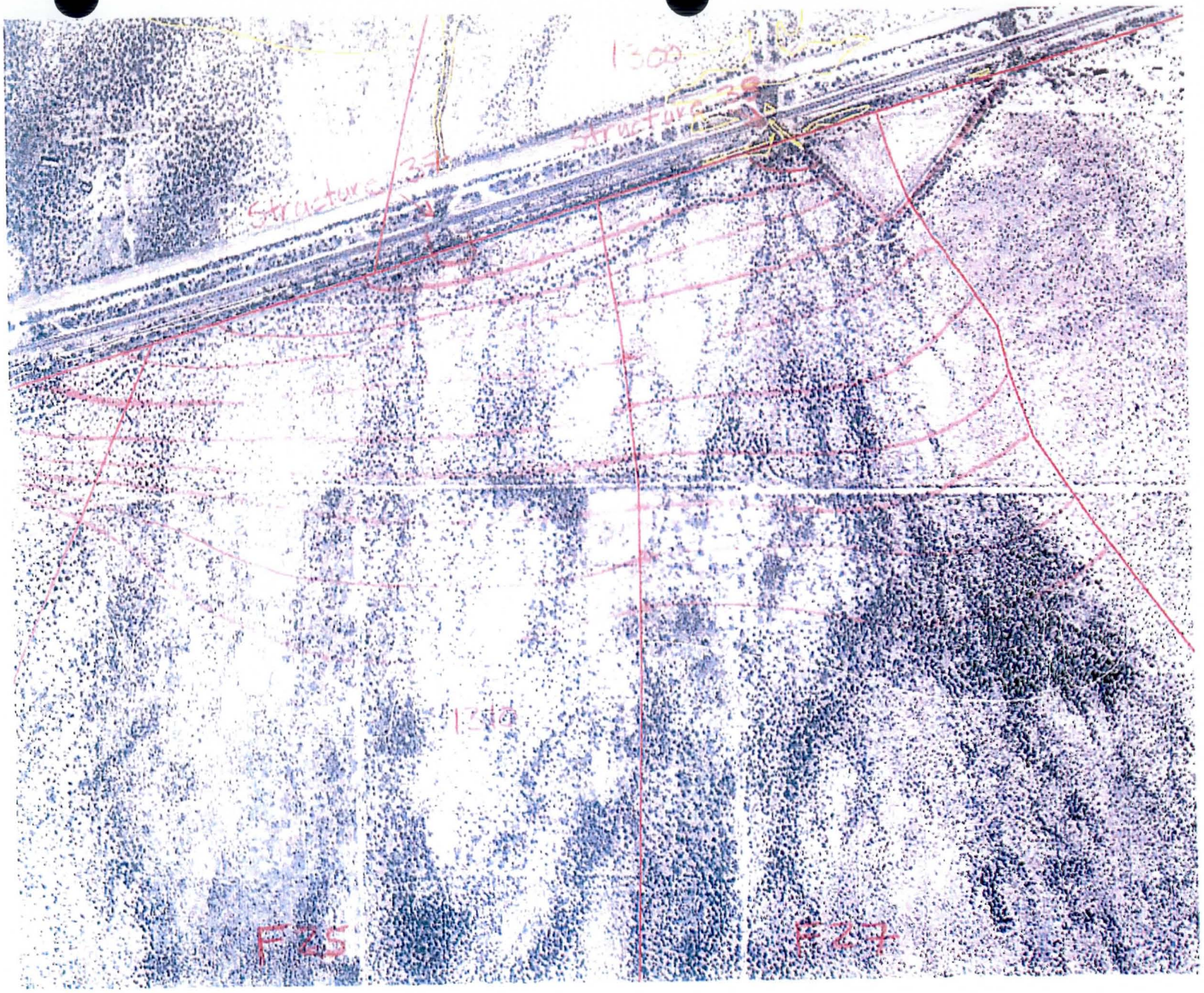

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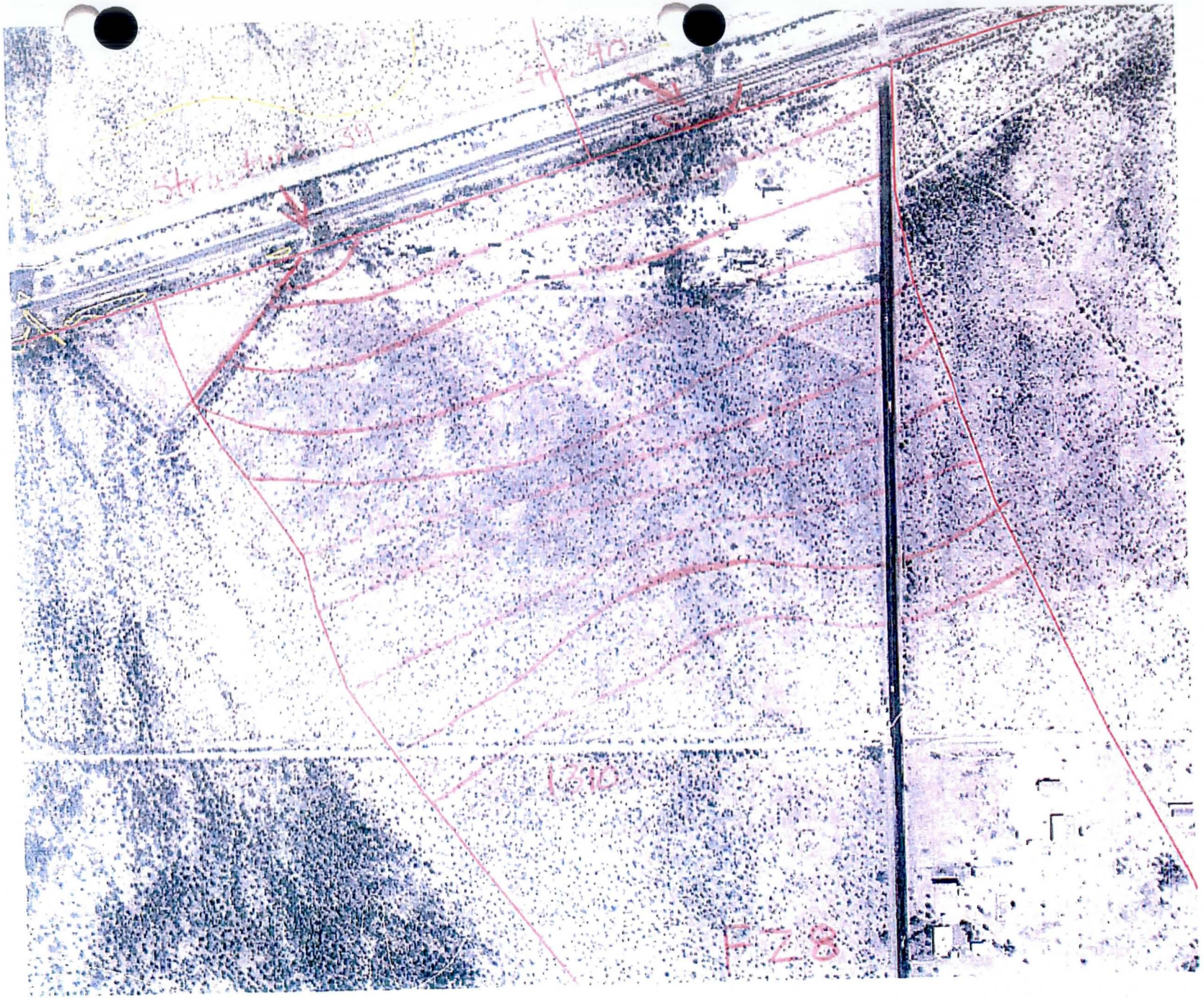

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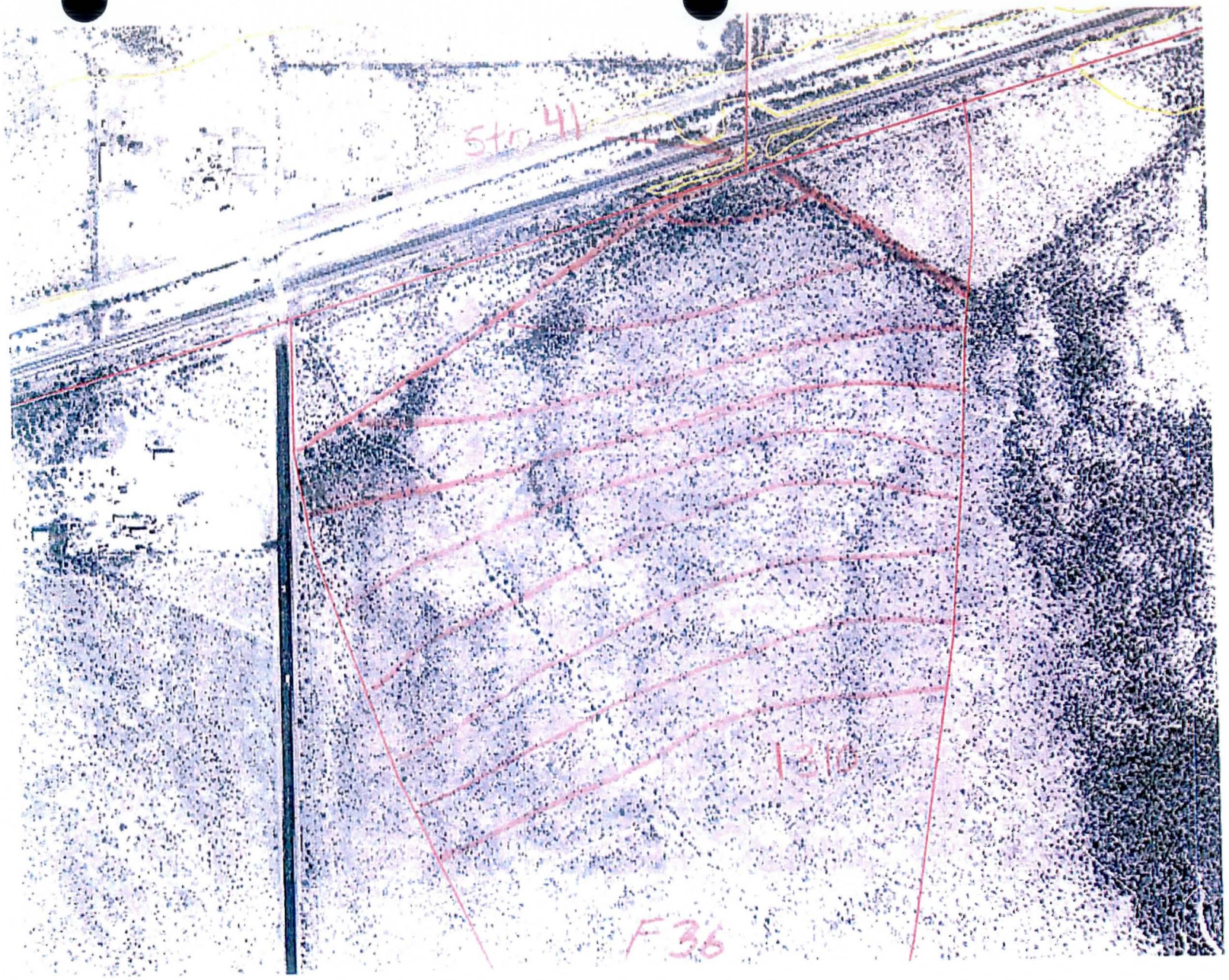

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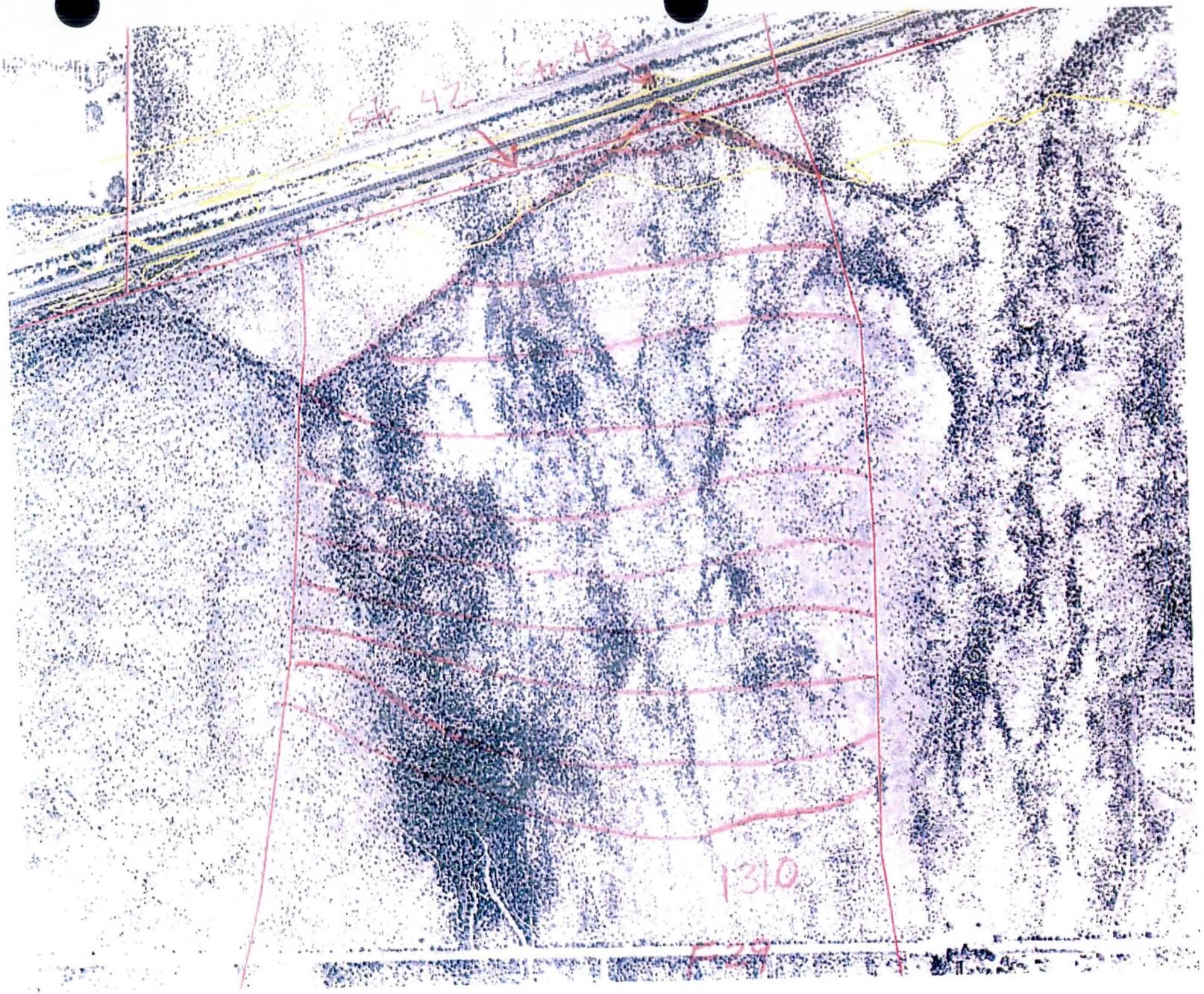

N

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PNDF04

N

1" = 500'

PNDF05

Technical Memorandum

URS

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Action	Info	File
Burke Lokey, P.E.	Rainbow Valley ADMP	23445383

From Elliot Silverston

Date September 21, 2010

Subject RVADMP Task 9.9 Hydrology – Flood Frequency Comparisons

Registered Professional Engineer (Civil) CERTIFICATE NO. 33658 ELLIOT SILVERSTON Date Signed 10-15-10 ARIZONA, U.S.A.

Exp Date: 6-30-11

URS reviewed the methodology utilized in developing the Region 13 Flood Magnitude curve for the 100-year flood. The methodology is presented in the United States Geological Survey (USGS) publication *Methods for Estimating Magnitude and Frequency of Floods in the Southwestern United States – Open-File Report 93-419.* We compared the results with the station data at the USGS gauging station 09514200, Waterman Wash near Buckeye, Arizona. The result from the Waterman Wash gauge is a low outlier in Region 13, even when compared to the low envelope curve shown by the Flood Control District of Maricopa County (District) in their comments. URS included the additional annual peak discharges through 1999 in the log Pearson Type III analysis and using the station skew, a peak discharge for the 100-year flood is still at the lower envelope limit. Therefore, it is concluded that Waterman Wash watershed peak floods are not as high as the Region 13 curve predicts. This can be accounted for by the topographic relief in the watershed causing both distributary and sheet flow patterns that store runoff and therefore attenuate peak flows in Waterman Wash, its tributaries and sub-basin discharge points (concentration points, Figure 1 – Flow Characteristics).

URS reviewed the comments provided by the District that compare the preliminary HEC-1 results to the results of the EEC HEC-1 models and the 100-year peak discharge relation curves for Region 13. The curves being used for the comparison were adapted from the Region 13 data presented in the USGS Open-File Report 93-419. The Region 13 flood-frequency analysis consisted of more than 1,300 gauging stations with a combined 40,000 station years of annual peak discharges through water year 1986. The USGS stopped recording data at Station 09514200 in 1999.

A District stream gauge that began operation in 1999 is located where Rainbow Valley Road crosses Waterman Wash (6833). This stream gauge has recorded only relatively minor flows since it started operation. URS attempted to conduct a statistical analysis using the District's stream gauge data and determined that there were insufficient data to provide reliable results. This conclusion is consistent with the previous evaluation conducted by EEC.

The USGS gauge station for Waterman Wash, Station 09514200, results is identified on Figure 8.9 of the District's *Draft Drainage Design Manual – Hydrology* (see Attachment A). Figure 8.9 is the Region 13 curve developed by the USGS (Open File Report 93-419). According to the 100-year peak discharge relation curve on Figure 8.9, the 100-year peak discharge for Station 09514200 is approximately 22,000 cfs. However, the predicted peak discharge (Log Pearson III analysis) for the actual gauge station shown on Figure 8.9 is approximately 9,140 cfs (see Attachment B from USGS Open File Report 93-419). The years of record used in the USGS analysis for Station 09514200 were from 1964 through 1986, for a total of 22 water years. URS updated the calculated peak discharges for Station 09514200 using the procedures in Bulletin 17-B for flood-frequency analysis that included additional years of record that extended through water year 1999, for a total of 35 water years (see Attachment C). The analysis was conducted using a station skew since Station 09514200 has over 30 years of data. The gauges that were used in the USGS Open File Report 93-419 required at least 10 years of data through water year 1986. The peak flow of record occurred in 1997 and was 9,400 cfs.

When the peak discharges and unit peak discharges from the URS analysis are compared to the USGS Region 13 100-year discharges, the results show that the URS values are still significantly lower than the peak discharges calculated from the Region 13 graphs (Table 1).

Table 1

100-Year Peak Discharge				
USGS Region 13	USGS -09514200	URS - 09514200	24-Hour Storm	24-Hour Storm
Regression Equation	Flood-Frequency	Flood-Frequency	HEC-1 (URS)	HEC-1 (EEC)
21,900	9,140	12,210	11,341	28,572

100-Year Peak Discharge per Square Mile				
USGS Region 13	USGS	URS	24-Hour Storm	24-Hour Storm
Regression Equation	Flood-Frequency	Flood-Frequency	HEC-1 (URS)	HEC-1 (EEC)
54	23	30	28	71

A large part of the Waterman Wash watershed is subject to distributary-flow type flooding according to the Flow Characteristics Map (Figure 1) that was developed during the initial stages of the Rainbow Valley ADMP. The USGS Open File Report 93-419 (page 14) states that distributary flow areas can have a large effect on the flood characteristics of streams and that the magnitude of peak discharges leaving a basin can be significantly reduced in basins with distributary flow areas. In addition, the report states that even during large floods, most of the peak discharge in the distributary flow areas can be lost to infiltration or attenuation. Various concentration points have been approximately located on the Figure 1 to show where the points are in relation to the distributary flow areas.

Peak discharge values for the 100-year storm in the URS model are generally lower than the EEC values because of three main factors:

1) The rainfall values have been reduced by approximately 25-percent
2) Routing cross sections have been revised to better reflect distributary-flow conditions
3) Updated diversion methodology and data

The specific responses to the individual comments received from the District regarding the differences in peak discharges are included in Table 2.

The published flow data that were used to develop the peak discharge relation curves shows that the peak discharge for Station 09514200 is significantly lower than is predicted by the Region 13 curve. This can be explained by the fact that a large portion of the Waterman Wash watershed consists of distributary flow area. URS is of the opinion that the peak discharge relation curve shown on Figure 8.9 overestimates the 100-year peak discharge for Waterman Wash, it's tributaries, and concentration points.

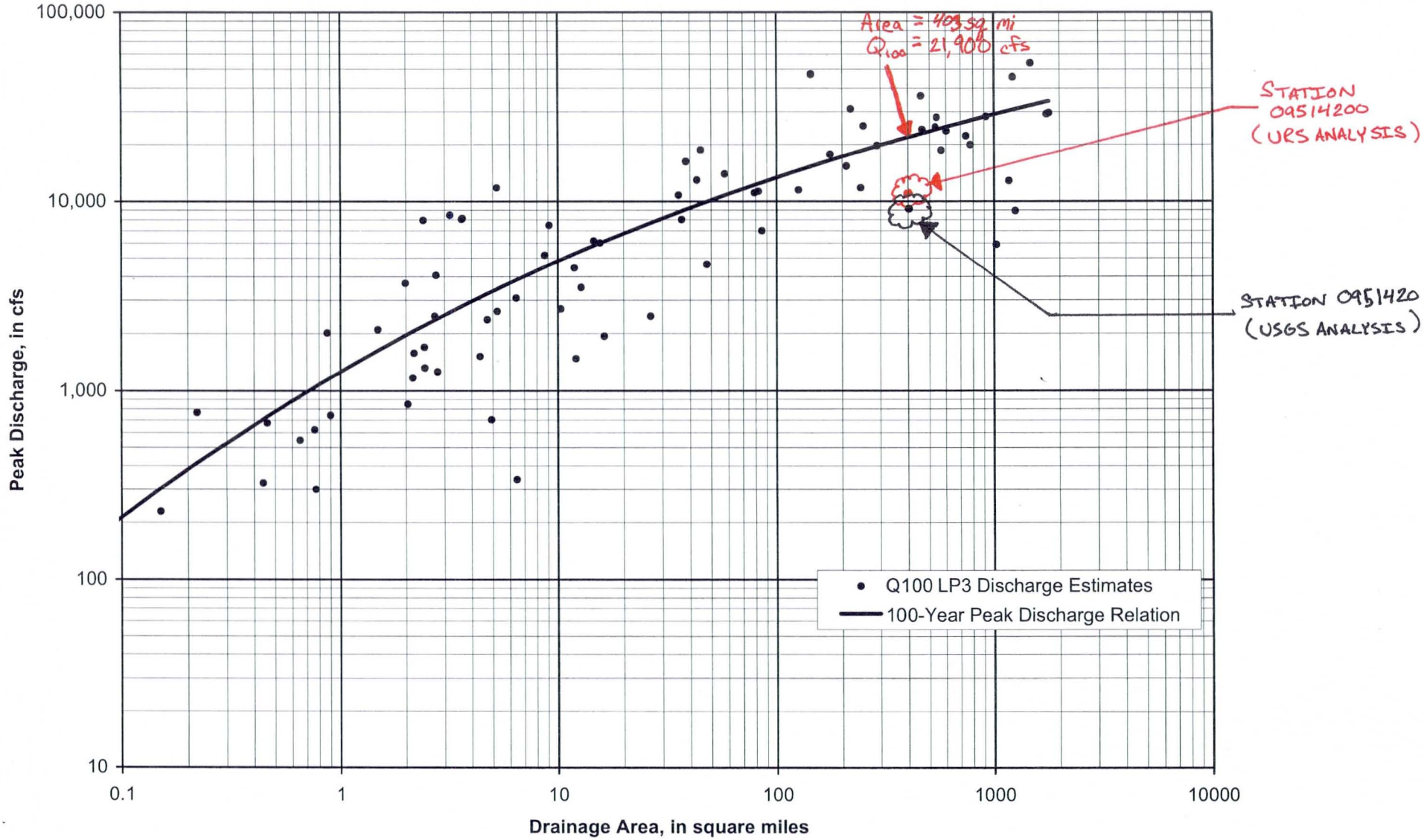
This technical memorandum has been prepared based on certain key assumptions made by URS which substantially affect the conclusions and recommendations of this memorandum. These assumptions, although thought to be reasonable and appropriate, may not prove to be true in the future. The conclusions and recommendations of URS are conditioned upon these assumptions.

ATTACHMENT A

Figure 8.9

100-YEAR PEAK DISCHARGE RELATION FOR FLOOD REGION 13

Adapted from data contained in USGS Open File Report 93-419



ATTACHMENT B

BASIN, CLIMATIC, AND FLOOD CHARACTERISTICS FOR STREAMFLOW-GAGING STATIONS IN THE SOUTHWESTERN UNITED STATES--Continued

Station number	Station name	Flood region	Latitude, in decimal degrees	Longitude, in decimal degrees	Years of record	Drainage area, in square miles	Mean basin elevation, in feet	Mean annual precipitation, in inches	Mean annual evaporation, in inches
09484590	Davidson Canyon Wash near Vail, Ariz.	13	31.994	110.544	14	50.50	4,340	14.5	63.1
09484600	Pantano Wash near Vail, Ariz.	13	32.036	110.677	28	457.00	4,500	15.4	61.7
09485000	Rincon Creek near Tucson, Ariz.	13	32.129	110.626	34	44.80	4,850	19.2	59.3
09485100	Saguaro Corners Wash near Tucson, Ariz.	13	32.170	110.737	10	0.17	3,040	12.0	58.6
09485500	Pantano Wash at Tucson, Ariz.	13	32.250	110.850	16	602.00	4,560	17.1	60.0
09485900	Pima Wash near Tucson, Ariz.	13	32.337	110.960	18	4.93	4,430	16.0	63.5
09485950	Geronimo Wash near Tucson, Ariz.	13	32.332	110.944	18	2.08	3,600	15.0	63.1
09486000	Rillito Creek near Tucson, Ariz.	13	32.295	110.984	67	918.00	4,400	15.5	64.5
09486300	Canada del Oro near Tucson, Ariz.	13	32.374	111.009	17	250.00	4,000	16.4	64.9
09486800	Altar Wash near Three Points, Ariz.	13	31.836	111.403	14	463.00	3,920	15.6	65.0
09487000	Brawley Wash near Three Points, Ariz.	13	32.076	111.337	15	776.00	3,710	14.6	65.0
09487100	Little Brawley Wash near Three Points, Ariz.	13	32.124	111.329	14	11.90	2,800	13.0	65.0
09487140	San Joaquin Wash near Tucson, Ariz.	13	32.169	111.133	13	0.45	2,530	11.0	65.5
09487250	Los Robles Wash near Marana, Ariz.	13	32.438	111.304	13	1,170.00	3,350	11.8	65.0
09487400	Quijotoa Wash Tributary near Quijotoa, Ariz.	13	32.174	112.108	13	2.44	2,800	10.1	65.0
09488500	Santa Rosa Wash near Vaiva Vo, Ariz.	13	32.667	111.927	19	1,782.00	2,340	10.2	65.0
09488600	Silver Reef Wash near Casa Grande, Ariz.	13	32.682	111.834	13	12.80	1,620	8.5	65.0
09514200	Waterman Wash near Buckeye, Ariz.	13	33.330	112.509	22	403.00	1,570	9.2	65.0
09517000	Hassayampa River near Arlington, Ariz.	13	33.347	112.725	23	1,470.00	3,010	15.9	64.4
09517200	Centennial Wash Tributary near Wenden, Ariz.	13	33.844	113.450	17	2.79	2,480	8.0	65.0
09517280	Tiger Wash near Aguila, Ariz.	13	33.742	113.279	17	85.20	2,590	9.6	64.0
09517400	Winters Wash near Tonopah, Ariz.	13	33.489	112.918	18	47.80	1,630	9.1	61.9
09519600	Rainbow Wash Tributary near Buckeye, Ariz.	13	33.243	112.537	17	2.43	--	7.6	65.9
09519750	Bender Wash near Gila Bend, Ariz.	13	32.907	112.551	17	68.80	1,900	8.5	69.8
09519760	Sauceda Wash near Gila Bend, Ariz.	13	32.871	112.758	17	126.00	1,980	8.2	75.9
09519780	Windmill Wash near Gila Bend, Ariz.	13	33.048	112.838	15	12.90	1,050	6.1	74.8
09520100	Military Wash near Sentinel, Ariz.	13	32.845	113.279	17	8.70	674	5.0	75.0
09520110	Hot Shot Arroyo near Ajo, Ariz.	13	32.347	112.809	16	0.44	1,760	8.1	64.1
09520130	Darby Arroyo near Ajo, Ariz.	13	32.355	112.825	16	4.72	1,920	8.1	64.2
09520160	Gibson Arroyo at Ajo, Ariz.	13	32.380	112.861	14	2.18	2,100	8.1	64.8
09520170	Rio Cornez near Ajo, Ariz.	13	32.499	112.881	14	243.00	1,950	8.4	68.2

ATTACHMENT B

BASIN, CLIMATIC, AND FLOOD CHARACTERISTICS FOR STREAMFLOW-GAGING STATIONS IN THE SOUTHWESTERN UNITED STATES--Continued

Station number	Relation characteristic L	H	D	O	U	Peak discharge (cubic feet per second) for indicated recurrence interval (years) 2	5	10	25	50	100	Maximum peak discharge of record (cubic feet per second)
09484590	-	-	-	-	1	----	----	----	----	----	----	6,860
						976	2,300	3,620	5,780	7,720	10,200	
09484600	0	1	1	0	0	3,120	7,800	12,400	20,300	27,600	36,400	38,000
						3,030	7,410	11,400	18,000	24,000	31,500	
09485000	0	0	0	0	0	956	2,760	4,830	8,860	13,100	18,800	9,660
						951	2,670	4,490	7,830	11,300	15,900	
09485100	-	-	-	-	1	----	----	----	----	----	----	49
						41	92	137	209	265	336	
09485500	0	0	0	0	0	1,710	4,610	7,600	12,800	17,700	23,700	20,000
						2,010	5,070	8,420	13,800	18,600	24,300	
09485900	1	1	0	1	0	73	177	272	423	555	703	460
						128	321	610	1,080	1,460	1,940	
09485950	1	0	0	0	0	116	270	418	665	895	1,170	705
						133	318	530	880	1,190	1,570	
09486000	1	0	0	0	0	5,090	9,520	13,200	18,600	23,200	28,300	29,700
						4,960	9,330	12,900	18,300	23,000	28,300	
09486300	0	0	0	0	0	2,620	6,130	9,430	14,700	19,600	25,200	17,000
						2,470	5,690	8,460	12,900	17,100	22,100	
09486800	0	0	0	0	0	4,280	7,910	11,000	15,600	19,600	24,100	22,000
						3,790	7,220	10,000	14,600	18,700	23,500	
09487000	0	0	0	0	0	3,640	6,390	8,770	12,500	16,000	20,000	19,100
						3,510	6,530	9,500	14,400	18,600	23,600	
09487100	0	0	0	0	0	777	1,450	2,010	2,870	3,610	4,450	13,800
						692	1,360	1,930	2,910	3,800	4,890	
09487140	-	-	-	-	1	----	----	----	----	----	----	520
						76	179	272	426	552	719	
09487250	0	1	0	0	0	1,130	3,090	4,930	7,790	10,200	12,900	32,000
						1,920	4,660	8,210	13,600	17,800	22,600	
09487400	1	0	0	0	0	167	369	547	819	1,050	1,320	715
						179	411	655	1,050	1,390	1,820	
09488500	1	0	0	0	0	805	3,160	6,270	12,800	20,000	29,600	53,100
						1,620	4,640	9,050	16,500	23,200	31,700	
09488600	0	0	0	0	0	265	660	1,070	1,820	2,570	3,500	1,400
						336	837	1,450	2,480	3,420	4,590	
09514200	1	0	0	0	0	1,430	2,730	3,870	5,660	7,280	9,140	6,300
						1,640	3,320	5,360	8,640	11,400	14,600	
09517000	1	0	0	0	0	3,110	8,390	14,400	25,800	37,900	53,900	39,000
						3,300	8,430	13,900	23,500	32,900	45,100	
09517200	0	0	0	0	0	131	312	480	747	986	1,260	720
						154	373	624	1,030	1,380	1,820	
09517280	1	0	0	0	0	1,010	2,120	3,070	4,480	5,680	7,000	4,550
						1,070	2,330	3,650	5,760	7,570	9,720	
09517400	1	0	0	0	0	854	1,540	2,120	3,000	3,770	4,640	3,640
						877	1,720	2,660	4,200	5,540	7,150	
09519600	1	0	0	0	0	482	747	947	1,230	1,450	1,700	1,430
						413	680	881	1,240	1,550	1,950	
09519750	-	-	-	-	1	----	----	----	----	----	----	2,670
						1,130	2,630	4,130	6,590	8,790	11,600	
09519760	1	0	1	0	0	583	1,870	3,310	5,910	8,450	11,500	3,150
						806	2,280	4,100	7,090	9,770	13,000	
09519780	-	-	-	-	1	----	----	----	----	-----	----	4,430
						501	1,210	1,910	3,070	4,120	5,490	
09520100	0	0	0	0	0	125	468	945	2,020	3,310	5,180	1,530
						196	609	1,190	2,250	3,340	4,850	
09520110	1	0	0	0	0	136	191	226	267	297	325	240
						120	187	243	341	420	517	
09520130	1	0	0	0	0	551	922	1,210	1,630	1,980	2,370	1,670
						485	865	1,180	1,720	2,210	2,810	
09520160	0	1	0	0	0	239	463	661	974	1,260	1,580	1,800
						226	464	692	1,080	1,420	1,840	
09520170	0	0	0	0	0	3,000	4,850	6,270	8,300	9,960	11,800	8,030
						2,710	4,720	6,540	9,610	12,300	15,400	

ATTACHMENT C

CA67G1ER.PRT

```
1
  Program PeakFq          U. S. GEOLOGICAL SURVEY            Seq.000.000
  Ver. 5.2            Annual peak flow frequency analysis    Run Date / Time
  11/01/2007          following Bulletin 17-B Guidelines     02/09/2009 18:26

                        --- PROCESSING OPTIONS ---

                      Plot option         = None
                      Basin char output   = None
                      Print option        = Yes
                      Debug print         = No
                      Input peaks listing = Long
                      Input peaks format  = WATSTORE peak file

                      Input files used:
                         peaks (ascii)  - C:\TMP\PEAKFQ\CA67G1ER.TXT

                         specifications - PKFQWPSF.TMP

                      Output file(s):
                         main - C:\TMP\PEAKFQ\CA67G1ER.PRT


1

  Program PeakFq          U. S. GEOLOGICAL SURVEY            Seq.001.001
  Ver. 5.2            Annual peak flow frequency analysis    Run Date / Time
  11/01/2007          following Bulletin 17-B Guidelines     02/09/2009 18:26

            Station - 09514200  WATERMAN WASH NEAR BUCKEYE, ARIZ.


                  I N P U T   D A T A   S U M M A R Y

              Number of peaks in record            =       33
              Peaks not used in analysis           =        0
              Systematic peaks in analysis         =       33
              Historic peaks in analysis           =        0
              Years of historic record             =        0
              Generalized skew                     =   -0.081
                   Standard error                  =    0.550
                   Mean Square error               =    0.303
              Skew option                          = STATION SKEW
              Gage base discharge                  =      0.0
              User supplied high outlier threshold =   --
              User supplied low outlier criterion  =   --
              Plotting position parameter          =     0.00


  *********  NOTICE  --  Preliminary machine computations.        *********
  *********  User responsible for assessment and interpretation.  *********

    WCF133I-SYSTEMATIC PEAKS BELOW GAGE BASE WERE NOTED.         3      0.0
    WCF198I-LOW OUTLIERS BELOW FLOOD BASE WERE DROPPED.        1      105.6
    WCF163I-NO HIGH OUTLIERS OR HISTORIC PEAKS EXCEEDED HHBASE.      15817.1
   *WCF151I-17B WEIGHTED SKEW REPLACED BY USER OPTION.     0.126     0.243  -1
1

  Program PeakFq          U. S. GEOLOGICAL SURVEY            Seq.001.002
  Ver. 5.2            Annual peak flow frequency analysis    Run Date / Time
```

ATTACHMENT C

Station - 09514200 WATERMAN WASH NEAR BUCKEYE, ARIZ.

ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	FLOOD BASE		LOGARITHMIC		
	DISCHARGE	EXCEEDANCE PROBABILITY	MEAN	STANDARD DEVIATION	SKEW
SYSTEMATIC RECORD	0.0	0.9091	3.0534	0.4595	-0.281
BULL.17B ESTIMATE	105.6	0.8788	3.0822	0.4081	0.243

ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

ANNUAL EXCEEDANCE PROBABILITY	BULL.17B ESTIMATE	SYSTEMATIC RECORD	'EXPECTED PROBABILITY' ESTIMATE	95-PCT CONFIDENCE LIMITS FOR BULL. 17B ESTIMATES LOWER	UPPER
0.9000	--	283.4	--	--	--
0.8000	543.0	472.4	531.7	379.0	724.8
0.6667	782.3	747.7	775.2	574.0	1026.0
0.5000	1163.0	1188.0	1163.0	881.9	1529.0
0.4292	1377.0	1432.0	1381.0	1050.0	1825.0
0.2000	2630.0	2787.0	2694.0	1973.0	3755.0
0.1000	4117.0	4235.0	4323.0	2970.0	6360.0
0.0400	6754.0	6484.0	7402.0	4597.0	11550.0
0.0200	9386.0	8446.0	10710.0	6115.0	17270.0
0.0100	12700.0	10640.0	15200.0	7927.0	25040.0
0.0050	16830.0	13060.0	21290.0	10080.0	35470.0
0.0020	23850.0	16620.0	32790.0	13550.0	54630.0

1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.001.003
Ver. 5.2 Annual peak flow frequency analysis Run Date / Time
11/01/2007 following Bulletin 17-B Guidelines 02/09/2009 18:26

Station - 09514200 WATERMAN WASH NEAR BUCKEYE, ARIZ.

I N P U T D A T A L I S T I N G

WATER YEAR	DISCHARGE	CODES	WATER YEAR	DISCHARGE	CODES
1964	2680.0		1982	1660.0	
1965	1200.0		1983	985.0	
1966	5560.0		1984	3520.0	
1967	6300.0		1985	950.0	
1968	560.0		1986	1500.0	
1969	400.0		1987	0.0	
1970	1600.0		1988	1430.0	
1971	2080.0		1989	402.0	
1972	2000.0		1990	6310.0	
1973	0.0		1991	413.0	
1974	100.0		1992	1770.0	
1975	1200.0		1993	670.0	
1976	1180.0		1996	1470.0	

ATTACHMENT C

1977	740.0	1997	9400.0
1978	1150.0	1998	325.0
1980	2220.0	1999	916.0
1981	0.0		

Explanation of peak discharge qualification codes

PeakFQ CODE	NWIS CODE	DEFINITION
D	3	Dam failure, non-recurrent flow anomaly
G	8	Discharge greater than stated value
X	3+8	Both of the above
L	4	Discharge less than stated value
K	6 OR C	Known effect of regulation or urbanization
H	7	Historic peak

- Minus-flagged discharge -- Not used in computation
  -8888.0 -- No discharge value given
- Minus-flagged water year -- Historic peak used in computation

1

Program PeakFq
Ver. 5.2
11/01/2007

U. S. GEOLOGICAL SURVEY
Annual peak flow frequency analysis
following Bulletin 17-B Guidelines

Seq.001.004
Run Date / Time
02/09/2009 18:26

Station - 09514200 WATERMAN WASH NEAR BUCKEYE, ARIZ.

EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

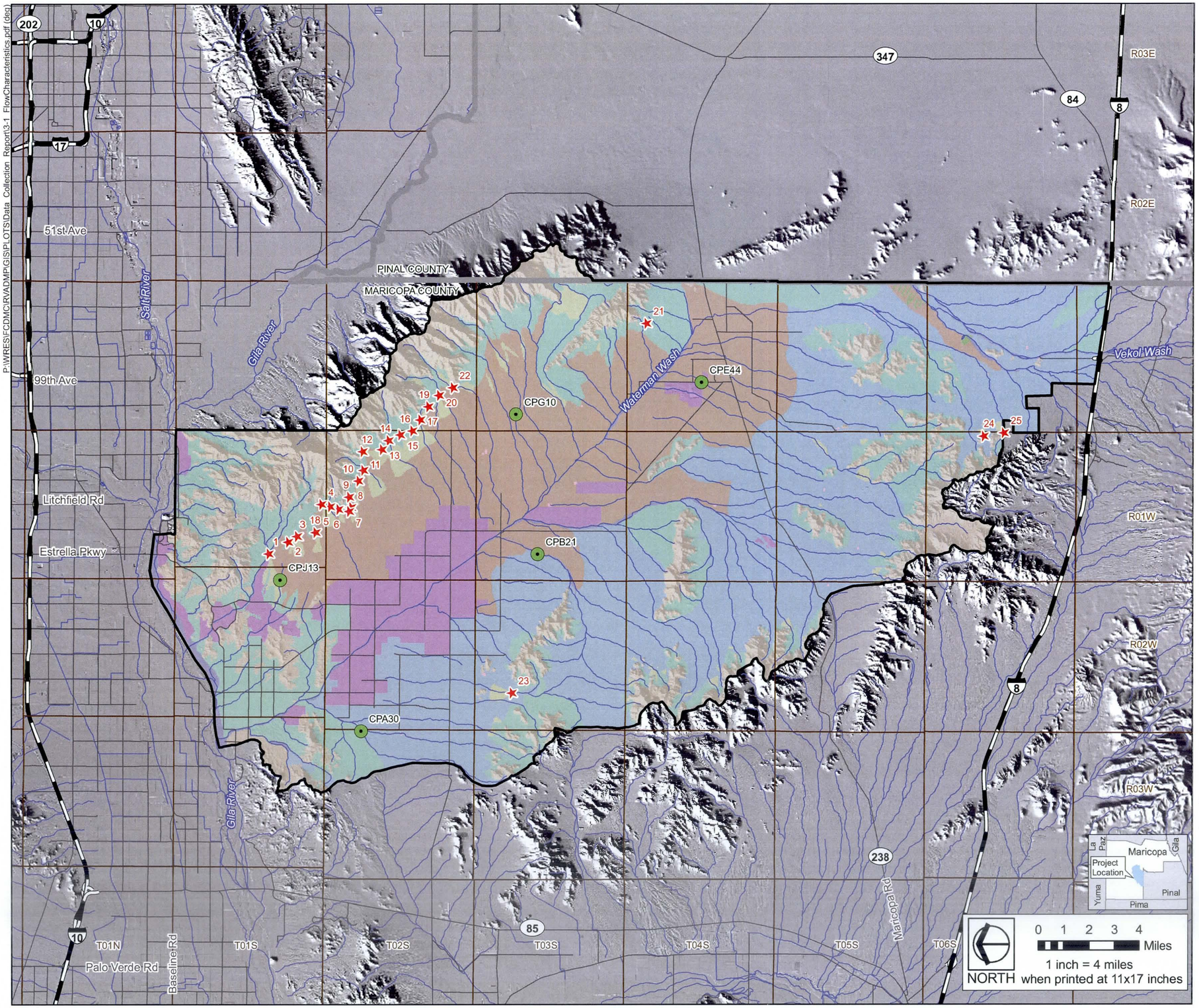
WATER YEAR	RANKED DISCHARGE	SYSTEMATIC RECORD	BULL.17B ESTIMATE
1997	9400.0	0.0294	0.0294
1990	6310.0	0.0588	0.0588
1967	6300.0	0.0882	0.0882
1966	5560.0	0.1176	0.1176
1984	3520.0	0.1471	0.1471
1964	2680.0	0.1765	0.1765
1980	2220.0	0.2059	0.2059
1971	2080.0	0.2353	0.2353
1972	2000.0	0.2647	0.2647
1992	1770.0	0.2941	0.2941
1982	1660.0	0.3235	0.3235
1970	1600.0	0.3529	0.3529
1986	1500.0	0.3824	0.3824
1996	1470.0	0.4118	0.4118
1988	1430.0	0.4412	0.4412
1965	1200.0	0.4706	0.4706
1975	1200.0	0.5000	0.5000
1976	1180.0	0.5294	0.5294
1978	1150.0	0.5588	0.5588
1983	985.0	0.5882	0.5882
1985	950.0	0.6176	0.6176
1999	916.0	0.6471	0.6471
1977	740.0	0.6765	0.6765
1993	670.0	0.7059	0.7059

ATTACHMENT C

1968	560.0	0.7353	0.7353
1991	413.0	0.7647	0.7647
1989	402.0	0.7941	0.7941
1969	400.0	0.8235	0.8235
1998	325.0	0.8529	0.8529
1974	100.0	0.8824	0.8824
1973	0.0	--	--
1981	0.0	--	--
1987	0.0	--	--

1

```
End PeakFQ analysis.
  Stations processed :       1
  Number of errors   :       0
  Stations skipped   :       0
  Station years      :      33

Data records may have been ignored for the stations listed below.
(Card type must be Y, Z, N, H, I, 2, 3, 4,  or *.)
(2, 4, and * records are ignored.)

 For the station below, the following records were ignored:

 FINISHED PROCESSING STATION:  09514200       USGS WATERMAN WASH NEAR BUCKEYE, A


 For the station below, the following records were ignored:

 FINISHED PROCESSING STATION:
```



P:\WRES\FCDMC\RVADMP\GIS\PLOTS\Data Collection Report\3-1 FlowCharacteristics.pdf (deg)

Rainbow Valley
Area Drainage Master Plan
Flow Characteristics

Figure 1

Project Features

- Concentration Point
- Alluvial Fans Selected for Floodplain Delineation

Flow Characteristics

- Alluvial Fan Flooding
- Disturbed Area
- Flood Retarding Structure
- Major River and Tributary Flooding
- Mountains
- Piedmont Distributary Flooding
- Piedmont Tributary Flooding
- Sheet Flooding
- Stockpond

Reference Features

- County Boundary
- Rainbow Valley ADMP Boundary
- Township and Range Boundary
- Interstate Highway/ Freeway
- Major Road
- River/Stream

Data Sources

Flood Control District of Maricopa County
Base Vector and Hillshade Data, 2008
JE Fuller/Hydrology & Geomorphology
Alluvial fan identification and flow characteristics assessment, 2008

DRAFT

Technical Memorandum

URS

7720 N. 16th Street
Suite 100
Phoenix, Arizona 85020
602.371.1100 Tel
602.371.1615 Fax

Action	Info	File
Burke Lokey	Rainbow Valley ADMP	23445383

From Elliot Silverston

Date October 1, 2008

Subject Vekol Wash

Registered Professional Engineer (Civil) CERTIFICATE NO. 33656 ELLIOT SILVERSTON Date Signed 10-1-08 ARIZONA, U.S.A.

Exp: June 30, 2011

Introduction

The purpose of this memorandum is to present the results of the Vekol Wash breakout evaluation. Vekol Wash originates in the Sand Tank Mountains south of the Waterman Wash watershed. Vekol Wash is parallel to Waterman Wash where both watercourses flow in a northeastern direction. The aerial imagery and USGS topographic mapping shows that there is a possibility for split flows in this area. The scope of work for the Rainbow Valley ADMP (Task 9.9.1.4) states that the potential flow split from Vekol Wash into Waterman Wash will be analyzed.

Field Reconnaissance

A field review was conducted by District and URS staff on August 20, 2008. The goal of the field review was to field evaluate the extent of inter-basin diversion of flow between Vekol Wash and Waterman Wash in the stock pond areas between Waterman Wash and Vekol Wash. The stock ponds are located in sections 2, 3, 10, and 11, Township 6 South, and Range 1 East, sections 25, 26, 35, and 36, Township 5 South, Range 1 East, and Section 30, Township 5 South Range 2 East of the Gila and Salt River Base and Meridian in Maricopa County, Arizona. Figure 1 shows the Field Map that was used for the field reconnaissance.

The western most stock pond is the most significant of all the structures identified on the aerial imagery and observed in the field. A Bureau of Land Management (BLM) monument was found that was stamped with an identification of "Vekol Dam" and was dated 1986. Vekol Dam impounds runoff from a tributary to Vekol Wash. Vekol Wash is approximately 1000 feet south of Vekol Dam.

The dam has an outlet structure consisting of a 54-inch corrugated metal pipe (CMP) with a concrete headwall, but the approximate inlet location was found and was clogged with debris. A breach was also discovered at the southeast corner of the dam embankment. The flowpath from this breach flows into Vekol Wash rather than down the historic flow path.

There is a dirt road branching off of Vekol Valley Road north of Vekol Dam and north and parallel to Vekol Valley Road. The field review team followed this road north to determine if there were any significant flow paths that would convey flow to Waterman Wash. There were no signs that the flows would be conveyed to Waterman Wash through defined channels. The wash from the Vekol Dam outlet appeared to flow towards the stock ponds to the northeast. Any flow between Vekol Wash and Waterman Wash would be through sheet flow and would be difficult to estimate. The amount of flow from Vekol Wash to Waterman Wash could be in the order of a few hundred feet per second. However, it is questionable whether the washes would have simultaneous peak flows so we can assume that the flow diversion is zero.

The field review team investigated the stock ponds located in sections 25, 35 and 36, Township 5 South, Range 1 East and Section 30, Township 5 South, Range 2 East. There are 9 stock pond berms in this location. Runoff flows from the southwest to the northeast. The berms detain the flow. The stock ponds have relatively small diameter outlets that allow flows to be conveyed to the next downstream stock pond. There is no apparent flow pattern that shows conveyance from the stocks ponds to Waterman Wash. Therefore it is assumed that the general flow pattern is to Vekol Wash with a significant portion of the flow infiltrating to the ground or being lost to evapotranspiration.

Methodology

The peak flow calculation for Vekol Wash and the Vekol Wash tributary were done using the USGS southwestern regional regression equation (Reference 1).

The basin delineation to determine the contributing watershed was developed using the following data sets:

- Topography
- Aerial Imagery

Topography

Available topography includes the following

- USGS 7.5 Minute Quadrangle mapping
- 10-feet contour mapping for the study area

The topography data helped in delineating the contributing watershed area and identifying the flow directions for Vekol Wash and Vekol Wash tributary.

Aerial Imagery

The one-foot aerial MrSID images provided by the FCDMC (2006) helped to identify the flow path of the stream segments and tributaries. The imagery was also used to identify vegetation density that could be used to define flow concentration and flow direction.

Figure 2 shows the basin delineations for Vekol Wash and the Vekol Wash tributary.

Peak Flow Estimation

The basin watersheds were delineated to determine the watershed area of the watershed. The 100-year peak flow was calculated using the Southwest Regional Regression Equation for Central Arizona Region 13 (Reference 1). The regression equation for Region 13 is a function of basin area.

100-year event: $$Q_{100} = 10^{(5.52-2.42\,AREA^{-0.12})}$$

The delineated watershed area for the point of interest for Vekol Wash is 242 mi^2 and 49 mi^2 for the Vekol Wash tributary. The calculated peak discharges are approximately 18,500 cfs and 10,000 cfs, respectively.

The details of the calculations are attached in Appendix A.

Conclusion

The results from the field reconnaissance showed that Vekol Dam is on a tributary to Vekol Wash and not on the main channel for Vekol Wash. The dam has an existing breach that has a flow path conveying flow from Vekol Dam to Vekol Wash. The topography separating Vekol Wash and Waterman Wash prevents flows from commingling. The historic flow path for the Vekol Wash tributary is diverted to Vekol Wash due to the dam breach. The flow that would be conveyed in the Vekol Wash tributary downstream of Vekol Dam is directed towards additional impoundments downstream of Vekol Dam. These impoundments direct flow back into Vekol Wash. There were no flow splits found along the watershed divide between Waterman Wash and the Vekol Wash tributary. Any flow that could potentially breakout into Waterman Wash would be in the form of sheet flow and would be difficult to quantify. It is also doubtful that there would be coincident peak flows in the Vekol Wash tributary and Waterman Wash. Therefore, the

recommended diversion of flow from the Vekol Wash watershed into Waterman Wash is estimated as zero.

This report has been prepared based on certain key assumptions made by URS which substantially affect the conclusions and recommendations of this report. These assumptions, although thought to be reasonable and appropriate, may not prove to be true in the future. The conclusions and recommendations of URS are conditioned upon these assumptions.

REFERENCES

1. U.S. Geological Survey, *Open-file Report 93-419, Methods for Estimating Magnitude and Frequency of Floods in the Southwestern United States*, 1994.

FIGURES

APPENDIX A

100-year Peak Discharge Calculations

URS

CALCULATION COVER SHEET

Client: FCDMC Project Name: RVADMP

Project/Calculation Number: 23445234

Title: Hydrologic Analysis – Vekol Wash Existing Conditions

Total Number of Pages: _____

Total Number of Computer Runs: _____

Prepared by: Ashley Meyer Date: 7/30/08

Checked by: T Bose B.T. Date: 7/31/08

Description and Purpose:
The purpose of this calculation is to determine the 100-yr peak discharge from Vekol Wash that could enter Waterman Wash in the event that the tank separating the two was to fail.

Design Basis /Assumptions
The peak discharge was computed using the "Methods for Estimating Magnitude and Frequency of Floods in the Southwestern United States" regional regression equation as a guide. The Vekol Wash watershed is located within Arizona Region 13, and the area was measured to be approximately 241.5 square miles. Refer to P:\WRES\FCDMC\RVADMP\GIS\MXDS\Working\waterman_fieldmap_l.mxd for the watershed delineation.

Remarks/Conclusions/Results:
Using the regional regression equation for Southern Arizona Region 13, the 100-yr peak discharge was calculated to be ~~18,505~~ 18,500 cfs.

Calculation Approved by: 9-24-08
Project Manager/Date

Revision No.:	Description of Revision:	Approved by:

Project Manager/Date

Generalized least-squares regression equation for estimating regional flood-frequency relations for the Southern Arizona Region 13:

$$Q_{100} = 10^{(5.52-2.42AREA^{-0.12})}$$

Where, Q = 100-yr peak discharge in cfs
AREA = drainage area in square miles

Vekol Wash area is approximately 241.5 square miles, therefore the 100-yr peak discharge equals:

$$Q_{100} = 10^{(5.52-2.42(241.5^{-0.12}))}$$

$$Q_{100} = 10^{4.267}$$

$$\underline{\underline{Q_{100} = 18{,}505cfs}}$$

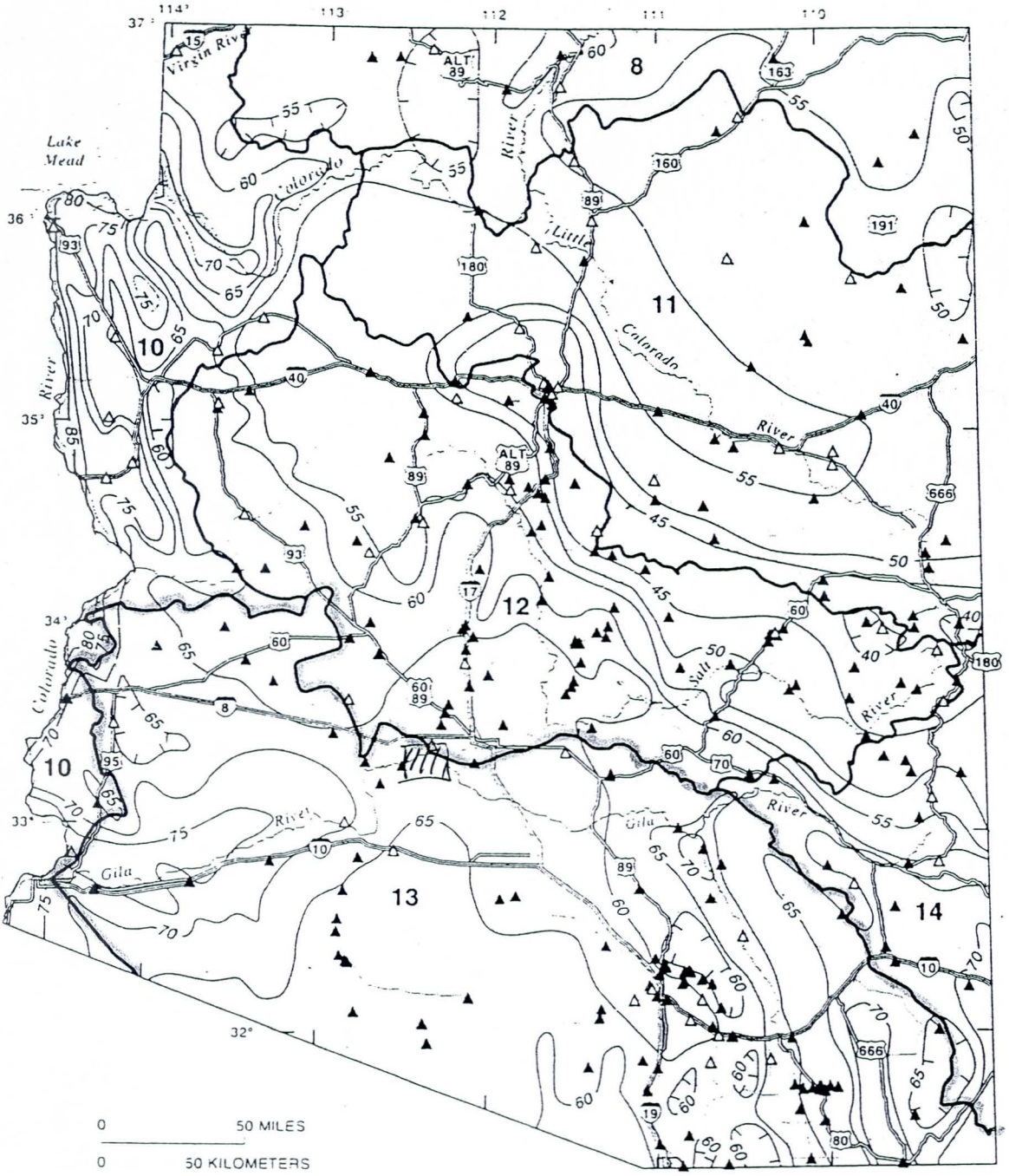
Methods for Estimating Magnitude and Frequency of Floods in the Southwestern United States

By BLAKEMORE E. THOMAS, H.W. HJALMARSON, and S.D. WALTEMEYER

U.S. GEOLOGICAL SURVEY
Open-File Report 93—419

Prepared in cooperation with the
COLORADO DEPARTMENT OF HIGHWAYS,
ARIZONA DEPARTMENT OF TRANSPORTATION,
CALIFORNIA DEPARTMENT OF TRANSPORTATION,
IDAHO DEPARTMENT OF TRANSPORTATION,
NEVADA DEPARTMENT OF TRANSPORTATION,
NEW MEXICO STATE HIGHWAY AND TRANSPORTATION DEPARTMENT,
OREGON DEPARTMENT OF TRANSPORTATION,
TEXAS DEPARTMENT OF TRANSPORTATION, and
UTAH DEPARTMENT OF TRANSPORTATION

Tucson, Arizona
1994



EXPLANATION

BOUNDARY OF FLOOD REGIONS

11 FLOOD-REGION NUMBER

INTERSTATE HIGHWAY

U.S. HIGHWAY

STATE HIGHWAY

60 LINE OF EQUAL FREE WATER-SURFACE EVAPORATION—Interval 5 inches (Farnsworth and others, 1982)

STREAMFLOW-GAGING STATION

▲ Station relation defined

△ Station relation undefined

Figure 7. Flood regions in Arizona.

Site Location

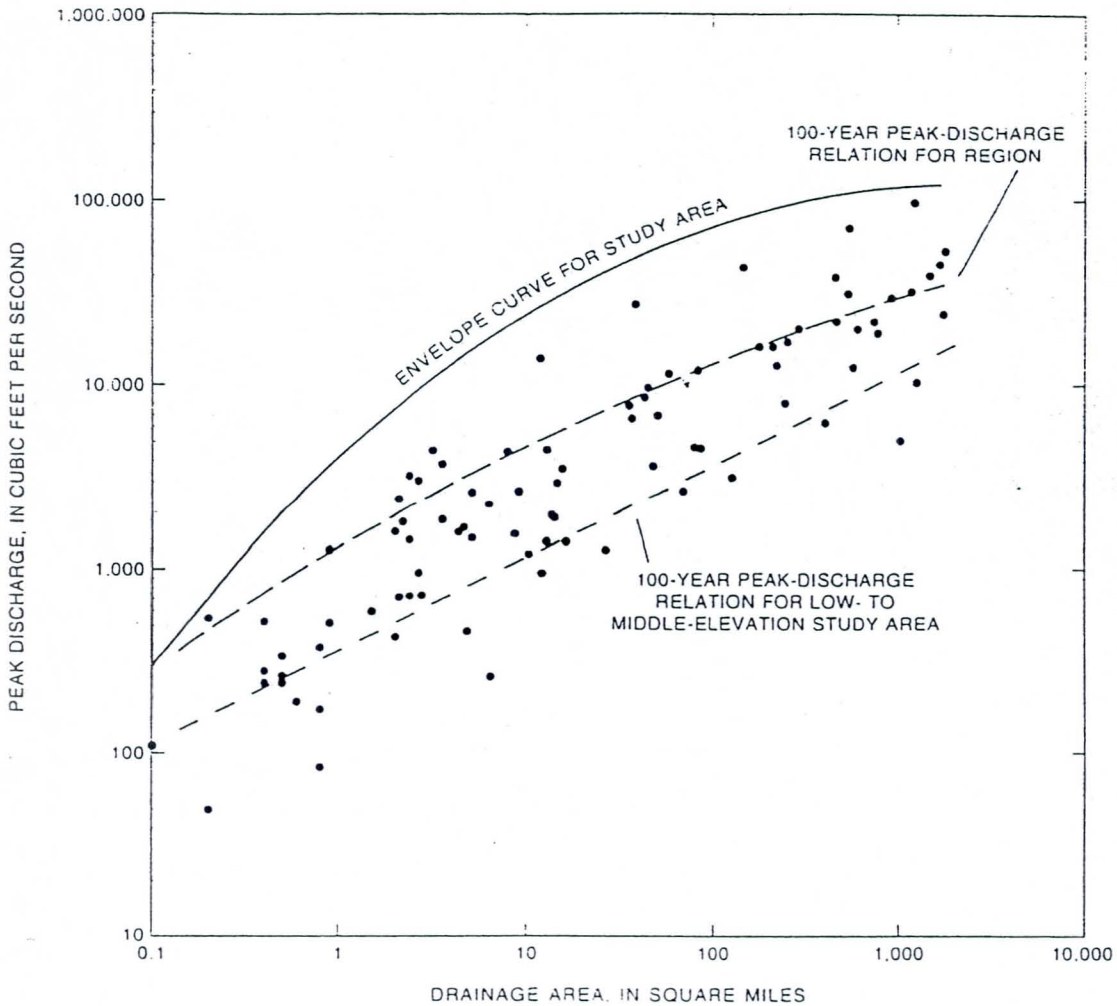


Figure 42. Relations between 100-year peak discharge and drainage area and plot of maximum peak discharge of record and drainage area for gaged sites in the Southern Arizona Region 13.

Table 17. Generalized least-squares regression equations for estimating regional flood-frequency relations for the Southern Arizona Region 13

Equation: Q, peak discharge, in cubic feet per second; and AREA, drainage area, in square miles. Data were based on 73 stations. Average number of years of systematic record is 21.

Recurrence interval, in years	Equation	Average standard error of prediction, in percent	Equivalent years of record
2	$Q=10^{(6.38-4.29AREA^{-0.06})}$	57	2.0
5	$Q=10^{(5.78-3.31AREA^{-0.08})}$	40	6.25
10	$Q=10^{(5.68-3.02AREA^{-0.09})}$	37	11.1
25	$Q=10^{(5.64-2.78AREA^{-0.10})}$	39	15.0
50	$Q=10^{(5.57-2.59AREA^{-0.11})}$	43	15.9
100	$Q=10^{(5.52-2.42AREA^{-0.12})}$	48	16.1

URS

CALCULATION COVER SHEET

Client: FCDMC Project Name: RVADMP

Project/Calculation Number: 23445234

Title: Hydrologic Analysis – Vekol Wash Existing Conditions

Total Number of Pages: _____

Total Number of Computer Runs: _____

Prepared by: TBose Date: 8/25/08

Checked by: Nathan Ewert Date: 8-25-08

Description and Purpose:
The purpose of this calculation is to determine the 100-yr peak discharge from Vekol Wash tributary that could enter Waterman Wash in the event that the tank separating the two was to fail.

Design Basis /Assumptions
The peak discharge was computed using the "Methods for Estimating Magnitude and Frequency of Floods in the Southwestern United States" regional regression equation as a guide. The Vekol Wash tributary watershed is located within Arizona Region 13, and the area was measured to be approximately 48.75 square miles. Refer to P:\WRES\FCDMC\RVADMP\GIS\MXDS\hydro\vekol_wash_working.mxd for the watershed delineation.

Remarks/Conclusions/Results:
Using the regional regression equation for Southern Arizona Region 13, the 100-yr peak discharge was calculated to be 10,047 cfs.
10,000 cfs is appropriate as

Calculation Approved by: Elliot [illegible] 8/25/08
Project Manager/Date

Revision No.:	Description of Revision:	Approved by:

Project Manager/Date

Generalized least-squares regression equation for estimating regional flood-frequency relations for the Southern Arizona Region 13:

$$Q_{100} = 10^{(5.52-2.42AREA^{-0.12})}$$

Where, Q = 100-yr peak discharge in cfs
AREA = drainage area in square miles

Vekol Wash area is approximately 48.75 square miles, therefore the 100-yr peak discharge equals:

$$Q_{100} = 10^{(5.52-2.42(48.75^{-0.12}))}$$

$$Q_{100} = 10^{4.002}$$

$$\underline{\underline{Q_{100} = 10{,}047 cfs}}$$

Methods for Estimating Magnitude and Frequency of Floods in the Southwestern United States

By BLAKEMORE E. THOMAS, H.W. HJALMARSON, and S.D. WALTEMEYER

U.S. GEOLOGICAL SURVEY
Open-File Report 93—419

Prepared in cooperation with the
COLORADO DEPARTMENT OF HIGHWAYS,
ARIZONA DEPARTMENT OF TRANSPORTATION,
CALIFORNIA DEPARTMENT OF TRANSPORTATION,
IDAHO DEPARTMENT OF TRANSPORTATION,
NEVADA DEPARTMENT OF TRANSPORTATION,
NEW MEXICO STATE HIGHWAY AND TRANSPORTATION DEPARTMENT,
OREGON DEPARTMENT OF TRANSPORTATION,
TEXAS DEPARTMENT OF TRANSPORTATION, and
UTAH DEPARTMENT OF TRANSPORTATION

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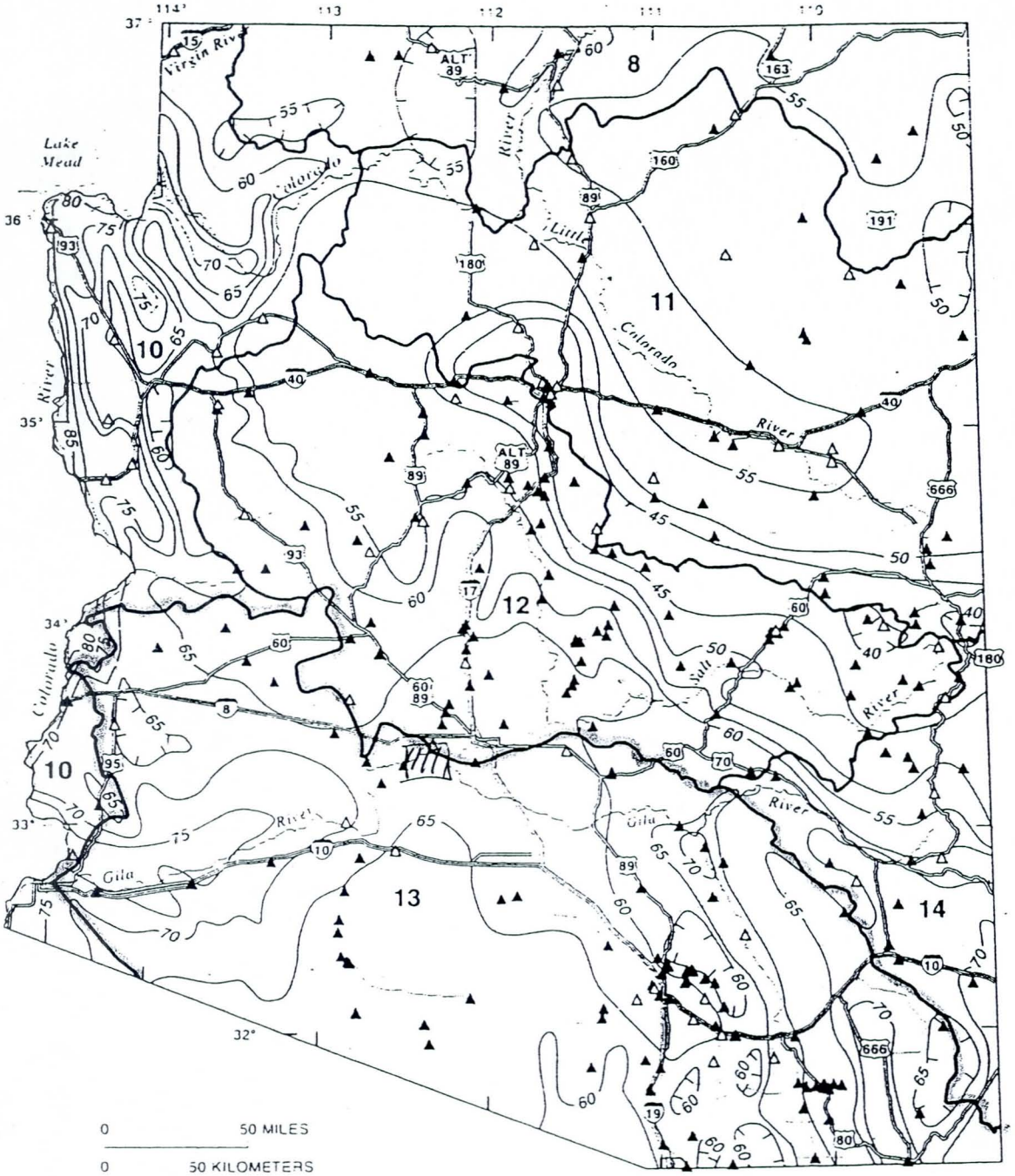
1994



EXPLANATION

BOUNDARY OF FLOOD REGIONS

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89 U.S. HIGHWAY

STATE HIGHWAY

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▲ Station relation defined

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Figure 7. Flood regions in Arizona.

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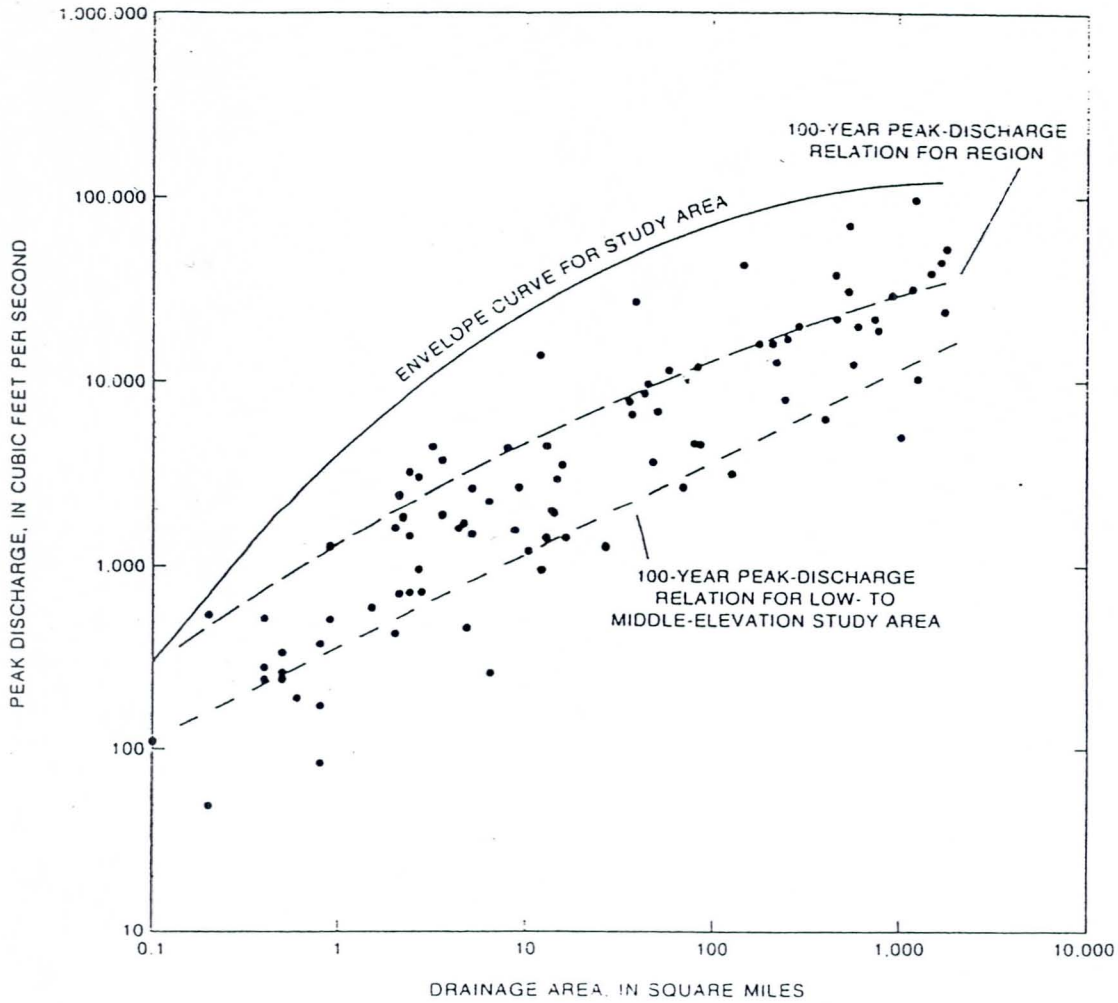

Figure 42. Relations between 100-year peak discharge and drainage area and plot of maximum peak discharge of record and drainage area for gaged sites in the Southern Arizona Region 13.

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50	$Q=10^{(5.57-2.59AREA^{-0.11})}$	43	15.9
100	$Q=10^{(5.52-2.42AREA^{-0.12})}$	48	16.1

Memorandum JE Fuller/ Hydrology & Geomorphology, Inc.

DATE: October 5, 2010

TO: Elliot Silverston, P.E.; Marc McIntosh, P.E.

FROM: Mike Kellogg, R.G.

RE: Rainbow Valley ADMP Task 9.2.8

CC: Jen Wennerlund

REGISTERED GEOLOGIST
CERTIFICATE NO.
43618
MICHAEL J.
KELLOGG
Date Signed 10/5/2010
ARIZONA, U.S.A.
Expires 12/31/2011

Introduction

Task 9.2 of the Rainbow Valley Area Drainage Master Plan (RVADMP) requires that a reconnaissance level geomorphic overview of the watershed study area be performed to identify the varying flood hazards. The geomorphic overview was performed by interpreting features observed on digital, orthorectified color aerial photographs, Arizona Geological Survey (AZGS) surficial mapping, and digital topography. Specifically, Task 9.2.2 includes the following:

- Development of a flow characteristics map to identify portions of the study area that are subject to alluvial fan flooding, distributary flow, sheet flooding, ponding, and riverine flooding based on a watershed geomorphic assessment. This includes a GIS map showing coverages for each flow characteristic type and a polygon showing mountain areas where the land slope exceeds 15% using a digital elevation model provided by the District. This map will be used to identify appropriate tools for hydrology and floodplain delineation.

The deliverables for the geomorphic overview component (Task 9.2.8) includes the following:

- A brief written technical memorandum of the geomorphic landforms in the study area, with particular emphasis on areas potentially subject to alluvial fan flooding, stable distributary flow, sheet flow, and ponding. The technical memorandum shall be coordinated with the GIS coverages showing the approximate areal boundaries of the specific hazard types.

GIS Shapefiles. The following shapefiles are provided as attachments to this memorandum:

- A GIS shapefile showing the approximate boundaries of the specific landform hazard types.
- GIS data showing mountain areas where the land slope exceeds 15%, using a digital elevation model provided by the District.

Methodology

The landform-flood hazard type delineation was done using the following data sets:

- Flow Bifurcations
- Channel Pattern
- Topography
- NRCS Soils Mapping
- AZGS Surficial Geologic Mapping
- Existing Floodplain Delineations

Flow Bifurcations[1]. The distribution of bifurcation points, as shown in Figure 1, can be used to identify distributary flow areas and alluvial fans. For the RVADMP study area, most of the mapped bifurcations occur on the piedmont surfaces, with a fewer number occurring on the major rivers and tributaries.

Channel Pattern. Aerial photographs indicate the two primary channel patterns within the RVADMP study area are 1) distributary and 2) tributary. The distributary pattern is dominant within most of the piedmont slopes while the tributary pattern is dominant within and near the base of the mountains. The major river and tributary drainages are characterized by a low sinuosity channel pattern.

Topography. Available watershed topography included the District's 10-foot contour interval mapping (Figure 2), 2-foot contour interval mapping, and the USGS topographic quadrangle maps. Topographic data were used to identify areas of steep slopes (darkened areas on Figure 2 due to close contour spacing), as well as alluvial fans (radial contours) and sheet flow areas (low crenulation planar surfaces).

NRCS Soils Mapping. NRCS soils unit mapping (Figure 3) were used to identify broad areas of similar soils type. However, the NRCS soil landform descriptions correlated poorly with actual landform characteristics in the study area.

AZGS Surficial Geologic Mapping. AZGS mapping for the RVADMP study area (Figure 4) was used to identify older versus younger geomorphic surfaces, distinguish piedmont alluvium from areas underlain by shallow bedrock, identify distributary versus tributary channel patterns, and identify areas of sheet flow.

Existing Floodplain Delineations. A number of floodplain delineations were previously completed by the District (Figure 5). These floodplains were used to identify the major rivers and tributaries within the study area.

Landform Slope. A landform slope analysis was performed using the District's 10-foot contour interval digital topography. The primary purpose of this analysis was to identify slopes greater than 15%. The 10-foot topography provided sufficient resolution and was

[1] A channel bifurcation is where a stream channel divides into two or more flow paths in the downstream direction.

available for the entire study area. The 2-foot topography was not available for the entire study area, thus was not included. Figure 6 shows the result of the analysis.

Landform Delineation

The data sets and information described above were used to define the following types of landforms in the RVADMP study area:

- Mountain Slope Areas (> 15% slope)
- Piedmont Areas with Tributary Drainage Systems
- Piedmont Areas with Distributary Drainage Systems
- Alluvial Fans
- Sheet Flow/Unconfined Flow Areas
- Major Riverine Floodplains
- Disturbed Areas
- Ponding Areas

The landform map for the RVADMP study area is shown in Figure 7.

Mountain Slope Areas. The Mountain Slope Area landform consists of steep mountainous terrain underlain by shallow or exposed bedrock. Mountain slope areas were identified from the aerial photographs, topographic maps and AZGS geologic maps. The Mountain Slope Area landform unit was observed primarily within the northeast and southwest quarters with other, smaller mountain areas distributed throughout (Figure 7). The channels in the Mountain Slope Area landform consist of well-defined, low sinuosity tributary streams located in bedrock or mountain canyons.

Piedmont[1] Areas with Tributary Drainage Systems. This landform unit consists of mildly sloping alluvial surfaces with dendritic tributary drainage networks. Piedmont areas with tributary systems were identified from aerial photographs, the bifurcation delineations, topographic maps, NRCS soils maps, and AZGS geologic maps. The Piedmont Area with Tributary Drainage System landform occurs as a buffer between the Mountain Slope Landform and the low-sloping piedmont or alluvial plain. The watercourses in the Piedmont Areas with Tributary Drainage Systems landform consist of moderately steep, well-defined channels with narrow floodplains.

Piedmont Areas with Distributary Drainage Systems. This landform unit consists of mild-to-low sloping alluvial surfaces with distributary[2] drainage networks. Piedmont areas with distributary systems were identified from aerial photographs, the bifurcation delineation, topographic maps, NRCS soils maps, and AZGS geologic maps. The Piedmont Area with Distributary Drainage System landform was the dominant landform within the study area. Both stable and unstable distributary drainage patterns were observed. In general, the

[1] The piedmont is a sloping landform located at the base of a mountain and is usually composed of or mantled by unconsolidated alluvium.

[2] Distributary flow areas have channels that branch and split in the downstream direction.

western piedmont sloping off of the Maricopa Mountains was identified as a stable distributary system. The stable distributary network is being actively created through the process of stream capture rather than the avulsion dominated processes on active distributary systems. The distributary portion of the Sierra Estrella Mountain piedmont is an active, unstable distributary system.

Alluvial Fans. Alluvial fans are characterized by specific landform characteristics relating to their composition, morphology, and location. Alluvial fans are composed of eroded rock material transported and deposited from the upstream watershed. Alluvial fans have the shape of a fan, either partially or fully extended, with a radial pattern of topographic contours. Alluvial fans are located near a topographic break, which may be expressed either laterally or vertically. Alluvial fan areas were identified from aerial photographs, the bifurcation delineations, topographic maps, and AZGS geologic maps. The reconnaissance level landform identification process used roughly corresponds to the Level 1 procedure outlined in the District's Piedmont Flood Hazard Assessment Manual. The Alluvial Fan landform occurs within the Piedmont Area landform. Potential alluvial fans were identified throughout the study area; however 25 fans were selected for detailed analysis in the RVADMP study. The 25 fans are identified in Figure 7 by a red star located at the fan apex.

Sheet Flow/Unconfined Flow Areas. Sheet and unconfined flow occurs where there is no well-developed or defined drainage network to convey the majority of floodwater. The term "sheet flow" refers to any form of unconfined runoff that occurs over a broad, expansive area. This broad definition of sheet flow incorporates several more narrowly defined flow types, including natural (classic) sheet flow, urban sheet flow, agricultural sheet flow, overland flow, perched flow, anastomosing flow, and distributary flow. Although sheet flow is the dominant process on high, geologically old swales, these individual landforms were not specifically identified as sheet flow due to their scale. Large sheet flow areas were identified within the study area and are shown on Figure 7.

Major Riverine Floodplains. A floodplain is a planar surface adjacent to a watercourse that is periodically inundated by flood water. Floodplains consist of relatively fine-grained, unconsolidated alluvium recently deposited by the watercourse. Floodplains were identified from aerial photographs, the bifurcation delineations, topographic mapping, AZGS mapping, and maps of existing and pending FEMA floodplain delineations. Of the watercourses in the RVADMP, only Waterman Wash and it major tributaries were large enough to be mapped as a distinct landform at the mapping scale used.

Ponding. Areas of ponding were identified throughout the study area, primarily as stockponds. Although minor ponding likely occurs on the upstream side of roadway, railroad, and other levee-like structures, they were not individually identified at the scale of mapping for this study.

Flood Diversion/Detention Structures. Several large flood diversion/detention structures were identified in the southeast portion of the study area.

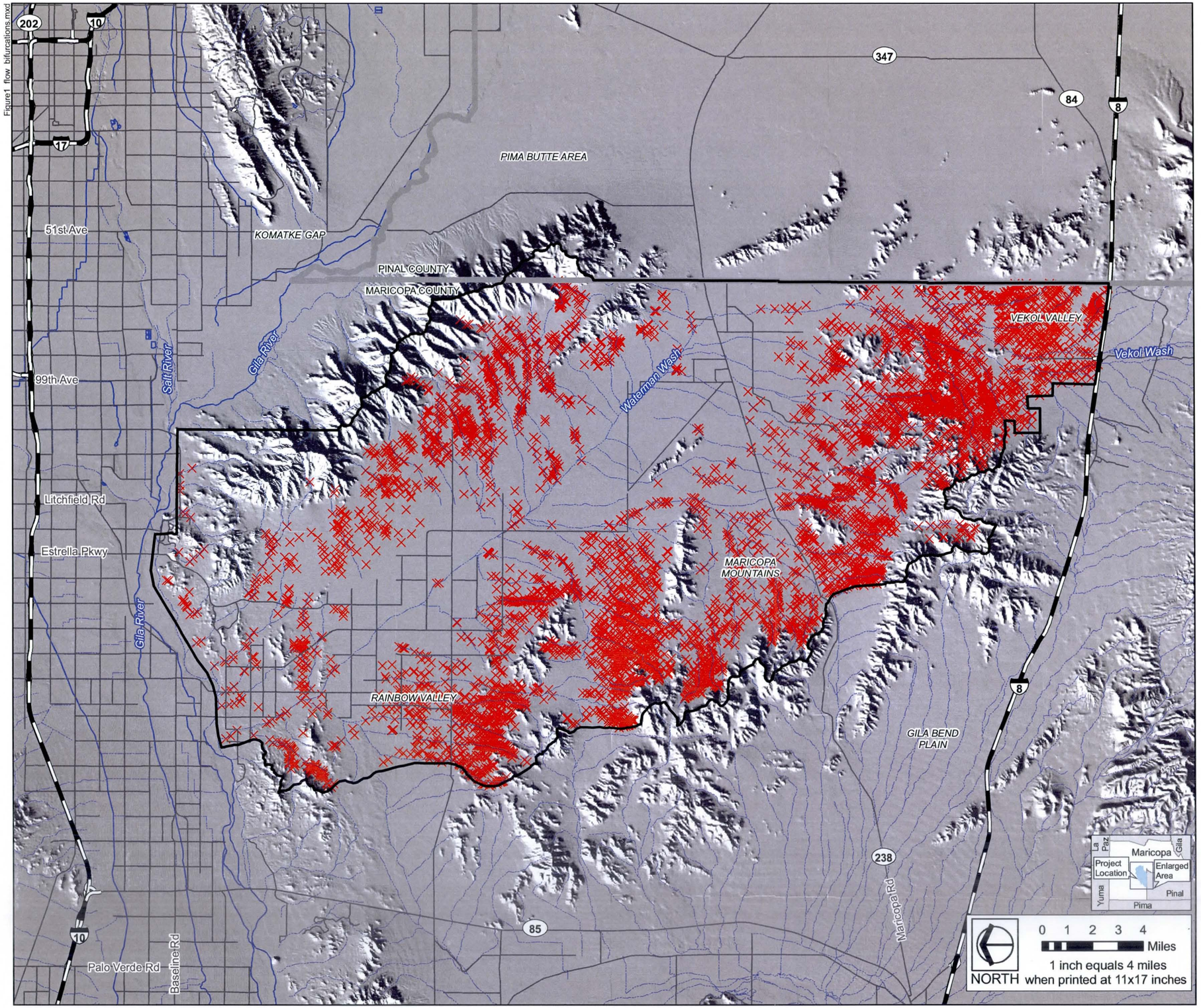
Landscape Characteristics

The District has identified and delineated landscape characteristic zones within the RVADMP study area. A comparison of the flow characteristics developed for this study with the District's landscape characteristics provides valuable information to planners. Figure 8 shows the flow and landscape characteristics plotted together. The figure shows a strong correlation between the units. Table 1 lists the landscape characteristics and the approximate corresponding flow characteristics.

Table 1. Landscape and Flow Characteristics Comparison

Landscape Characteristic	Flow Characteristic
River Channel	Major River and Tributary Flooding
River Terrace	Major River and Tributary Flooding
Valley Wash	Major River and Tributary Flooding
Valley Plain	Sheet Flooding
Arroyo	Major River and Tributary Flooding
Foothills	Tributary Flooding
Lower Bajada	Distributary Flooding
Upper Bajada	Tributary Flooding
Mountains	Mountains

Figure1 flow bifurcations.mxd



Rainbow Valley
Area Drainage Master Plan
Flow Bifurcations

Figure 1

Project Features

- Flow Bifurcations

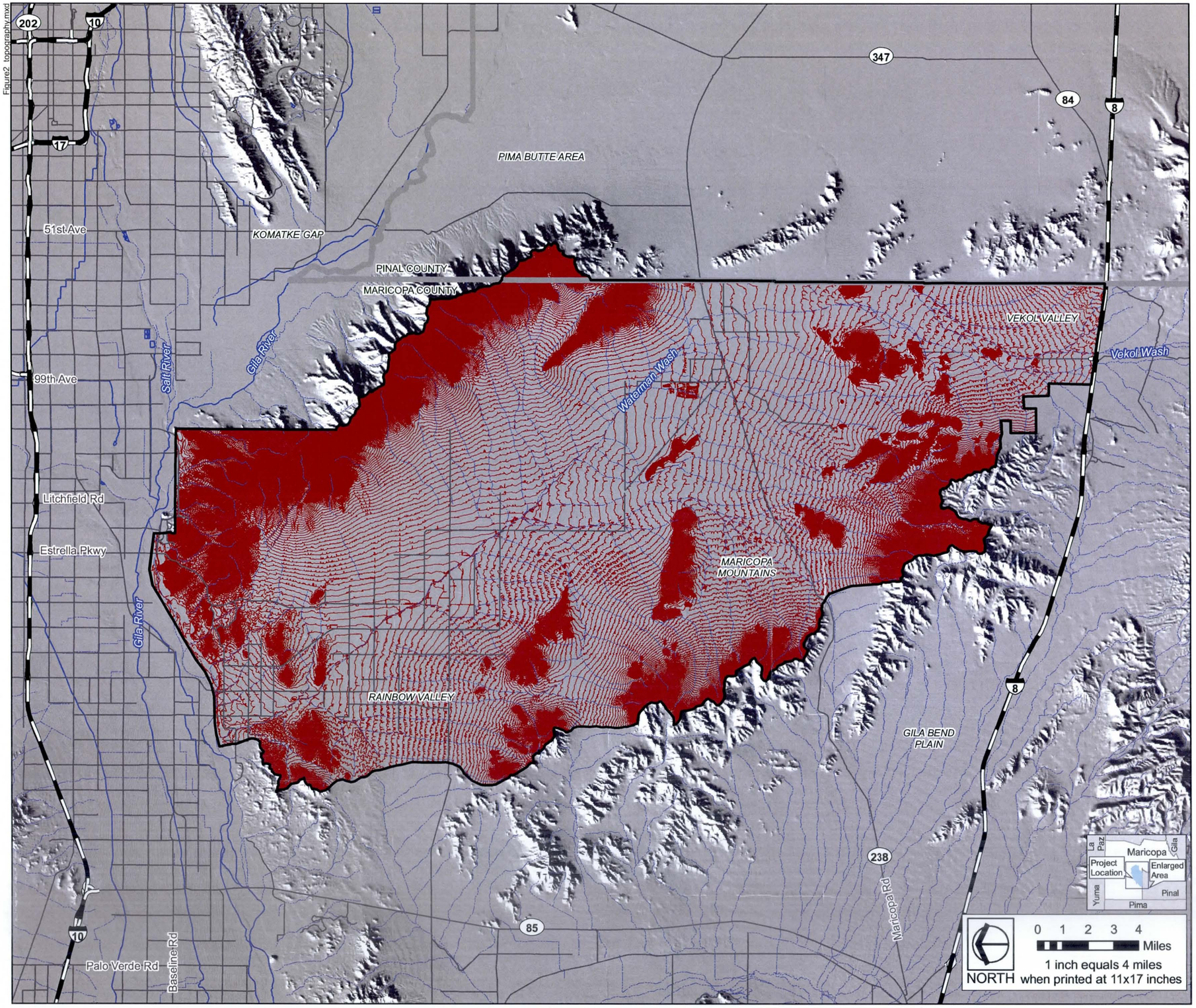
Reference Features

- County Boundary
- Rainbow Valley ADMP Boundary
- Interstate Highways/ Freeways
- State Highways
- Perennial Streams
- Intermittent Streams

Data Sources

JE Fuller/Hydrology & Geomorphology flow bifurcation data (2008).

Figure2 topography.mxd



Rainbow Valley
Area Drainage Master Plan
Topography

Figure 2

Project Features

Elevation Contours (contour interval 10-feet)

Reference Features

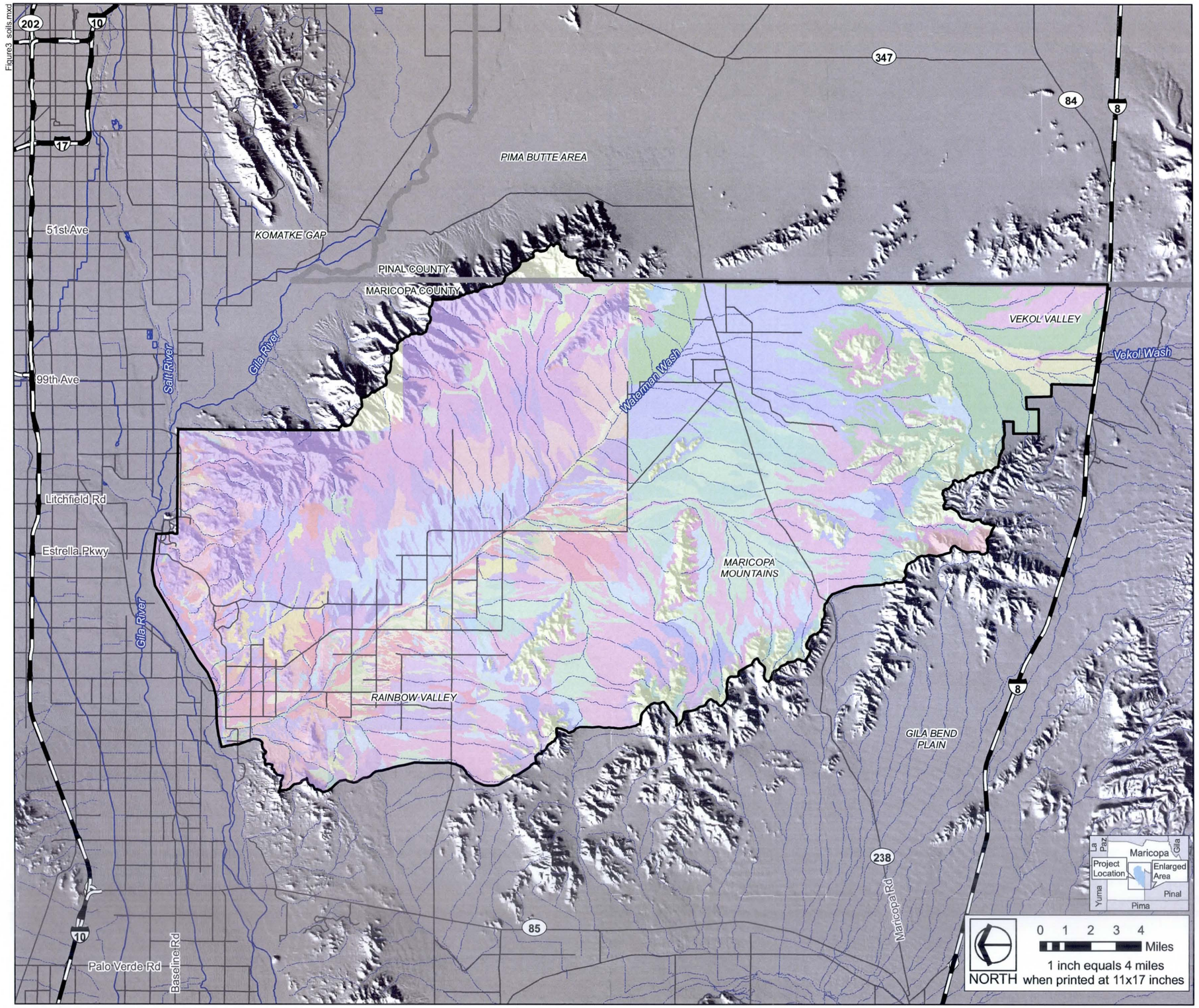
- County Boundary
- Rainbow Valley ADMP Boundary
- Interstate Highways/ Freeways
- State Highways
- Perennial Streams
- Intermittent Streams

Data Sources

Flood Control District of Maricopa County:
County- Wide 10-foot contour interval digital topography (December 2000).

Rainbow Valley
Area Drainage Master Plan
National Resource Conservation Service Soils

Figure 3



Project Features

Note: Unit descriptions are available from District GIS information and are not repeated here as there are over hundred individual units represented. The objective of this illustration is to highlight the location of large areas of uniform soil types.

Reference Features

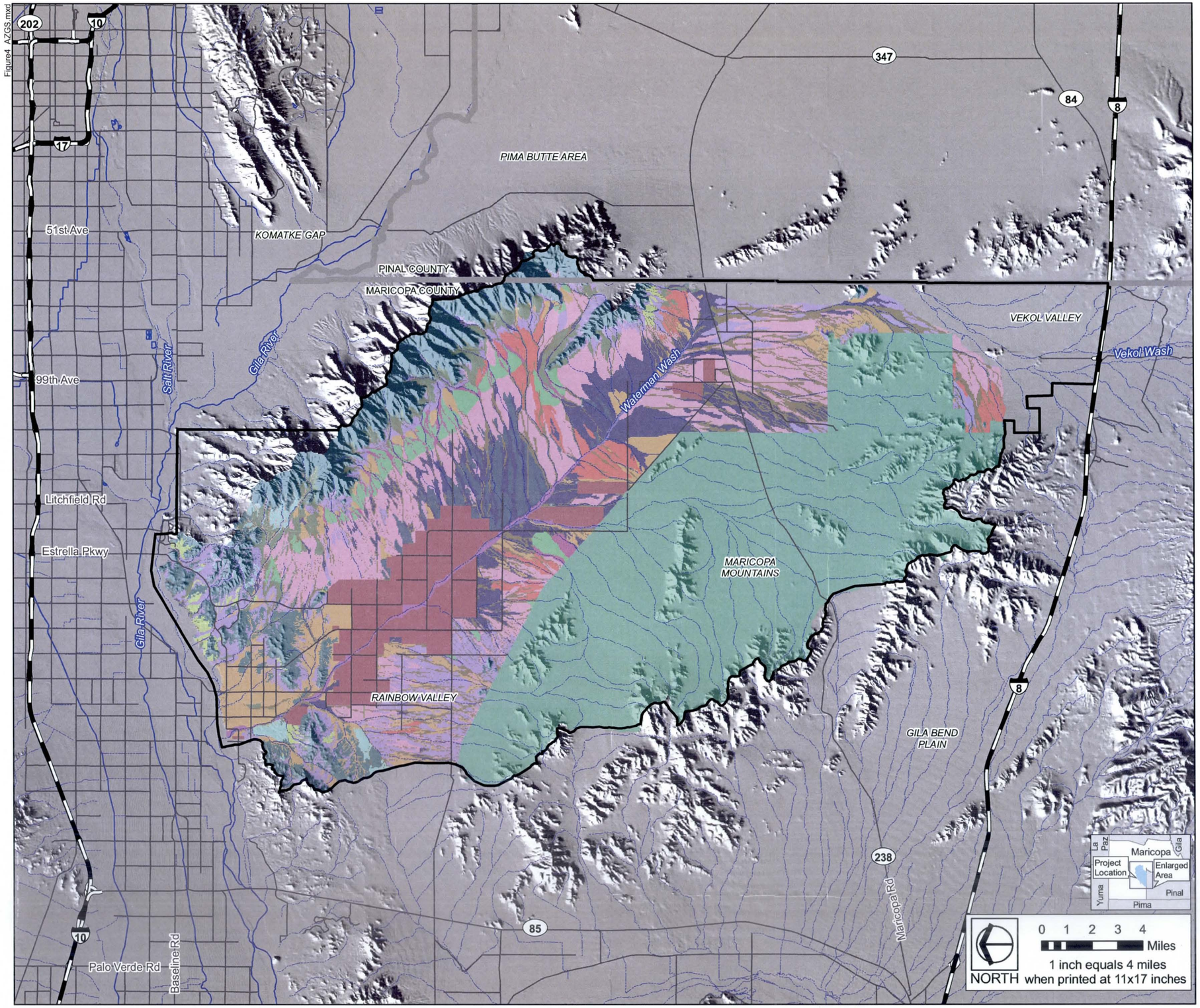
- County Boundary
- Rainbow Valley ADMP Boundary
- Interstate Highways/ Freeways
- State Highways
- Perennial Streams
- Intermittent Streams

Data Sources

National Resource Conservation Service Digital Soils Mapping Sources:
1. Gila Bend-Ajo Area, Arizona, Parts of Maricopa and Pima Counties (NRCS Area Symbol AZ653)
2. Gila River Indian Reservation, Parts of Maricopa and Pinal Counties, Arizona (NRCS Area Symbol AZ 658)
3. Maricopa County, Arizona, Central Part (NRCS Area Symbol AZ651)

Rainbow Valley
Area Drainage Master Plan
Arizona Geological Survey Geologic Mapping

Figure 4



Project Features

- Active alluvial fans
- Active channels, bars and low terraces
- Active swales and sheetflood areas
- Agricultural Land
- Bedrock, undivided
- Channels of large tributary washes
- Colluvium and talus
- Early Pleistocene alluvium
- Existing channels and drainageway associated with active alluvial fans
- Holocene alluvium, undivided
- Holocene and Pleistocene alluvium on piedmont slopes
- Inactive Holocene alluvial fans and terraces
- Late Pleistocene alluvium
- Middle Pleistocene alluvium
- Mixed Holocene alluvial and eolian deposits on lower piedmont slopes
- Modern river channels
- Modern river terraces and bars
- Pleistocene and Holocene oninactive alluvial fans and piedmont slopes
- River terraces
- Sonoran National Monument
- Tertiary sediment, undivided
- Ditches
- Tanks

Reference Features

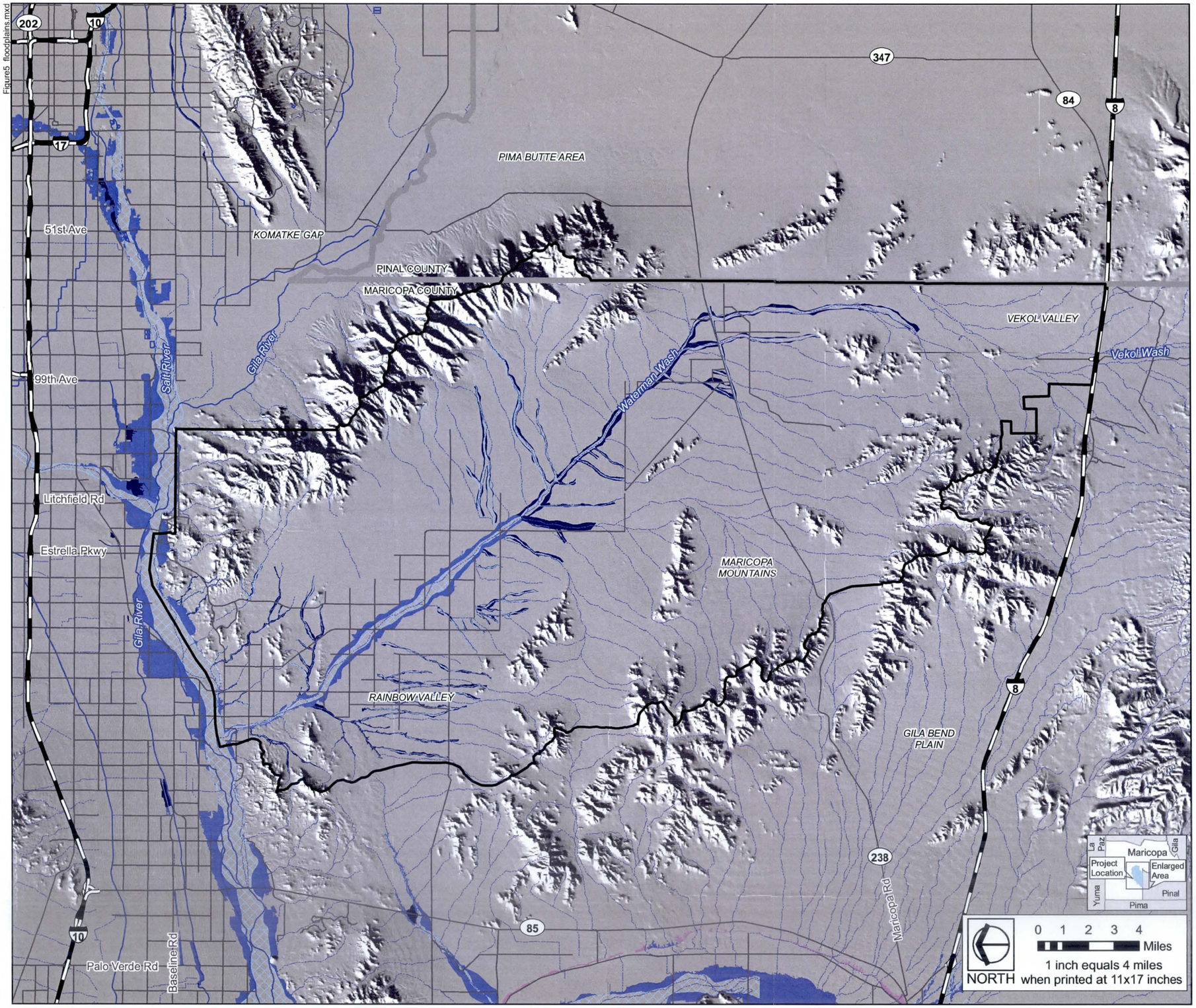
- County Boundary
- Rainbow Valley ADMP Boundary
- Interstate Highways/ Freeways
- State Highways
- Perennial Streams
- Intermittent Streams

Data Sources

Arizona Geological Survey Digital Geologic Maps:
1. Geologic Map for the Buckeye 7.5' Quadrangle, Maricopa County, Arizona (AZGS DGM-15).
2. Geologic Map for the Avondale SW 7.5' Quadrangle, Maricopa County, Arizona (AZGS DGM-16).

Rainbow Valley
Area Drainage Master Plan
Mapped Floodplains

Figure 5



Project Features

Flood Zones

- Floodway
- Administrative Floodway
- 100-year flood with base flood elevations
- 100-year flood with no base flood elevations
- 100-year shallow flooding (depths >1<3 feet)

Reference Features

- County Boundary
- Rainbow Valley ADMP Boundary
- Interstate Highways/ Freeways
- State Highways
- Perennial Streams
- Intermittent Streams

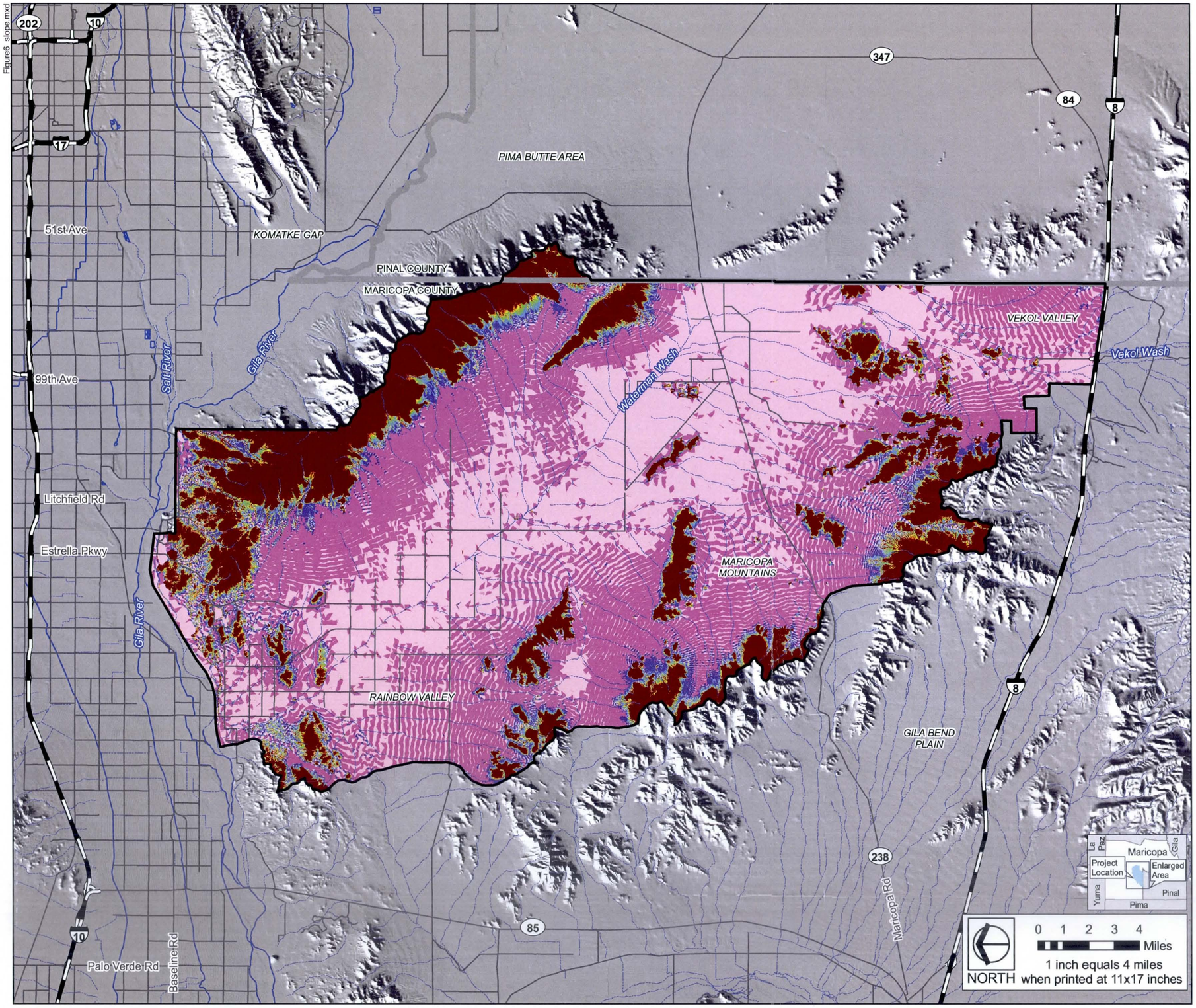
Data Sources

Flood Control District of Maricopa County Digital Floodplain Dataset:

1. Salt/Gila River Master Plan (1991)
2. Waterman Wash FDS (1989) (2005)

Rainbow Valley
Area Drainage Master Plan
Slope Analysis

Figure 6



Project Features

- 0 % slope
- 1 - 2 % slope
- 3 - 4 % slope
- 5 - 6 % slope
- 7 - 8 % slope
- 9 - 10 % slope
- 11 - 12 % slope
- 13 - 15 % slope
- >15 % slope

Reference Features

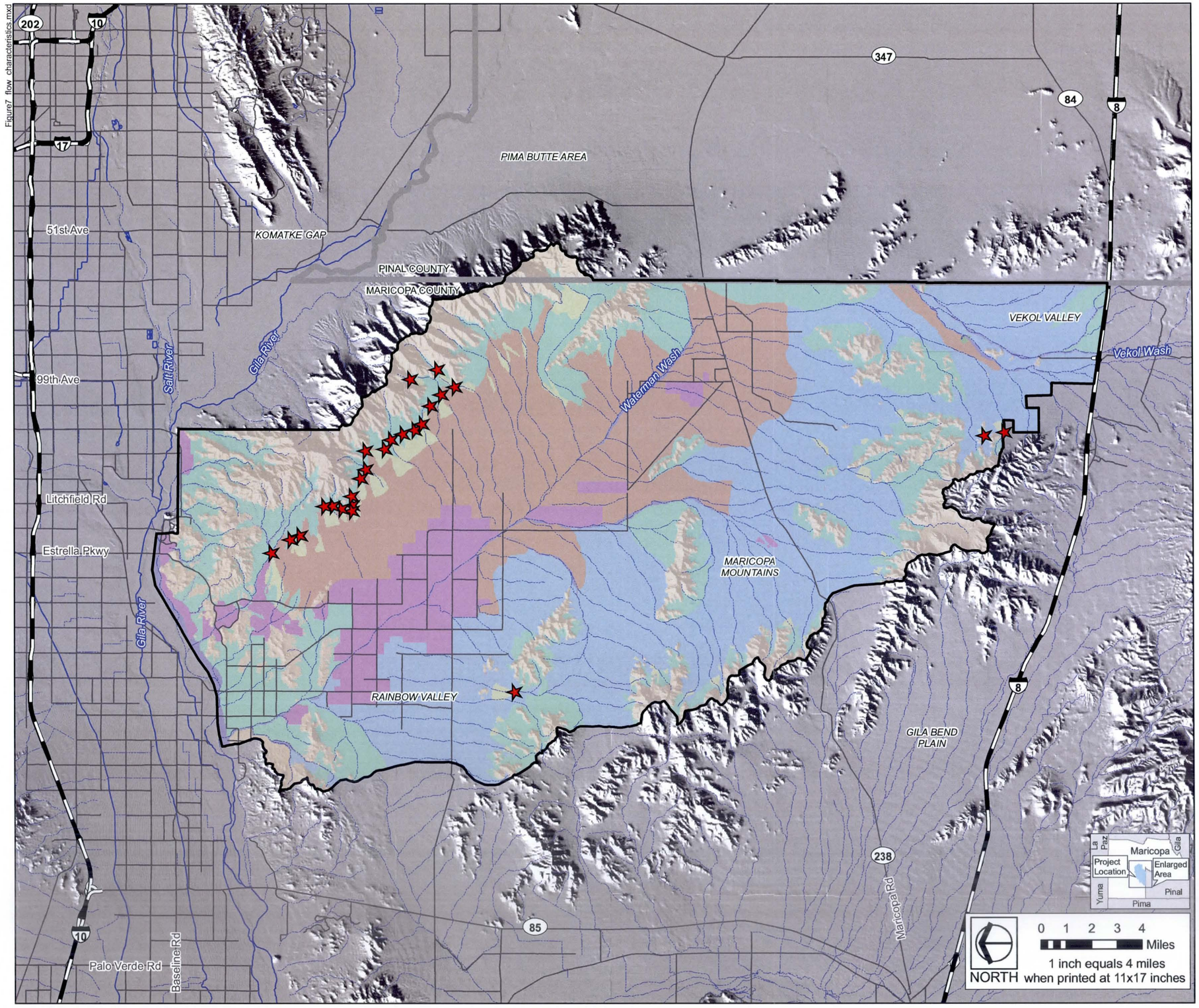
- County Boundary
- Rainbow Valley ADMP Boundary
- Interstate Highways/ Freeways
- State Highways
- Perennial Streams
- Intermittent Streams

Data Sources

Flood Control District of Maricopa County:
County- Wide 10-foot contour interval digital topography (December 2000).

Rainbow Valley
Area Drainage Master Plan
Flow Characteristics

Figure 7



Project Features

- Alluvial fans selected for floodplain delineation

Flow Characteristics

- Alluvial Fan Flooding
- Disturbed Area
- Flood Retarding Structure
- Major River and Tributary Flooding
- Mountains
- Piedmont Distributary Flooding
- Piedmont Tributary Flooding
- Sheet Flooding
- Stockpond

Reference Features

- County Boundary
- Rainbow Valley ADMP Boundary
- Interstate Highways/ Freeways
- State Highways
- Perennial Streams
- Intermittent Streams

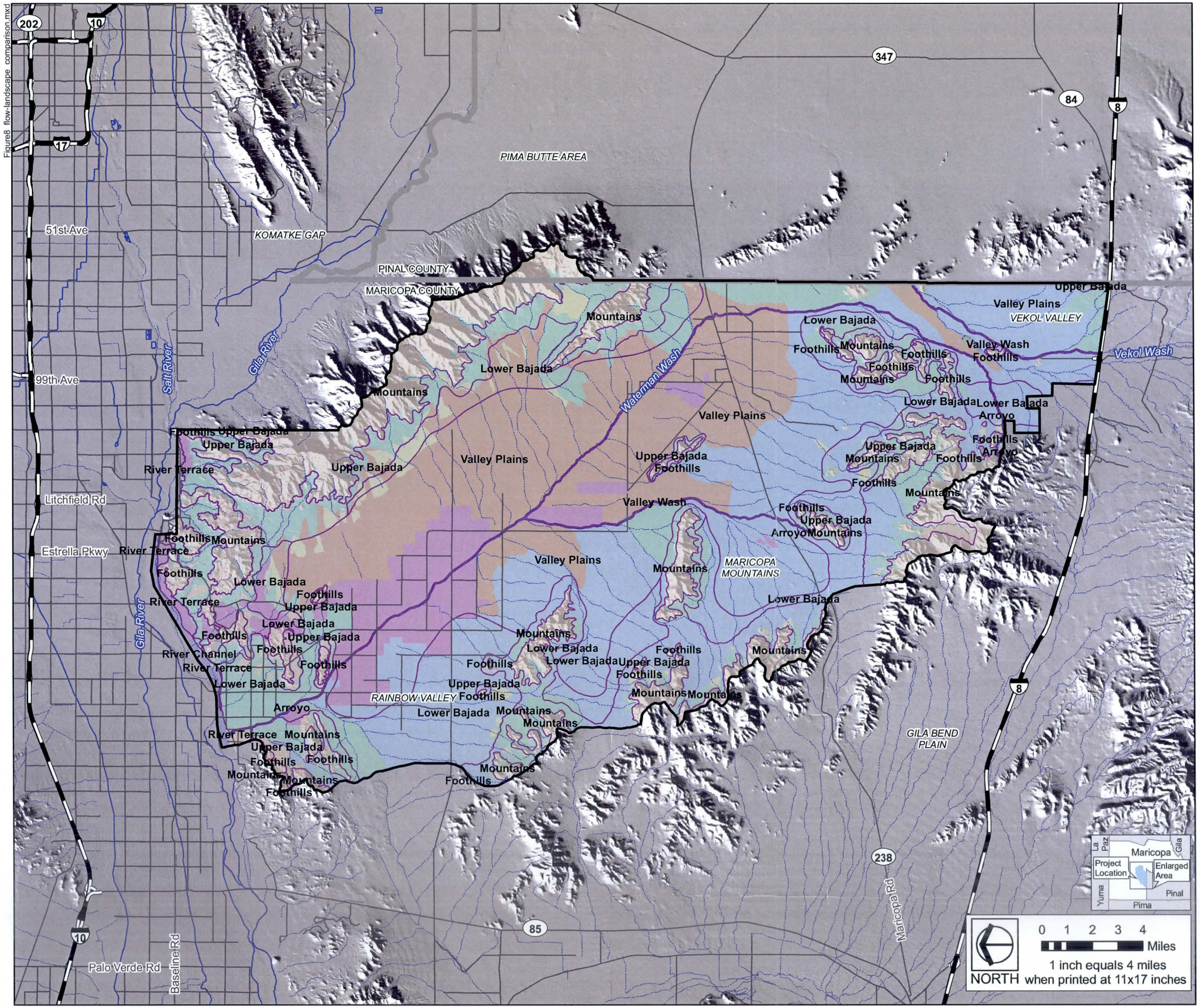
Data Sources

JE Fuller/Hydrology & Geomorphology alluvial fan identification and flow characteristics assessment (2008).

Rainbow Valley
Area Drainage Master Plan
Landscape and Flow Characteristics Comparison

Figure 8

Figure8_flow-landscape_comparison.mxd



Project Features

- District Landscape Characteristic Zones

Flow Characteristics

- Alluvial Fan Flooding
- Disturbed Area
- Flood Retarding Structure
- Major River and Tributary Flooding
- Mountains
- Piedmont Distributary Flooding
- Piedmont Tributary Flooding
- Sheet Flooding
- Stockpond

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- Rainbow Valley ADMP Boundary
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- State Highways
- Perennial Streams
- Intermittent Streams

Data Sources

Flood Control District of Maricopa County Landscape Inventory &
Analysis (LIA) (2008).

JE Fuller/Hydrology & Geomorphology flow characteristics assessment (2008).