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SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY

96th Street Storm Drain
and
Arizona Canal Outfall Channel

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Engineering Design Calculations

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ARIZONA, U.S.A.

EKA #3182

May 11, 1992

EVANS, KUHN & ASSOCIATES, INC.

EVANS, KUHN & ASSOCIATES, INC.

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A. INTRODUCTION

This documents the design criteria and methodologies which were used in the design of the storm drainage facilities for the Arizona Canal Outfall Channel from the Pima Freeway to 96th Street and for the storm drain in 96th Street from the Arizona Canal to the Northern Boundary. A brief explanation follows for these detailed calculations. Structural design calculations will be added with the Final (100%) Plans.

ALIGNMENT

The horizontal alignment begins at the point of intersection of the Pima Freeway East right-of-way line with the north right-of-way line of the Arizona Canal (Sta. 10+00E). The Arizona Canal Outfall Channel alignment parallels this alignment to 96th Street. Horizontal control for the Arizona Canal Outfall Channel is the north right-of-way line of the Arizona Canal. At 96th Street the north right-of-way line of the Arizona Canal intersects the monument line of 96th Street (Sta. 42+76.59E = Sta 61+60.45N). This is the beginning of the alignment for the storm drain in 96th Street. The storm drain and interceptor channel follow an alignment parallel to the 96th Street monument line north from the Arizona Canal to the north boundary of the Salt River Pima-Maricopa Indian Community (Sta. 207+74.65N).

The vertical alignment for the storm drain in 96th Street was designed by performing a regression analysis of the optimum grades between the Arizona Canal and the North Boundary. An optimum profile with appropriate grade breaks was selected such that the difference between the existing elevation and the mean elevation of the profile did not differ by more than + or - 0.5 feet after extracting extreme variations.

The levee (roadway) embankment was then set at 1 foot above this profile. The roadway profile serves as the vertical control for the design of the interceptor channel and storm drain. The interceptor channel was located at 4.5 or 5.5 feet below the top of road. The crown of the storm drain was located 7 feet below the top of road. This is true except for the transition area downstream of Sta. 74+00. This segment needed to vary to meet the criteria of the outfall channel.

The vertical alignment for the Arizona Canal Outfall Channel was determined by matching the invert at the western end of the channel with the invert of the proposed ADOT Interceptor Channel. The slope of the channel was designed to be the same as the slope of the Arizona Canal, which it parallels.

RIGHT-OF-WAY

The SRP-MIC will obtain 110 feet of right-of-way for 96th Street and 100 feet of right-of-way for the Arizona Canal Outfall Channel. A future bridge crossing of the Arizona Canal is anticipated and maintenance access to the outlet structure is necessary. A roadway approach embankment and the necessary right-of-way will be acquired with this project. The maintenance road along the outfall channel requires a turn around at the Pima Freeway. Right-of-Way therefore varies at the west end of the outfall channel and on 96th Street from the Arizona Canal to Lincoln Drive (Sta. 74+00). Right-of-Way Maps were prepared for approval and dedication by the SRP-MIC.

HYDROLOGY

The design of this project uses the results of the Salt River Pima-Maricopa Indian Community Northwest Area Master Drainage Plan, Evans, Kuhn & Associates, Inc., March 9, 1992. Design flows for 96th Street were selected to be slightly greater than those determined in the study. For example the peak design flow used for the storm drain was 2,000 cfs compared with the study flow of 1,969 cfs. The design flows for the Arizona Canal Outfall Channel were taken from the results of the Pima Freeway design requirements as 8,000 cfs.

Future street improvements for 96th Street will have a surface flow capacity of 500 cfs. The interceptor channel was then chosen to also have a design flow of 500 cfs. The design flow for the storm drain was therefore determined to be 1,500 cfs. This is true except for the decreased flows at the upstream inlet locations.

ARIZONA CANAL OUTFALL CHANNEL HYDRAULICS

Hydraulic analysis was performed using the HEC-2 water surface profile computer code. Two profile conditions were analyzed, the existing flow condition and the improved flow condition. The channel improvements were sized so that the water surface profile elevations for the improved condition were less than or equal to the water surface profile elevations for the existing condition. This resulted in an allowable encroachment that would preserve a 200 foot (top width) drainage way for a two stage outflow channel. The 58 foot (top width) low flow concrete lined channel will be constructed with this project.

96TH STREET STORM DRAIN HYDRAULICS

The hydraulic analyses for the 96th Street storm drain, inlets, connector pipes and interceptor channel were performed using a specially designed computer spreadsheet code. A minimum of one foot of freeboard was maintained between the interceptor channel water surface and the top of the roadway. The storm drain was sized to provide approximately 4′ of head at all inlet locations. Connector pipes were sized to maintain the required one foot of freeboard at the inlets while taking into account all entrance, exit, and pipe losses associated with the inlet structures. The outlet structure will partly be located below grade. Ponding water will be drained from the conduit by drywells in 36 hours. A rectangular outlet pipe was designed for the last 500 feet of the storm drain. This will provide for sediment entrapment and removal on a periodic basis.

The interceptor channel was sized for a flow capacity greater than the design flow of 500 cfs and a one (1) freeboard below the top of road. Grade control structures (cut-off walls) were located on the downstream side of inlet structures and roadway dip crossings. This will help prevent against serious channel scour and damage to inlets.

Inlets were sized for a flow capacity greater than the design flow of 250 cfs and a headwater elevation one (1) foot below the top of road.

CONSTRUCTION QUANTITIES

Earthwork calculations were determined for in-place conditions. The excavation and backfill required for structural pay items were not included in the earthwork quantities because all work associated with the structures is to be included in the associated lump sum costs. All quantities are approximate.

MEETING MINUTES AND CORRESPONDENCE

At the start of design, discussions and alternatives considered a 11.5′ x 11.5′ CBC, an interim earth channel, and a minimization of right-of-way to 24 feet. These alternatives were evaluated, discussed with SRP-MIC staff, and a decision made to acquire full right-of-way for 96th Street and the outfall channel. The interim channel alternative was discarded.

Later in the design process, representatives from Salt River Sand and Rock were invited to participate in a value engineering process to improve constructability and reduce cost. This resulted in an analysis which optimized the use of CBC, CIPP, and RCP. Also considered was the potential use of an upstream detention basin near Indian Bend Road and the use of an outfall detention basin along the Arizona Canal. Following discussions with SRP-MIC staff, it was decided to design for CIPP and an outfall channel. During design, ADOT modified hydrology for the Pima Freeway. This reduced the design flows for 96th Street and the Arizona Canal.

Salt River Pima - Maricopa Indian Community 3182
Optimum Profile Design 05/05/92
bjf

Centerline Profile Data

Reach	Point	North	East	Elevation	Est. Elev	Delta	Regressio	DELTA	DEPTH ROAD	1.06	CROWN
								0			
								0			
Reach	Point	North	East	Elevation	Est. Elev		ELEVATION	DELTA	ELEVATION		ELEVATION
GB 1		6160					1281.28		1282.34		1275.34
	2042	6306.09	9995.87	1282.00	1279.85	-2.16	1281.98	-0.03	1283.04	1.03	1276.04
	2036	6359.39	9997.11	1282.39	1280.09	-2.29	1282.23	-0.15	1283.29	0.91	1276.29
	2030	6448.41	10000.57	1282.47	1280.50	-1.97	1282.66	0.19	1283.72	1.25	1276.72
		6600					1283.38		1284.44		1277.44
	1930	7663.58	10004.46	1288.48	1286.09	-2.40	1288.47	-0.02	1289.53	1.04	1282.53
GB 2		7802					1289.13		1290.19		1283.19
	271	8999.00	10001.80	1293.08	1292.23	-0.85	1293.02	-0.06	1294.08	1.00	1287.08
	262	9064.16	10003.29	1293.46	1292.53	-0.94	1293.23	-0.23	1294.29	0.83	1287.29
	257	9162.06	10003.01	1293.40	1292.98	-0.42	1293.55	0.15	1294.61	1.21	1287.61
	247	9264.37	9999.11	1294.05	1293.45	-0.60	1293.88	-0.17	1294.94	0.89	1287.94
	237	9375.57	10002.84	1294.54	1293.96	-0.58	1294.25	-0.30	1295.31	0.76	1288.31
GB 3		9900					1295.95		1297.01		1290.01
	11	10000.00	9995.69	1295.86	1296.83	0.97	1296.42	0.56	1297.48	1.62	1290.48
	174	10029.74	10000.03	1296.48	1296.96	0.48	1296.56	0.08	1297.62	1.14	1290.62
	1926	10058.73	9997.67	1297.13	1297.10	-0.03	1296.70	-0.43	1297.76	0.63	1290.76
	1925	10059.26	10002.01	1296.70	1297.10	0.40	1296.70	0.00	1297.76	1.06	1290.76
	1716	11455.97	9996.03	1303.88	1303.52	-0.36	1303.32	-0.56	1304.38	0.50	1297.38
		11594					1303.97		1305.03		1298.03
	1351	11651.88	9995.22	1304.44	1304.42	-0.02	1304.24	-0.19	1305.30	0.87	1298.30
	1352	11760.77	9995.38	1305.02	1304.92	-0.10	1304.76	-0.26	1305.82	0.80	1298.82
	1353	11853.65	9995.52	1305.27	1305.35	0.08	1305.20	-0.07	1306.26	0.99	1299.26
	1354	11960.68	9995.68	1305.82	1305.84	0.02	1305.71	-0.12	1306.77	0.94	1299.77
	1771	12060.95	10002.62	1306.04	1306.30	0.26	1306.18	0.14	1307.24	1.20	1300.24
	1772	12061.55	9999.21	1306.41	1306.30	-0.11	1306.18	-0.23	1307.24	0.83	1300.24
	1355	12062.89	9995.84	1306.45	1306.31	-0.14	1306.19	-0.26	1307.25	0.80	1300.25
	1782	12149.75	9998.88	1305.97	1306.71	0.74	1306.60	0.63	1307.66	1.69	1300.66
	1781	12150.77	10001.53	1306.07	1306.72	0.65	1306.61	0.54	1307.67	1.60	1300.67
	1780	12151.51	10004.62	1306.76	1306.72	-0.05	1306.61	-0.15	1307.67	0.91	1300.67
	1356	12160.66	9995.98	1306.35	1306.76	0.41	1306.65	0.30	1307.71	1.36	1300.71
	1796	12244.01	10000.97	1307.52	1307.14	-0.38	1307.05	-0.47	1308.11	0.59	1301.11
	1797	12244.98	9995.88	1306.48	1307.15	0.67	1307.05	0.57	1308.11	1.63	1301.11
	1357	12254.42	9996.13	1306.49	1307.19	0.70	1307.10	0.61	1308.16	1.67	1301.16
		12260					1307.12		1308.18		1301.18
	1358	12360.56	9996.29	1307.95	1307.68	-0.27	1307.60	-0.35	1308.66	0.71	1301.66
	1810	12369.27	10004.39	1307.84	1307.72	-0.12	1307.64	-0.20	1308.70	0.86	1301.70
	1359	12462.00	9996.44	1308.23	1308.15	-0.09	1308.08	-0.15	1309.14	0.91	1302.14
	1360	12560.50	9996.59	1308.82	1308.60	-0.22	1308.55	-0.27	1309.61	0.79	1302.61
	1361	12654.50	9995.96	1309.16	1309.03	-0.13	1308.99	-0.17	1310.05	0.89	1303.05
	10	12669.57	9996.75	1309.59	1309.10	-0.49	1309.06	-0.53	1310.12	0.53	1303.12
	3226	12669.65	9996.74	1309.48	1309.10	-0.38	1309.06	-0.42	1310.12	0.64	1303.12
		12720					1309.30		1310.36		1303.36
	1362	12765.62	9996.86	1309.58	1309.54	-0.04	1309.52	-0.06	1310.58	1.00	1303.58
	1363	12865.61	9996.92	1309.75	1310.00	0.25	1309.99	0.24	1311.05	1.30	1304.05
GB 4		12933					1310.31		1311.37		1304.37
	1364	12965.68	9997.35	1310.22	1310.46	0.24	1310.44	0.22	1311.50	1.28	1304.50
	1365	13064.86	9997.55	1310.64	1310.92	0.28	1310.84	0.21	1311.90	1.27	1304.90
	1684	13065.32	10004.39	1310.31	1310.92	0.61	1310.84	0.54	1311.90	1.60	1304.90
	1366	13165.56	9997.75	1311.24	1311.38	0.15	1311.25	0.01	1312.31	1.07	1305.31
	1367	13270.71	9997.97	1311.61	1311.86	0.25	1311.67	0.06	1312.73	1.12	1305.73
		13300					1311.79		1312.85		1305.85
	1368	13365.48	9998.16	1312.04	1312.30	0.26	1312.05	0.02	1313.11	1.08	1306.11
	1369	13466.26	9998.36	1312.65	1312.76	0.12	1312.46	-0.19	1313.52	0.87	1306.52
	1370	13565.43	9998.56	1313.47	1313.22	-0.25	1312.86	-0.61	1313.92	0.45	1306.92
	1371	13675.15	9998.78	1313.84	1313.72	-0.12	1313.30	-0.54	1314.36	0.52	1307.36

	1372	13763.97	9998.96	1313.99	1314.14	0.15	1313.87	-0.32	1314.73	0.74	1307.73
	1622	13765.52	9998.09	1314.19	1314.14	-0.05	1313.67	-0.52	1314.73	0.54	1307.73
	1628	13860.35	10002.63	1314.57	1314.57	0.00	1314.05	-0.52	1315.11	0.54	1308.11
	1373	13870.54	9999.18	1314.56	1314.62	0.06	1314.09	-0.47	1315.15	0.59	1308.15
	3358	13939.65	9995.49	1315.27	1314.94	-0.33	1314.37	-0.90	1315.43	0.16	1308.43
	1621	13952.93	10003.16	1315.64	1315.00	-0.64	1314.42	-1.21	1315.48	-0.15	1308.48
	1620	13953.45	10001.71	1315.31	1315.00	-0.31	1314.43	-0.88	1315.49	0.18	1308.49
	1619	13954.05	9999.49	1315.25	1315.00	-0.25	1314.43	-0.82	1315.49	0.24	1308.49
	1618	13955.13	9997.07	1315.59	1315.01	-0.58	1314.43	-1.16	1315.49	-0.10	1308.49
	1374	13965.60	9999.10	1315.64	1315.06	-0.58	1314.48	-1.16	1315.54	-0.10	1308.54
	3356	13988.07	10003.31	1315.60	1315.16	-0.44	1314.57	-1.04	1315.63	0.02	1308.63
	1609	14069.53	10004.66	1315.12	1315.54	0.42	1314.89	-0.22	1315.95	0.84	1308.95
	1375	14095.24	9999.35	1315.12	1315.65	0.54	1315.00	-0.12	1316.06	0.94	1309.06
		14130					1315.14		1316.20		1309.20
	1	14164.84	9998.91	1315.44	1315.97	0.53	1315.28	-0.17	1316.34	0.89	1309.34
	1376	14164.87	9999.28	1315.39	1315.97	0.58	1315.28	-0.11	1316.34	0.95	1309.34
	1377	14266.54	9999.45	1315.65	1316.44	0.79	1315.69	0.04	1316.75	1.10	1309.75
		14273					1315.72		1316.78		1309.78
	282	14365.43	9999.60	1316.18	1316.90	0.72	1316.09	-0.09	1317.15	0.97	1310.15
	1378	14365.62	9999.62	1316.14	1316.90	0.76	1316.09	-0.05	1317.15	1.01	1310.15
	1379	14467.05	9999.78	1316.13	1317.36	1.23	1316.50	0.36	1317.56	1.42	1310.56
	1579	14467.87	9998.13	1316.28	1317.37	1.09	1316.50	0.23	1317.56	1.29	1310.56
		14500					1316.63		1317.69		1310.69
	1380	14565.28	10000.07	1316.51	1317.81	1.30	1316.89	0.38	1317.95	1.44	1310.95
	1492	14565.29	10000.02	1316.49	1317.81	1.33	1316.89	0.41	1317.95	1.47	1310.95
	1381	14664.51	10000.23	1317.29	1318.27	0.98	1317.29	0.00	1318.35	1.06	1311.35
	1487	14671.36	10001.91	1317.38	1318.30	0.93	1317.32	-0.05	1318.38	1.01	1311.38
	1480	14764.46	9999.21	1317.68	1318.73	1.05	1317.70	0.01	1318.76	1.07	1311.76
	1382	14765.27	10000.38	1317.80	1318.73	0.93	1317.70	-0.10	1318.76	0.96	1311.76
		14804					1317.86		1318.92		1311.92
	1383	14867.95	10000.54	1318.31	1319.21	0.89	1318.11	-0.20	1319.17	0.86	1312.17
		14900					1318.24		1319.30		1312.30
68 5		14951					1318.45		1319.51		1312.51
	1384	14963.35	10000.69	1318.69	1319.64	0.96	1318.51	-0.18	1319.57	0.88	1312.57
	1385	15065.73	10000.84	1319.06	1320.12	1.05	1318.99	-0.07	1320.05	0.99	1313.05
	1463	15070.34	10002.69	1319.08	1320.14	1.05	1319.01	-0.07	1320.07	0.99	1313.07
	1386	15165.43	10001.00	1319.68	1320.57	0.90	1319.46	-0.21	1320.52	0.85	1313.52
	1387	15266.16	10001.15	1320.06	1321.04	0.98	1319.94	-0.12	1321.00	0.94	1314.00
	1454	15269.91	9999.89	1320.03	1321.05	1.02	1319.95	-0.08	1321.01	0.98	1314.01
	1388	15371.56	10001.94	1320.34	1321.52	1.18	1320.43	0.09	1321.49	1.15	1314.49
	1448	15371.57	9999.55	1320.29	1321.52	1.24	1320.43	0.15	1321.49	1.21	1314.49
	1389	15470.20	10001.58	1320.78	1321.97	1.20	1320.90	0.12	1321.96	1.18	1314.96
	1409	15470.51	9998.94	1320.67	1321.98	1.31	1320.90	0.23	1321.96	1.29	1314.96
	14	15492.45	10001.50	1320.79	1322.08	1.29	1321.00	0.21	1322.06	1.27	1315.06
	1390	15565.54	10001.59	1321.32	1322.41	1.09	1321.35	0.02	1322.41	1.08	1315.41
	1391	15663.64	10001.69	1321.78	1322.86	1.08	1321.81	0.03	1322.87	1.09	1315.87
	1392	15765.53	10001.79	1322.32	1323.33	1.01	1322.29	-0.03	1323.35	1.03	1316.35
	1393	15869.65	10001.90	1322.75	1323.81	1.06	1322.78	0.03	1323.84	1.09	1316.84
	1394	15965.38	10002.00	1323.19	1324.25	1.06	1323.23	0.05	1324.29	1.11	1317.29
	1395	16066.43	10002.11	1323.66	1324.72	1.05	1323.71	0.05	1324.77	1.11	1317.77
	1396	16165.56	10002.21	1324.17	1325.17	1.00	1324.18	0.01	1325.24	1.07	1318.24
	1397	16265.74	10002.32	1324.73	1325.63	0.90	1324.65	-0.08	1325.71	0.98	1318.71
	1398	16365.20	10002.42	1325.20	1326.09	0.89	1325.12	-0.08	1326.18	0.98	1319.18
	1399	16461.69	10002.52	1325.43	1326.53	1.10	1325.58	0.14	1326.64	1.20	1319.64
	1400	16565.41	10002.63	1326.31	1327.01	0.70	1326.07	-0.25	1327.13	0.81	1320.13
	1401	16667.23	10002.74	1326.61	1327.48	0.87	1326.55	-0.06	1327.61	1.00	1320.61
	1402	16765.47	10002.85	1327.26	1327.93	0.67	1327.01	-0.25	1328.07	0.81	1321.07
	1403	16864.09	10002.71	1327.61	1328.38	0.77	1327.47	-0.14	1328.53	0.92	1321.53
	1557	16965.12	9998.25	1327.74	1328.85	1.10	1327.95	0.21	1329.01	1.27	1322.01
	1404	16965.99	10003.09	1327.80	1328.85	1.05	1327.95	0.16	1329.01	1.22	1322.01
	1405	17062.22	10003.02	1328.16	1329.29	1.14	1328.41	0.25	1329.47	1.31	1322.47
	1406	17165.38	10003.12	1329.14	1329.77	0.62	1328.90	-0.25	1329.96	0.81	1322.96
	112	17360.43	10003.53	1330.01	1330.66	0.65	1329.82	-0.19	1330.88	0.87	1323.88
	801	17459.43	10003.57	1330.45	1331.12	0.67	1330.28	-0.16	1331.34	0.90	1324.34
	796	17560.40	10004.12	1330.98	1331.58	0.60	1330.76	-0.23	1331.82	0.83	1324.82
	789	17661.43	10004.49	1331.20	1332.05	0.85	1331.23	0.03	1332.29	1.09	1325.29
	790	17661.52	10000.78	1331.24	1332.05	0.81	1331.24	0.01	1332.29	1.05	1325.29

B2

	782	17759.61	9998.95	1331.64	1332.50	0.86	1331.70	0.05	1332.76	1.11	1325.76
	781	17760.45	10004.37	1331.65	1332.50	0.85	1331.70	0.05	1332.76	1.11	1325.76
	780	17812.34	9995.67	1331.95	1332.74	0.79	1331.95	-0.01	1333.01	1.05	1326.01
	771	17861.67	10000.80	1332.06	1332.97	0.90	1332.18	0.11	1333.24	1.17	1326.24
	777	17862.16	10004.66	1332.15	1332.97	0.82	1332.18	0.03	1333.24	1.09	1326.24
	764	17960.43	10004.44	1332.34	1333.42	1.08	1332.65	0.30	1333.71	1.36	1326.71
	765	17960.48	10000.08	1332.59	1333.42	0.84	1332.65	0.06	1333.71	1.12	1326.71
	736	18060.50	10001.15	1332.90	1333.88	0.98	1333.12	0.22	1334.18	1.28	1327.18
	753	18060.73	9998.54	1332.93	1333.88	0.96	1333.12	0.19	1334.18	1.25	1327.18
	726	18160.27	10004.41	1333.54	1334.34	0.80	1333.59	0.04	1334.65	1.10	1327.65
GB 6		18254					1334.03		1335.09		1328.09
	717	18258.55	9998.40	1334.16	1334.79	0.63	1334.06	-0.11	1335.12	0.95	1328.12
	716	18258.89	10004.52	1333.70	1334.79	1.09	1334.06	0.35	1335.12	1.41	1328.12
	709	18360.32	10004.30	1334.65	1335.26	0.61	1334.62	-0.03	1335.68	1.03	1328.68
	124	18560.43	10004.09	1335.62	1336.18	0.56	1335.74	0.12	1336.80	1.18	1329.80
	749	18560.80	10004.08	1335.42	1336.18	0.76	1335.74	0.33	1336.80	1.39	1329.80
	748	18560.80	10004.09	1335.31	1336.18	0.88	1335.74	0.44	1336.80	1.50	1329.80
	812	18560.81	10004.08	1335.42	1336.18	0.76	1335.74	0.32	1336.80	1.38	1329.80
	761	18560.81	10004.09	1335.38	1336.18	0.81	1335.74	0.37	1336.80	1.43	1329.80
	686	18658.68	10003.82	1336.11	1336.63	0.52	1336.29	0.18	1337.35	1.24	1330.35
	677	18760.32	10003.89	1336.75	1337.10	0.35	1336.86	0.11	1337.92	1.17	1330.92
	684	18760.40	10001.84	1336.73	1337.10	0.37	1336.86	0.13	1337.92	1.19	1330.92
	672	18858.26	10003.49	1337.25	1337.55	0.30	1337.41	0.15	1338.47	1.21	1331.47
	670	18858.53	10000.33	1337.31	1337.55	0.25	1337.41	0.10	1338.47	1.16	1331.47
	663	18960.24	10003.82	1338.16	1338.02	-0.14	1337.97	-0.18	1339.03	0.88	1332.03
	651	19062.18	10003.64	1338.77	1338.49	-0.28	1338.54	-0.23	1339.60	0.83	1332.60
	644	19160.35	10003.89	1339.65	1338.94	-0.71	1339.09	-0.56	1340.15	0.50	1333.15
	637	19258.42	10003.50	1339.92	1339.39	-0.53	1339.64	-0.28	1340.70	0.78	1333.70
	643	19258.49	9998.40	1339.91	1339.39	-0.52	1339.64	-0.27	1340.70	0.79	1333.70
	660	19360.42	10003.54	1340.49	1339.86	-0.64	1340.21	-0.28	1341.27	0.78	1334.27
	571	19360.42	10003.55	1340.46	1339.86	-0.61	1340.21	-0.25	1341.27	0.81	1334.27
	636	19360.95	9995.84	1340.52	1339.86	-0.66	1340.21	-0.31	1341.27	0.75	1334.27
	624	19457.48	10003.39	1341.03	1340.30	-0.73	1340.75	-0.28	1341.81	0.78	1334.81
	629	19457.53	10004.99	1341.03	1340.30	-0.72	1340.75	-0.27	1341.81	0.79	1334.81
	618	19560.18	10003.37	1341.57	1340.78	-0.80	1341.33	-0.25	1342.39	0.81	1335.39
	609	19663.23	10003.34	1342.22	1341.25	-0.97	1341.90	-0.32	1342.96	0.74	1335.96
	662	19760.27	10003.28	1342.65	1341.70	-0.95	1342.44	-0.20	1343.50	0.86	1336.50
	661	19760.27	10003.28	1342.47	1341.70	-0.77	1342.44	-0.02	1343.50	1.04	1336.50
	136	19760.43	10003.28	1342.74	1341.70	-1.04	1342.44	-0.30	1343.50	0.76	1336.50
	600	19870.80	10002.96	1343.09	1342.20	-0.89	1343.06	-0.03	1344.12	1.03	1337.12
	588	19965.51	10003.02	1343.43	1342.64	-0.79	1343.59	0.16	1344.65	1.22	1337.65
	2080	20159.31	9995.38	1344.30	1343.53	-0.77	1344.67	0.37	1345.73	1.43	1338.73
	2093	20162.31	10001.86	1344.23	1343.54	-0.68	1344.69	0.46	1345.75	1.52	1338.75
	2100	20268.29	9996.12	1345.61	1344.03	-1.58	1345.28	-0.33	1346.34	0.73	1339.34
	142	20360.43	10002.88	1345.65	1344.46	-1.19	1345.80	0.15	1346.86	1.21	1339.86
	2102	20367.55	10004.22	1345.51	1344.49	-1.02	1345.84	0.33	1346.90	1.39	1339.90
	144	20560.43	10002.74	1346.78	1345.37	-1.41	1346.91	0.13	1347.97	1.19	1340.97
	559	20627.15	10000.95	1346.87	1345.68	-1.19	1347.29	0.42	1348.35	1.48	1341.35
	558	20659.42	10003.42	1347.43	1345.83	-1.61	1347.47	0.03	1348.53	1.09	1341.53
	566	20668.51	10004.32	1347.29	1345.87	-1.42	1347.52	0.23	1348.58	1.29	1341.58
	33	20774.63	10002.60	1347.76	1346.36	-1.40	1348.11	0.35	1349.17	1.41	1342.17
	521	20779.58	9995.48	1348.58	1346.38	-2.20	1348.14	-0.44	1349.20	0.62	1342.20
GB 7		20780					1348.14		1349.20		1342.20

Max	20780.00	10004.99	1348.58	1346.38	1.33	1348.14	0.63	1349.20	1.69	1342.20
Min	6306.09	9995.22	1282.00	1279.85	-2.40	1281.98	-1.21	1283.04	-0.15	1276.04
Avg	15241.82	10000.72	1321.63	1321.80	0.17	1320.71	-0.06	1321.77	0.94	1314.77
std	3384.37	2.86	15.28	15.29	0.85	15.54	0.32	15.54	0.39	15.54
					2.549749					

Regression Output:

Constant	1250.858
Std Err of Y Est	0.850027
R Squared	0.99697

B3

No. of Observations 161
Degrees of Freedom 159

X Coefficient(s) 0.004586
Std Err of Coef. 2.01E-05
X Coefficient(s) 0.004597
Std Err of Coef. 3.2E-05

Regression from GB1 to GB2

Regression Output:

Constant	1251.823
Std Err of Y Est	0.174384
R Squared	0.997898
No. of Observations	4
Degrees of Freedom	2

X Coefficient(s) 0.004782
Std Err of Coef. 0.000155

Regression from GB2 to GB3

Regression Output:

Constant	1263.788
Std Err of Y Est	0.284677
R Squared	0.987308
No. of Observations	7
Degrees of Freedom	5

X Coefficient(s) 0.003248
Std Err of Coef. 0.000165

Regression from GB3 to GB4

Regression Output:

Constant	1249.048
Std Err of Y Est	0.347888
R Squared	0.99565
No. of Observations	49
Degrees of Freedom	47

X Coefficient(s) 0.004737
Std Err of Coef. 4.57E-05

Regression from GB4 to GB5

Regression Output:

Constant	1258.167
Std Err of Y Est	0.212335
R Squared	0.971928
No. of Observations	18
Degrees of Freedom	16

X Coefficient(s) 0.004032
Std Err of Coef. 0.000171

Regression from GB5 to GB6

Regression Output:

Constant	1247.951
Std Err of Y Est	0.149528
R Squared	0.99895
No. of Observations	39
Degrees of Freedom	37

X Coefficient(s) 0.004715

Std Err of Coef. 2.51E-05

Regression from GB6 to GB7

Regression Output:

Constant	1232.057
Std Err of Y Est	0.271097
R Squared	0.996879
No. of Observations	46
Degrees of Freedom	44

X Coefficient(s) 0.005586
Std Err of Coef. 4.71E-05

Summary of y = mx + b

GB	M	B	X	Y
1			6160.00	1281.28
	0.00478	1251.82		
2			7801.69	1289.13
	0.00325	1263.79		
3			9900.04	1295.95
	0.00474	1249.05		
4			12932.91	1310.31
	0.00403	1258.17		
5			14951.04	1318.45
	0.00472	1247.95		
6			18253.96	1334.03
	0.00559	1232.06		
7			20780.00	1348.14

GB2: Solve for station(x) and elevation(y) using optimization

	y	x		b
Obj. Function	0	0		0
Conatraints	1	-0.00478	=	1251.823
	1	-0.00325	=	1263.788
Solution	1289.13	7801.691		

GB3: Solve for station(x) and elevation(y) using optimization

	y	x		b
Obj. Function	0	0		0
Conatraints	1	-0.00325	=	1263.788
	1	-0.00474	=	1249.048
Solution	1295.946	9900.04		

GB4: Solve for station(x) and elevation(y) using optimization

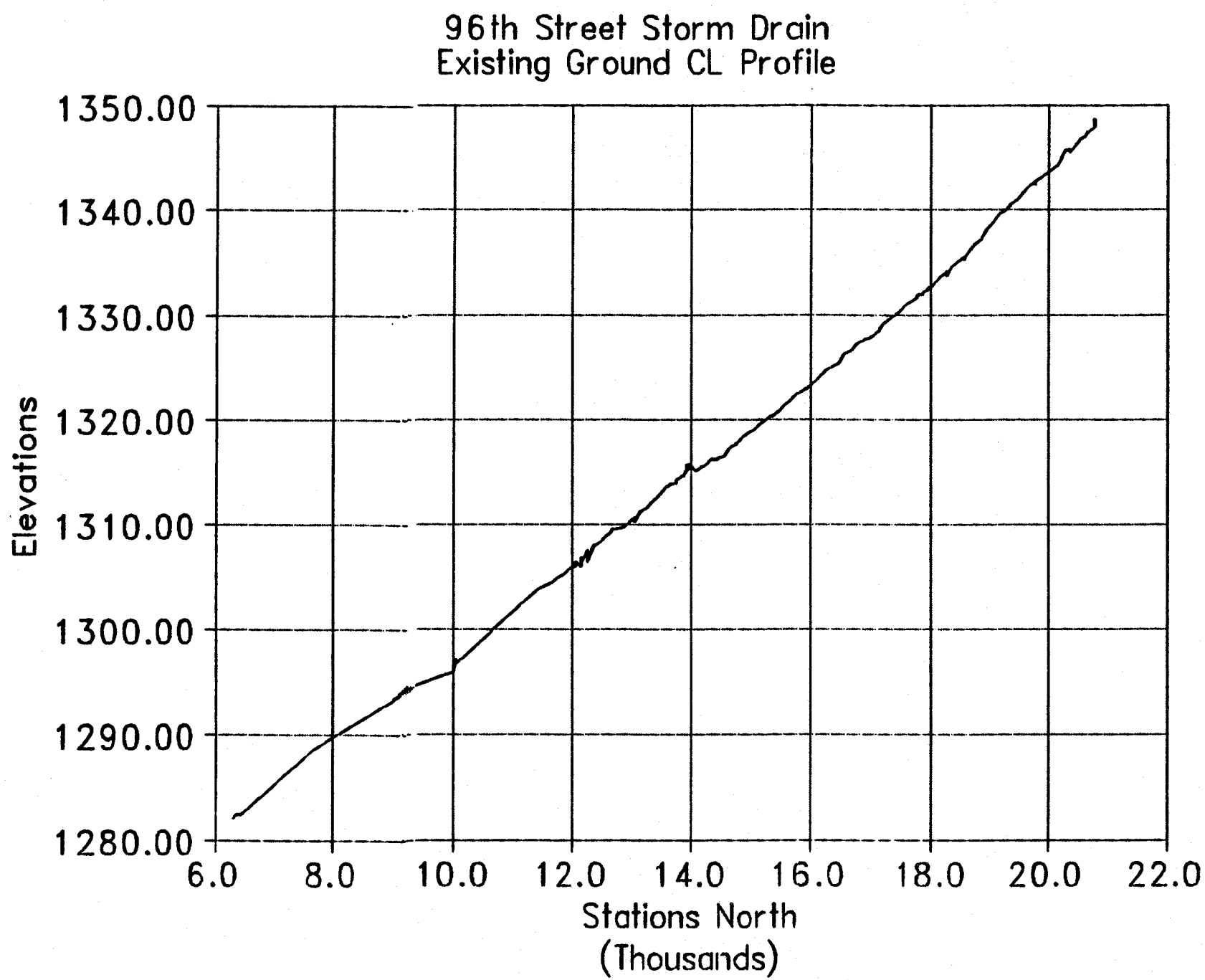
	y	x		b
Obj. Function	0	0		0
Conatraints	1	-0.00474	=	1249.048
	1	-0.00403	=	1258.167
Solution	1310.314	12932.91		

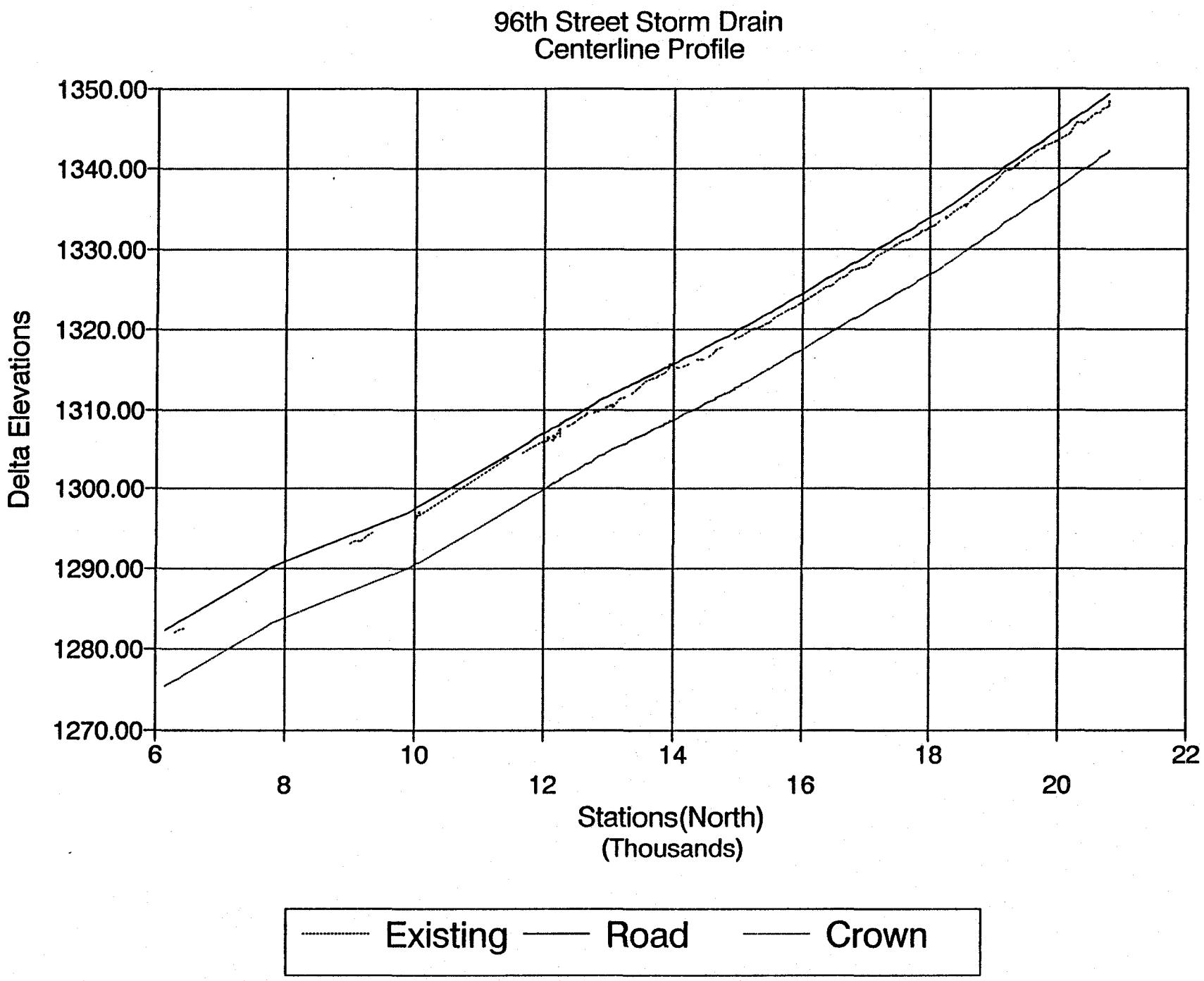
GB5: Solve for station(x) and elevation(y) using optimization

	y	x		b
Obj. Function	0	0		0
Conatraints	1	-0.00403	=	1258.167
	1	-0.00472	=	1247.951
Solution	1318.451	14951.04		

GB6: Solve for station(x) and elevation(y) using optimization

	y	x		b
Obj. Function	0	0		0
Conatraints	1	-0.00472	=	1247.951
	1	-0.00559	=	1232.057
Solution	1334.026	18253.96		


96th Street Storm Drain
Existing Ground CL Profile
1350.00
1340.00
1330.00
1320.00
1310.00
1300.00
1290.00
1280.00
Elevations
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
22.0
Stations North
(Thousands)

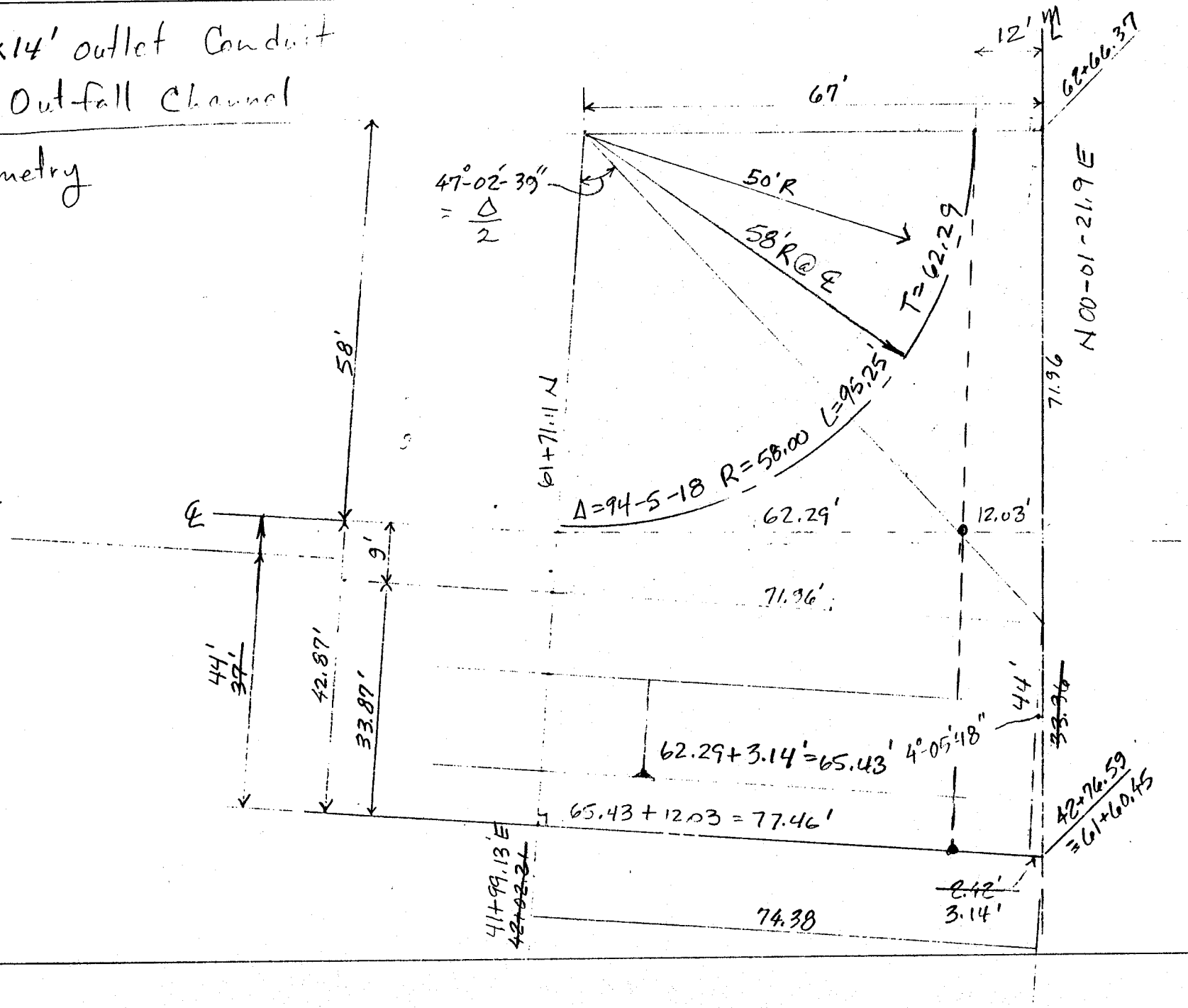

96th Street Storm Drain
Centerline Profile
Delta Elevations
1350.00
1340.00
1330.00
1320.00
1310.00
1300.00
1290.00
1280.00
1270.00
6
8
10
12
14
16
18
20
22
Stations(North)
(Thousands)
Existing
Road
Crown

NATIONAL 42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE

SRP-MIC/3182 | 94th St. S.D. Outlet Structure | 4/23/92 BJF

7'6'x14' outlet Conduit at Outfall Channel

Geometry



Geometry

R/W ESMT

```
 2 START OF JOB
     3182 1 1
        FIGURE AREA   107          COORDINATE AREA  2189
28 AREA BEARINGS
   (36 50 323 327 326 328 324 50 36)
    36       6160.4459       9988.3896
                                          S  0- 1-22.0 W      237.6000
    50       5922.8459       9988.2952
                                          S 89-18-50.4 E       95.0000
   323       5921.7085      10083.2884
                                          S  3-36-16.9 W      925.8278
   327       4997.7124      10025.0795
                                          N 89-48- 3.0 W       40.0000
   326       4997.8515       9985.0798
                                          N 89-48- 3.0 W       40.0000
   328       4997.9905       9945.0800
                                          N  3-10-52.4 W      931.0252
   324       5927.5809       9893.4133
                                          S 87- 8-35.0 E       95.0000
    50       5922.8459       9988.2952
                                          N  0- 1-22.0 E      237.6000
    36       6160.4459       9988.3896

             AREA=   124898.110 SQ.FT.=   2.86726608 ACRES

50 36
    50       5922.8459       9988.2952
                                          N  0- 1-22.0 E      237.6000
    36       6160.4459       9988.3896
------ ERROR
 FIRST POINT DIFFERENT FROM LAST
  4 END OF RUN
        FIGURE AREA   109          COORDINATE AREA  2189
        JOB  3182     1 COMPLETED          1 ERRORS
```

C1

```
 2 START OF JOB
     3182 1 1
        FIGURE AREA    88          COORDINATE AREA  2189
82 LIST FIGURES
   10-30
              10 (36 12 32 30 10 14 15 33)

              11 (36 12 32 30 10 14)

              12 (14 15 33)

              13 (600-608)

              14 (610-617)

              15 (620-627)

              16 (45 40-44 36 12 32 30 10 14 15 33)

              20 (36 44 43 42 41 300-317 12 319 321 322 36)

70 STORE FIGURE
   21(36 44 43 42 41 300-303 308 313-317 12 319 321 322 36)
              21
28 AREA BEARINGS
   21
```

Drainage Esmt.

36	6160.4459	9988.3896		
			N 85-53-20.1 W	397.6071
44	6188.9506	9591.8056		
			N 80-56- 9.3 W	938.9697
43	6336.8749	8664.5611		
			N 80-47-52.5 W	1338.4917
42	6550.9227	7343.2953		
			N 80-45-46.9 W	601.5166
41	6647.4771	6749.5787		
			N 18-19-41.0 E	151.9083
300	6791.6792	6797.3473		
			S 80-45-46.9 E	225.9979
301	6755.4024	7020.4146		
			S 9-14-13.1 W	50.0000
302	6706.0508	7012.3887		
			S 80-45-46.9 E	351.4862 ✓
303	6649.6309	7359.3170		
			S 80-47-52.5 E	1338.3408 ✓
308	6435.6072	8680.4339		
			S 80-56- 9.3 E	934.5243 ✓
313	6288.3832	9603.2885		
			N 0- 0- .0 E	.0000 ✓
314	6288.3832	9603.2885		
			N 46-33-17.5 E	200.0000
315	6425.9152	9748.4951		
			N 60-35-32.0 E	172.2254

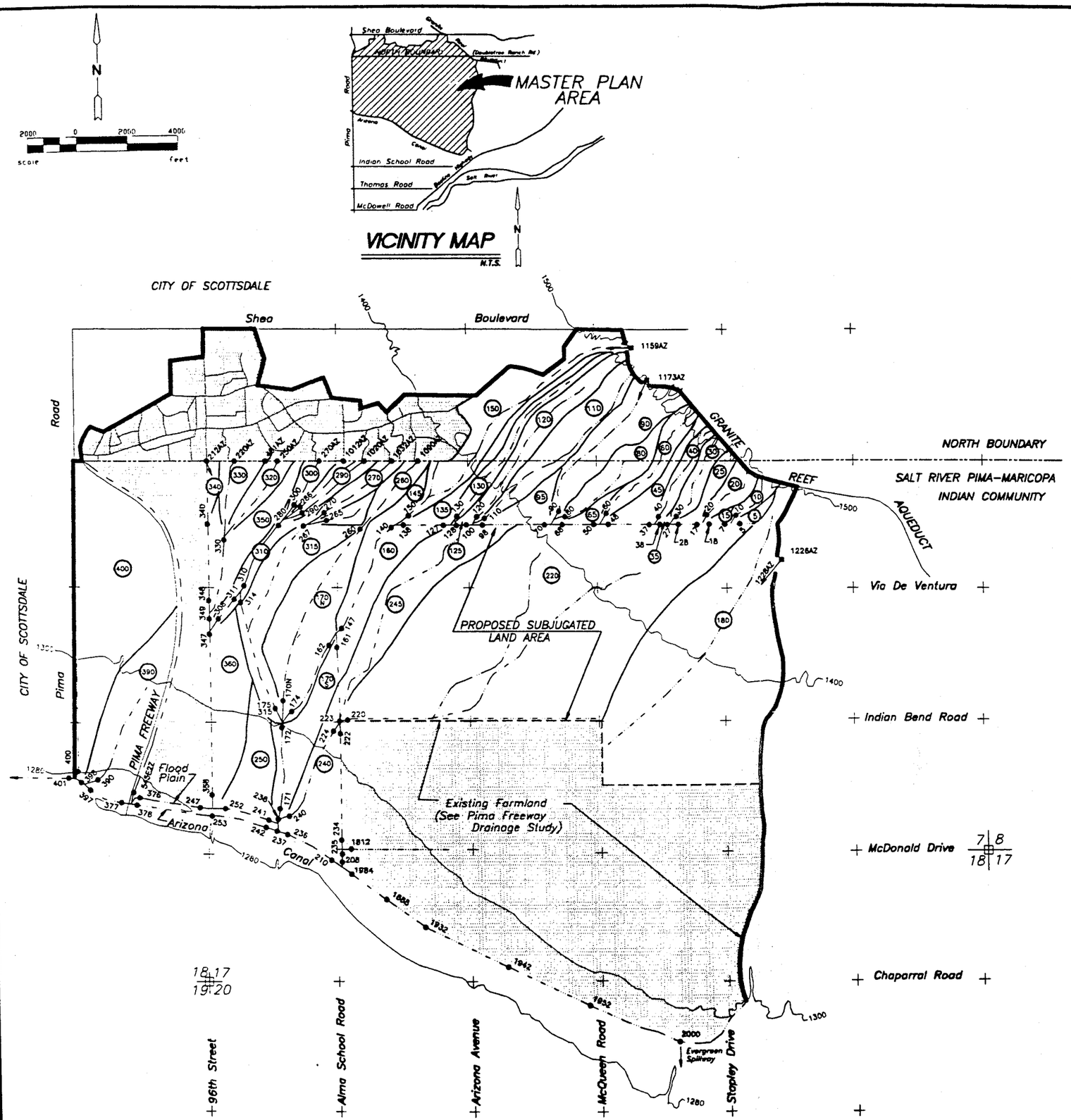
1

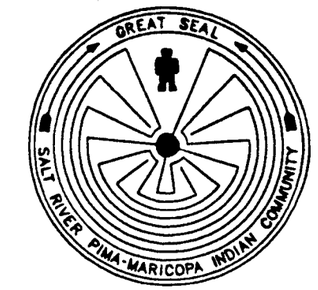
C2

318	6910.4818	9898.5287		
			N 2-17-30.4 E	884.0332
317	7393.8077	9933.8799		
			S 89-58-38.0 E	55.0000
12	7393.7858	9988.8798		
			S 89-58-38.0 E	105.0393
319	7393.7440	10093.9191		
			S 2-14-46.4 E	884.0332
321	6510.3902	10128.5680		
			S 15-55- 6.5 E	363.9552
322	6160.3916	10228.3896		
			N 89-59-13.3 W	240.0000
36	6160.4459	9988.3896		

AREA= 638615.283 SQ.FT.= 14.66058961 ACRES

4 END OF RUN
FIGURE AREA 91 COORDINATE AREA 2189
JOB 3182 1 COMPLETED 0 ERRORS





LEGEND

- DRAINAGE AREA BOUNDARY
- SUB-BASIN DRAINAGE BOUNDARY
- STREAM FLOW
- CONCENTRATION POINT (OF FLOW)
- CONCENTRATION POINT FOR OFF-SITE DRAINAGE ENTERING THE STUDY AREA
- SECTION CORNERS
- ORIGINAL PIMA FREEWAY HYDROLOGIC DATA BY ARIZONA DEPARTMENT OF TRANSPORTATION UNMODIFIED FOR THIS STUDY
- SUB BASIN AREA

Salt River Pima-Maricopa Indian Community

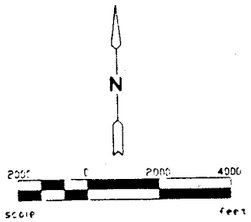
MASTER DRAINAGE PLAN

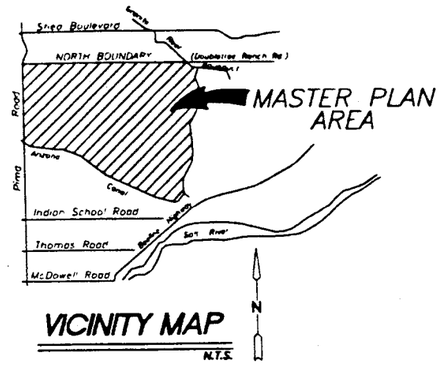
SUB-BASINS & CONCENTRATION POINTS

EVANS, KUHN & ASSOCIATES, INC.
CONSULTING ENGINEERS

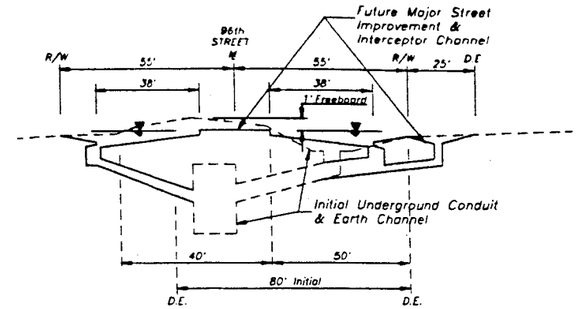
JOB # 3182.2 March 11, 1992

D1

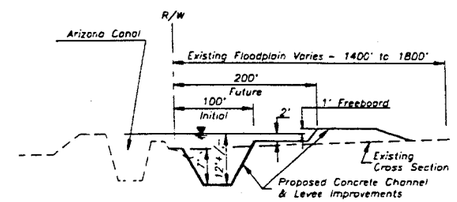




VICINITY MAP
N.T.S.



SECTION A-A
N.T.S.



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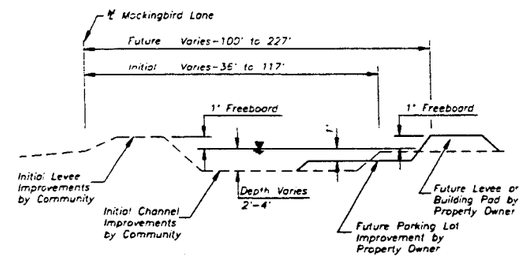

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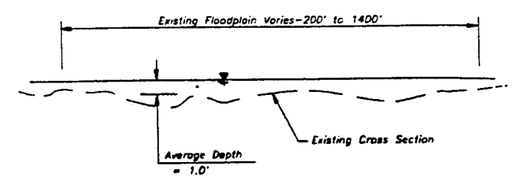

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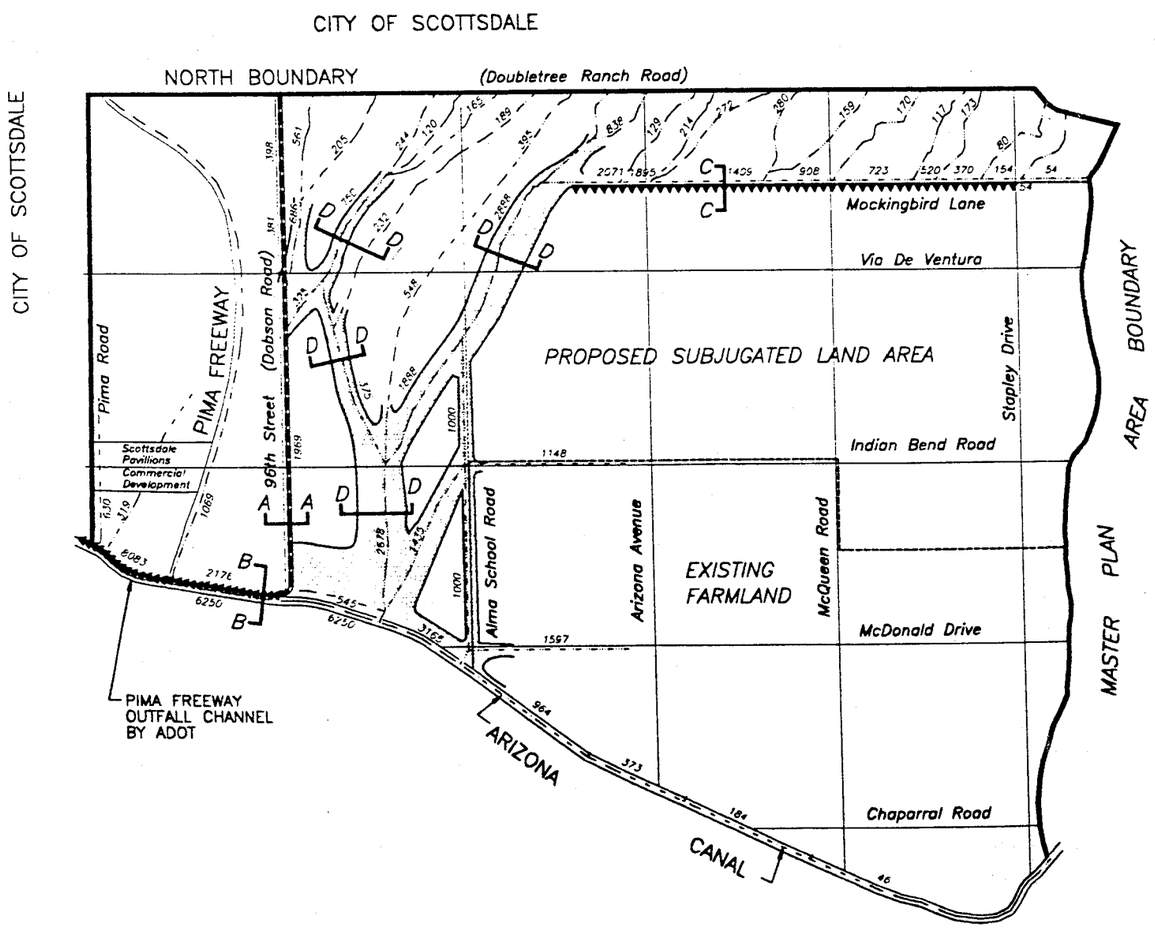


LEGEND

- PROPOSED DIVERSION CHANNEL & LEVEE IMPROVEMENT
- NATURAL DRAINAGE WAY AND APPROXIMATE LIMITS OF SHALLOW SHEET FLOW. DRAINAGE WAY LIMITS AND DEDICATED EASEMENTS MUST BE DETERMINED AT TIME OF DEVELOPMENT
- PROPOSED UNDERGROUND STORM DRAIN IMPROVEMENT
- PROPOSED OUTFALL CHANNEL IMPROVEMENTS
- 350 — 100-YEAR STORM WATER RUNOFF (Cubic Feet per Second)
- NATURAL DRAINAGE WAY. EASEMENTS MAY BE REQUIRED

GENERAL NOTES

1. ALL SUB-AREAS LOCATED WITHIN THIS MASTER DRAINAGE PLAN ARE SUBJECT TO ON-SITE RETENTION REQUIREMENTS FOR THE 100 YEAR-12 HOUR STORM(3.86 inches) TO BE DRAINED WITHIN 36 HOURS.
2. ALL ARTERIAL STREETS WILL BE DRAINED TO PROVIDE ONE 12' DRY LANE IN BOTH DIRECTIONS FOR THE 2-YEAR STORM EVENT.
3. THE MAXIMUM DEPTH OF RUNOFF FROM THE 100 YEAR STORM WITHIN STREET R.O.W. WILL BE 12 INCHES.
4. RUNOFF FROM THE 100-YEAR STORM EVENT WILL BE CONTAINED WITHIN STREET R.O.W. OR DEDICATED DRAINAGE WAY EASEMENTS.
5. DEVELOPMENT IN AREAS CONTAINING NATURAL DRAINAGE WAYS WILL PROVIDE DRAINAGE EASEMENTS FOR THE FLOWS SHOWN ON THIS MAP AT THE TIME OF DEVELOPMENT.
6. THE PROPOSED WATER SURFACE ELEVATION SHOULD BE AT OR BELOW EXISTING GROUND FOR SECTIONS A-A AND C-C.
7. THE PROPOSED WATER SURFACE ELEVATION SHOULD BE AT OR BELOW THE EXISTING WATER SURFACE ELEVATION FOR SECTION B-B.
8. THE PROPOSED WATER SURFACE ELEVATION FOR NATURAL DRAINAGE WAYS MAY BE RAISED NO MORE THAN ONE FOOT(1') ABOVE THE EXISTING WATER SURFACE ELEVATION PROVIDED THAT UPSTREAM AND DOWNSTREAM PROPERTIES ARE NOT ADVERSELY IMPACTED.

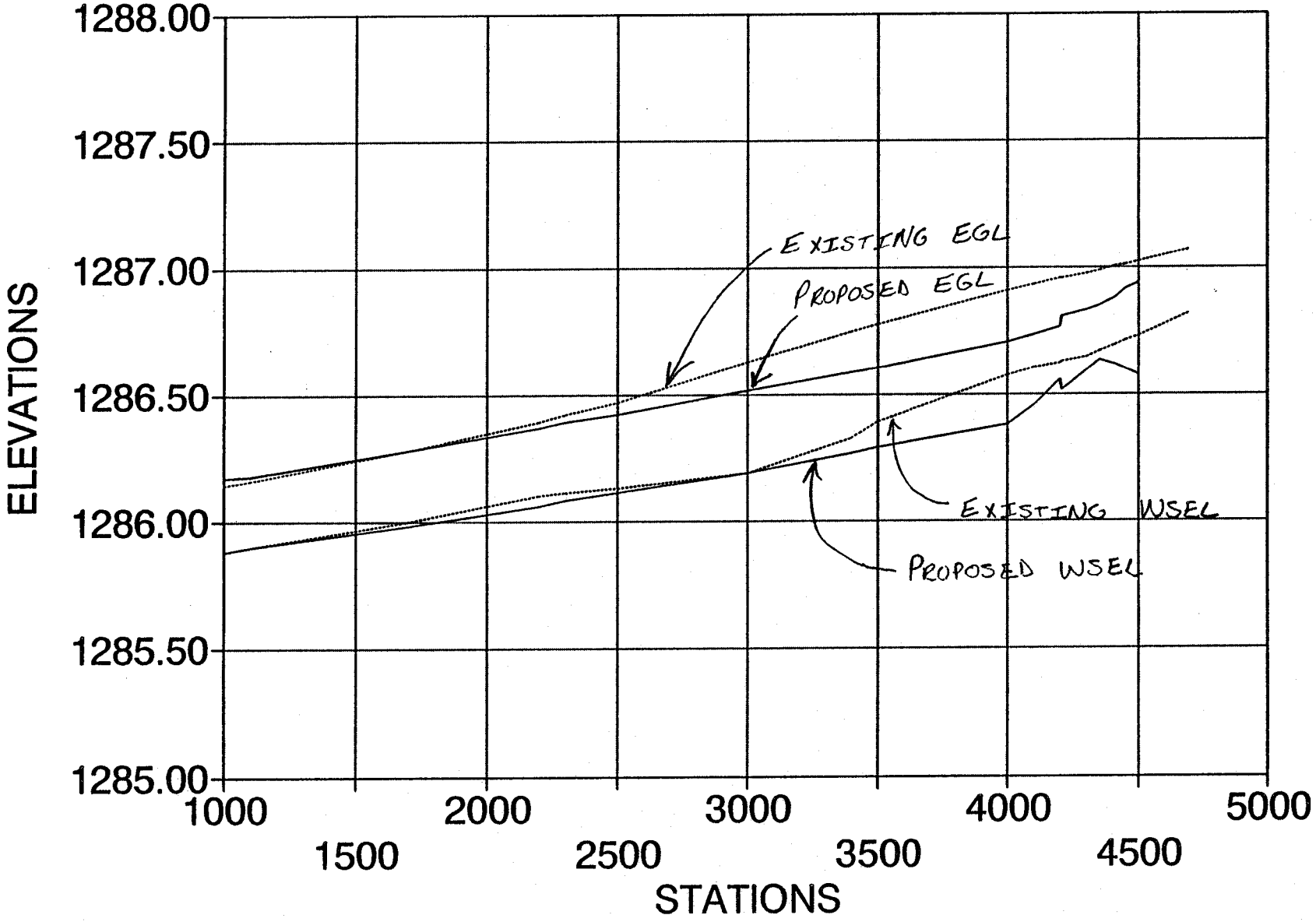
Salt River Pima-Maricopa Indian Community

MASTER DRAINAGE PLAN NORTHWEST AREA

EVANS, KUHN & ASSOCIATES, INC.
CONSULTING ENGINEERS

JOB # 3182.2 March 11, 1992

ARIZONA CANAL OUTFALL CHANNEL
HYDRAULIC PROFILE



Salt River Pima - Maricopa Indian Community
Arizona Canal Outfall Channel
Water Surface Profile Summary

EKA 3182
05/04/92
BJF

Results from Hec 2 Water Surface Profile Calculations

Sta.	FLOW (CFS)	EXISTING CWSEL	EG	PROPOSED CWSEL	EG	DELTA CWSEL	
1000	8,000	1285.88	1286.14	1285.88	1286.17	0.00	
1100	8,000	1285.90	1286.16	1285.90	1286.18	0.00	
1700	8,000	1286.00	1286.28	1285.98	1286.28	-0.02	
2200	8,000	1286.10	1286.39	1286.06	1286.37	-0.04	
2300	8,000	1286.11	1286.42	1286.08	1286.39	-0.03	
2500	8,000	1286.13	1286.47	1286.11	1286.42	-0.02	
3000	8,000	1286.19	1286.63	1286.19	1286.52	0.00	
3400	8,000	1286.33	1286.75	1286.27	1286.59	-0.06	
3500	8,000	1286.39	1286.78	1286.29	1286.61	-0.10	
4000	8,000	1286.58	1286.91	1286.38	1286.71	-0.20	
4106	8,000	1286.60	1286.93	1286.46	1286.74	-0.14	(a)
4206	8,000	1286.63	1286.96	1286.56	1286.77	-0.07	(a)
4207	6,500	1286.63	1286.96	1286.52	1286.81	-0.11	(a)
4300	6,500	1286.65	1286.98	1286.60	1286.84	-0.05	(a)
4353	6,500	1286.67	1286.99	1286.64	1286.85	-0.03	(a)
4410	6,500	1286.70	1287.00	1286.62	1286.88	-0.08	(a)
4450	6,500	1286.71	1287.01	1286.60	1286.92	-0.11	(a)
4500	6,500	1286.74	1287.03	1286.58	1286.94	-0.16	(a)
4700	6,500	1286.82	1287.07	na	na		(a)

(a) Delta CWSEL computed from interpolated values.

HEC2 S/N: 1126260365 HMVersion: 6.20 Data File: exist12.hc2

```
*****************************************
* HEC-2 WATER SURFACE PROFILES          *
*                                       *
* Version   4.6.0;  February 1991       *
*                                       *
* RUN DATE   17JAN92   TIME   9:52:54   *
*****************************************
```

```
*****************************************
* U.S. ARMY CORPS OF ENGINEERS          *
* HYDROLOGIC ENGINEERING CENTER         *
* 609 SECOND STREET, SUITE D            *
* DAVIS, CALIFORNIA 95616-4687          *
*          (916) 756-1104               *
*****************************************
```

Existing Conditions

```
X     X  XXXXXXX   XXXXX            XXXXX
X     X  X        X     X          X     X
X     X  X        X                      X
XXXXXXX  XXXX     X         XXXXX   XXXXX
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX           XXXXXXX
```

```
:::::::::::::::::::::::::::::::::::::::::::::
:::::::::::::::::::::::::::::::::::::::::::::
:::                                       :::
:::   FULL MICRO-COMPUTER IMPLEMENTATION   :::
:::                                       :::
:::::::::::::::::::::::::::::::::::::::::::::
:::::::::::::::::::::::::::::::::::::::::::::
```

==========
HAESTAD METHODS
==========

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS RUN EXECUTED 17JAN92 9:52:54

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************************************
HEC-2 WATER SURFACE PROFILES

Version  4.6.0:  February 1991
************************************
```

EXIST12.HC2 MODELS EXISTING CONDITIONS ALONG ARIZONA CANAL USING EKA CONTOURS
EKA PLAN STATION 10+00 AT R/W = DCCO STA 99+00. n = .045 FOR FLOODPLAIN AND
.018 FOR ARIZONA CANAL. STARTING WSEL BASED ON DCCO APPENDIX C
FLOWS BASED ON HYDROLOGY FOR 100-YR 12HR STORM (12HR.IN)
EXTEND EKA CONTOURS FOR SECTION 4700

Canal is left overbank & Channel

Floodplain is Rt. overbank

```
T1      SRP - MIC
T2      EKA CONTOUR MODEL
T3      EXISTING FLOODPLAIN

J1  ICHECK   IND     NINV    IDIR    STRT    METRIC  HVINS   Q       WSEL    FQ

      0       2                                                     1285.88

J2  NPROF    IPLOT   PRFVS   XSECV   XSECH   FN      ALLDC   IBW     CHNIM   ITRACE

      0       0      -1                                                      15

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

    38       1       4      34      13      55      14      26      15       3

QT       1    8000
NC    .018    .045    .045      .1      .3
X1    1000      20      90     140      39      39      39
X3      10
GR  1286.8       0  1274.8      12  1274.8      82  1283.0      90  1283.0     104
GR  1283.0     110  1282.0     115  1281.0     117  1280.0     120  1280.0     130
GR  1281.0     132  1281.1     140  1282.0     433  1283.0     676  1284.0     920
GR  1285.0    1162  1286.0    1400  1287.0    1540  1288.0    1840  1289.0    2065

X1    1100      20      90     140     100     100     100
X3      10
GR  1286.8       0  1274.8      12  1274.8      82  1283.13     90  1283.0      97
GR  1283.0     110  1282.0     113  1281.0     116  1280.0     118  1280.0     132
GR  1280.3     140  1281.0     150  1282.0     468  1283.0     668  1284.0     840
GR  1285.0    1120  1286.0    1370  1287.0    1545  1288.0    1870  1289.0    2075

X1    1700      21      90     140     600     600     600
X3      10
```

E4

GR	1287.0	0	1275.0	12	1275.0	82	1284.56	90	1284.0	100
GR	1284.0	110	1283.0	113	1282.0	115	1281.0	117	1280.0	120
GR	1280.0	124	1281.0	128	1281.1	140	1282.0	350	1283.0	610
GR	1284.0	870	1285.0	1100	1286.0	1345	1287.0	1605	1288.0	1870
GR	1289.0	2040								

```
X1    2200      21      90     140     500     500     500
X3      10
GR   1287.2       0  1275.2      12  1275.2      82 1283.94      90 1283.94     110
GR   1283.0     115  1282.0     118  1281.0     120  1280.0     122  1280.0     126
GR   1281.0     130  1281.5     140  1282.0     254  1283.0     604  1284.0     875
GR   1285.0    1120  1286.0    1340  1287.0    1586  1288.0    1818  1289.0    2026
GR   1290.0    2200

X1    2300      21      90     140     100     100     100
X3      10
GR   1286.7       0  1275.2    11.5  1275.2    81.5 1284.81      90 1284.81     110
GR   1284.0     113  1283.0     116  1282.0     118  1281.0     120  1281.0     130
GR   1282.0     140  1282.0     155  1282.0     230  1283.0     600  1284.0     845
GR   1285.0    1100  1286.0    1320  1287.0    1575  1288.0    1815  1289.0    2060
GR   1290.0    2215

X1    2500      21      90     140     200     200     200
X3      10
GR   1286.8       0  1275.3    11.5  1275.3    81.5 1284.95      90 1284.95     110
GR   1284.0     115  1283.0     117  1282.0     120  1281.0     122  1281.0     130
GR   1282.0     140  1282.0     190  1282.0     195  1283.0     545  1284.0     790
GR   1285.0    1060  1286.0    1315  1287.0    1582  1288.0    1845  1289.0    2095
GR   1290.0    2255

X1    3000      22      90     140     500     500     500
X3      10
GR   1287.0       0  1275.5    11.5  1275.5    81.5 1285.35      90  1285.0     100
GR   1285.0     110  1284.0     120  1283.0     121  1282.0     123  1281.0     124
GR   1281.0     126  1282.0     130  1283.0     140  1283.0     158  1283.0     454
GR   1284.0     700  1285.0     982  1286.0    1230  1287.0    1545  1288.0    1775
GR   1289.0    2080  1290.0    2340

X1    3400      19      90     140     400     400     400
X3      10
GR   1287.1       0  1275.6    11.5  1275.6    81.5  1284.9      90  1284.9     110
GR   1284.0     116  1283.0     120  1281.0     121  1281.0     122  1281.0     127
GR   1282.0     140  1283.0     318  1284.0     635  1285.0     915  1286.0    1220
GR   1287.0    1510  1288.0    1780  1289.0    2100  1290.0    2325

X1    3500      19      90     140     100     100     100
X3      10
GR   1287.2       0  1275.7    11.5  1275.7    81.5  1284.35      90  1284.35     110
GR   1284.0     112  1283.0     120  1282.0     121  1281.0     122  1281.0     140
GR   1282.0     162  1283.0     328  1284.0     635  1285.0     910  1286.0    1200
GR   1287.0    1500  1288.0    1780  1289.0    2080  1290.0    2315

NC    .018    .045    .045      .1      .3
X1    4000      22      90     140     500     500     500
X3      10
GR   1287.4       0  1275.9    11.5  1275.9    81.5 1283.73      90 1283.73     110
GR   1284.0     111  1283.0     112  1282.0     113  1281.0     114  1280.0     116
```

E6

GR	1280.0	120	1281.0	125	1282.0	130	1282.08	140	1283.0	375
GR	1284.0	690	1285.0	875	1286.0	1130	1287.0	1430	1288.0	1710

GR	1289.0	2010	1290.0	2270

X1	4300	21	90	140	300	300	300			
X3	10									
GR	1287.0	0	1276.0	11	1276.0	81	1284.0	90	1284.0	110
GR	1283.5	111	1283.0	112	1282.0	120	1282.0	140	1283.0	426
GR	1284.0	640	1285.0	678	1285.0	788	1285.0	820	1285.0	970
GR	1286.0	1035	1286.0	1215	1287.0	1435	1288.0	1530	1289.0	1840
GR	1290.0	2210								
QT	1	6000								
X1	4700	13	90	140	400	400	400			
X3	10									
GR	1287.0	0	1276.2	11	1276.2	81	1284.2	90	1283.7	140
GR	1283.0	220	1284.0	540	1285.0	740	1286.0	950	1287.0	1250
GR	1288.0	1520	1289.0	1900	1290.0	2190				

SECND	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*PROF 1

CCHV= .100 CEHV= .300

*SECND 1000.000

1000.000	11.08	1285.88	.00	1285.88	1286.14	.26	.00	.00	1283.00
8000.0	4716.6	240.4	3042.0	892.8	207.6	3096.9	.0	.0	1281.10
.00	5.28	1.16	.98	.018	.045	.045	.000	1274.80	.92
.000188	39.	39.	39.	0	0	0	.00	1370.52	1371.44

FLOW DISTRIBUTION FOR SECND= 1000.00 CWSEL= 1285.88

STA=	1.	12.	82.	90.	140.	433.	676.	920.	1162.	1371.
PER Q=	2.2	54.5	2.3	3.0	19.1	10.5	5.9	2.3	.3	
AREA=	61.4	775.6	55.8	207.6	1268.7	821.3	580.7	334.0	92.2	
VEL=	2.8	5.6	3.3	1.2	1.2	1.0	.8	.6	.3	
DEPTH=	5.5	11.1	7.0	4.2	4.3	3.4	2.4	1.4	.4	

*SECND 1100.000

1100.000	11.10	1285.90	.00	.00	1286.16	.26	.02	.00	1283.13
8000.0	4701.5	264.5	3034.0	894.0	220.3	3036.3	9.6	3.1	1280.30
.01	5.26	1.20	1.00	.018	.045	.045	.000	1274.80	.90
.000186	100.	100.	100.	0	0	0	.00	1343.80	1344.70

FLOW DISTRIBUTION FOR SECND= 1100.00 CWSEL= 1285.90

STA=	1.	12.	82.	90.	140.	150.	468.	668.	840.	1120.	1345.
PER Q=	2.2	54.4	2.2	3.3	.9	21.1	8.6	4.2	2.8	.3	
AREA=	61.6	776.9	55.5	220.3	52.5	1398.8	679.8	412.6	391.7	101.0	
VEL=	2.8	5.6	3.2	1.2	1.4	1.2	1.0	.8	.6	.3	
DEPTH=	5.5	11.1	6.9	4.4	5.2	4.4	3.4	2.4	1.4	.4	

*SECND 1700.000

1700.000	11.00	1286.00	.00	.00	1286.28	.28	.12	.01	1284.56
8000.0	4801.4	201.6	2996.9	881.0	183.0	2971.4	66.0	21.6	1281.10
.05	5.45	1.10	1.01	.018	.045	.045	.000	1275.00	.99
.000202	600.	600.	600.	1	0	0	.00	1346.04	1347.03

SECND	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

FLOW DISTRIBUTION FOR SECND= 1700.00 CWSEL= 1286.00

STA=	1.	12.	82.	90.	140.	350.	610.	870.	1100.	1345.
PER Q=	2.2	56.0	1.8	2.5	14.9	12.4	7.1	2.7	.5	
AREA=	60.6	770.5	49.8	183.0	936.1	912.0	652.0	346.8	124.4	
VEL=	2.9	5.8	3.0	1.1	1.3	1.1	.9	.6	.3	
DEPTH=	5.5	11.0	6.2	3.7	4.5	3.5	2.5	1.5	.5	

*SECND 2200.000

2200.000	10.90	1286.10	.00	.00	1286.39	.29	.10	.00	1283.94
8000.0	4817.6	204.7	2977.7	874.5	182.8	2983.5	112.3	37.2	1281.50
.09	5.51	1.12	1.00	.018	.045	.045	.000	1275.20	1.10
.000209	500.	500.	500.	0	0	0	.00	1363.04	1364.14

FLOW DISTRIBUTION FOR SECND= 2200.00 CWSEL= 1286.10

STA=	1.	12.	82.	90.	140.	254.	604.	875.	1120.	1340.	1364.
PER Q=	2.2	55.9	2.1	2.6	7.9	17.6	7.9	3.2	.6	.0	
AREA=	59.4	762.9	52.2	182.8	495.7	1259.4	704.1	391.5	131.6	1.2	
VEL=	2.9	5.9	3.2	1.1	1.3	1.1	.9	.7	.3	.1	
DEPTH=	5.4	10.9	6.5	3.7	4.3	3.6	2.6	1.6	.6	.0	

*SECND 2300.000

2300.000	10.91	1286.11	.00	.00	1286.42	.31	.02	.01	1284.81
8000.0	4926.6	155.4	2918.0	875.4	152.8	2895.9	121.5	40.3	1282.00
.10	5.63	1.02	1.01	.018	.045	.045	.000	1275.20	.59
.000218	100.	100.	100.	1	0	0	.00	1348.43	1349.01

FLOW DISTRIBUTION FOR SECND= 2300.00 CWSEL= 1286.11

STA=	1.	12.	82.	90.	140.	155.	230.	600.	845.	1100.	1320.	1349.
PER Q=	2.2	57.3	2.0	1.9	1.0	4.8	19.2	7.4	3.5	.6	.0	
AREA=	59.6	764.0	51.9	152.9	61.7	308.5	1337.1	640.4	411.5	135.0	1.7	
VEL=	3.0	6.0	3.1	1.0	1.3	1.3	1.1	.9	.7	.4	.1	
DEPTH=	5.5	10.9	6.1	3.1	4.1	4.1	2.6	2.6	1.6	.6	.1	

*SECND 2500.000

2500.000	10.83	1286.13	.00	.00	1286.47	.33	.05	.01	1284.95
8000.0	5034.5	147.7	2817.8	868.9	145.3	2760.5	139.1	46.5	1282.09
.11	5.79	1.02	1.02	.018	.045	.045	.000	1275.30	.66
.000233	200.	200.	200.	1	0	0	.00	1352.48	1353.13

SECNO	DEPTH	CWSEL	CRIWS	WSELE	E6	HV	HL	DLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICUNT	CORAR	TOPWID	ENDST

FLOW DISTRIBUTION FOR SECNO= 2500.00 CWSEL= 1286.13

STA=	1.	12.	82.	90.	140.	190.	195.	545.	790.	1060.	1315.	1353.
PER Q=	2.3	58.6	2.0	1.8	3.4	.3	19.0	7.8	3.9	.8	.0	
AREA=	58.8	759.0	51.2	145.3	207.1	20.7	1275.0	647.5	443.6	163.9	2.7	
VEL=	3.1	6.2	3.2	1.0	1.3	1.3	1.2	1.0	.7	.4	.1	
DEPTH=	5.4	10.8	6.0	2.9	4.1	4.1	3.6	2.6	1.6	.6	.1	

*SECNO 3000.000

3000.000	10.69	1286.19	.00	.00	1286.63	.44	.13	.03	1285.35
8000.0	5480.5	118.7	2400.8	854.3	119.7	2315.3	179.7	61.7	1283.00
.14	6.42	.99	1.04	.018	.045	.045	.000	1275.50	.81
.000292	500.	500.	500.	2	0	0	.00	1288.64	1289.45

FLOW DISTRIBUTION FOR SECNO= 3000.00 CWSEL= 1286.19

STA=	1.	12.	82.	90.	140.	158.	454.	700.	982.	1230.	1289.
PER Q=	2.4	64.0	2.1	1.5	.9	14.4	9.0	4.8	.9	.0	
AREA=	57.1	749.2	49.0	119.7	57.4	943.9	661.4	476.2	170.8	5.6	
VEL=	3.4	6.8	3.4	1.0	1.2	1.2	1.1	.8	.4	.1	
DEPTH=	5.3	10.7	5.8	2.4	3.2	3.2	2.7	1.7	.7	.1	

*SECNO 3400.000

3400.000	10.73	1286.33	.00	.00	1286.75	.41	.11	.00	1284.90
8000.0	5382.2	168.6	2449.2	860.7	150.5	2364.6	210.3	73.6	1282.00
.17	6.25	1.12	1.04	.018	.045	.045	.000	1275.60	.77
.000275	400.	400.	400.	2	0	0	.00	1316.02	1316.78

FLOW DISTRIBUTION FOR SECNO= 3400.00 CWSEL= 1286.33

STA=	1.	12.	82.	90.	140.	318.	635.	915.	1220.	1317.
PER Q=	2.4	62.6	2.3	2.1	11.4	12.3	5.3	1.5	.0	
AREA=	57.6	751.4	51.7	150.5	682.4	898.3	513.4	254.3	16.2	
VEL=	3.3	6.7	3.5	1.1	1.3	1.1	.8	.5	.2	
DEPTH=	5.4	10.7	6.1	3.0	3.8	2.8	1.8	.8	.2	

*SECNO 3500.000

3500.000	10.69	1286.39	.00	.00	1286.78	.38	.03	.00	1284.35
8000.0	5242.0	211.9	2546.1	859.9	174.3	2445.4	218.1	76.6	1281.00
.17	6.10	1.22	1.04	.018	.045	.045	.000	1275.70	.81
.000262	100.	100.	100.	2	0	0	.00	1317.26	1318.07

SECND	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	DLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

FLOW DISTRIBUTION FOR SECND= 3500.00 CWSEL= 1286.39

STA=	1.	12.	82.	90.	140.	162.	328.	635.	910.	1209.	1318.
PER Q=	2.3	60.8	2.5	2.6	2.1	10.7	12.1	5.3	1.6	.1	
AREA=	57.2	748.6	54.1	174.3	107.7	646.3	888.3	520.7	259.1	23.2	
VEL=	3.2	6.5	3.6	1.2	1.5	1.3	1.1	.8	.5	.2	
DEPTH=	5.3	10.7	6.4	3.5	4.9	3.9	2.9	1.9	.9	.2	

CCHV= .100 CEHV= .300

*SECND 4000.000

4000.000	10.68	1286.58	.00	.00	1286.91	.33	.12	.01	1283.73
8000.0	4988.3	274.6	2737.1	861.8	211.5	2626.2	259.3	91.7	1282.08
.21	5.79	1.30	1.04	.018	.045	.045	.000	1275.90	.82
.000236	500.	500.	500.	2	0	0	.00	1302.14	1302.96

FLOW DISTRIBUTION FOR SECND= 4000.00 CWSEL= 1286.58

STA=	1.	12.	82.	90.	140.	375.	690.	875.	1130.	1303.
PER Q=	2.2	57.5	2.7	3.4	15.3	13.0	4.0	1.8	.1	
AREA=	57.0	747.4	57.5	211.5	948.6	969.1	384.2	274.5	49.9	
VEL=	3.1	6.2	3.7	1.3	1.3	1.1	.8	.5	.2	
DEPTH=	5.3	10.7	6.8	4.2	4.0	3.1	2.1	1.1	.3	

*SECND 4300.000

4300.000	10.65	1286.65	.00	.00	1286.95	.32	.07	.00	1284.00
8000.0	4974.8	224.8	2800.4	862.2	185.6	2664.2	284.8	100.8	1282.00
.23	5.77	1.21	1.05	.018	.045	.045	.000	1276.00	.32
.000236	300.	300.	300.	0	0	0	.00	1357.93	1358.27

FLOW DISTRIBUTION FOR SECND= 4300.00 CWSEL= 1286.65

STA=	0.	81.	90.	140.	426.	640.	970.	1358.
PER Q=	59.4	2.8	2.8	19.5	9.2	5.1	1.2	
AREA=	802.3	59.9	185.6	1187.3	674.4	563.9	238.7	
VEL=	5.9	3.7	1.2	1.3	1.1	.7	.4	
DEPTH=	9.9	6.7	3.7	4.2	3.2	1.7	.6	

SECND	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	DLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 4700.000

4700.000	10.62	1286.82	.00	.00	1287.07	.25	.08	.01	1284.20
6000.0	4107.9	122.0	1770.0	860.6	143.6	2183.7	316.5	112.6	1283.70
.26	4.77	.85	.81	.018	.045	.045	.000	1276.20	.18
.000162	400.	400.	400.	2	0	0	.00	1196.28	1196.46

FLOW DISTRIBUTION FOR SECNO= 4700.00 CWSEL= 1286.82

STA=	0.	11.	81.	90.	140.	220.	540.	740.	950.	1196.
PER Q=	2.4	63.0	3.0	2.0	4.5	16.6	5.7	2.3	.4	
AREA=	57.5	743.5	59.6	143.6	277.7	1062.9	464.3	277.5	101.2	
VEL=	2.6	5.1	3.1	.8	1.0	.9	.7	.5	.2	
DEPTH=	5.3	10.6	6.6	2.9	3.5	3.3	2.3	1.3	.4	

THIS RUN EXECUTED 17JAN92 9:52:01

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.0; February 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

EXISTING FLOODPLAIN

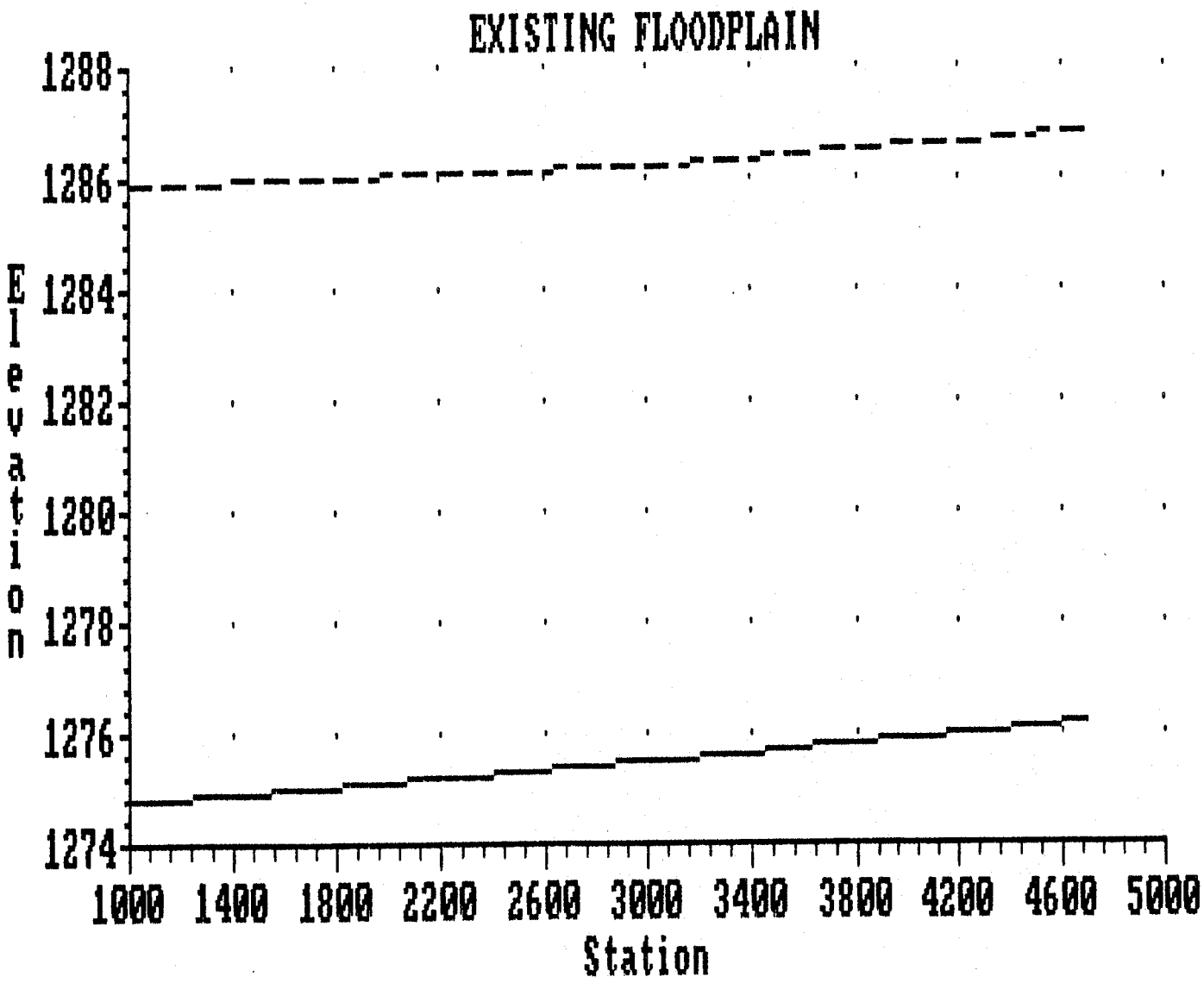
SUMMARY PRINTOUT

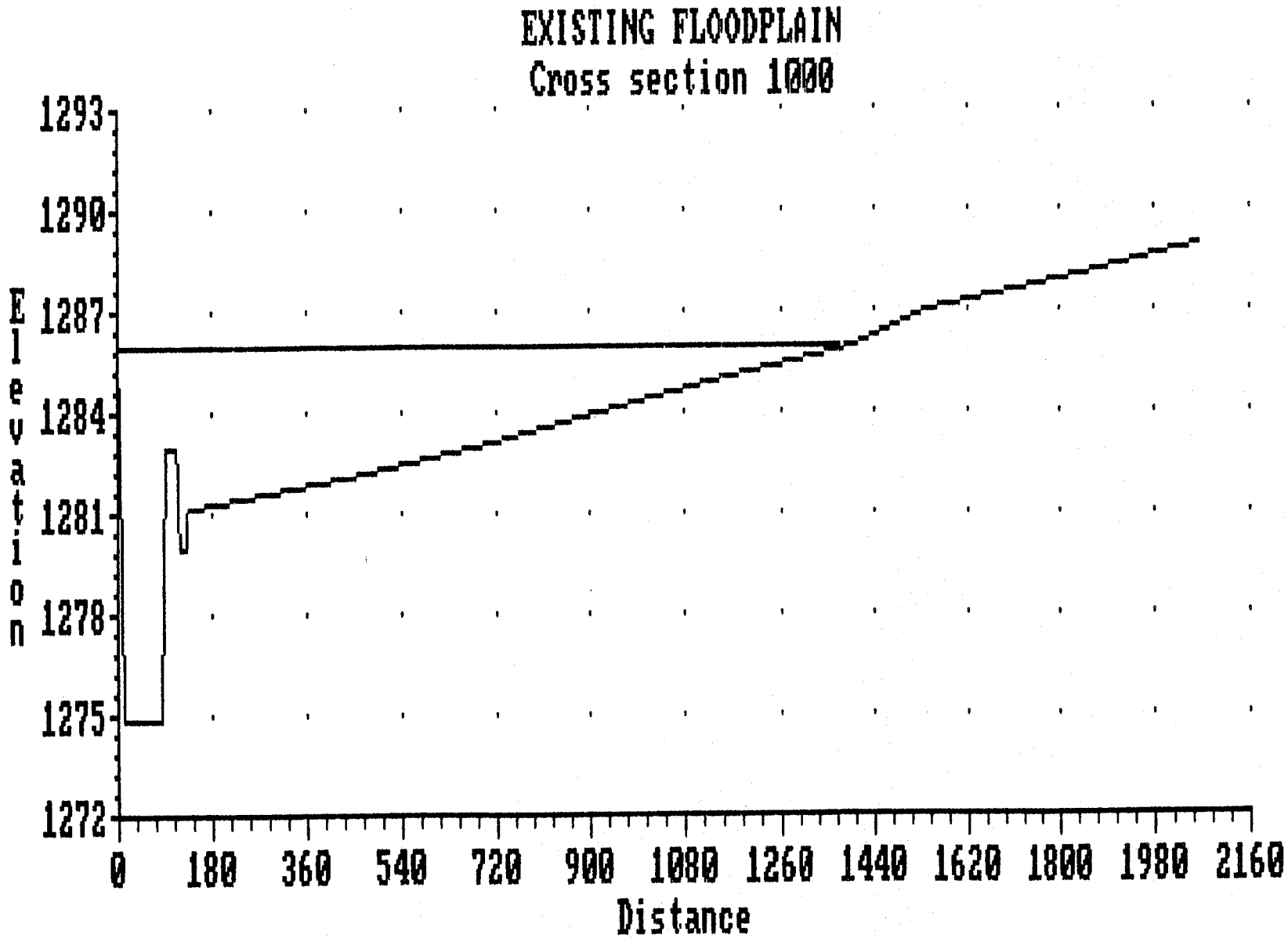
SECNO	CWSEL	TOPWID	.01K	QLOB	VLOB	QCH	VCH	QROB	10*ES
1000.000	1285.88	1370.52	5836.48	4716.57	5.28	240.41	1.16	3043.02	1.88
1100.000	1285.90	1343.80	5867.83	4701.47	5.26	264.55	1.20	3033.99	1.86
1700.000	1286.00	1346.04	5624.07	4801.42	5.45	201.63	1.10	2996.95	2.02
2200.000	1286.10	1363.04	5533.72	4817.63	5.51	204.70	1.12	2977.67	2.09
2300.000	1286.11	1348.43	5412.61	4926.64	5.63	155.38	1.02	2917.99	2.18
2500.000	1286.13	1352.48	5235.45	5034.46	5.79	147.73	1.02	2817.81	2.33
3000.000	1286.19	1288.64	4685.37	5480.53	6.42	118.72	.99	2400.75	2.92
3400.000	1286.33	1316.02	4821.39	5382.19	6.25	168.61	1.12	2449.19	2.75
3500.000	1286.39	1317.26	4937.75	5242.02	6.10	211.87	1.22	2546.11	2.62
4000.000	1286.58	1302.14	5202.68	4988.33	5.79	274.59	1.30	2737.08	2.36
4300.000	1286.65	1357.93	5205.92	4974.78	5.77	224.84	1.21	2800.39	2.36
4700.000	1286.82	1196.28	4709.45	4107.92	4.77	122.04	.85	1770.05	1.62

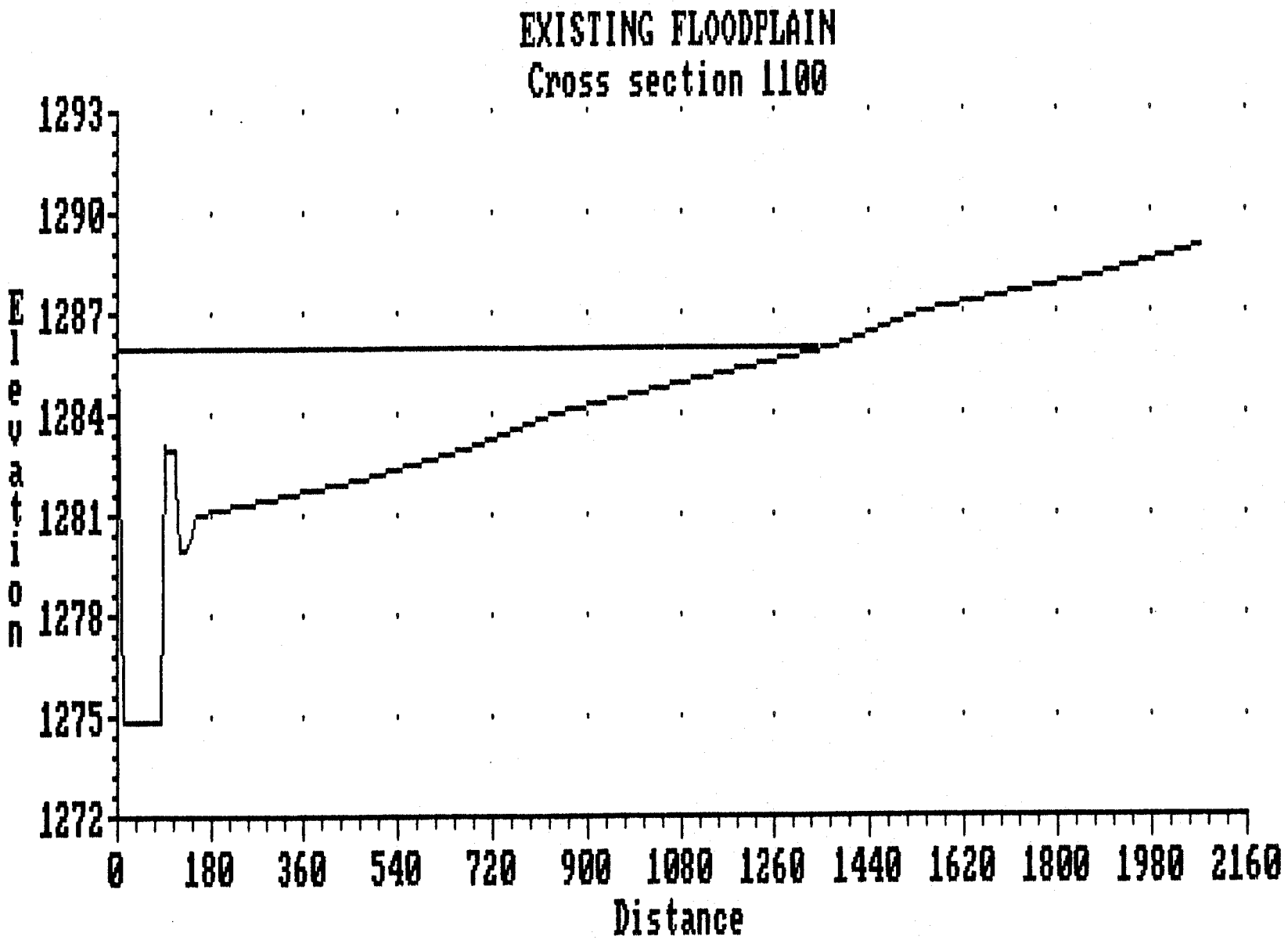
E14

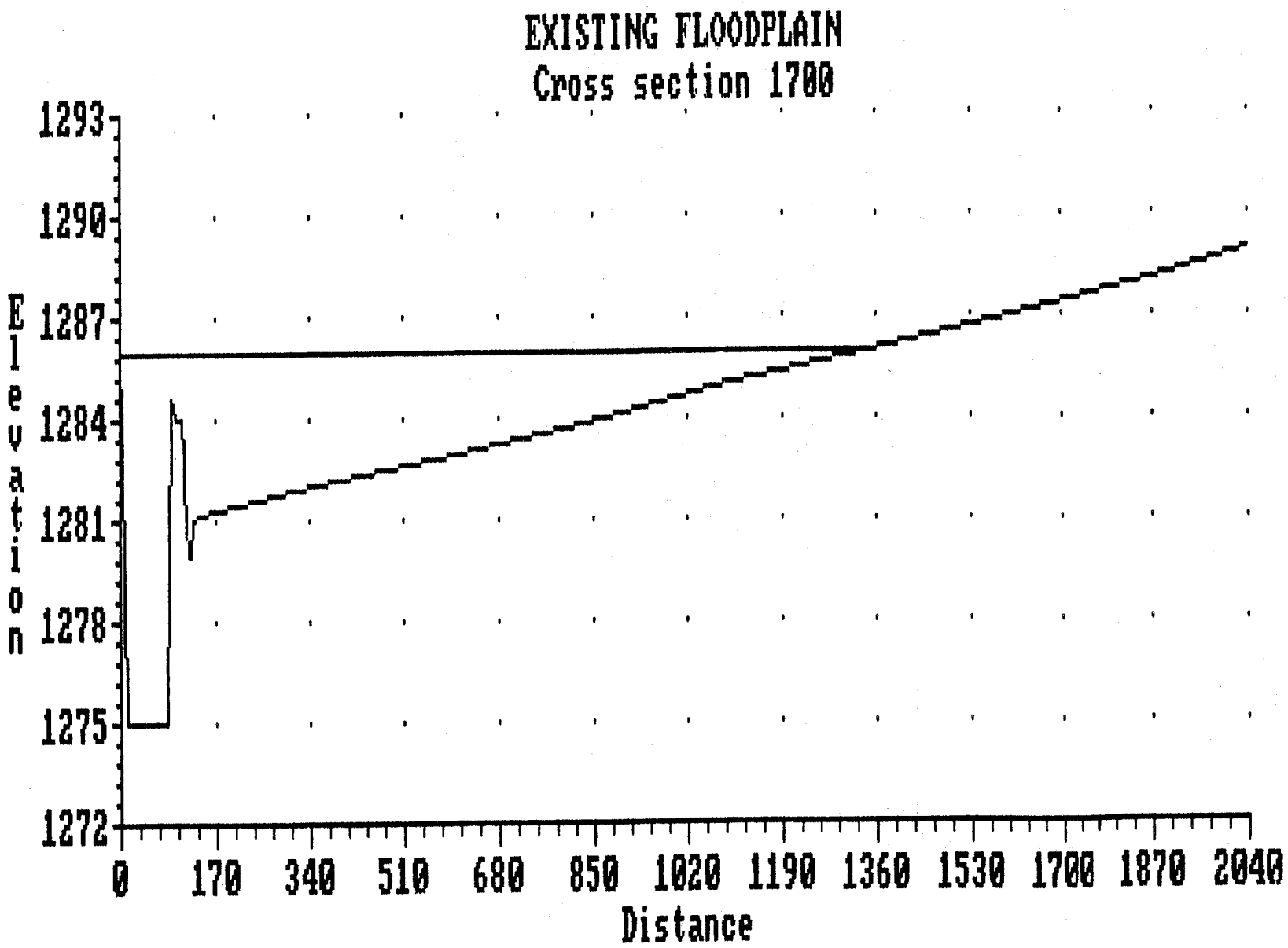
SUMMARY OF ERRORS AND SPECIAL NOTES

Normal program termination


EXISTING FLOODPLAIN
Elevation
1288
1286
1284
1282
1280
1278
1276
1274
1000 1400 1800 2200 2600 3000 3400 3800 4200 4600 5000
Station


EXISTING FLOODPLAIN
Cross section 1000
Elevation
1293
1290
1287
1284
1281
1278
1275
1272
0
180
360
540
720
900
1080
1260
1440
1620
1800
1980
2160
Distance


EXISTING FLOODPLAIN
Cross section 1100
Elevation
1293
1290
1287
1284
1281
1278
1275
1272
0
180
360
540
720
900
1080
1260
1440
1620
1800
1980
2160
Distance


EXISTING FLOODPLAIN
Cross section 1700
Elevation
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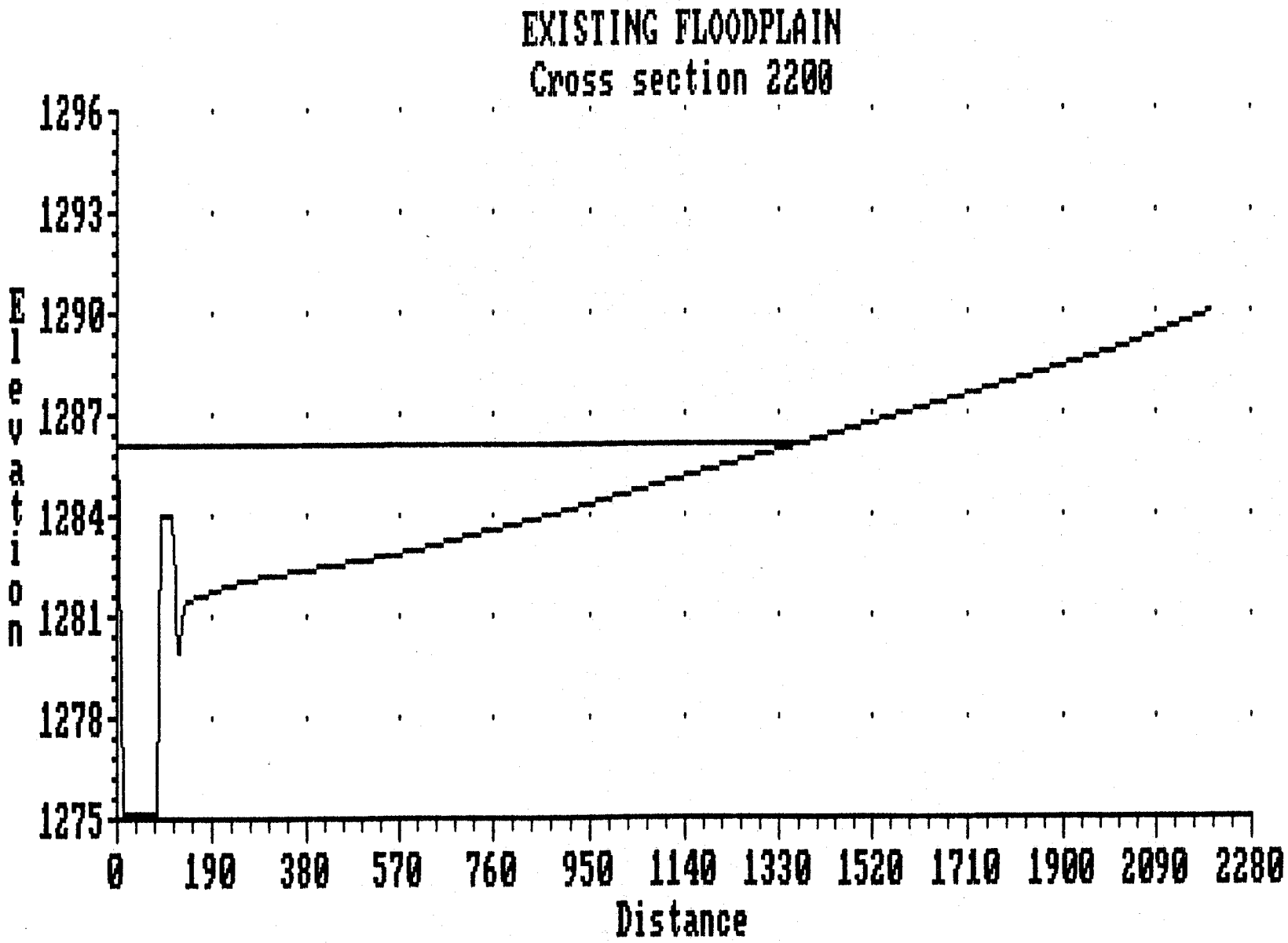
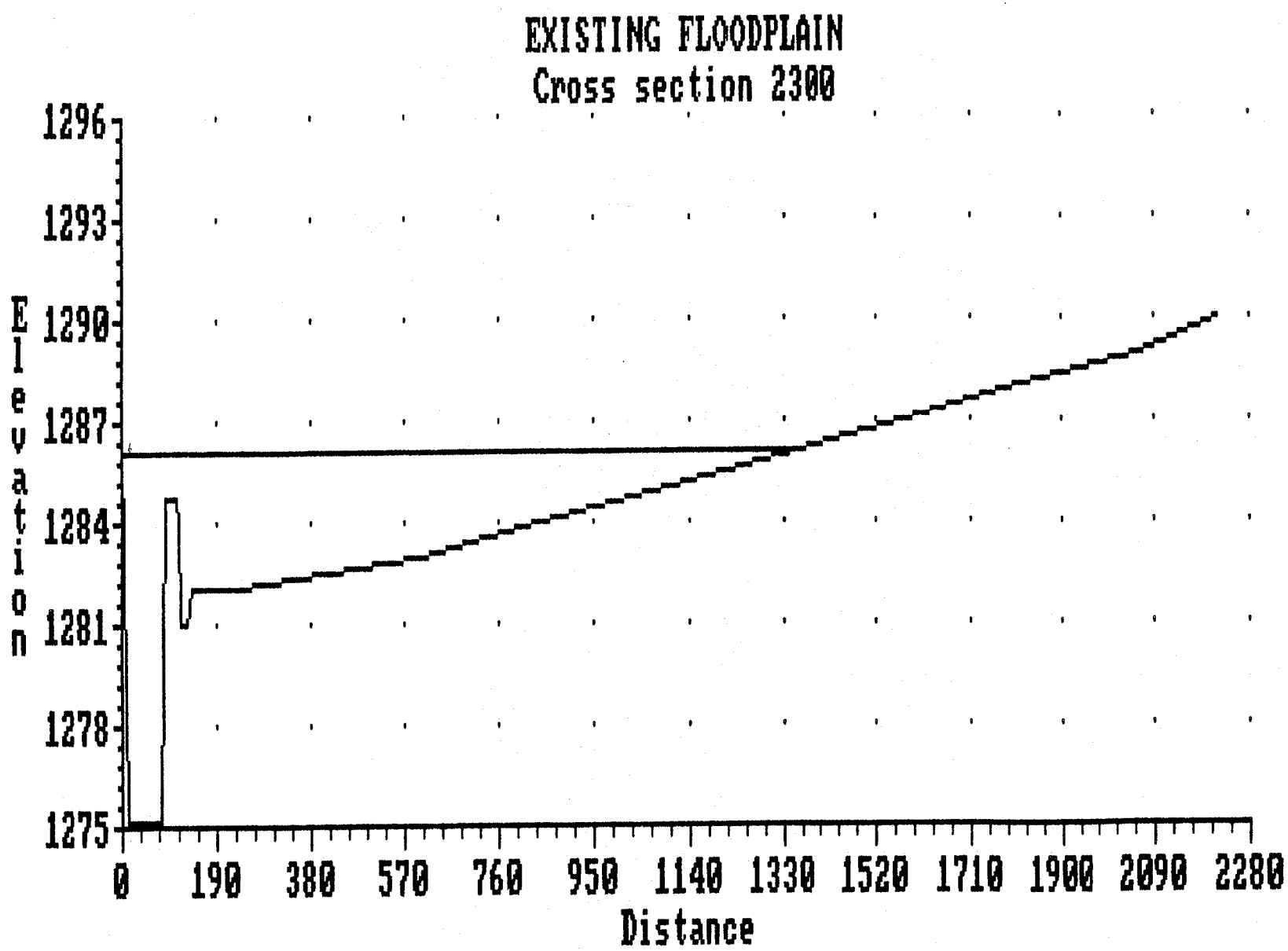
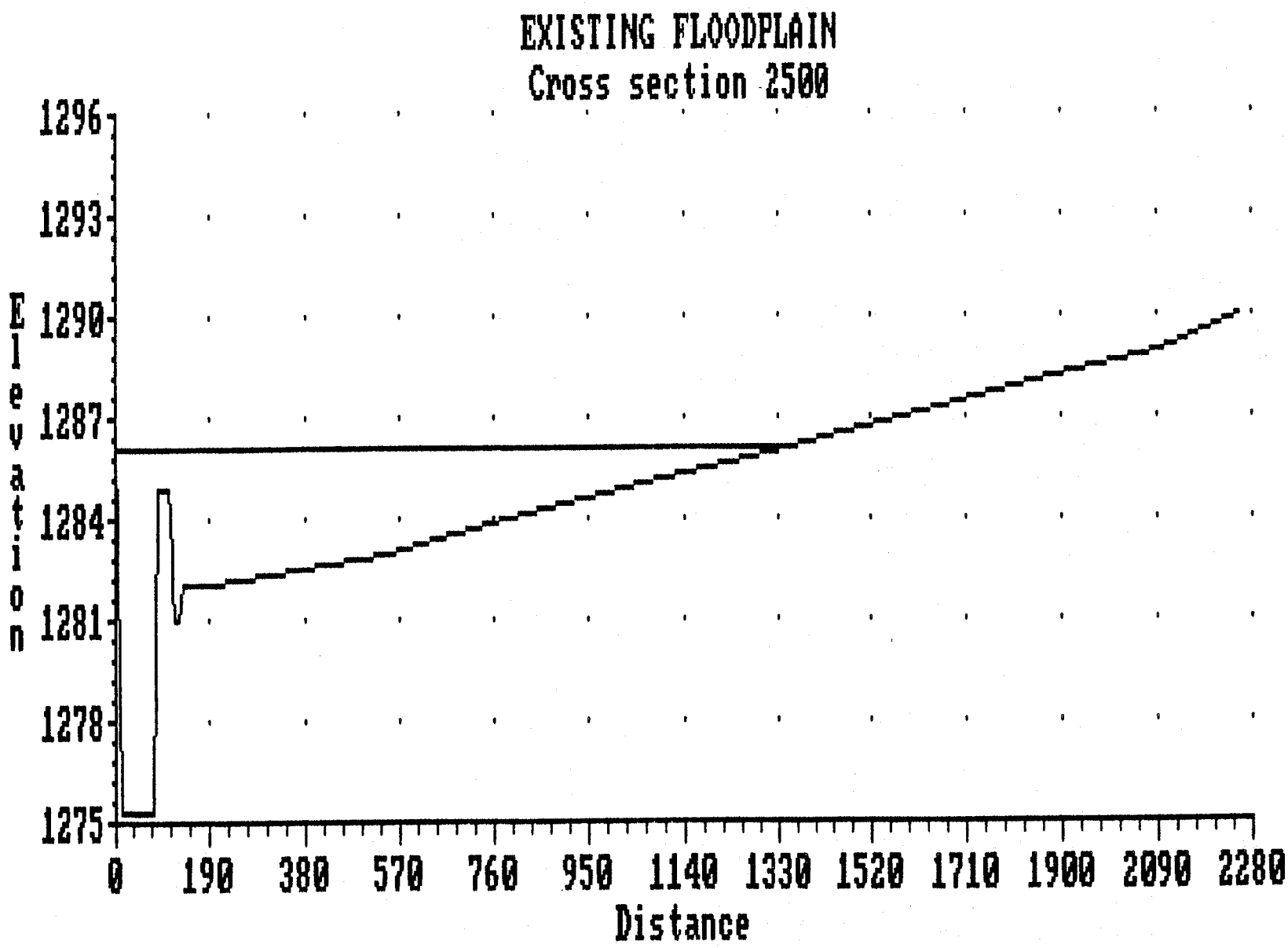
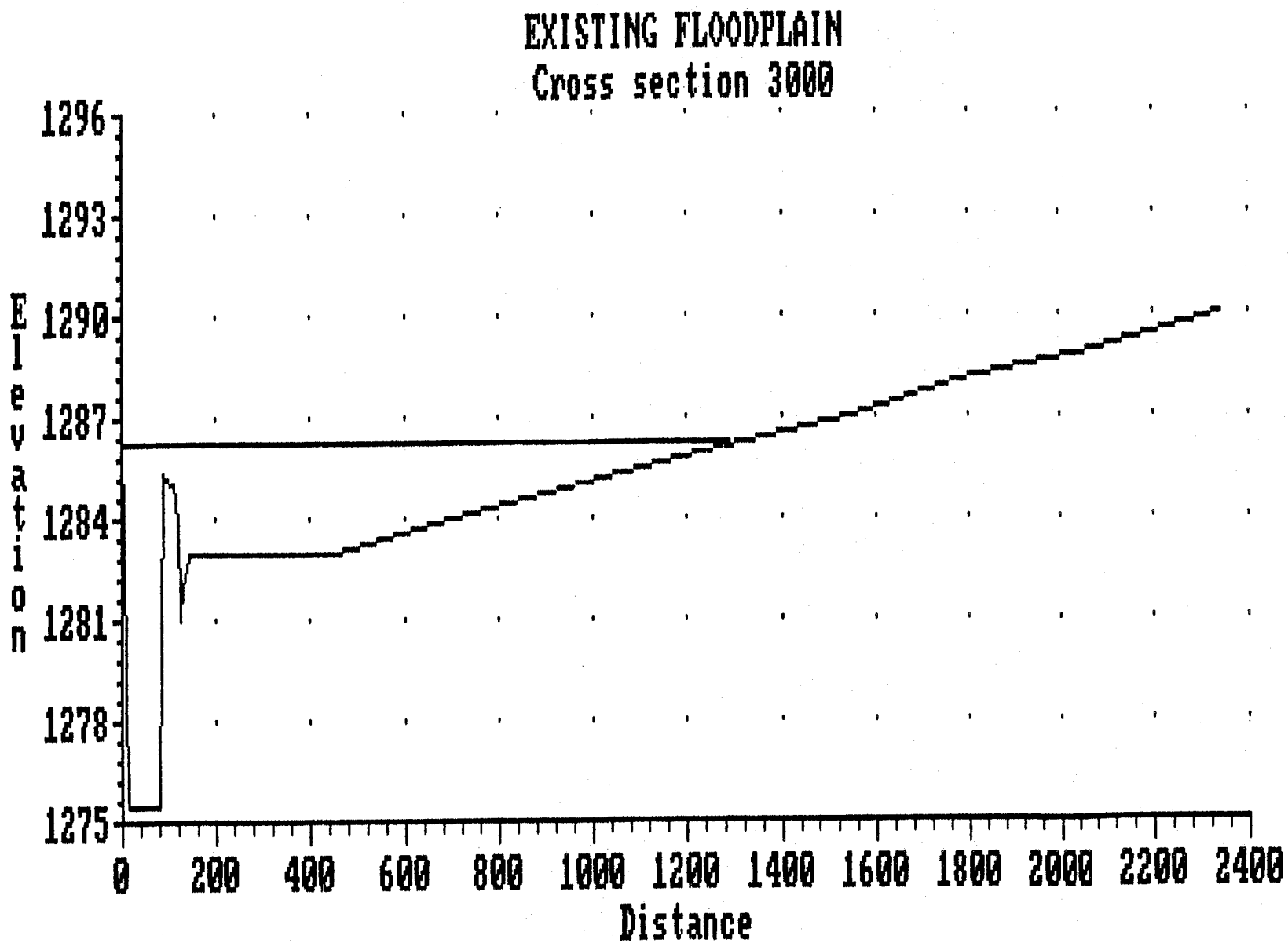
1290
1287
1284
1281
1278
1275
1272
0
170
340
510
680
850
1020
1190
1360
1530
1700
1870
2040
Distance

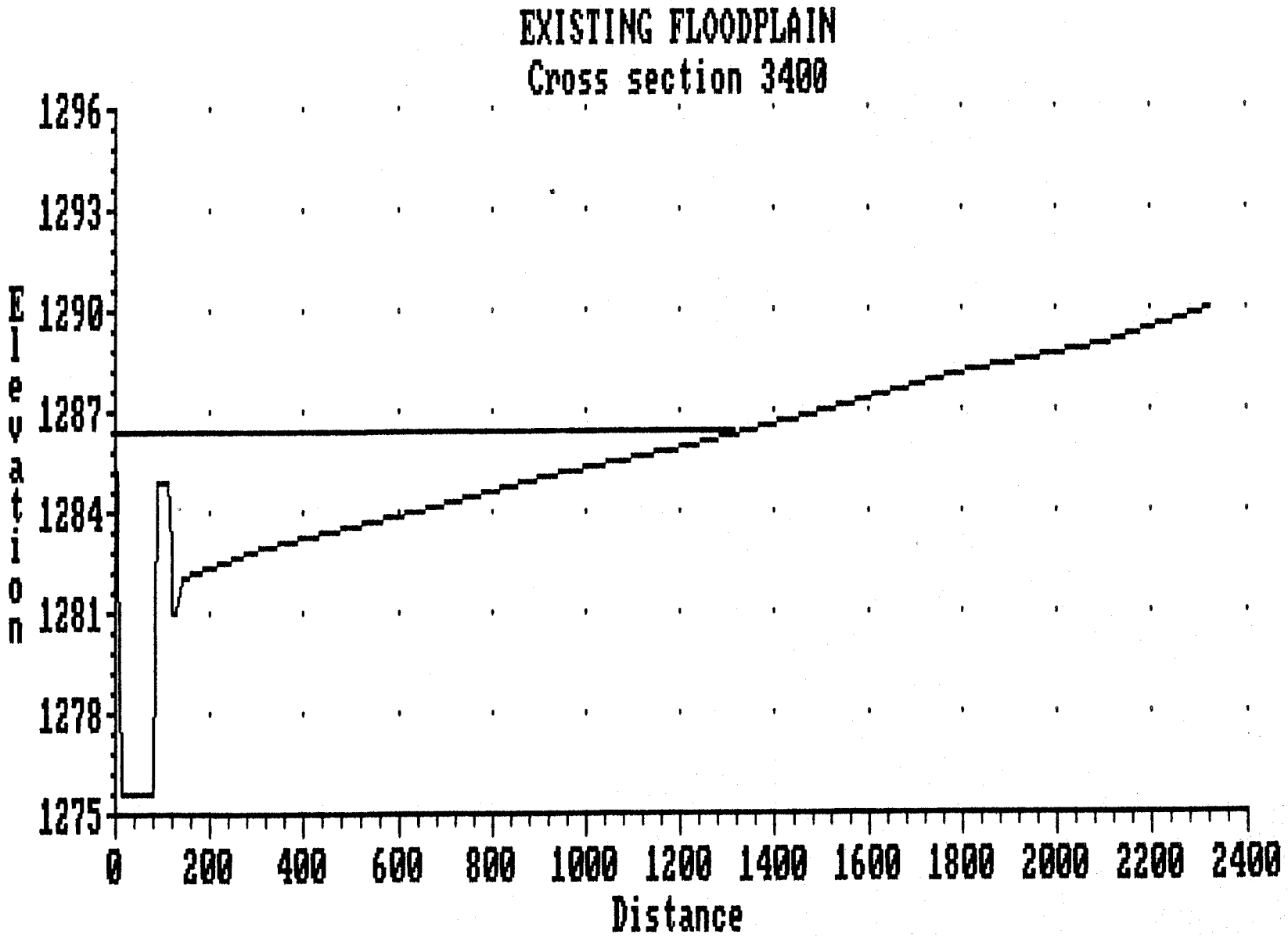

EXISTING FLOODPLAIN
Cross section 2200
Elevation
1296
1293
1290
1287
1284
1281
1278
1275
0
190
380
570
760
950
1140
1330
1520
1710
1900
2090
2280
Distance

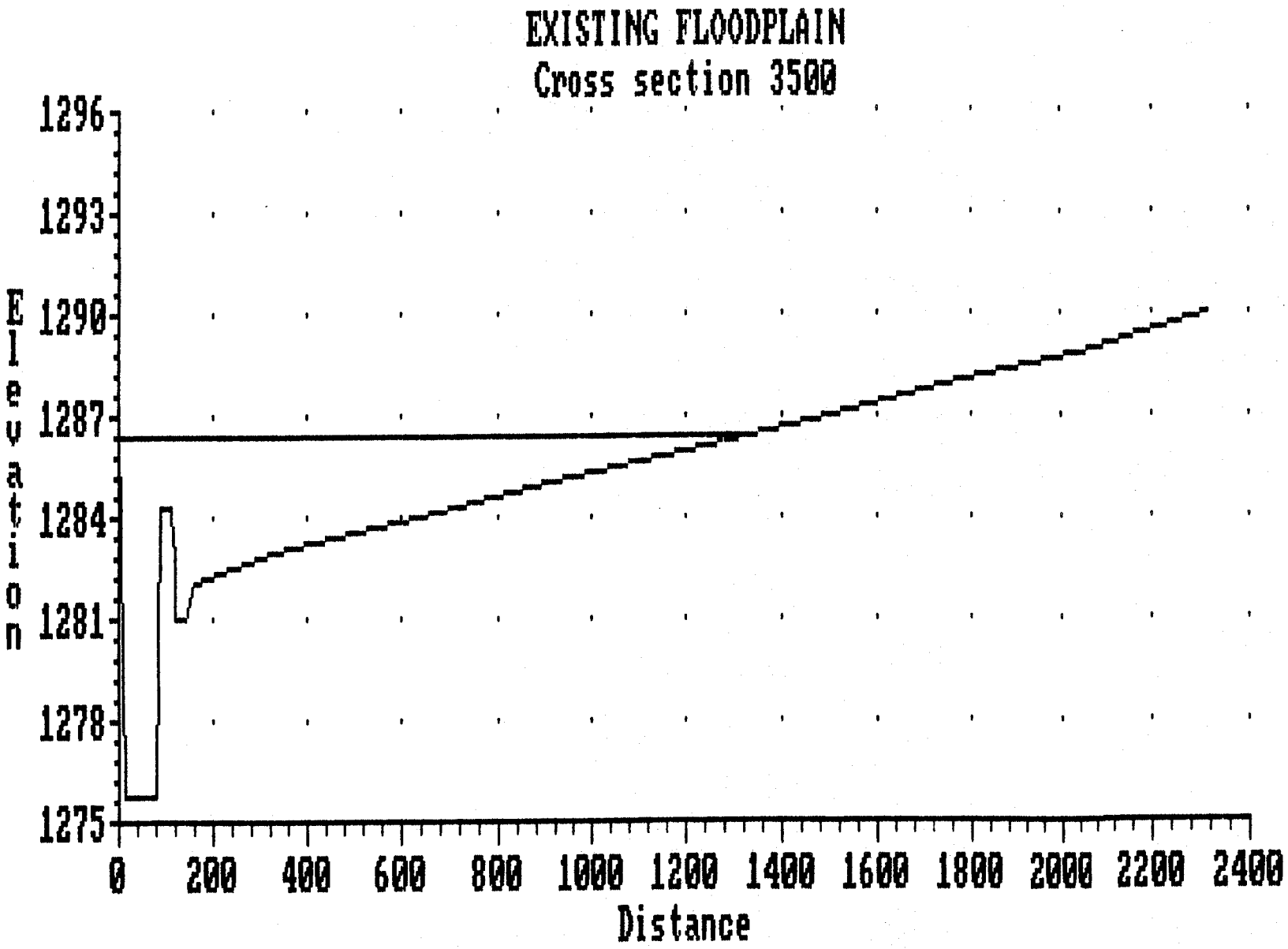
E20

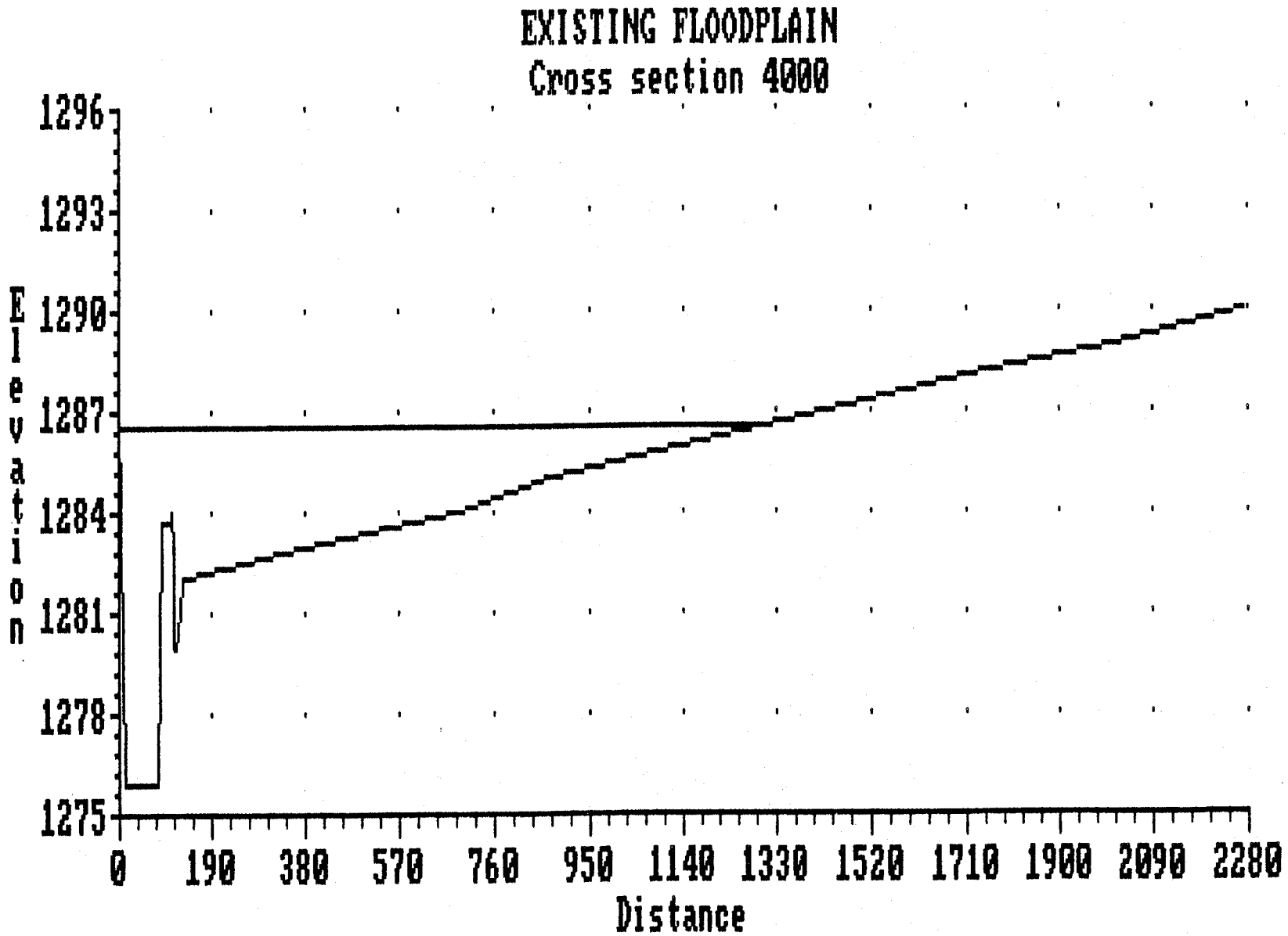

EXISTING FLOODPLAIN
Cross section 2300
Elevation
1296
1293
1290
1287
1284
1281
1278
1275
0
190
380
570
760
950
1140
1330
1520
1710
1900
2090
2280
Distance


EXISTING FLOODPLAIN
Cross section 2500
Elevation
1296
1293
1290
1287
1284
1281
1278
1275
0
190
380
570
760
950
1140
1330
1520
1710
1900
2090
2280
Distance

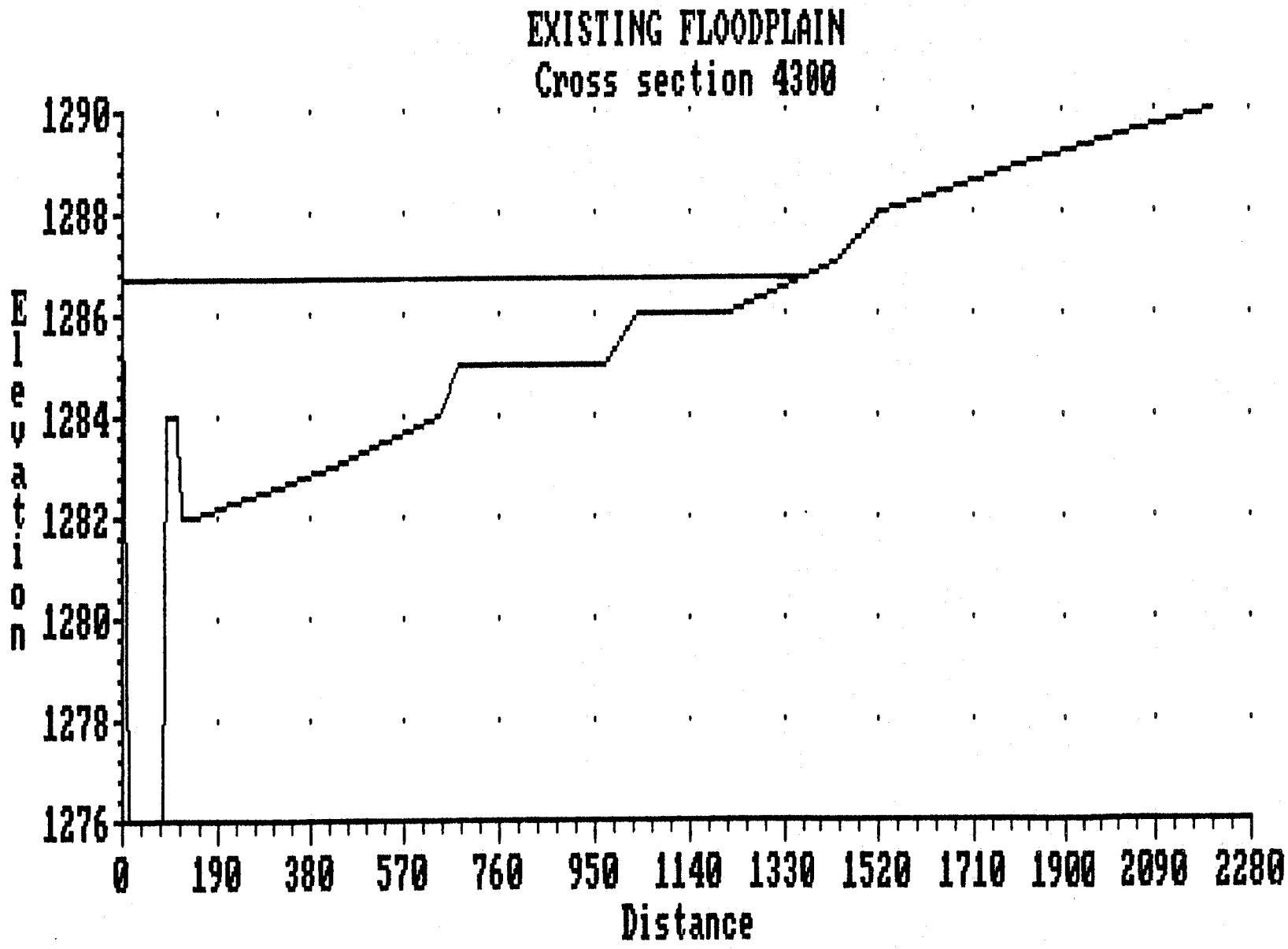

EXISTING FLOODPLAIN
Cross section 3000
Elevation
1296
1293
1290
1287
1284
1281
1278
1275
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
Distance


EXISTING FLOODPLAIN
Cross section 3400
Elevation
1296
1293
1290
1287
1284
1281
1278
1275
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
Distance


EXISTING FLOODPLAIN
Cross section 3500
Elevation
1296
1293
1290
1287
1284
1281
1278
1275
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
Distance


EXISTING FLOODPLAIN
Cross section 4000
Elevation
1296
1293
1290
1287
1284
1281
1278
1275
0
190
380
570
760
950
1140
1330
1520
1710
1900
2090
2280
Distance

E26


EXISTING FLOODPLAIN
Cross section 4300
Elevation
1290
1288
1286
1284
1282
1280
1278
1276
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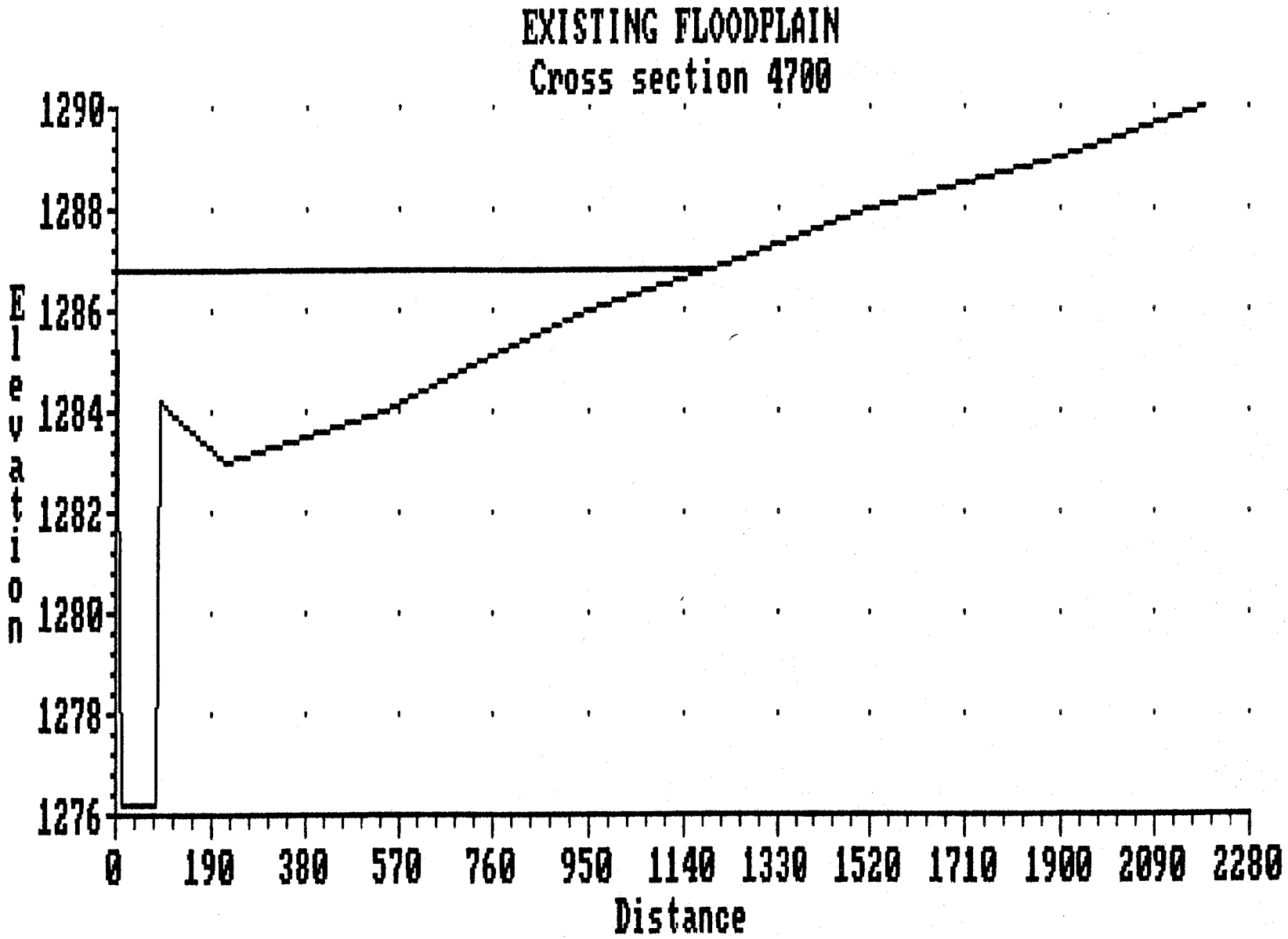
190
380
570
760
950
1140
1330
1520
1710
1900
2090
2280
Distance


EXISTING FLOODPLAIN
Cross section 4700
Elevation
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1288
1286
1284
1282
1280
1278
1276
0
190
380
570
760
950
1140
1330
1520
1710
1900
2090
2280
Distance

HEC2 S/N: 1126260365 HMVersion: 6.20 Data File: bridge1.hc2

```
*****************************************
* HEC-2 WATER SURFACE PROFILES          *
*                                       *
* Version   4.6.0:  February 1991       *
*                                       *
* RUN DATE    23JAN92    TIME   16:27:13 *
*****************************************
```

```
*****************************************
* U.S. ARMY CORPS OF ENGINEERS          *
* HYDROLOGIC ENGINEERING CENTER         *
* 609 SECOND STREET, SUITE D            *
* DAVIS, CALIFORNIA 95616-4687          *
*          (916) 756-1104               *
*****************************************
```

PROPOSED CONDITION

```
X     X  XXXXXXX   XXXXX             XXXXX
X     X  X        X     X           X     X
X     X  X        X                       X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                 X
X     X  X        X     X           X
X     X  XXXXXXX   XXXXX             XXXXXXX
```

```
:::::::::::::::::::::::::::::::::::::::::::::
:::::::::::::::::::::::::::::::::::::::::::::
:::                                       :::
:::   FULL MICRO-COMPUTER IMPLEMENTATION   :::
:::                                       :::
:::::::::::::::::::::::::::::::::::::::::::::
:::::::::::::::::::::::::::::::::::::::::::::
```

==========
HAESTAD METHODS
==========

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS RUN EXECUTED 23JAN92 16:27:13

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************************************
HEC-2 WATER SURFACE PROFILES

Version  4.6.0:  February 1991
************************************
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BRIDGE1.HC2 FLOWS BASED ON 12 HOUR STORM. 30' BOTTOM WIDTH OUTFALL CHANNEL BUILT UP BUILDING PAD/LEVEE MODELED AS FLAT PARKING AREA OUT TO 200'. PARKING ELEVATION SET AT 2.0' BELOW EXISTING WATER SURFACE ELEVATION EKA PLAN STATION 10+00 AT R/W = DCCO STA 99+00. n = .045 FOR FLOODPLAIN AND .018 FOR ARIZONA CANAL AND OUTFALL CHANNEL. CROSS SECTION DATA FOR CANAL TAKEN FROM DCCO. STARTING WSEL TAKEN FROM DCCO APPENDIX C. OUTFALL CHANNEL BANK SLOPES UP AT 4:1 TO INTERSECT LEVEL PARKING AREA

Canal = Lt. O.B.
Low Flow & Overflow Channel = Rt OB
Area between Canal & Channel = Channel.

MODELS OUTFALL AREA FOR BRIDGE ROW

T1 SRP - MIC
T2 EKA CONTOUR MODEL
T3 ACOC/PARKING FLOODPLAIN

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	2							1285.88	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	0	0	-1							0

J3 VARIABLE CODES FOR SUMMARY PRINTOUT

	38	1	4	43	13	55	14	26	15	3
QT	1	8000								
NC	.018	.025	.018	.1	.3					
NH	4	.018	90	.045	147	.018	205	.025	340	
X1	1000	19	90	140	0	0	0			
X3	10					340	1285.88			
GR	1286.8	0	1274.8	12	1274.8	82	1283.04	90	1283.0	104
GR	1283.0	110	1282.0	115	1281.0	117	1280.0	120	1280.0	130
GR	1281.0	132	1281.1	140	1281.1	145	1280.54	147	1273.54	161
GR	1273.5	191	1280.54	205	1283.88	218	1283.88	340		
NH	4	.018	90	.045	147	.018	205	.025	340	
X1	1100	19	90	140	100	100	100			
X3	10					340	1285.90			
GR	1286.8	0	1274.8	12	1274.8	82	1283.13	90	1283.0	97
GR	1283.0	110	1282.0	113	1281.0	116	1280.0	118	1280.0	132
GR	1280.3	140	1280.7	146	1280.57	147	1273.57	161	1273.57	172
GR	1273.6	191	1280.57	205	1283.90	218	1283.90	340		

E30

NH	4	.018	90	.045	147	.018	205	.025	340	
X1	1700	20	90	140	600	600	600			
X3						340	1286.00			
GR	1287.0	0	1275.0	12	1275.0	82	1284.56	90	1284.0	100
GR	1284.0	110	1283.0	113	1282.0	115	1281.0	117	1280.0	120
GR	1280.0	124	1281.0	128	1281.1	140	1281.1	146	1280.79	147
GR	1273.8	161	1273.79	191	1280.79	205	1284.0	218	1284.00	340
NH	4	.018	90	.045	147	.018	205	.025	340	
X1	2200	19	90	140	500	500	500			
X3	10					340	1286.10			
GR	1287.2	0	1275.2	12	1275.2	82	1283.94	90	1283.94	110
GR	1283.0	115	1282.0	118	1281.0	120	1280.0	122	1280.0	128
GR	1281.0	130	1281.5	140	1281.5	145	1280.97	147	1273.97	161
GR	1274.0	191	1280.97	205	1284.1	218	1284.1	340		
NH	4	.018	90	.045	147	.018	205	.025	340	
X1	2300	18	90	140	100	100	100			
X3	10					340	1286.11			
GR	1286.7	0	1275.2	11.5	1275.2	81.5	1284.81	90	1284.81	110
GR	1284.0	113	1283.0	116	1282.0	118	1281.0	120	1281.0	130
GR	1282.0	140	1282.0	143	1281.0	147	1274.0	161	1274.0	191
GR	1281.0	205	1284.11	217	1284.11	340				
NH	4	.018	90	.045	147	.018	205	.025	340	
X1	2500	18	90	140	200	200	200			
X3	10					340	1286.13			
GR	1286.8	0	1275.3	11.5	1275.3	81.5	1284.95	90	1284.95	110
GR	1284.0	115	1283.0	117	1282.0	120	1281.0	122	1281.0	130
GR	1282.0	140	1282.0	143	1281.08	147	1274.08	161	1274.08	191
GR	1281.1	205	1284.13	217	1284.13	340				
NH	4	.018	90	.045	147	.018	205	.025	340	
X1	3000	20	90	140	500	500	500			
X3	10					340	1286.19			
GR	1287.0	0	1275.5	11.5	1275.5	81.5	1285.35	90	1285.0	100
GR	1285.0	110	1284.0	120	1283.0	121	1282.0	123	1281.0	124
GR	1281.0	126	1282.0	130	1283.0	140	1283.0	140.1	1281.26	147
GR	1274.2	161	1274.26	191	1281.26	205	1284.19	217	1284.19	340
NH	4	.018	90	.045	147	.018	205	.025	340	
X1	3400	18	90	140	400	400	400			
X3	10					340	1286.33			
GR	1287.1	0	1275.6	11.5	1275.6	81.5	1284.9	90	1284.9	110
GR	1284.0	116	1283.0	120	1282.0	121	1281.0	122	1281.0	127
GR	1282.0	140	1282.0	145	1281.4	147	1274.4	161	1274.4	191
GR	1281.4	205	1284.33	217	1284.33	340				

```
NH      4     .018      90     .045     147     .018     205     .025     340
X1   3500       16      90     140     100      100     100
X3     10                              340    1286.39
GR  1287.2       0  1275.7      11.5  1275.7    81.5  1284.35      90  1284.35     110
GR  1284.0     112  1283.0     120    1282.0    121   1281.0     122   1281.0     140
GR  1281.4     147  1274.44    161    1274.44   191   1281.44    205  1284.39     217
GR  1284.4     340

NC    .018    .025     .045      .3       .5
NH      4     .018      90     .045     147     .018     205     .025     340
X1   4000       21      90     140     500      500     500
X3     10                              340    1286.58
GR  1287.4       0  1275.9      11.5  1275.9    81.5  1283.73      90  1284.0      100
GR  1284.0     110  1283.0     112    1282.0    113   1281.0     114   1280.0     116
GR  1280.0     120  1281.0     125    1282.0    130   1282.0     140   1282.1     145
GR  1281.6     147  1274.62    161    1274.62   191   1281.62    205  1284.58     217
GR  1284.6     340

          TOP OF RAMP


NH      4     .018      90     .045     147     .018     227     .025     340
X1   4106       21      90     140     106      106     106
X3                                     340     1300
GR  1287.4       0  1275.9      11.5  1275.9    81.5  1283.7      90  1284.0      111
GR  1283.0     112  1283.0     113    1281.0    114   1280.0     116   1280.0     120
GR  1281.0     125  1282.0     130    1282.1    140   1282.1     145  1281.66     147
GR  1274.7     161  1274.66    191    1276.66   195   1276.66    211   1284.6     227
GR  1284.6     340

NH      4     .018      90     .045     147     .018     217     .025     340
X1   4206       18      90     140     100      100     100
X3                                     340     1300
GR  1287.0       0  1276.0      11    1276.0     81   1284.0      90  1284.0      110
GR  1283.5     111  1283.0     112    1282.0    120   1282.0     140   1282.0     146
GR  1281.9     147  1273.69    161    1263.6    162   1263.6     191  1273.69     192
GR  1281.9     205  1284.6     217    1284.6    340

OT      1    6500
NH      4     .018      90     .045     147     .018     205     .025     340
X1   4207       15      90     140       1       1       1
X3                                     340     1300
GR  1287.0       0  1276.0      11    1276.0     81   1284.0      90  1284.0      110
GR  1283.5     111  1283.0     112    1282.0    120   1282.0     140   1282.0     146
GR  1281.9     147  1278.3     161    1278.3    191   1281.9     205  1284.65     221
GR  1284.5     340

NH      4     .018      90     .045     146     .018     248     .025     370
X1   4353       15      90     140     147      99     147
X3                                     370     1300
GR  1287.0       0  1276.0      11    1276.0     81   1284.0      90  1284.0      110
GR  1283.5     111  1283.0     112    1282.0    120   1282.0     140   1282.0     146
GR  1279.0     161  1279.0     235    1284.6    248   1284.6     348  1290.15     370
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E32

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NH      6     .018      90     .045     140     .018     210     .045     280     .018
NH    317     .025     395
X1   4410       17      90     140      57      34      57
X3                                             395 1300.00
GR 1287.0        0  1276.0      11  1276.0      81  1284.0      90  1284.0     110
GR 1283.5      111  1283.0     112  1282.0     120  1282.0     140  1282.0     146
GR 1282.5      210  1282.6     280  1279.0     291  1279.0     304 1284.65     317
GR 1284.5      373 1290.15     395

NH      4     .018      90     .045     335     .018     370     .025     415
X1   4450       18      90     140      40      27      40
X3                                             415    1300
GR 1287.0        0  1276.0      11  1276.0      81  1284.0      90  1284.0     110
GR 1283.5      111  1283.0     112  1282.0     120  1282.0     140  1282.0     146
GR 1282.5      225  1283.0     310  1283.0     335  1279.4     346  1279.4     356
GR 1284.5      370 1284.65     393 1290.15     415

NC   .018     .018     .045      .1      .3
NH      3     .018      90     .045     400     .018     451
X1   4500       10      90     140      50      35      50
X3                                             451    1300
GR 1287.0        0  1276.2      11  1276.2      81  1284.2      90  1283.7     140
GR 1283.0      290  1283.2     400  1279.6     411  1279.6     421  1290.5     451

NH      3     .018      90     .045     465     .025     528
X1   4550       10      90     140      50      36      50
X3                                             528    1300
GR 1287.0        0  1276.2      11  1276.2      81  1284.2      90  1283.7     140
GR 1283.0      265  1283.3     465  1279.8     479  1279.8     487 1290.15     528

NH      3     .018      90     .045     595     .025     656
X1   4600       10      90     140      50      78      50
X3                                             656    1300
GR 1287.0        0  1276.2      11  1276.2      81  1284.2      90  1283.7     140
GR 1283.0      245  1283.5     595  1280.0     609  1280.0     617 1289.65     656

NH      3     .018      90     .045     765     .025     822
X1   4650       11      90     140      50     118      50
X3                                             822    1300
GR 1287.0        0  1276.2      11  1276.2      81  1284.2      90  1283.7     140
GR 1283.0      225  1284.0     615  1284.4     765  1280.9     779  1280.9     787
GR 1289.7      822

QT      1    6000
NH      2     .018      90     .045    2190
X1   4700       13      90     140      50      90      50
X3     10
GR 1287.0        0  1276.2      11  1276.2      81  1284.2      90  1283.7     140
GR 1283.0      220  1284.0     540  1285.0     740  1286.0     950  1287.0    1250
GR 1288.0     1520  1289.0    1900  1290.0    2190
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E33

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	DLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

```
*PROF 1


CCHV=     .100 CEHV=     .300
1490 NH CARD USED
*SECNO 1000.000
3280 CROSS SECTION   1000.00 EXTENDED      2.00 FEET


3470 ENCROACHMENT STATIONS=         .0     340.0  TYPE=      1  TARGET=      339.999
  1000.000     12.38   1285.88       .00   1285.88   1286.17       .29       .00       .00   1283.04
    8000.0    4307.1     219.1    3473.8     892.7     207.3     944.3        .0        .0   1281.10
       .00      4.82      1.06      3.68      .018      .045      .019      .000   1273.50       .92
   .000157        0.        0.        0.         0         0         0       .00    339.08    340.00


FLOW DISTRIBUTION FOR SECNO=   1000.00          CWSEL=   1285.88

STA=       1.      82.      90.     140.     161.     191.     205.     340.
  PER Q=     51.8      2.1      2.7      6.8     25.6      6.4      4.6
   AREA=    837.0     55.7    207.3    157.8    370.8    124.0    291.7
    VEL=      4.9      3.0      1.1      3.5      5.5      4.1      1.3
  DEPTH=     10.3      7.0      4.1      7.5     12.4      8.9      2.2

1490 NH CARD USED
*SECNO 1100.000
3280 CROSS SECTION   1100.00 EXTENDED      2.00 FEET


3470 ENCROACHMENT STATIONS=         .0     340.0  TYPE=      1  TARGET=      339.999
  1100.000     12.33   1285.90       .00       .00   1286.18       .28       .02       .00   1283.13
    8000.0    4304.3     242.0    3453.7     893.7     220.1     945.1       4.7        .8   1280.30
       .01      4.82      1.10      3.65      .018      .045      .019      .000   1273.57       .90
   .000156      100.      100.      100.         0         0         0       .00    339.10    340.00


FLOW DISTRIBUTION FOR SECNO=   1100.00          CWSEL=   1285.90

STA=       1.      82.      90.     140.     161.     172.     191.     205.     340.
  PER Q=     51.8      2.0      3.0      6.9      9.3     16.1      6.3      4.6
   AREA=    838.2     55.4    220.1    161.2    135.6    233.9    123.3    291.1
    VEL=      4.9      2.9      1.1      3.4      5.5      5.5      4.1      1.3
  DEPTH=     10.3      6.9      4.4      7.7     12.3     12.3      8.8      2.2
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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

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1490 NH CARD USED
*SECNO 1700.000
3280 CROSS SECTION   1700.00 EXTENDED      1.99 FEET


3470 ENCROACHMENT STATIONS=        .0     340.0  TYPE=      1  TARGET=      339.999
  1700.000     12.19   1285.98       .00       .00   1286.28       .30       .10       .00   1284.55
    8000.0    4329.7     181.0    3489.3     879.6     182.2     933.7      32.6       5.4   1281.10
       .05      4.92       .99      3.74      .018      .045      .019      .000   1273.79      1.01
   .000165      600.      600.      600.         0         0         0       .00    338.99    340.00


FLOW DISTRIBUTION FOR SECNO=   1700.00          CWSEL=   1285.98

STA=       1.      82.      90.     140.     161.     191.     205.     340.
  PER Q=    52.5      1.7      2.3      6.9     25.7      6.3      4.7
   AREA=   829.9     49.7    182.2    156.2    365.9    121.8    289.8
    VEL=     5.1      2.7      1.0      3.5      5.6      4.2      1.3
  DEPTH=    10.2      6.2      3.6      7.4     12.2      8.7      2.1

1490 NH CARD USED
*SECNO 2200.000
3280 CROSS SECTION   2200.00 EXTENDED      1.96 FEET


3470 ENCROACHMENT STATIONS=        .0     340.0  TYPE=      1  TARGET=      339.999
  2200.000     12.09   1286.06       .00       .00   1286.37       .31       .08       .00   1283.94
    8000.0    4336.3     182.4    3481.2     871.5     181.1     920.9      55.4       9.3   1281.50
       .08      4.98      1.01      3.78      .018      .045      .019      .000   1273.97      1.14
   .000171      500.      500.      500.         0         0         0       .00    338.86    340.00


FLOW DISTRIBUTION FOR SECNO=   2200.00          CWSEL=   1286.06

STA=       1.      82.      90.     140.     161.     191.     205.     340.
  PER Q=    52.3      1.9      2.3      6.8     25.8      6.3      4.6
   AREA=   819.6     52.0    181.1    152.8    362.4    120.1    285.6
    VEL=     5.1      2.9      1.0      3.6      5.7      4.2      1.3
  DEPTH=    10.1      6.5      3.6      7.3     12.1      8.6      2.1
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SECND	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

1490 NH CARD USED
*SECND 2300.000
3280 CROSS SECTION 2300.00 EXTENDED 1.97 FEET

3470 ENCROACHMENT STATIONS= .0 340.0 TYPE= 1 TARGET= 339.999

2300.000	12.08	1286.08	.00	.00	1286.39	.31	.02	.00	1284.81
8000.0	4367.1	136.0	3496.9	872.5	151.1	917.9	59.9	10.1	1282.00
.08	5.01	.90	3.81	.018	.045	.019	.000	1274.00	.62
.000173	100.	100.	100.	0	0	0	.00	339.38	340.00

FLOW DISTRIBUTION FOR SECND= 2300.00 CWSEL= 1286.08

STA=	1.	82.	90.	140.	161.	191.	205.	340.
PER Q=	52.8	1.8	1.7	6.8	25.9	6.4	4.6	
AREA=	820.8	51.6	151.1	150.7	362.4	120.1	284.7	
VEL=	5.1	2.8	.9	3.6	5.7	4.2	1.3	
DEPTH=	10.1	6.1	3.0	7.2	12.1	8.6	2.1	

1490 NH CARD USED
*SECND 2500.000
3280 CROSS SECTION 2500.00 EXTENDED 1.98 FEET

3470 ENCROACHMENT STATIONS= .0 340.0 TYPE= 1 TARGET= 339.999

2500.000	12.03	1286.11	.00	.00	1286.42	.32	.04	.00	1284.95
8000.0	4363.1	126.4	3510.5	866.1	143.7	916.0	68.8	11.7	1282.00
.10	5.04	.88	3.83	.018	.045	.019	.000	1274.08	.69
.000177	200.	200.	200.	0	0	0	.00	339.31	340.00

FLOW DISTRIBUTION FOR SECND= 2500.00 CWSEL= 1286.11

STA=	1.	82.	90.	140.	161.	191.	205.	340.
PER Q=	52.8	1.7	1.6	6.8	26.0	6.3	4.7	
AREA=	815.2	50.9	143.7	150.1	360.9	119.3	285.7	
VEL=	5.2	2.7	.9	3.6	5.8	4.3	1.3	
DEPTH=	10.1	6.0	2.9	7.1	12.0	8.5	2.1	

E36

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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        QLOSS     L-BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WIN       ELMIN     SS14
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDSI


1490 NH CARD USED
*SECNO 3000.000
3280 CROSS SECTION   3000.00 EXTENDED      2.01 FEET


3470 ENCROACHMENT STATIONS=        .0     340.0  TYPE=      1  TARGET=      339.999
  3000.000     11.93   1286.19       .00       .00   1286.52       .33       .09       .00   1285.35
    8000.0    4370.6      95.1    3534.3     855.0     120.1     910.3      90.7      15.6   1283.00
       .13      5.11       .79      3.88      .018      .045      .019      .000   1274.26       .80
   .000185      500.      500.      500.         0         0         0       .00    339.20    340.00


FLOW DISTRIBUTION FOR SECNO=   3000.00         CWSEL=   1286.19

STA=       1.      82.      90.     140.     161.     191.     205.     340.
  PER Q=     53.0      1.7      1.2      6.8     26.2      6.4      4.9
   AREA=    806.0     49.1    120.1    146.2    357.5    118.1    288.5
    VEL=      5.3      2.7       .8      3.7      5.9      4.3      1.4
  DEPTH=     10.0      5.8      2.4      7.0     11.9      8.4      2.1

1490 NH CARD USED
*SECNO 3400.000
3280 CROSS SECTION   3400.00 EXTENDED      1.94 FEET


3470 ENCROACHMENT STATIONS=        .0     340.0  TYPE=      1  TARGET=      339.999
  3400.000     11.87   1286.27       .00       .00   1286.59       .32       .07       .00   1284.90
    8000.0    4370.7     132.4    3496.9     854.6     146.1     899.4     108.0      18.7   1282.00
       .15      5.11       .91      3.89      .018      .045      .019      .000   1274.40       .83
   .000186      400.      400.      400.         0         0         0       .00    339.16    340.00


FLOW DISTRIBUTION FOR SECNO=   3400.00         CWSEL=   1286.27

STA=       1.      82.      90.     140.     161.     191.     205.     340.
  PER Q=     52.8      1.8      1.7      6.8     26.0      6.3      4.6
   AREA=    803.4     51.1    146.1    147.6    355.9    117.1    278.8
    VEL=      5.3      2.9       .9      3.7      5.9      4.3      1.3
  DEPTH=     10.0      6.0      2.9      7.0     11.9      8.4      2.1
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   SECND     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        DLOSS     L-BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

1490 NH CARD USED
*SECND 3500.000
3280 CROSS SECTION   3500.00 EXTENDED      1.89 FEET


3470 ENCROACHMENT STATIONS=        .0     340.0  TYPE=      1  TARGET=      339.999
  3500.000     11.85   1286.29       .00       .00   1286.61       .32       .02       .00   1284.35
    8000.0    4337.3     169.3    3493.4     850.3     168.9     898.0     112.4      19.5   1281.00
       .16      5.10      1.00      3.89      .018      .045      .019      .000   1274.44       .91
   .000186      100.      100.      100.         0         0         0       .00    339.09    340.00


FLOW DISTRIBUTION FOR SECND=   3500.00          CWSEL=   1286.29

STA=       1.      82.      90.     140.     161.     191.     205.     340.
  PER Q=     52.2      2.0      2.1      6.9     26.0      6.3      4.5
   AREA=    797.0     53.2    168.9    152.7    355.4    116.8    273.0
    VEL=      5.2      3.0      1.0      3.6      5.9      4.3      1.3
  DEPTH=      9.9      6.3      3.4      7.3     11.8      8.3      2.0

CCHV=     .300 CEHV=     .500
1490 NH CARD USED
*SECND 4000.000
3280 CROSS SECTION   4000.00 EXTENDED      1.78 FEET


3470 ENCROACHMENT STATIONS=        .0     340.0  TYPE=      1  TARGET=      339.999
  4000.000     11.76   1286.38       .00       .00   1286.71       .33       .09       .00   1283.73
    8000.0    4230.3     222.0    3447.7     844.5     198.4     874.8     134.4      23.4   1282.00
       .19      5.13      1.12      3.94      .018      .045      .019      .000   1274.62      1.02
   .000190      500.      500.      500.         0         0         0       .00    338.98    340.00


FLOW DISTRIBUTION FOR SECND=   4000.00          CWSEL=   1286.38

STA=       1.      82.      90.     140.     161.     191.     205.     340.
  PER Q=     51.9      2.3      2.8      6.7     26.0      6.2      4.2
   AREA=    788.7     55.8    198.4    146.5    352.9    115.7    259.8
    VEL=      5.3      3.3      1.1      3.7      5.9      4.3      1.3
  DEPTH=      9.8      6.6      4.0      7.0     11.8      8.3      1.9
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   SECND     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST


1490 NH CARD USED
*SECND 4106.000
3280 CROSS SECTION   4106.00 EXTENDED      1.87 FEET


3470 ENCROACHMENT STATIONS=        .0     340.0  TYPE=      1  TARGET=      339.999
  4106.000     11.80   1286.46       .00       .00   1286.74       .28       .02       .02   1283.70
    8000.0    3964.0     205.6    3830.4     852.0     202.4    1004.8     139.3      24.2   1282.10
       .20      4.65      1.02      3.81      .018      .045      .019      .000   1274.66       .33
   .000155      106.      106.      106.         2         0         0       .00    339.06    340.00


FLOW DISTRIBUTION FOR SECND=   4106.00         CWSEL=   1286.46

STA=       1.      82.      90.     140.     161.     191.     211.     227.     340.
  PER Q=     47.4      2.1      2.6      6.1     23.5     11.7      3.6      2.9
   AREA=    795.4     56.7    202.4    147.0    353.6    200.1     93.4    210.8
    VEL=      4.8      3.0      1.0      3.3      5.3      4.7      3.1      1.1
  DEPTH=      9.9      6.7      4.0      7.0     11.8     10.0      5.8      1.9

1490 NH CARD USED
*SECND 4206.000
3280 CROSS SECTION   4206.00 EXTENDED      1.96 FEET


3470 ENCROACHMENT STATIONS=        .0     340.0  TYPE=      1  TARGET=      339.999
  4206.000     22.96   1286.56       .00       .00   1286.77       .21       .01       .02   1284.00
    8000.0    3371.9     148.3    4479.8     853.8     180.9    1250.6     144.3      25.0   1282.00
       .20      3.95       .82      3.58      .018      .045      .019      .000   1263.60       .44
   .000112      100.      100.      100.         2         0         0       .00    339.56    340.00


FLOW DISTRIBUTION FOR SECND=   4206.00         CWSEL=   1286.56

STA=       0.      81.      90.     140.     161.     191.     205.     340.
  PER Q=     40.3      1.9      1.9      5.5     41.6      5.0      3.9
   AREA=    794.8     59.0    180.9    154.6    683.7    131.8    280.5
    VEL=      4.1      2.5       .8      2.9      4.9      3.0      1.1
  DEPTH=      9.9      6.6      3.6      7.4     22.8      9.4      2.1
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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	DLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

1490 NH CARD USED
*SECNO 4207.000
3280 CROSS SECTION 4207.00 EXTENDED 2.02 FEET

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .65

3470 ENCROACHMENT STATIONS= .0 340.0 TYPE= 1 TARGET= 339.999

4207.000	10.52	1286.52	.00	.00	1286.81	.28	.00	.03	1284.00
6500.0	4163.8	181.3	2154.9	850.7	179.2	742.1	144.3	25.0	1282.00
.20	4.89	1.01	2.90	.018	.045	.020	.000	1276.00	.48
.000173	1.	1.	1.	2	0	0	.00	339.52	340.00

FLOW DISTRIBUTION FOR SECNO= 4207.00 CWSEL= 1286.52

STA=	0.	81.	90.	140.	161.	191.	205.	340.
PER Q=	61.2	2.8	2.8	5.7	16.8	5.1	5.7	
AREA=	792.0	58.7	179.2	121.6	246.7	89.9	283.8	
VEL=	5.0	3.1	1.0	3.0	4.4	3.7	1.3	
DEPTH=	9.8	6.5	3.6	5.8	8.2	6.4	2.1	

1490 NH CARD USED
*SECNO 4353.000

3470 ENCROACHMENT STATIONS= .0 370.0 TYPE= 1 TARGET= 369.999

4353.000	10.64	1286.64	.00	.00	1286.85	.20	.02	.02	1284.00
6500.0	3617.4	163.1	2719.4	861.5	185.2	961.2	149.7	25.9	1282.00
.21	4.20	.88	2.83	.018	.045	.019	.000	1276.00	.36
.000125	147.	147.	99.	2	0	0	.00	355.74	356.10

FLOW DISTRIBUTION FOR SECNO= 4353.00 CWSEL= 1286.64

STA=	0.	81.	90.	140.	161.	235.	348.	356.
PER Q=	53.2	2.5	2.5	4.8	31.2	5.8	.1	
AREA=	901.7	59.8	185.2	120.0	565.6	267.3	8.3	
VEL=	4.3	2.7	.9	2.6	3.6	1.4	.7	
DEPTH=	9.9	6.6	3.7	5.7	7.6	2.4	1.0	

```
  SECNO     DEPTH     CWSEL     CRIWS     WSELR     EG        HV        HL        ULOSS     L-BANK ELEV
  Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
  TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WIN       ELMIN     SSIA
  SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDS!


1490 NH CARD USED
*SECNO 4410.000

3470 ENCROACHMENT STATIONS=        .0     395.0  TYPE=      1  TARGET=      394.999
  4410.000     10.62   1286.62       .00       .00   1286.88       .26       .01       .03   1284.00
    6500.0    4169.2     186.8    2143.9     859.5     184.1     941.4     151.8      26.3   1282.00
       .22      4.85      1.01      2.28      .018      .045      .022      .000   1276.00       .38
   .000167       57.       57.       34.         2         0         0       .00    380.88    381.26


FLOW DISTRIBUTION FOR SECNO=   4410.00          CWSEL=   1286.62

STA=       0.      81.      90.     140.     210.     280.     291.     304.     373.     381.
  PER Q=     61.3      2.8      2.9     13.6      4.8      3.3      6.3      4.9       .1
   AREA=    799.9     59.6    184.1    307.5    285.0     64.0     99.1    177.0      8.8
    VEL=      5.0      3.1      1.0      2.9      1.1      3.3      4.1      1.8       .8
  DEPTH=      9.9      6.6      3.7      4.4      4.1      5.8      7.6      2.6      1.1

1490 NH CARD USED
*SECNO 4450.000

3470 ENCROACHMENT STATIONS=        .0     415.0  TYPE=      1  TARGET=      414.999
  4450.000     10.60   1286.60       .00       .00   1286.92       .32       .01       .03   1284.00
    6500.0    4560.4     203.0    1736.6     857.5     182.9    1038.9     153.4      26.6   1282.00
       .22      5.32      1.11      1.67      .018      .045      .033      .000   1276.00       .40
   .000202       40.       40.       27.         2         0         0       .00    400.39    400.79


FLOW DISTRIBUTION FOR SECNO=   4450.00          CWSEL=   1286.60

STA=       0.      81.      90.     140.     225.     310.     346.     356.     370.     401.
  PER Q=     67.1      3.1      3.1      7.2      5.8      4.7      4.8      3.1      1.1
   AREA=    798.1     59.4    182.9    371.1    327.1    149.4     72.0     65.1     54.1
    VEL=      5.5      3.4      1.1      1.3      1.2      2.1      4.4      3.1      1.3
  DEPTH=      9.9      6.6      3.7      4.4      3.8      4.1      7.2      4.6      1.8

CCHV=     .100 CEHV=     .300
1490 NH CARD USED
*SECNO 4500.000

3470 ENCROACHMENT STATIONS=        .0     451.0  TYPE=      1  TARGET=      450.999
```

```
  SECND     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
  Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
  TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
  SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST


 4500.000     10.38   1286.58       .00       .00   1286.94       .36       .01       .01   1284.20
   6500.0    4694.3     125.4    1680.3     838.9     131.5    1061.0     155.4      26.9   1283.70
      .22      5.60       .95      1.58      .018      .045      .034      .000   1276.20       .43
  .000230       50.       50.       35.         2         0         0       .00    439.78    440.21


FLOW DISTRIBUTION FOR SECND=   4500.00          CWSEL=   1286.58

STA=       0.      11.      81.      90.     140.     290.     400.     411.     421.     440.
  PER Q=     2.5     66.6      3.1      1.9      8.2      6.8      3.2      4.9      2.8
   AREA=    54.9    726.6     57.4    131.5    484.5    382.8     57.0     69.8     67.0
    VEL=     3.0      6.0      3.5      1.0      1.1      1.1      3.6      4.6      2.8
  DEPTH=     5.2     10.4      6.4      2.6      3.2      3.5      5.2      7.0      3.5

1490 NH CARD USED
*SECND 4550.000

3470 ENCROACHMENT STATIONS=         .0     528.0  TYPE=      1  TARGET=      527.999
 4550.000     10.41   1286.61       .00       .00   1286.95       .34       .01       .00   1284.20
   6500.0    4623.9     125.4    1750.7     841.8     133.1    1317.8     157.5      27.4   1283.70
      .22      5.49       .94      1.33      .018      .045      .039      .000   1276.20       .39
  .000220       50.       50.       36.         2         0         0       .00    513.59    513.99


FLOW DISTRIBUTION FOR SECND=   4550.00          CWSEL=   1286.61

STA=       0.      11.      81.      90.     140.     265.     465.     479.     487.     514.
  PER Q=     2.5     65.5      3.1      1.9      6.8     12.0      2.8      2.7      2.8
   AREA=    55.2    728.9     57.7    132.1    407.9    692.6     70.9     54.5     91.8
    VEL=     2.9      5.8      3.5       .9      1.1      1.1      2.6      3.2      2.0
  DEPTH=     5.2     10.4      6.4      2.7      3.3      3.5      5.1      6.8      3.4

1490 NH CARD USED
*SECND 4600.000

3470 ENCROACHMENT STATIONS=         .0     656.0  TYPE=      1  TARGET=      655.999
 4600.000     10.50   1286.70       .00       .00   1286.97       .27       .01       .01   1284.20
   6500.0    4306.8     121.6    2071.6     849.8     137.6    1773.7     161.4      28.3   1283.70
      .23      5.07       .88      1.17      .018      .045      .040      .000   1276.20       .30
  .000186       50.       50.       78.         2         0         0       .00    643.78    644.08
```

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

FLOW DISTRIBUTION FOR SECNO= 4600.00 CWSEL= 1286.70

STA=	0.	11.	81.	90.	140.	245.	595.	609.	617.	644.
PER Q=	2.3	61.0	2.9	1.9	5.5	19.1	2.5	2.4	2.5	
AREA=	56.2	735.1	58.5	137.6	351.9	1208.1	69.3	53.6	90.8	
VEL=	2.7	5.4	3.2	.9	1.0	1.0	2.3	2.9	1.8	
DEPTH=	5.3	10.5	6.5	2.8	3.4	3.5	5.0	6.7	3.4	

1490 NH CARD USED
*SECNO 4650.000

3470 ENCROACHMENT STATIONS= .0 822.0 TYPE= 1 TARGET= 821.999

4650.000	10.53	1286.73	.00	.00	1286.99	.26	.01	.00	1284.20
6500.0	4236.3	120.7	2143.0	851.7	138.7	2093.3	167.8	30.1	1283.70
.23	4.97	.87	1.02	.018	.045	.042	.000	1276.20	.28
.000178	50.	50.	118.	1	0	0	.00	809.88	810.16

FLOW DISTRIBUTION FOR SECNO= 4650.00 CWSEL= 1286.73

STA=	0.	11.	81.	90.	140.	225.	615.	765.	779.	787.	810.
PER Q=	2.3	60.0	2.9	1.9	4.4	18.6	4.8	1.7	1.8	1.6	
AREA=	56.4	736.6	58.7	138.7	286.7	1257.0	378.5	57.0	46.6	67.4	
VEL=	2.7	5.3	3.2	.9	1.0	1.0	.8	2.0	2.6	1.6	
DEPTH=	5.3	10.5	6.5	2.8	3.4	3.2	2.5	4.1	5.8	2.9	

1490 NH CARD USED
*SECNO 4700.000

4700.000	10.54	1286.74	.00	.00	1287.00	.26	.01	.00	1284.20
6000.0	4156.1	119.4	1724.5	853.5	139.6	2101.3	173.3	32.0	1282.70
.24	4.87	.86	.82	.018	.045	.045	.000	1276.20	.26
.000171	50.	50.	90.	0	0	0	.00	1172.54	1172.80

FLOW DISTRIBUTION FOR SECNO= 4700.00 CWSEL= 1286.74

STA=	0.	11.	81.	90.	140.	220.	540.	740.	950.	1173.
PER Q=	2.5	63.8	3.0	2.0	4.4	16.3	5.5	2.2	.3	
AREA=	56.6	738.0	58.9	139.6	271.4	1037.7	448.5	261.0	82.7	
VEL=	2.6	5.2	3.1	.9	1.0	.9	.7	.5	.2	
DEPTH=	5.3	10.5	6.5	2.8	3.4	3.2	2.2	1.2	.4	

THIS RUN EXECUTED 23JAN92 16:27:26

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.0: February 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

ACDC/PARKING FLOODPLAIN

SUMMARY PRINTOUT

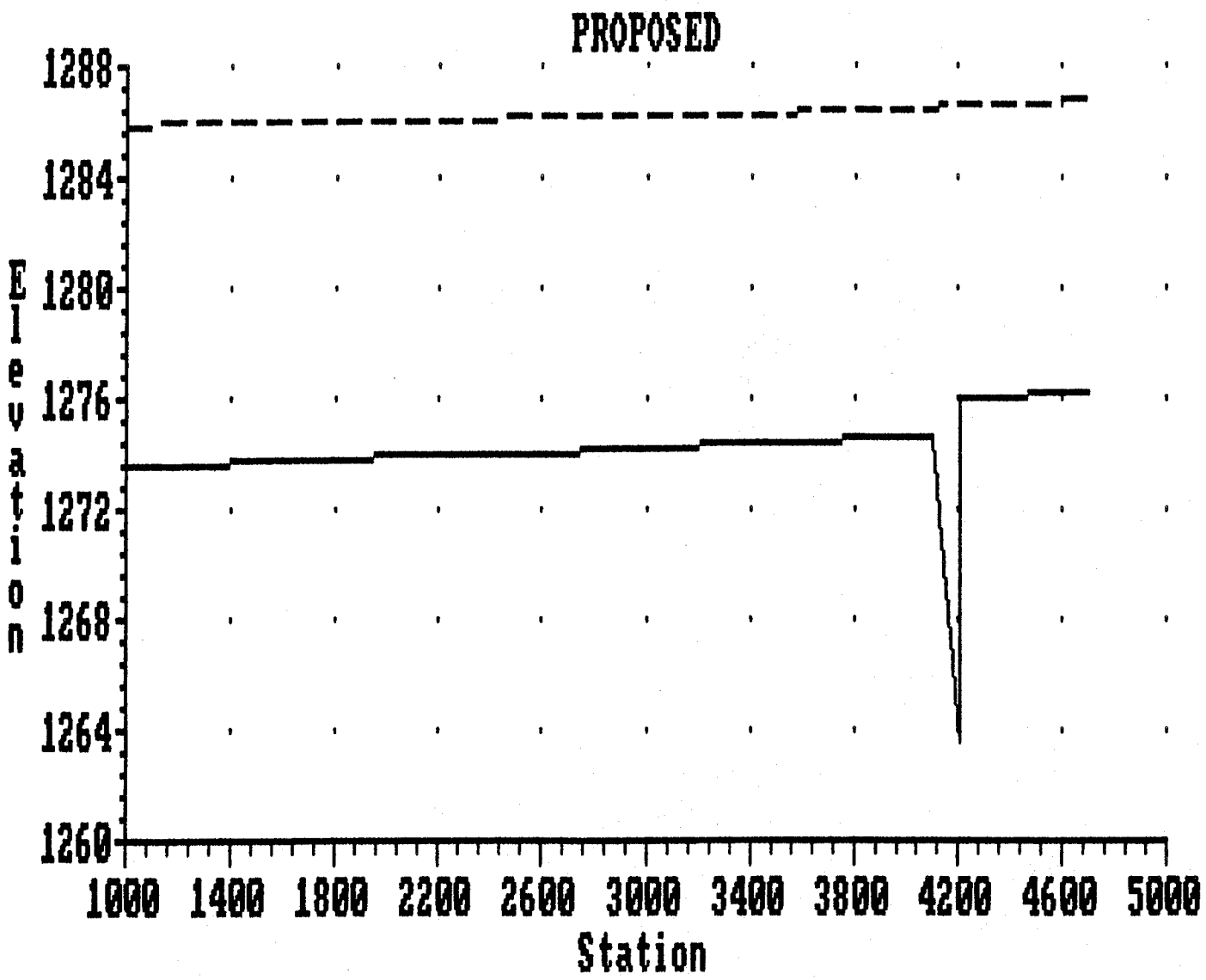
	SECNO	CWSEL	TOPWID	Q	QLOB	VLOB	QCH	VCH	QROB	EG
	1000.000	1285.89	339.08	8000.00	4307.07	4.82	219.09	1.06	3473.84	1286.17
	1100.000	1285.90	339.10	8000.00	4304.26	4.82	242.02	1.10	3453.72	1286.18
	1700.000	1285.98	338.99	8000.00	4329.74	4.92	180.97	.99	3489.29	1286.28
	2200.000	1286.05	338.86	8000.00	4336.33	4.98	182.42	1.01	3481.24	1286.37
	2300.000	1286.08	339.38	8000.00	4367.10	5.01	135.97	.90	3496.93	1286.39
	2500.000	1286.11	339.31	8000.00	4363.15	5.04	126.38	.88	3510.48	1286.42
	3000.000	1286.19	339.20	8000.00	4370.58	5.11	95.08	.79	3534.34	1286.52
	3400.000	1286.27	339.16	8000.00	4370.66	5.11	132.43	.91	3496.91	1286.59
	3500.000	1286.29	339.09	8000.00	4337.26	5.10	169.33	1.00	3493.41	1286.61
	4000.000	1286.38	338.98	8000.00	4330.31	5.13	222.00	1.12	3447.69	1286.71
	4106.000	1286.46	339.06	8000.00	3964.01	4.65	205.56	1.02	3830.43	1286.74
	4206.000	1286.56	339.56	8000.00	3571.87	3.95	148.31	.82	4479.82	1286.77
*	4207.000	1286.52	339.52	6500.00	4163.80	4.89	181.29	1.01	2154.91	1286.81
	4253.000	1286.64	355.74	6500.00	3617.44	4.20	163.12	.88	2719.44	1286.85
	4410.000	1286.62	380.88	6500.00	4169.22	4.85	186.84	1.01	2143.94	1286.88
	4450.000	1286.60	400.39	6500.00	4560.37	5.32	203.01	1.11	1736.62	1286.92
	4500.000	1286.58	439.78	6500.00	4694.34	5.60	125.38	.95	1680.28	1286.94

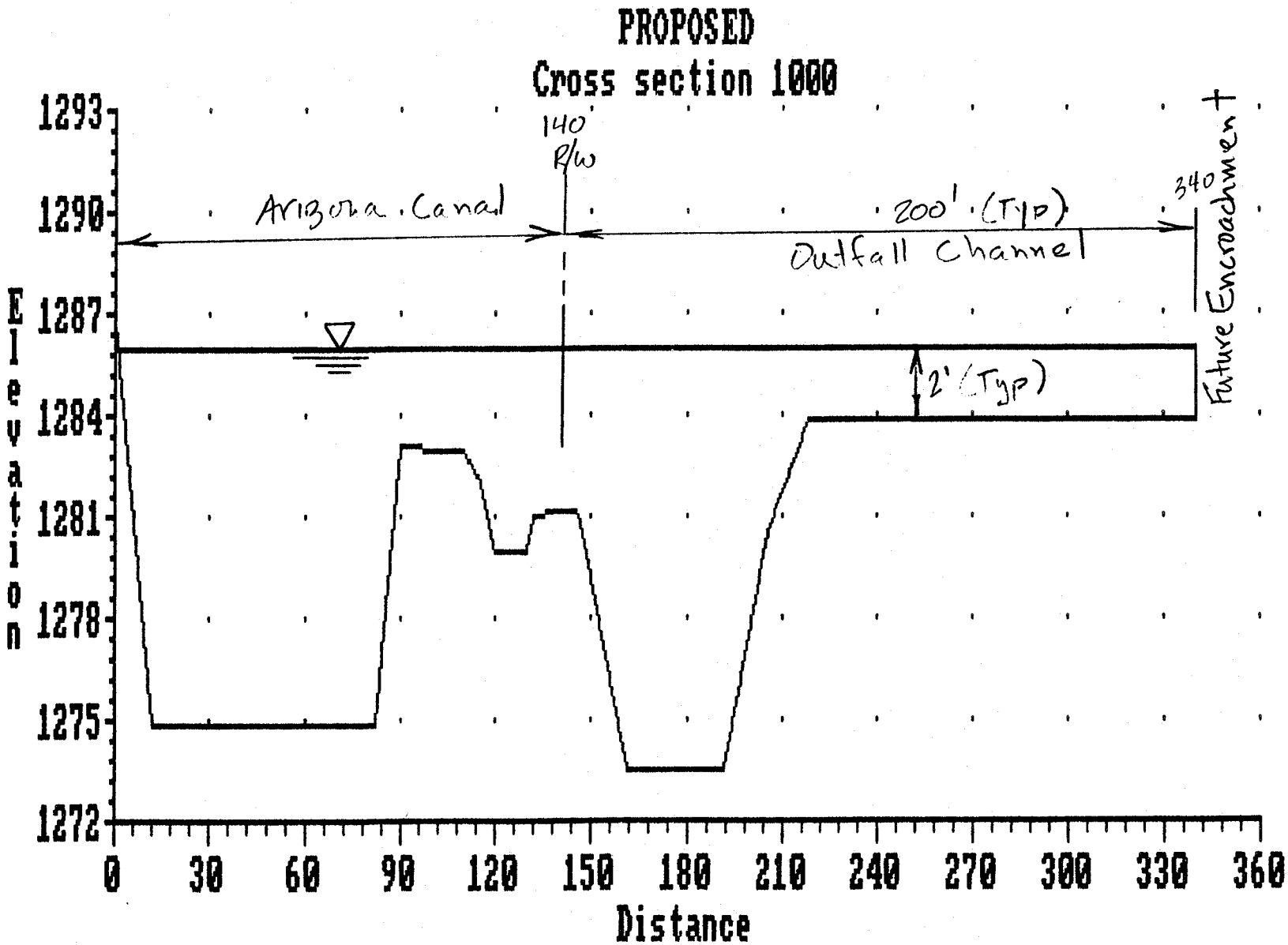
SECNO	CWSEL	TOPWID	Q	QLOB	VLOB	QCH	VCH	QROB	EG
4550.000	1286.61	513.59	6500.00	4623.93	5.49	125.41	.94	1750.66	1286.95
4600.000	1286.70	643.78	6500.00	4306.81	5.07	121.56	.88	2071.63	1286.97
4650.000	1286.73	809.88	6500.00	4236.29	4.97	120.69	.87	2143.02	1286.99
4700.000	1286.74	1172.54	6000.00	4156.08	4.87	119.41	.86	1724.51	1287.00

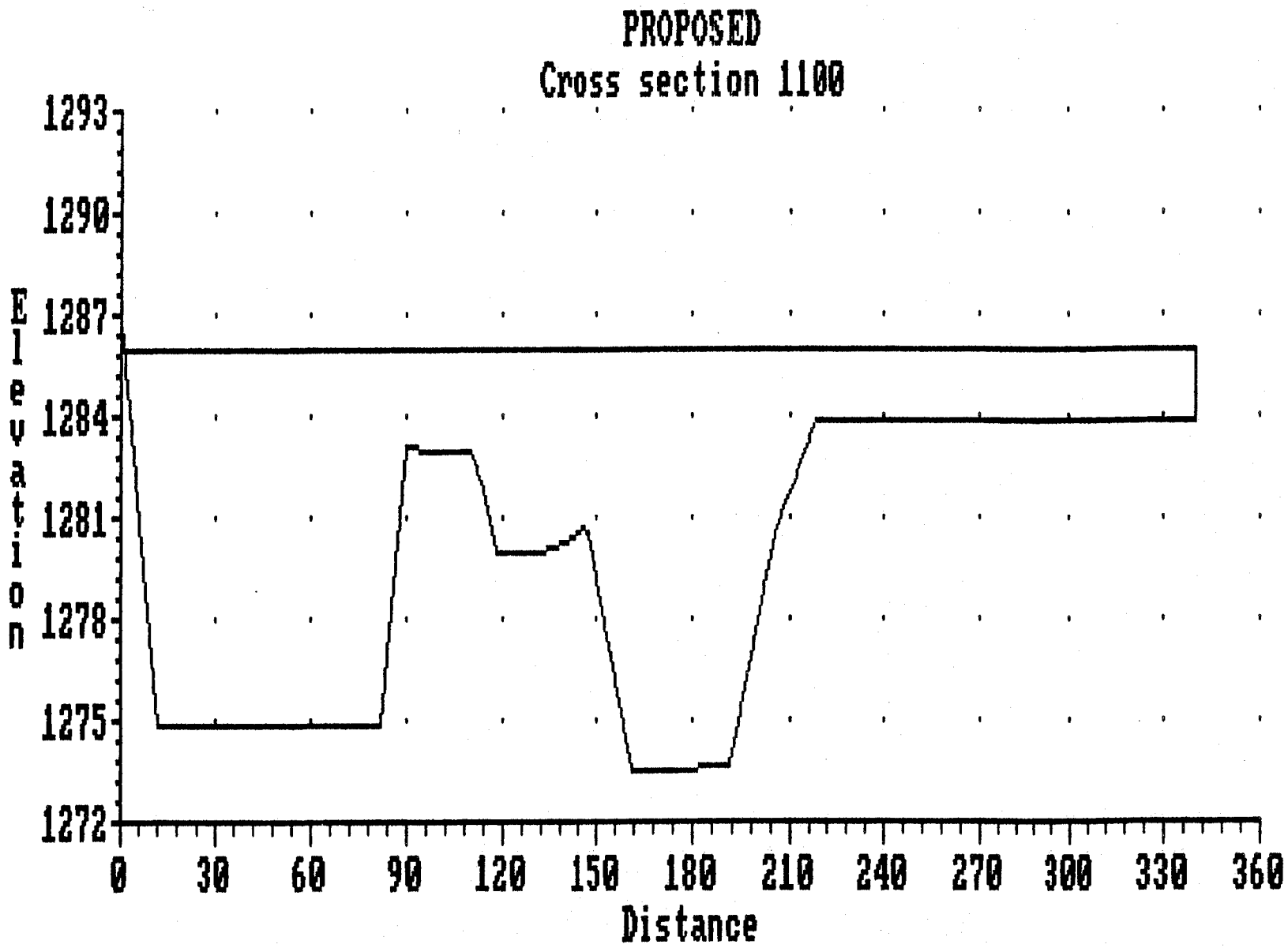
SUMMARY OF ERRORS AND SPECIAL NOTES

WARNING SECNO= 4207.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

Normal program termination


PROPOSED
Elevation
1288
1284
1280
1276
1272
1268
1264
1260
1000
1400
1800
2200
2600
3000
3400
3800
4200
4600
5000
Station


PROPOSED
Cross section 1000
140'
R/W
Arizona Canal
200' (Typ)
Outfall Channel
340
Future Encroachment
2' (Typ)
Elevation
1293
1290
1287
1284
1281
1278
1275
1272
0
30
60
90
120
150
180
210
240
270
300
330
360
Distance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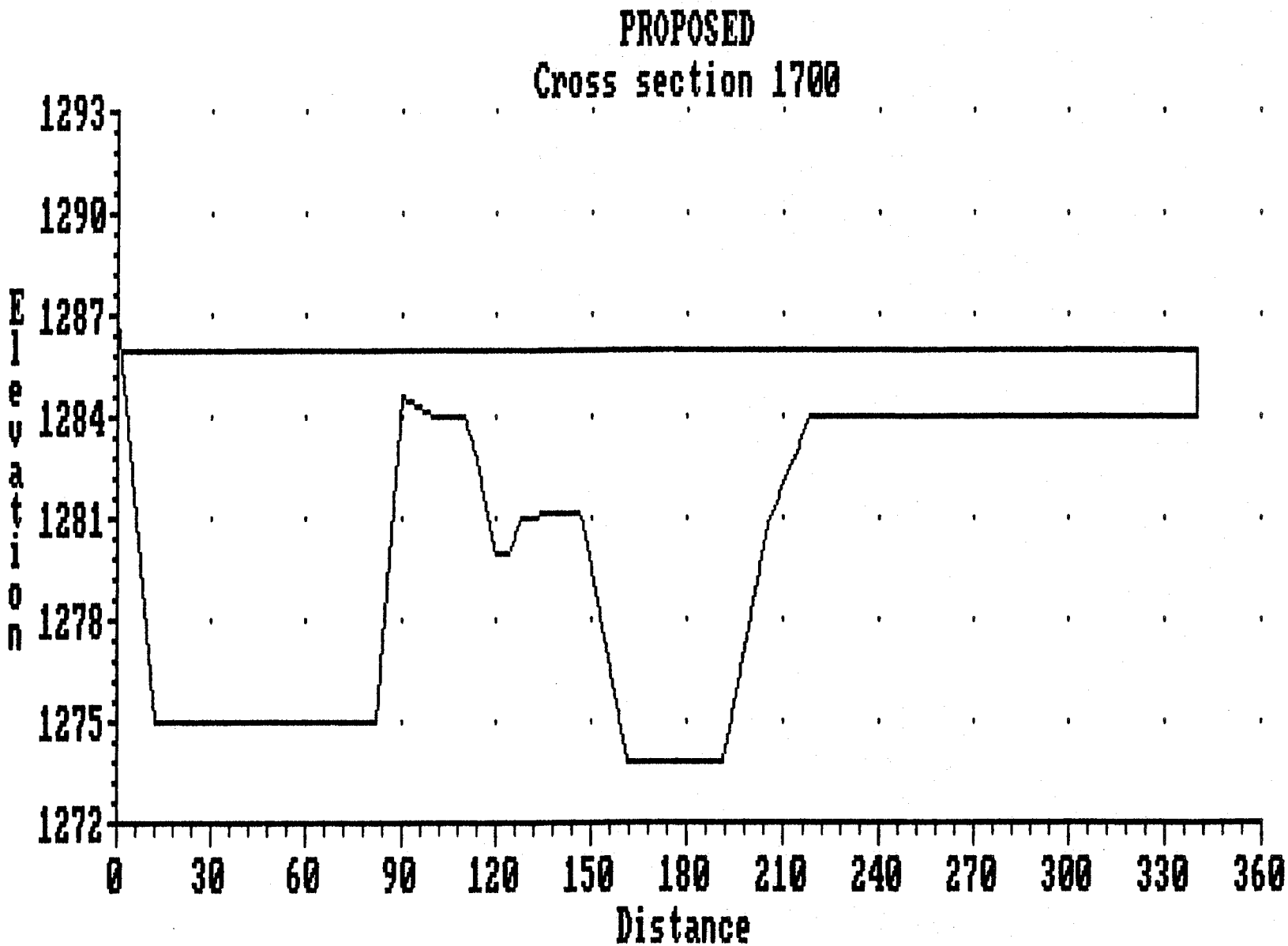
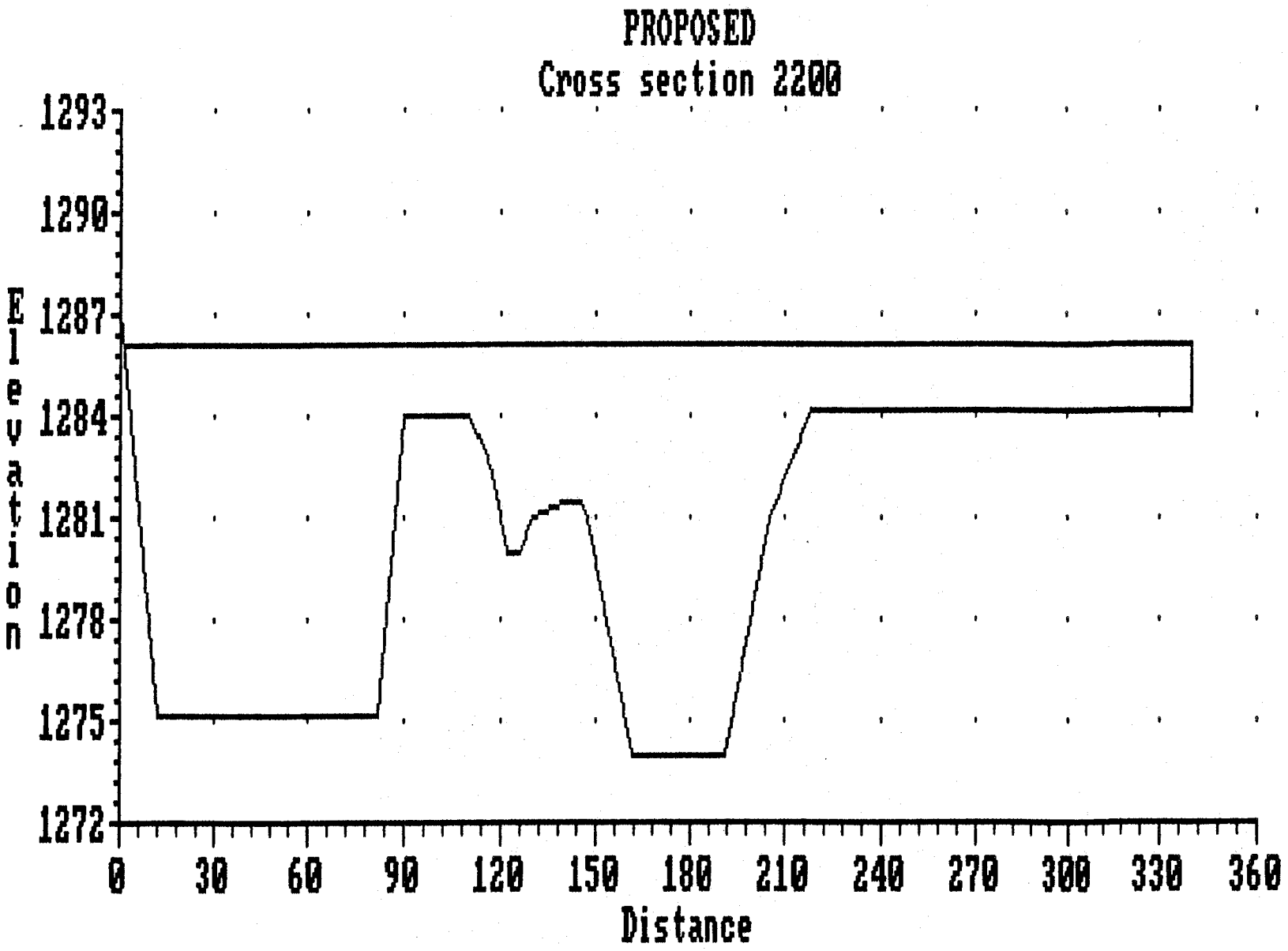
Cross section 1100
Elevation
1293
1290
1287
1284
1281
1278
1275
1272
0
30
60
90
120
150
180
210
240
270
300
330
360
Distance

E4A


PROPOSED
Cross section 1700
Elevation
1293
1290
1287
1284
1281
1278
1275
1272
0
30
60
90
120
150
180
210
240
270
300
330
360
Distance

E50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Cross section 2200
Elevation
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1290
1287
1284
1281
1278
1275
1272
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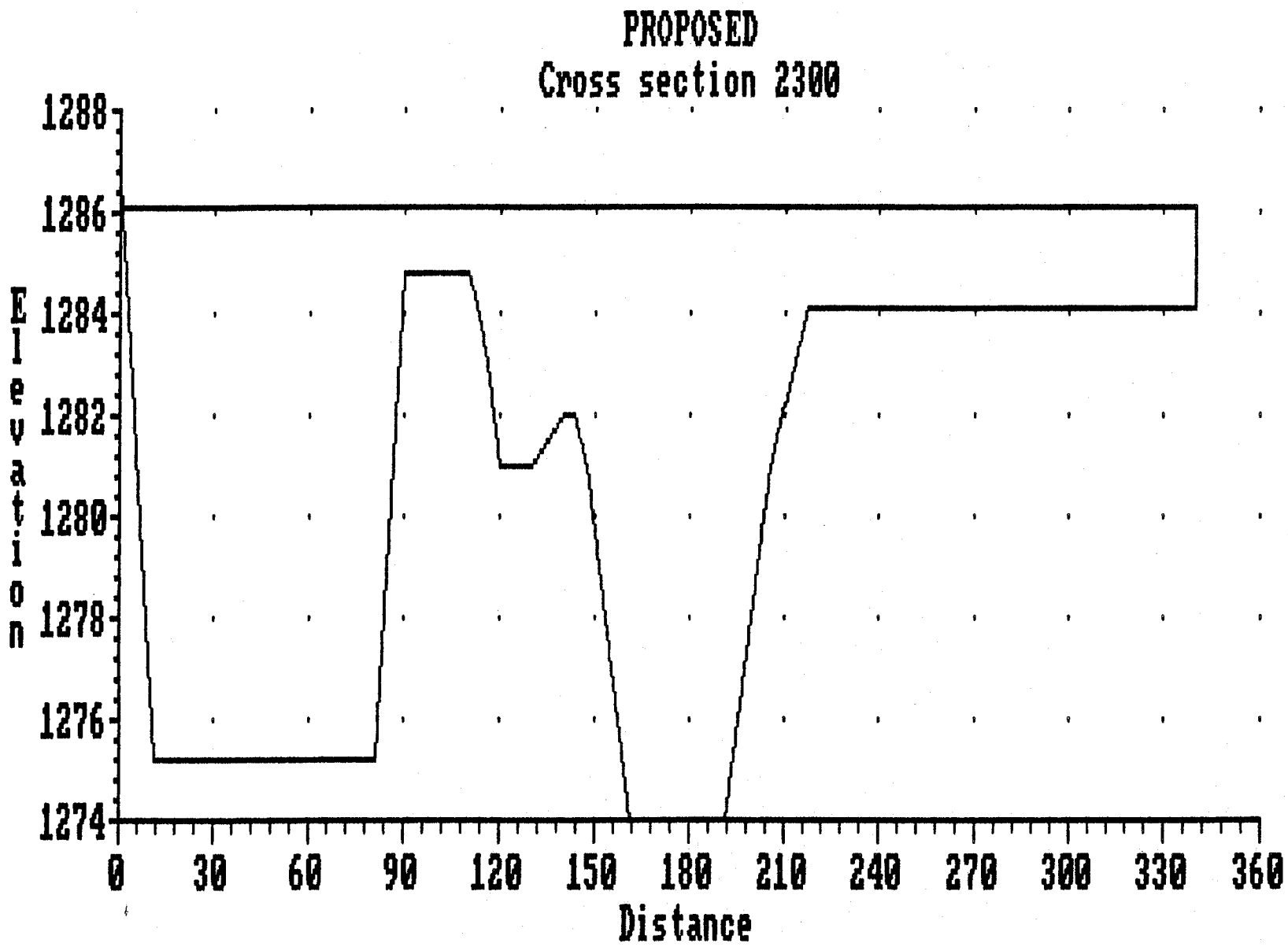
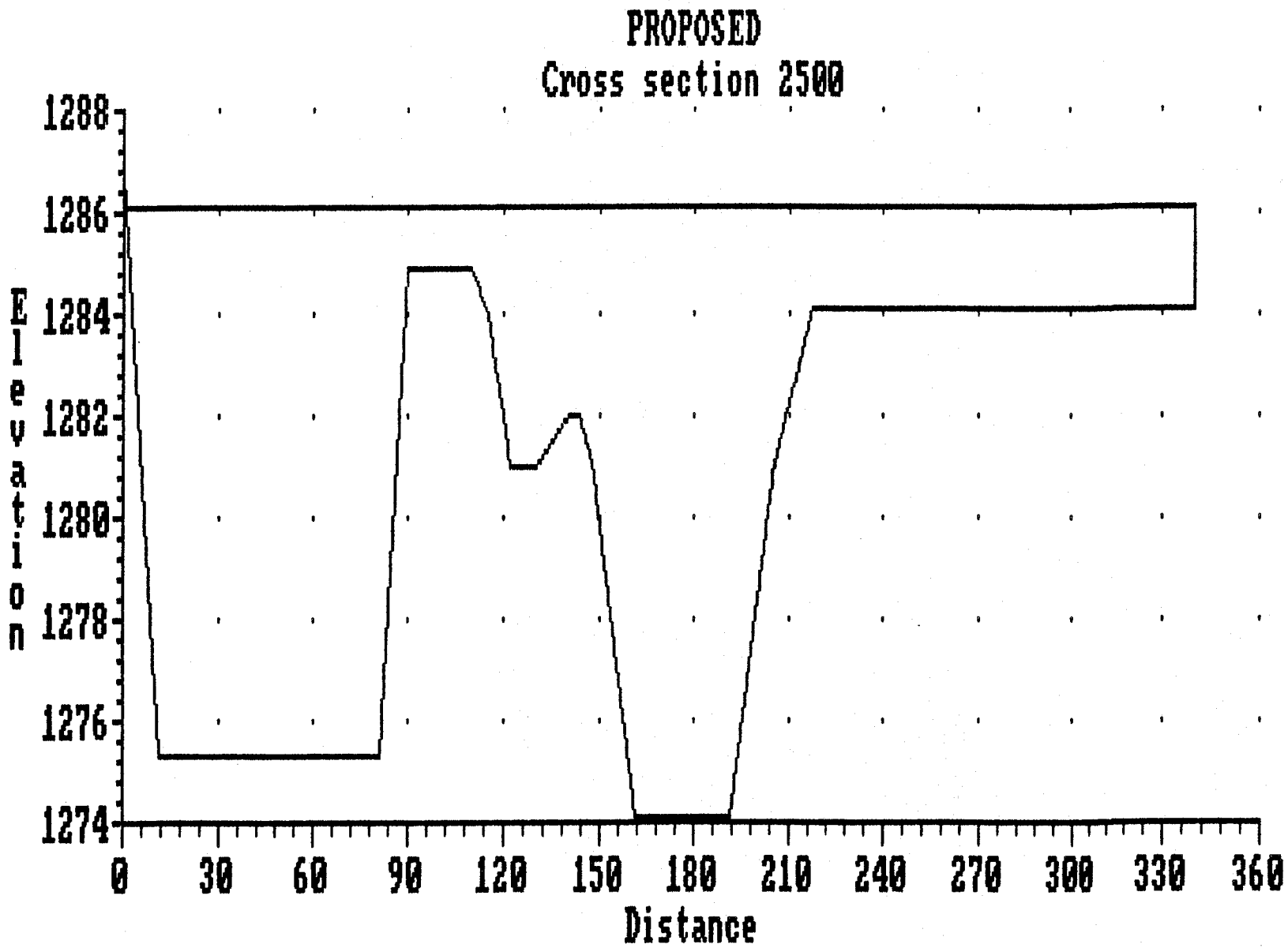
60
90
120
150
180
210
240
270
300
330
360
Distance


PROPOSED
Cross section 2300
Elevation
1288
1286
1284
1282
1280
1278
1276
1274
0
30
60
90
120
150
180
210
240
270
300
330
360
Distance

E52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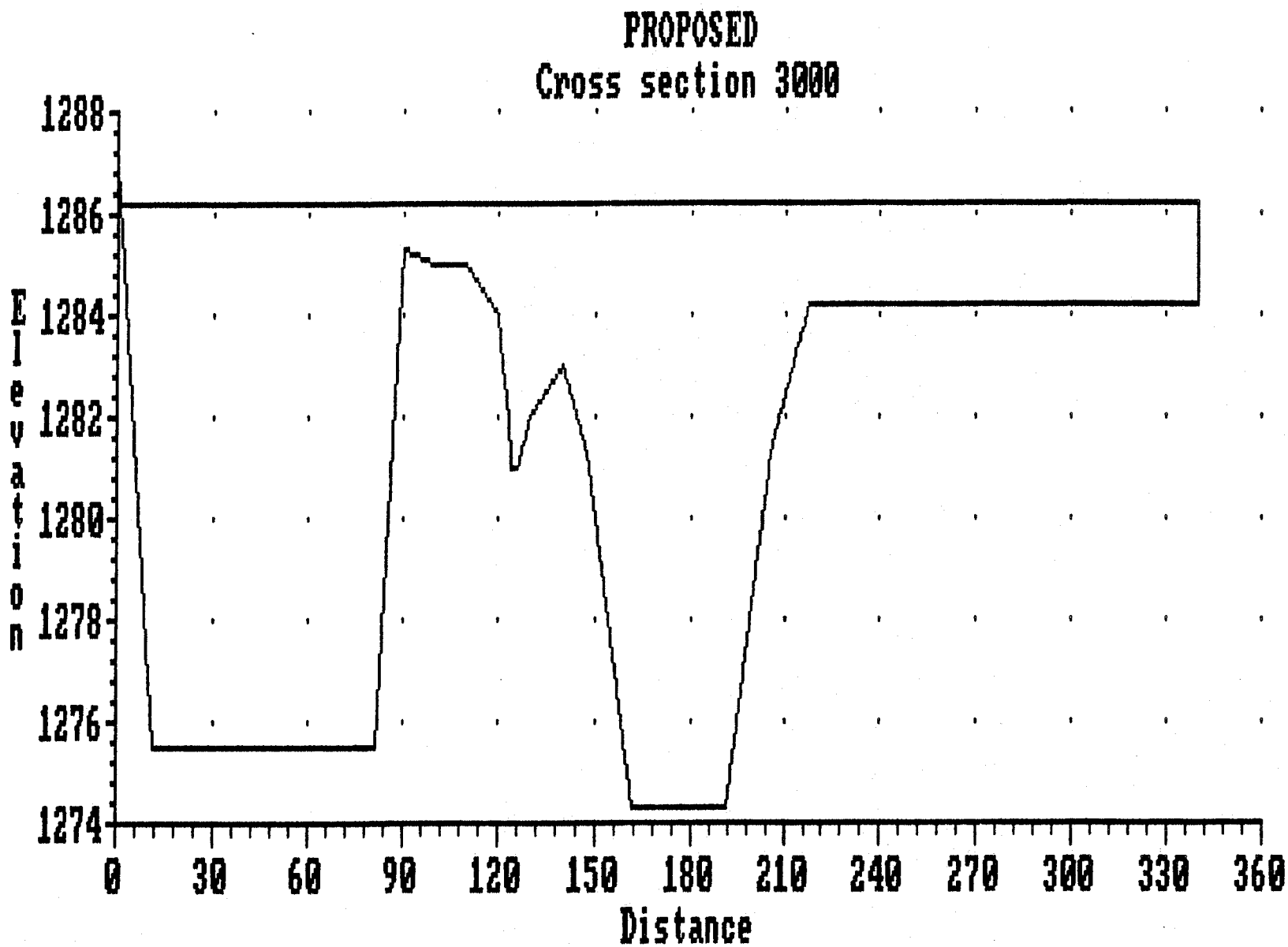
Cross section 2500
Elevation
1288
1286
1284
1282
1280
1278
1276
1274
0
30
60
90
120
150
180
210
240
270
300
330
360
Distance

E53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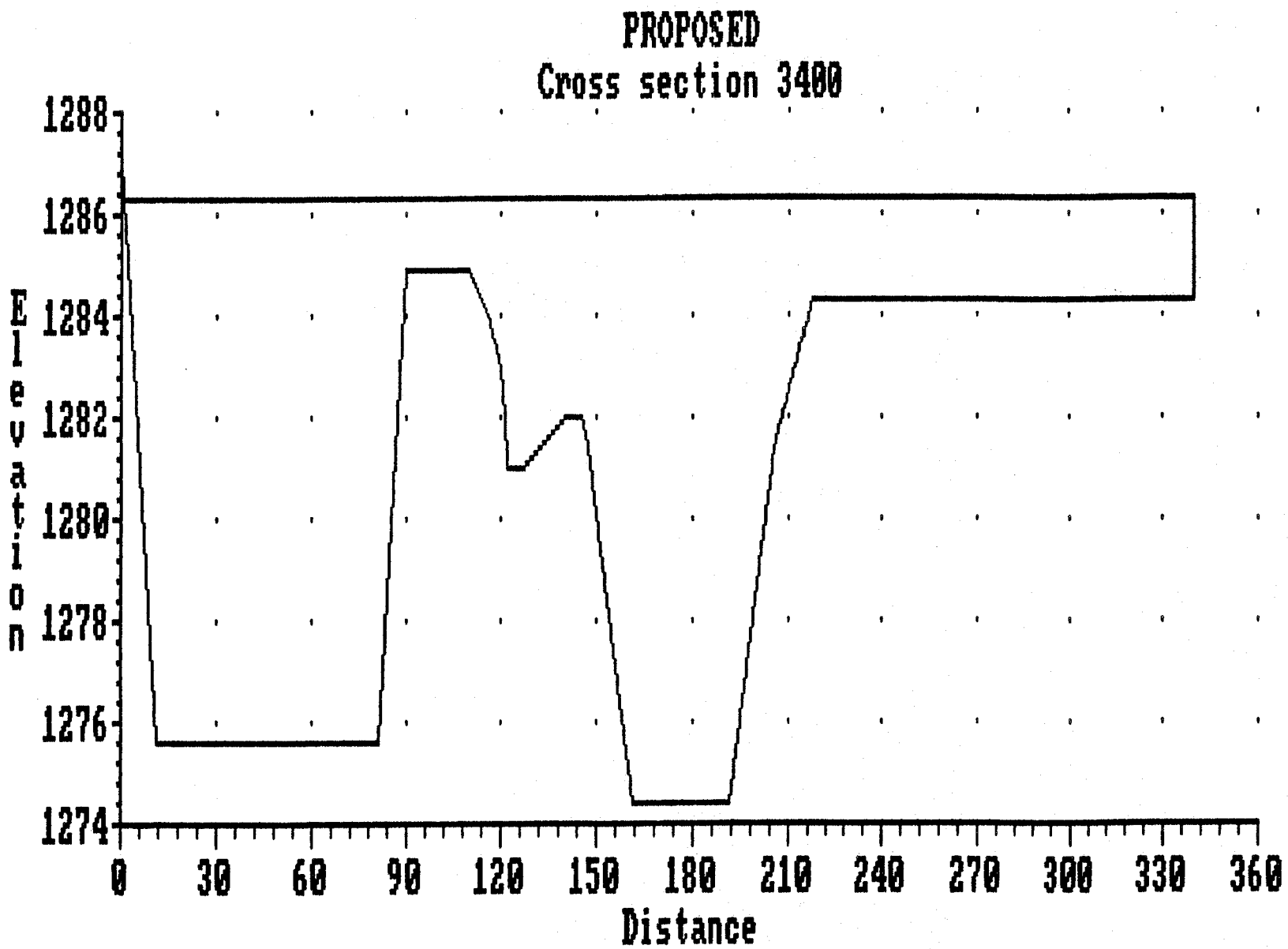
Cross section 3000
Elevation
1288
1286
1284
1282
1280
1278
1276
1274
0
30
60
90
120
150
180
210
240
270
300
330
360
Distance

E54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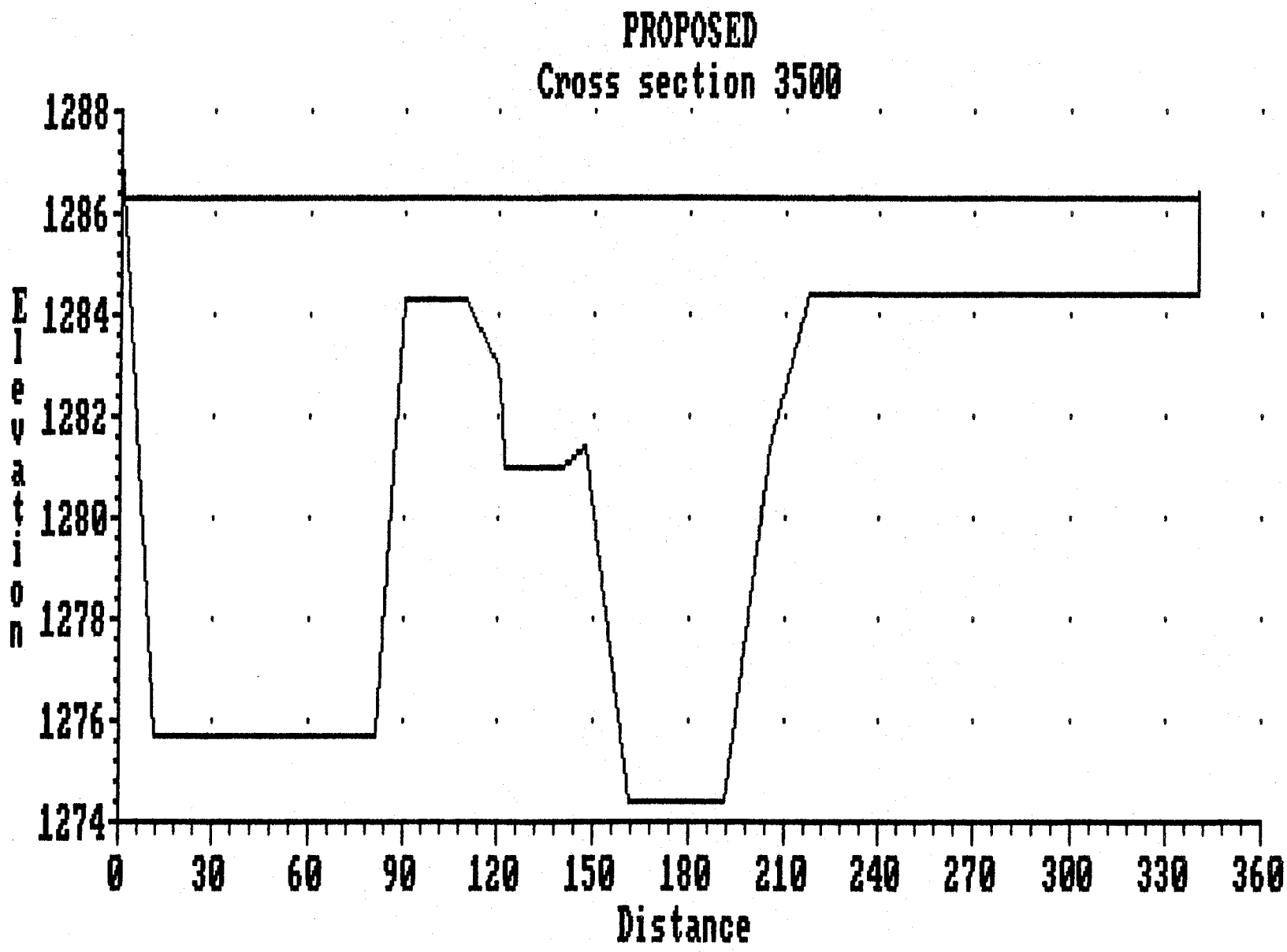
Cross section 3400
Elevation
1288
1286
1284
1282
1280
1278
1276
1274
0
30
60
90
120
150
180
210
240
270
300
330
360
Distance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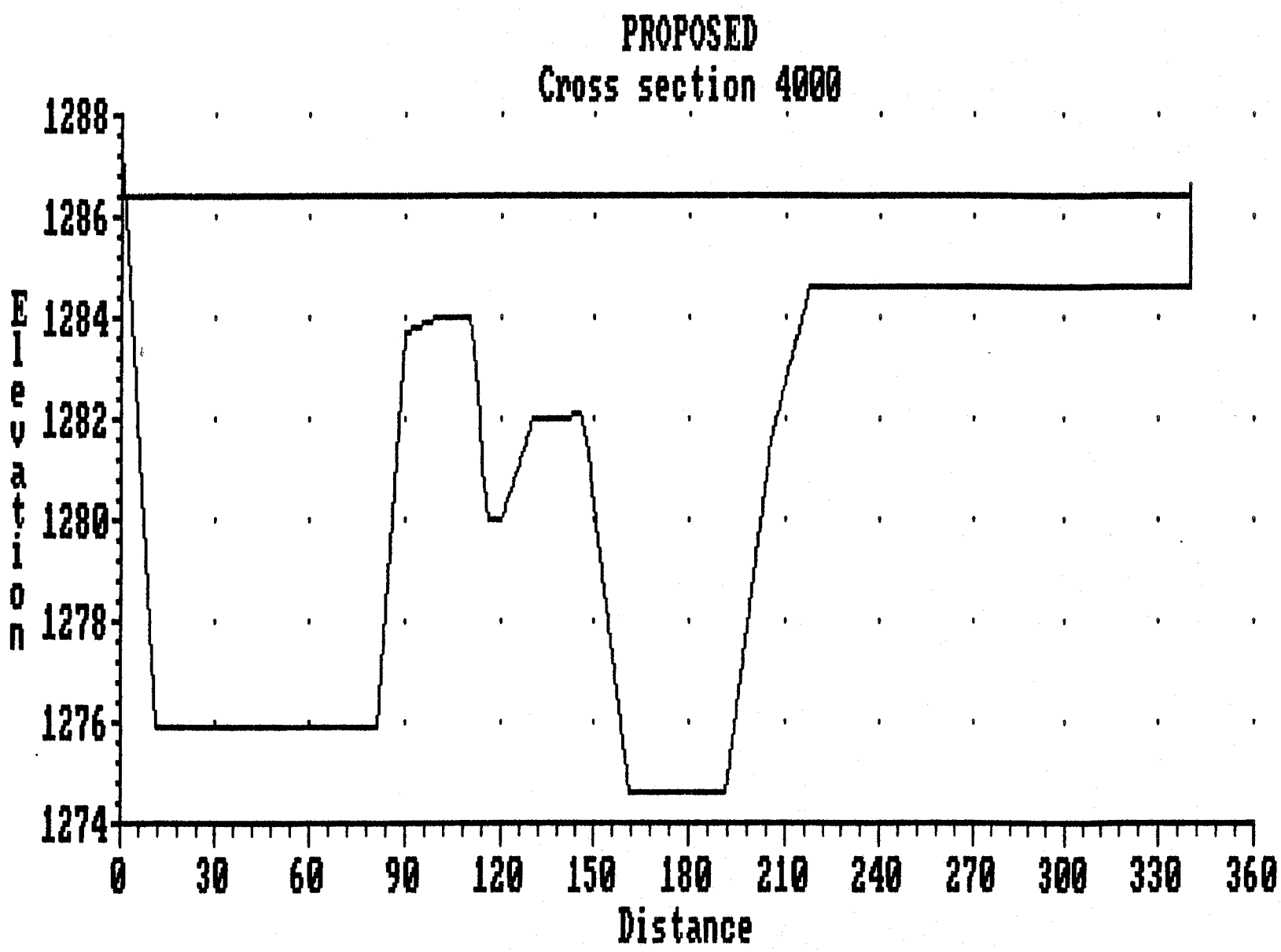
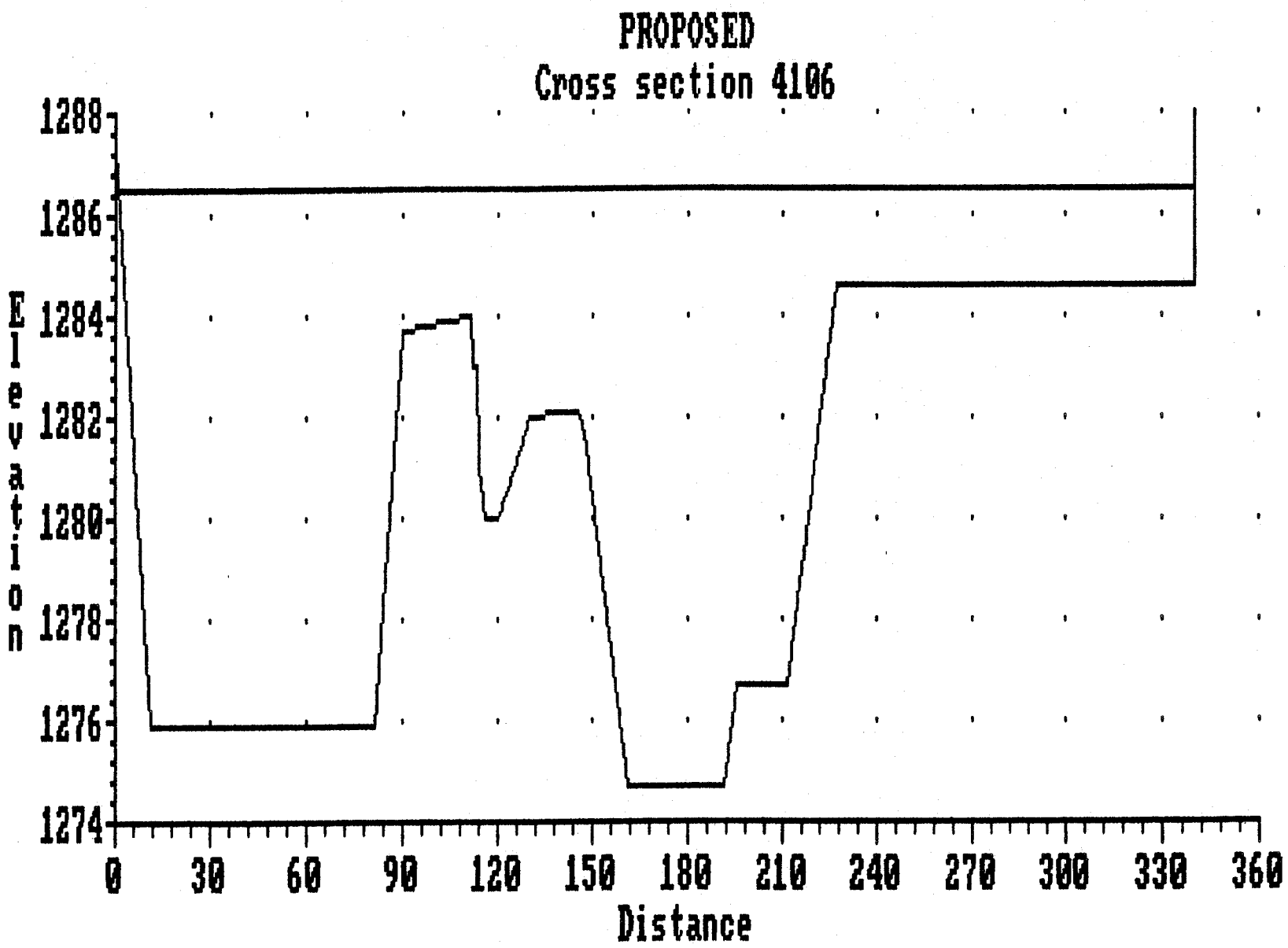
Cross section 3500
Elevation
1288
1286
1284
1282
1280
1278
1276
1274
0
30
60
90
120
150
180
210
240
270
300
330
360
Distance

E56


PROPOSED
Cross section 4000
Elevation
1288
1286
1284
1282
1280
1278
1276
1274
0
30
60
90
120
150
180
210
240
270
300
330
360
Distance

E57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Cross section 4106
Elevation
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1286
1284
1282
1280
1278
1276
1274
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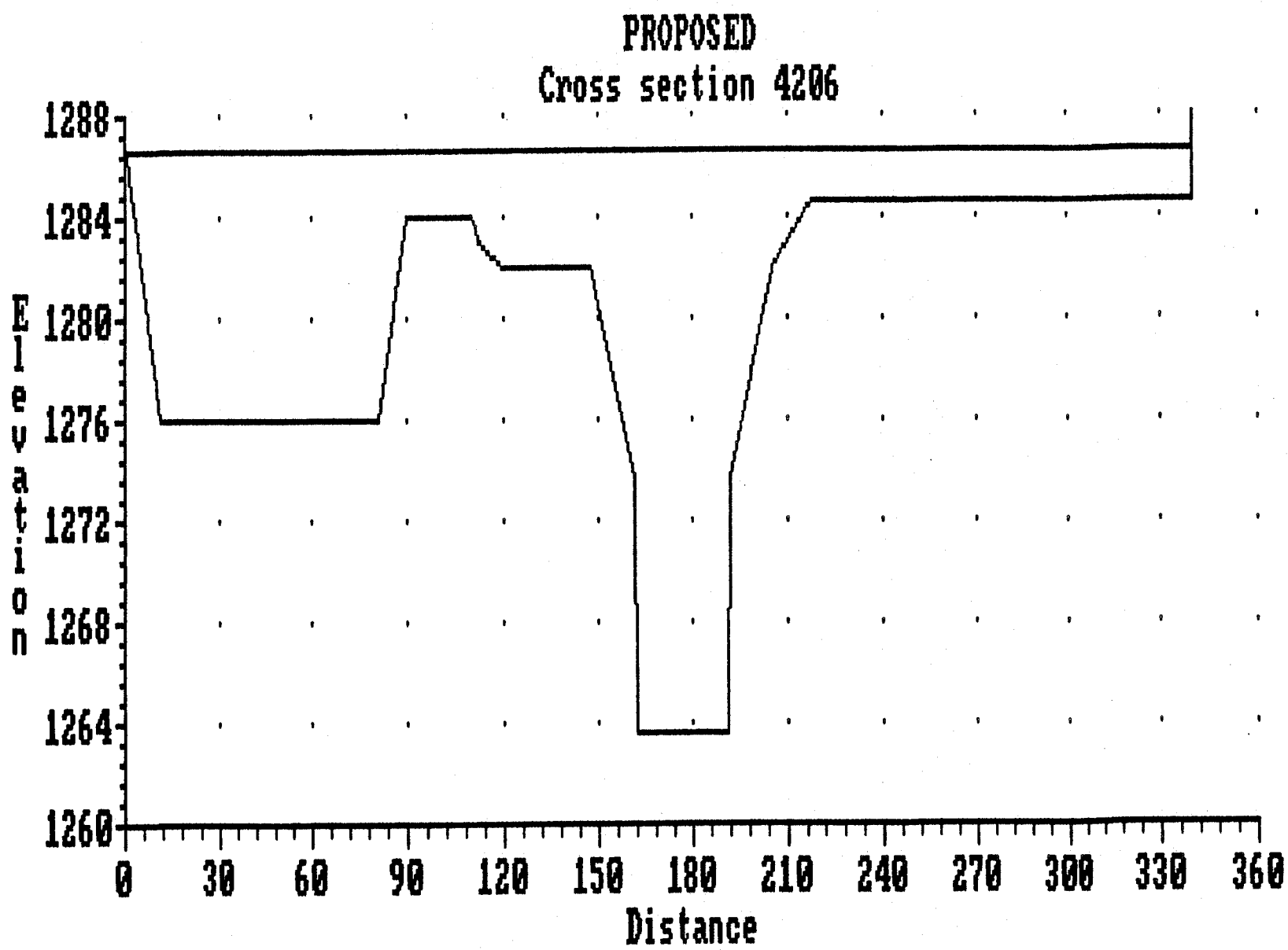
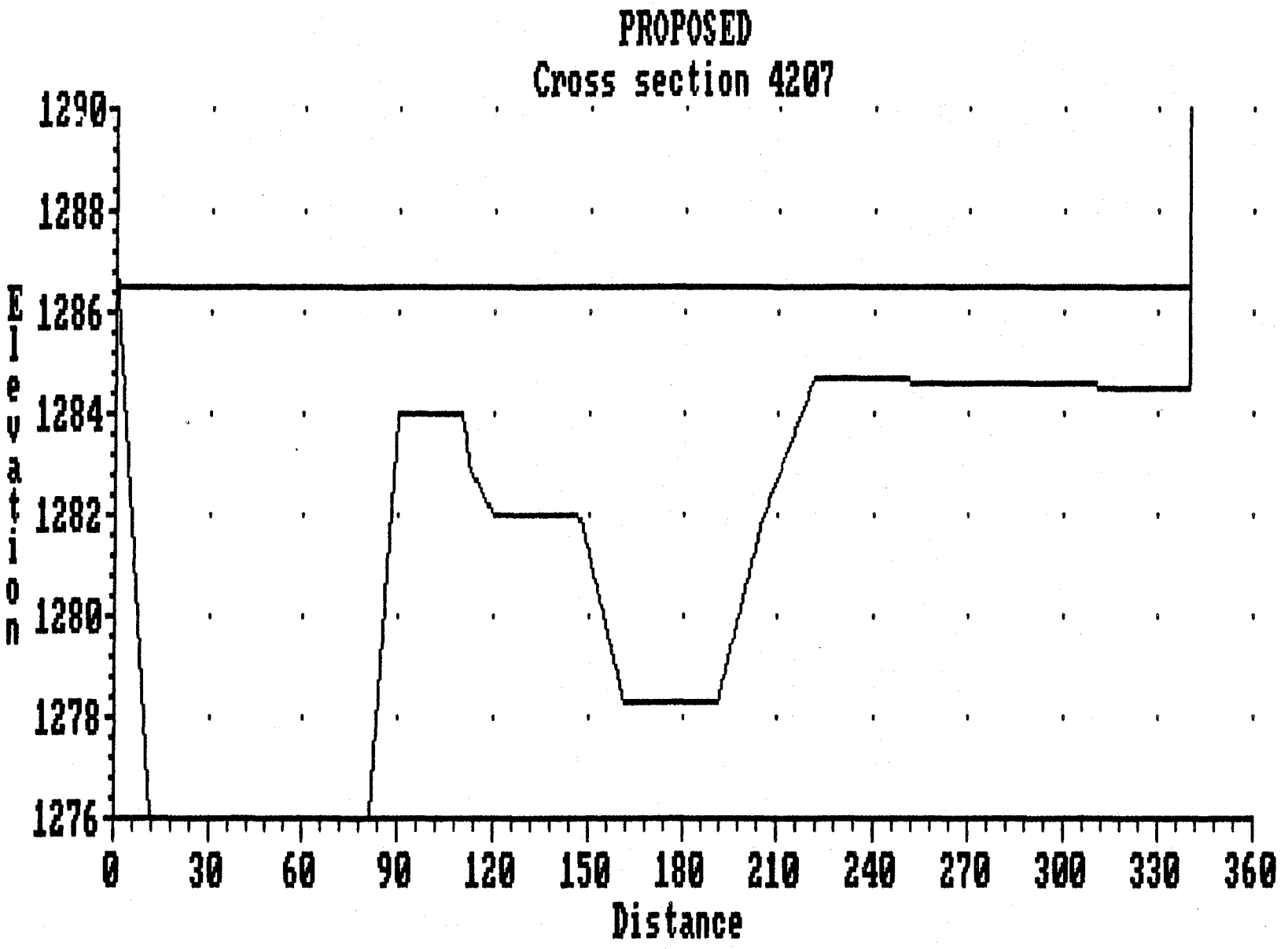
30
60
90
120
150
180
210
240
270
300
330
360
Distance


PROPOSED
Cross section 4206
Elevation
1288
1284
1280
1276
1272
1268
1264
1260
0
30
60
90
120
150
180
210
240
270
300
330
360
Distance

E59


PROPOSED
Cross section 4207
Elevation
1290
1288
1286
1284
1282
1280
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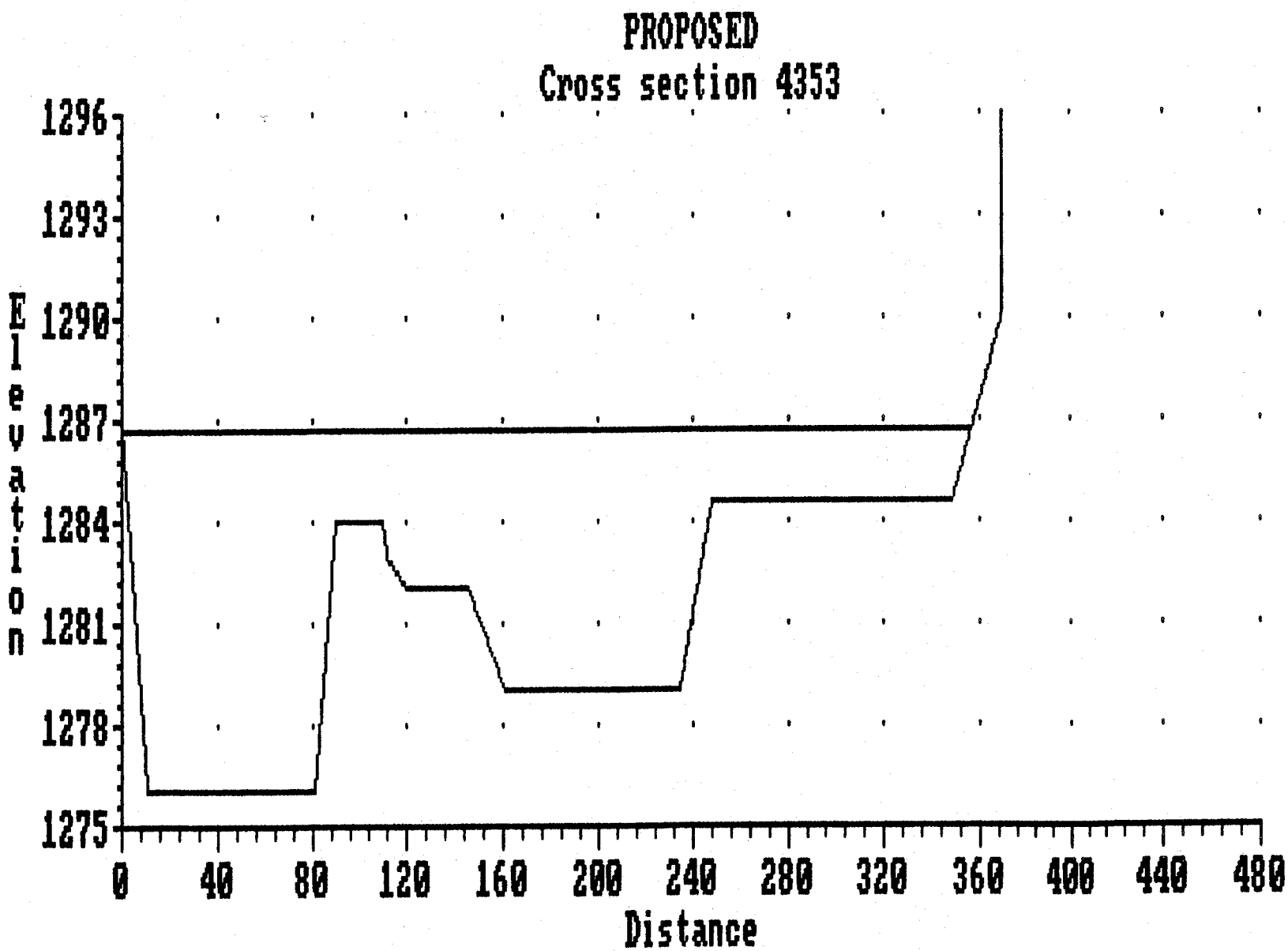
1276
0
30
60
90
120
150
180
210
240
270
300
330
360
Distance

E10D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Cross section 4353
Elevation
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1287
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200
240
280
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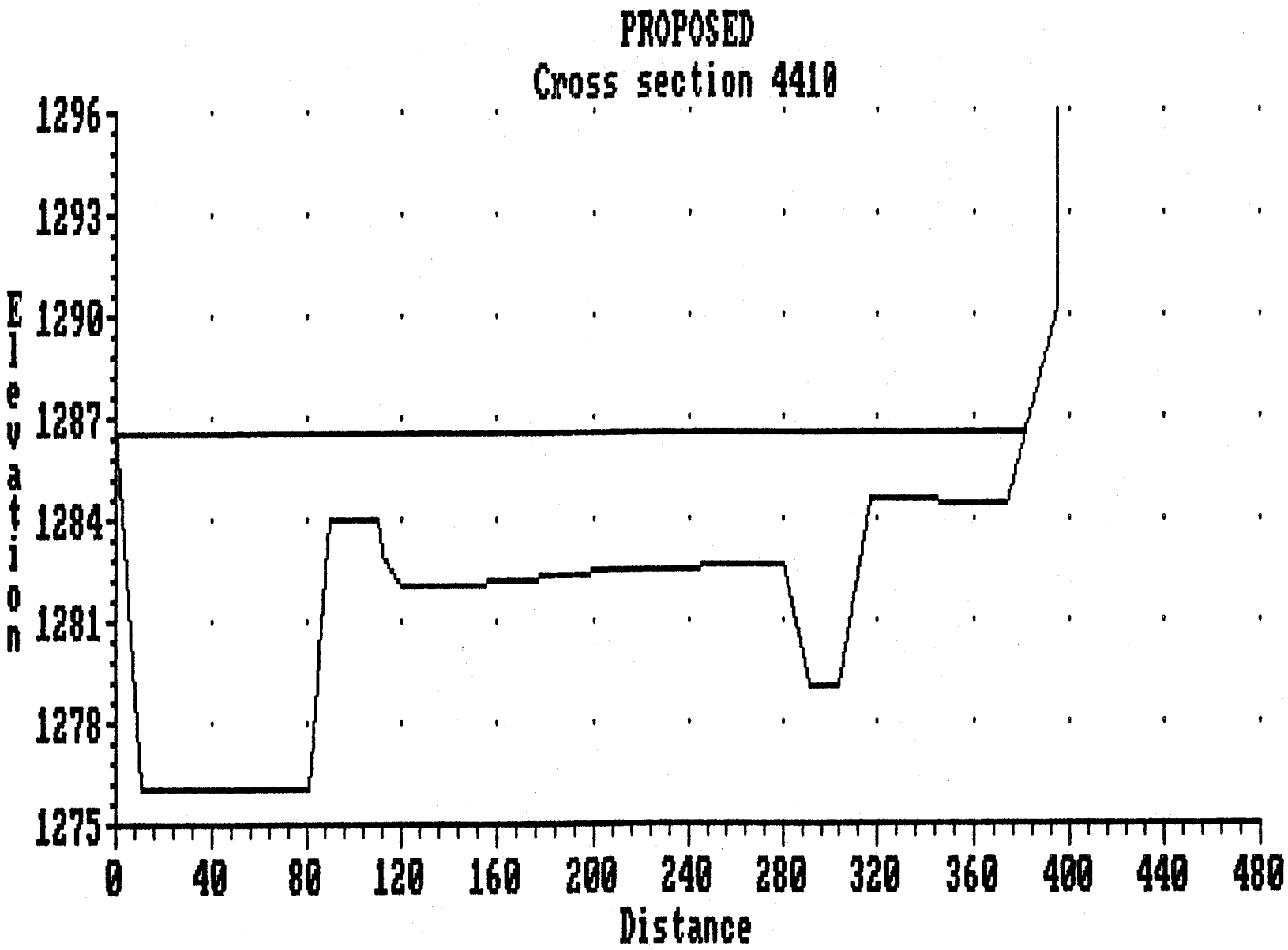
360
400
440
480
Distance

E61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Cross section 4410
Elevation
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1287
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440
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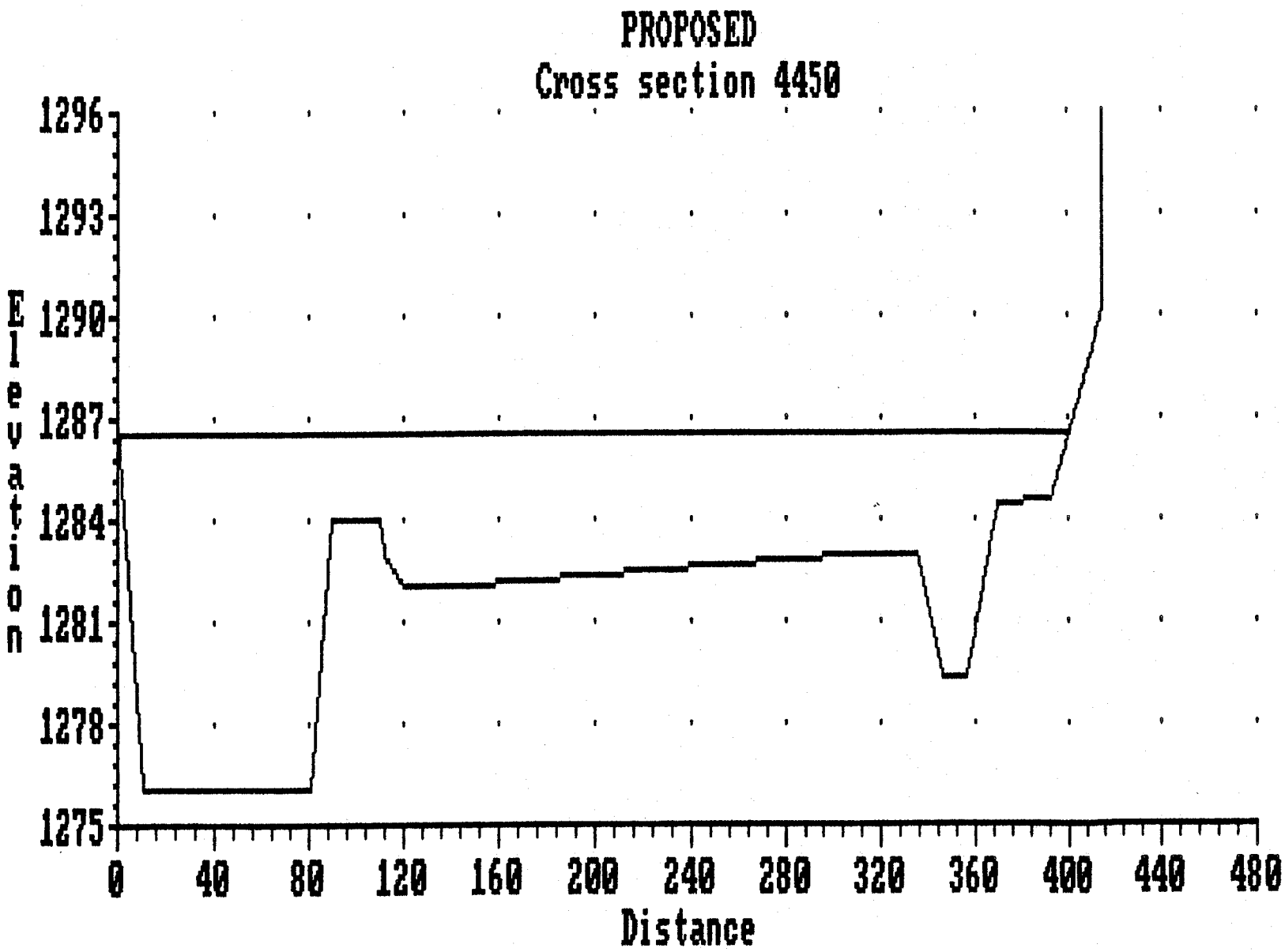
Distance

E02


PROPOSED
Cross section 4450
Elevation
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1293
1290
1287
1284
1281
1278
1275
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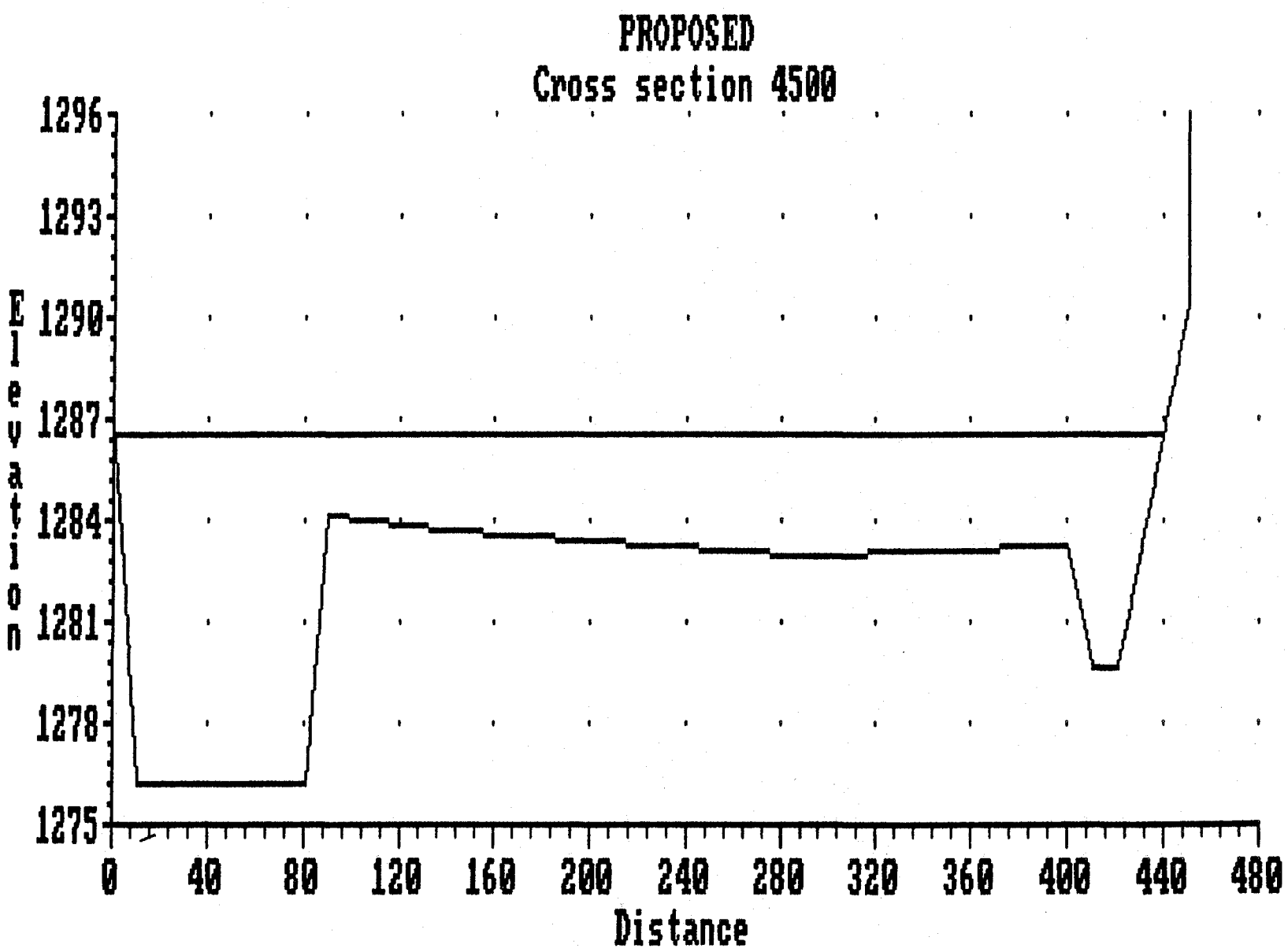
40
80
120
160
200
240
280
320
360
400
440
480
Distance

E63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Cross section 4500
Elevation
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200
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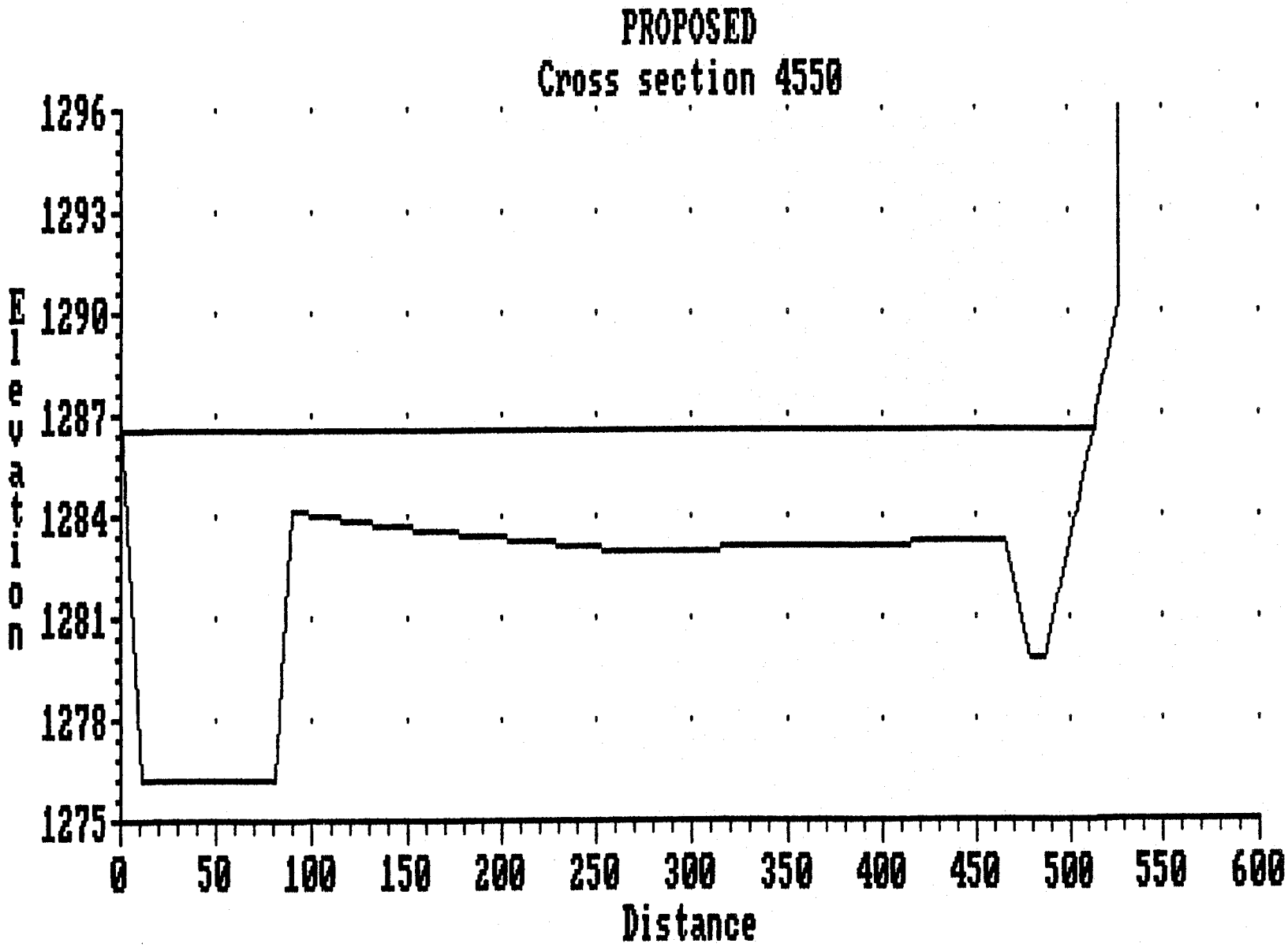
280
320
360
400
440
480
Distance

E64


PROPOSED
Cross section 4550
Elevation
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1293
1290
1287
1284
1281
1278
1275
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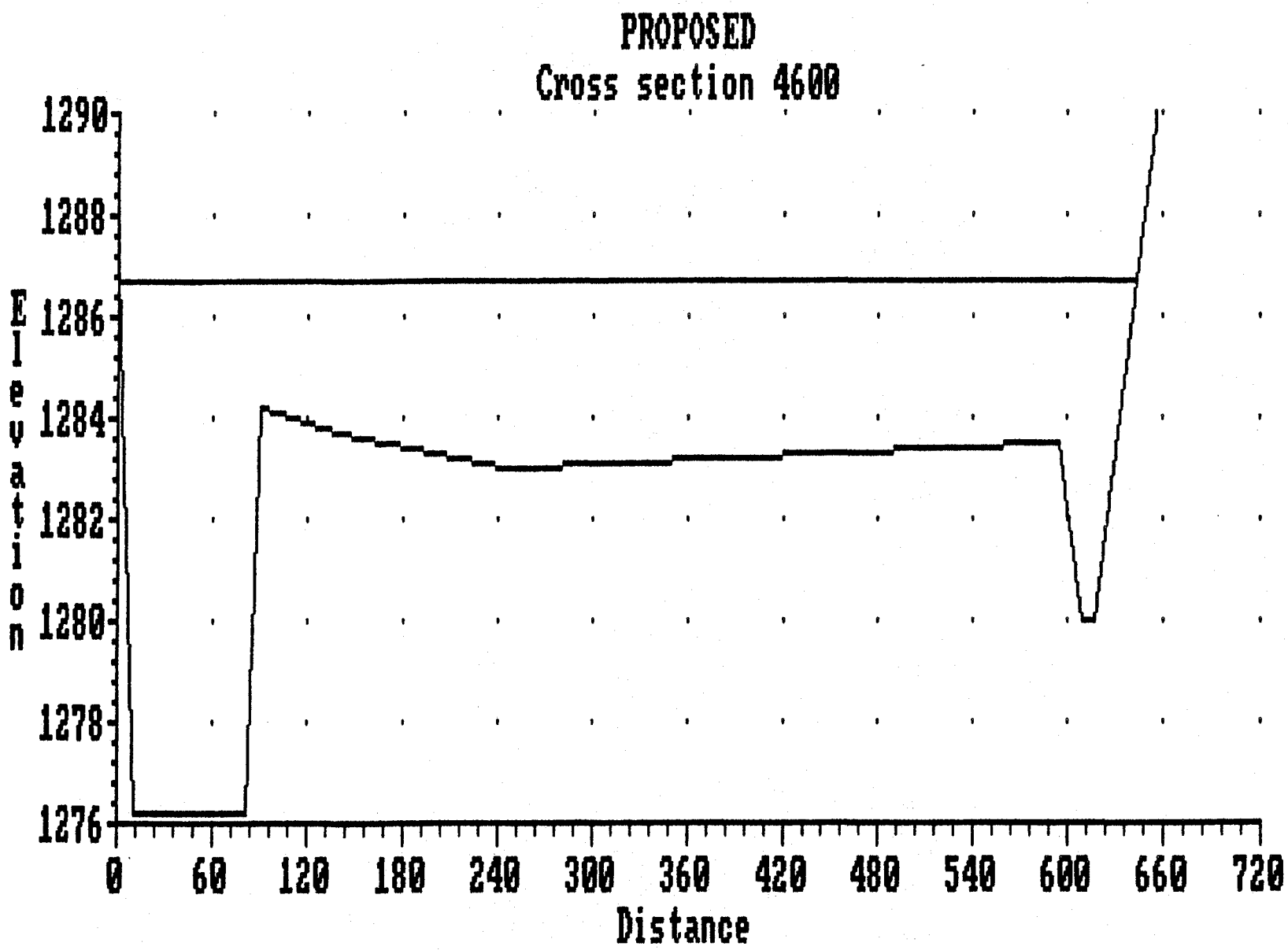
50
100
150
200
250
300
350
400
450
500
550
600
Distance

Fig. 3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Cross section 4600
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1286
1284
1282
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1276
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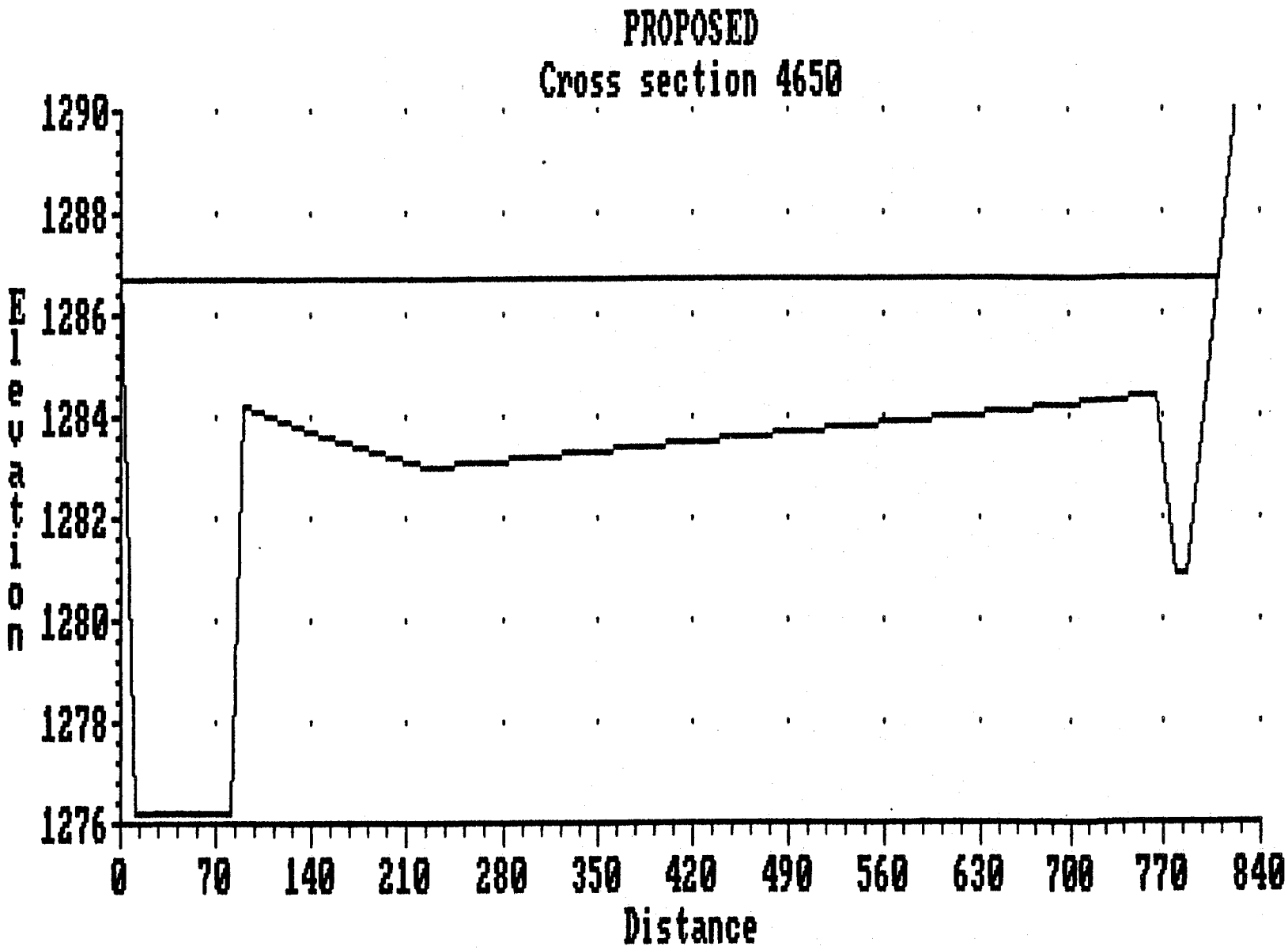
240
300
360
420
480
540
600
660
720
Distance

Elev


PROPOSED
Cross section 4650
Elevation
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1286
1284
1282
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1278
1276
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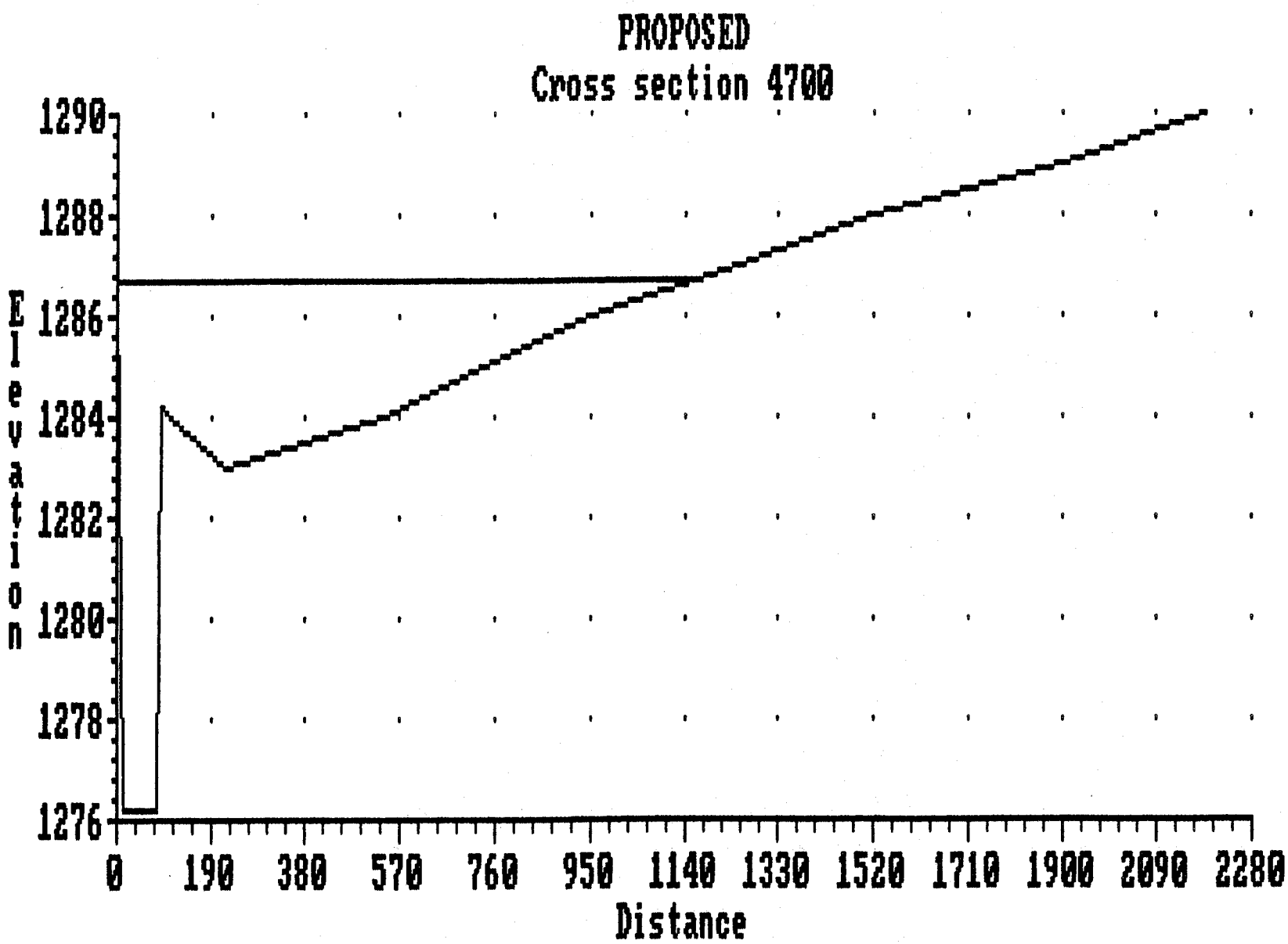
70
140
210
280
350
420
490
560
630
700
770
840
Distance

E67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Cross section 4700
Elevation
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1286
1284
1282
1280
1278
1276
0
190
380
570
760
950
1140
1330
1520
1710
1900
2090
2280
Distance

393

See Storm Drain Hydraulics Sheet F1 – Back Pocket

Salt River Pima-Maricopa Indian Community DRYWELL.WQ1
Drywell Calculations 05/05/92

Drywells will be used to drain standing water from the conduit after the storm water has stopped flowing. It is assumed that each drywell will accept drainage at the rate of 0.5 cfs. The calculations for the number of drywells required are as follows:

Volume of water to be drained:

Ramp	=	60,000 cu ft
Conduit	=	142,500 cu ft
Total	=	202,500 cu ft
Detention Volume Used for Design	=	200,000 cu ft

Average Release Rate

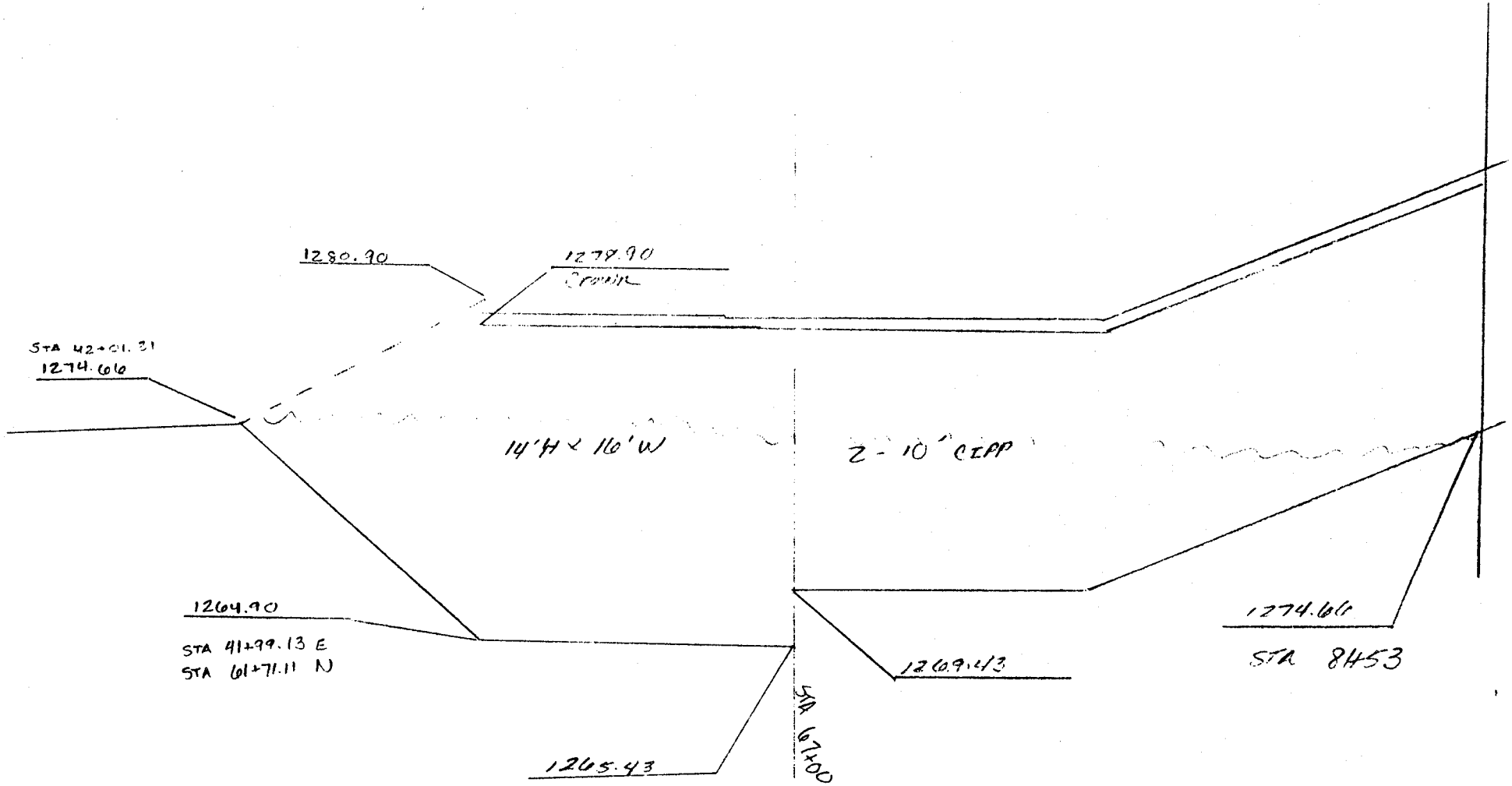
Detention Volume Used for Design	=	200,000 cu ft
Detention Time	/	36 hrs
	/	3,600 sec/hr
Average Release Rate	=	1.5 cfs

Drywells Required

Drainage Rate Per Drywell	0.5 cfs
Drywells Required	3.1

Therefore, Use 4 Drywells

F2



76.99 - 74.66 = 2.33

$\frac{2.33}{L} = 0.00325$

$L = 2.33 / 0.00325 = 716.92$

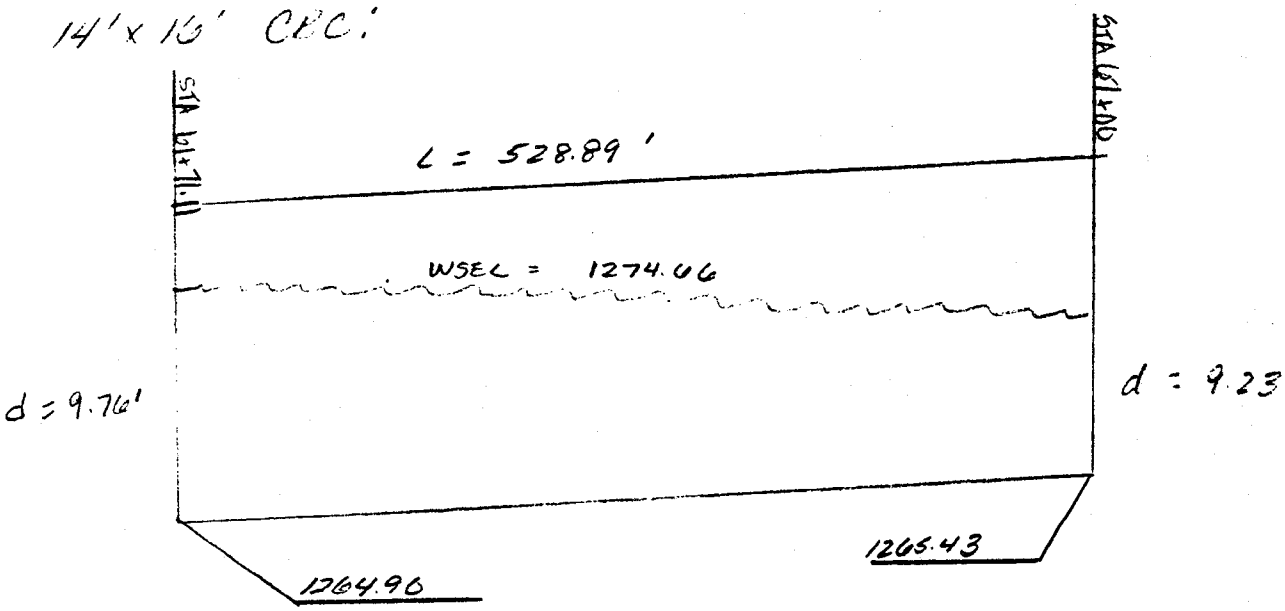
88+70 - 716.92 =

81+53

F3

CONDUIT

14' x 16' CBC:



$$\bar{d} = \frac{9.76 + 9.23}{2} = 9.495'$$

$L = 528.89'$

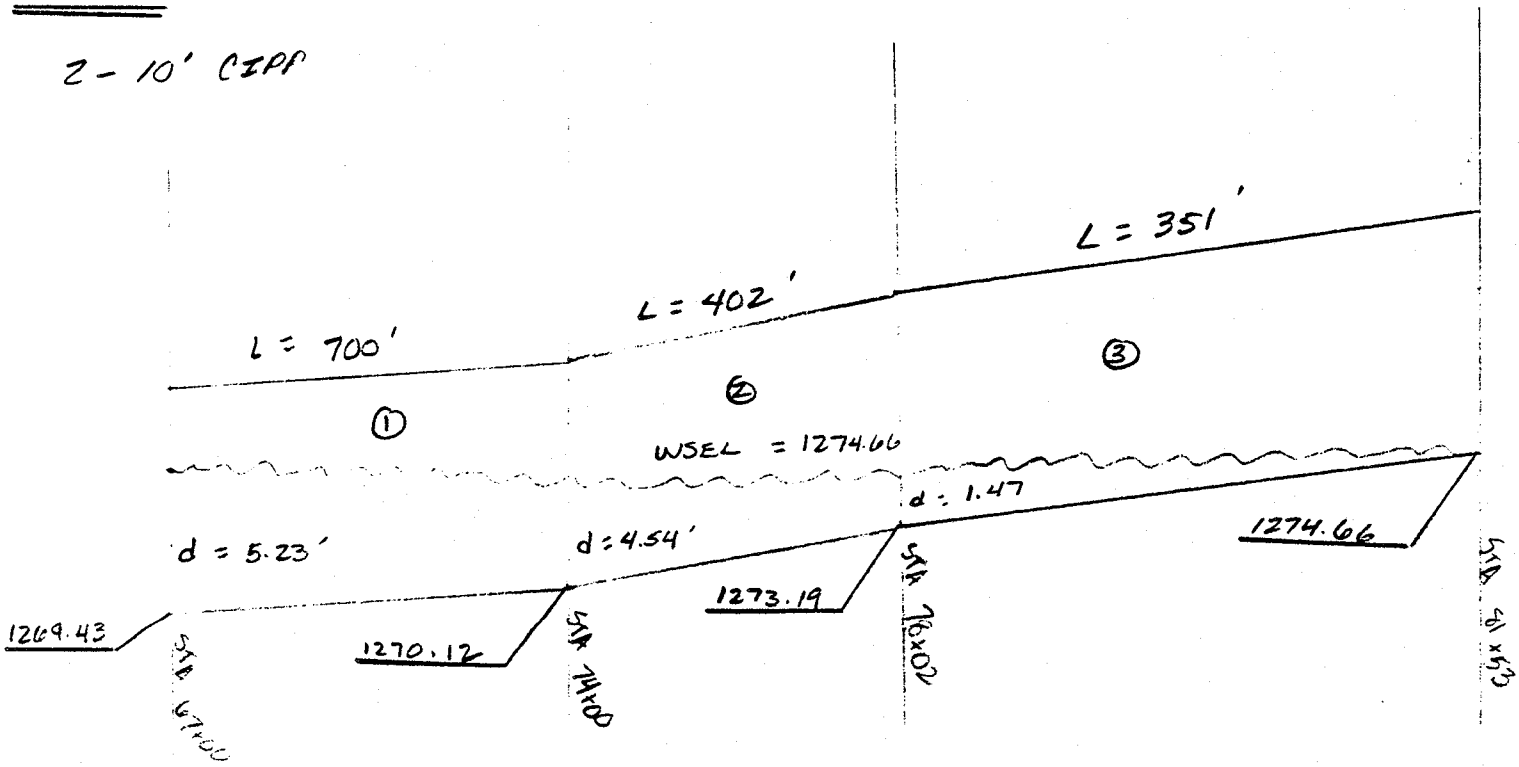
$W = 16'$

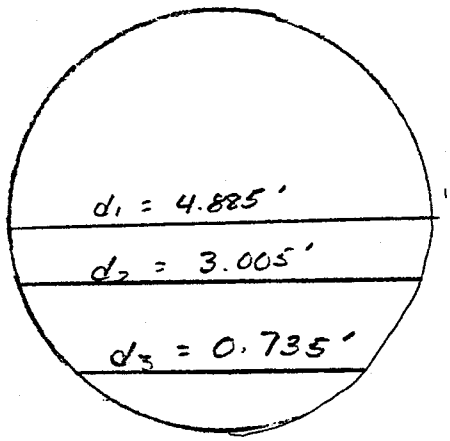
$V = 16' \times 528.89' \times 9.495'$

$V = 80349$ CU. FT.

CONDUIT

2 - 10' CIPP





$$\bar{d}_1 = \frac{5.23 + 4.54}{2} = 4.885$$

$$\bar{d}_2 = \frac{4.54 + 1.47}{2} = 3.005'$$

$$\bar{d}_3 = \frac{1.47 + 0}{2} = 0.735'$$

AREA COMPUTATION

1. $A = 2/3\ mC$

$m = 4.885'$

$C = 2\sqrt{5^2 - (5-4.885)^2}$

$C = 9.997'$

$A = 2/3 \times 4.885 \times 9.997$

$A = 32.56$ SF

2. $A = 2/3\ mC$

$m = 3.005'$

$C = 2\sqrt{5^2 - (5-3.005)^2}$

$C = 9.170'$

$A = 2/3 \times 3.005 \times 9.170'$

$A = 18.37$ SF

3. $A = 2/3\ mC$

$m = 0.735$

$C = 2\sqrt{5^2 - 4}$

$C = 5.219'$

$A = 2/3 \times .735 \times$

$A = 2.56$ SF

Volume Computation

1. Sta. 67+00 to Sta. 74+00

A = 32.56 SF
L = 700'

V = 22792 CU Ft

double Pipe: V = 45,584 CU. FT.

2. Sta 74+00 to Sta. 78+02

A = 18.37 SF
L = 402

V = 7384.74 CU FT

double pipe: V = 14770 CU.FT.

3. Sta 78+02 to Sta 81+53

A = 2.56 SF
L = 351'

V = 898.56 SF

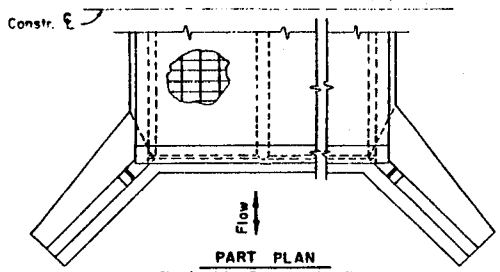
double Pipe: V = 1797 CU. Ft.

CIPP VOLUME: 62,151 CU FT
CBC VOLUME: 80,349 CU FT

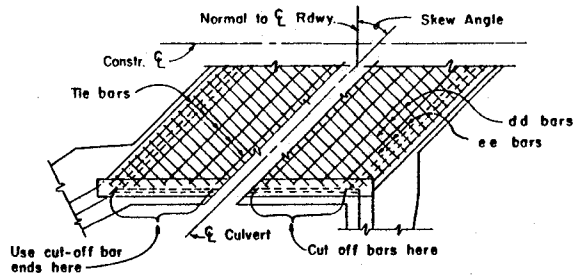
TOTAL CONDUIT VOLUME: 142,500 CU. FT.

F6

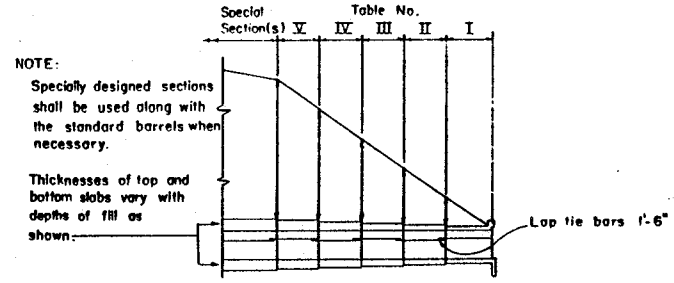
DESIGN	DW	8-72	NO.	DESCRIPTION OF REVISIONS	MADE BY	DATE	NO.	DESCRIPTION OF REVISIONS	MADE BY	DATE
DRAWN	RDL	9-72	(1)	Page Form Added with Note	[illegible]	[illegible]	(4)	General Notes	JEM	10-86
CHECKED	MB	3-73	(2)	Added Notes & Changed Details	JTW	7-76	(5)	Addition to Sect. A-A	JEM	3-88
			(3)	General Notes	CH	7-82	(6)			



PART PLAN
Showing Inlet & Outlet Details



PART PLAN-SKEWED CULVERT
Showing Reinf. Steel Placement

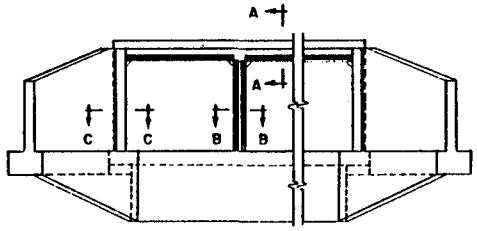


NOTE:
Specially designed sections shall be used along with the standard barrels when necessary.

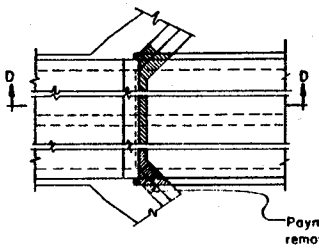
Thicknesses of top and bottom slabs vary with depths of fill as shown.

DIAGRAM SHOWING TABLES TO BE USED FOR VARIOUS FILL HEIGHTS

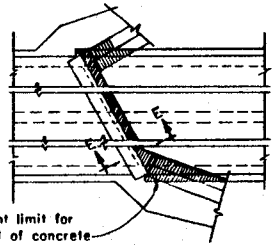
NOTE: Culvert barrels always begin and end with Table No. I.



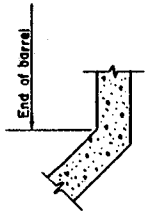
TYPICAL ELEVATION



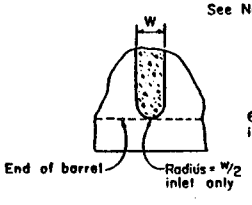
RIGHT ANGLE CULVERT



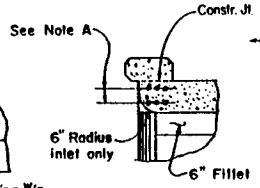
SKEWED CULVERT



SECTION C-C

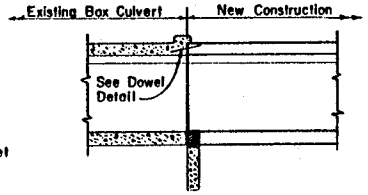


SECTION B-B

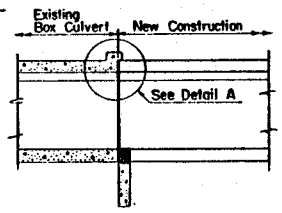


SECTION A-A

TYPICAL DETAILS



SECTION D-D



SECTION E-E

EXTENSION OF CULVERTS

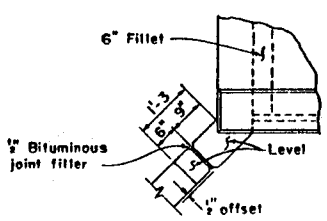
QUANTITY NOTE:
Total Box Culvert Quantities include Barrel Quantities and Headwall Quantities. Add Apron Quantity when apron is used.
Standard headwall quantities include wings, curb and cut-off wall.
Barrel Quantities are obtained by multiplying length of box by quantities per linear foot of box.

GENERAL NOTES:
Construction-Arizona Department of Transportation Standard Specification for Road and Bridge Construction.
Design-AASHTO Standard Specifications for Highway Bridges, 1983 Edition, and 1984 and 1985 Supplements.
Loading Class-HS 20-44 and Interstate Alternate Loading.
All Concrete shall be Class 'S', f'c = 3000 psi.
Reinforcing Steel shall conform to ASTM Specification A615.
Bar size #6 and smaller shall be designed as Grade 40 and furnished as Grade 40 or Grade 60, fs = 20,000 psi. Bar sizes #7 and larger shall be Grade 60, fs = 24,000 psi.
All bend dimensions for reinforcing steel shall be out to out of bars. All placement dimensions for reinforcing steel shall be to center of bars except as noted.
All reinforcing steel shall have 2" clear cover unless noted otherwise.

JOINT NOTE:
All structures shall have formed Constr. joints in top slab and walls (optional in floor slab) spaced not more than 38'-6" apart or as shown. Reinforcing steel shall project 1'-6" thru the joint. The joint shall be made with ¾" plywood bulkhead which shall be left in place.

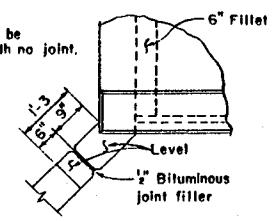
CONSTRUCTION NOTE:
Remove existing headwall as required for new construction.
If concrete headwall is removed to face of curb, no dowels are needed.
Use projecting reinforcing steel for bond in new concrete.
Curb to remain unless within 1'-0" of finish grade.
Wingwalls to be removed a Min. of 1'-6" to provide steel for bond.

NOTE A:
For culverts skewed over 5° to 30° use 3 #7 bars* top and bottom of slab
For culverts skewed over 30° to 45°, use 3 #8 bars* top and bottom of slab
For culverts skewed over 45°, requires a special edge beam design.
* Reinforcing bar quantities have to be calculated.

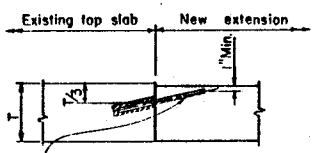


WINGWALL JOINT DETAIL
For all barrels 8 ft. and over (H ≥ 8')

NOTE:
Footing shall be continuous with no joint.

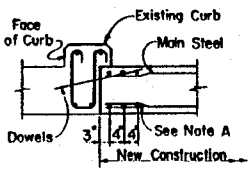


WINGWALL JOINT DETAIL
For all barrels under 8 ft. (H < 8')

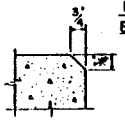


Drill hole 8" deep with 1" ϕ hole for #6 x 1'-9 dowel @ 18". Epoxy dowel in hole with approved adhesive. Top slab only. Anchorage shall develop a tensile pullout strength of 13 kips.

DOWEL NOTE



DETAIL A
EDGE BEAM

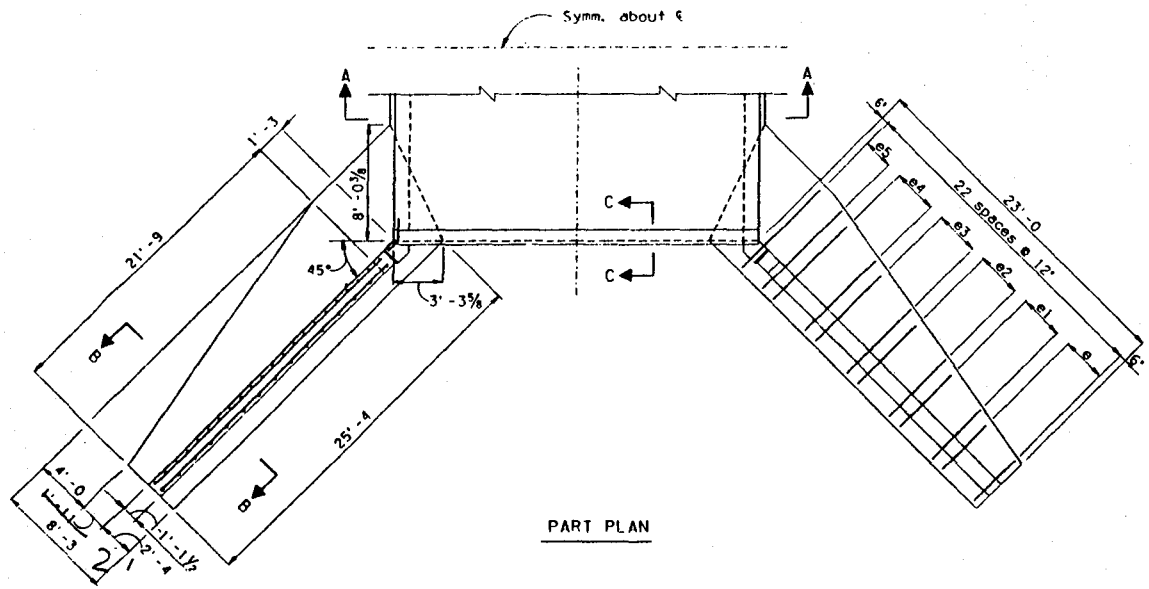


Chamfer all exposed corners thus unless otherwise noted.
This note applicable to all culvert sheets pertaining to the project.

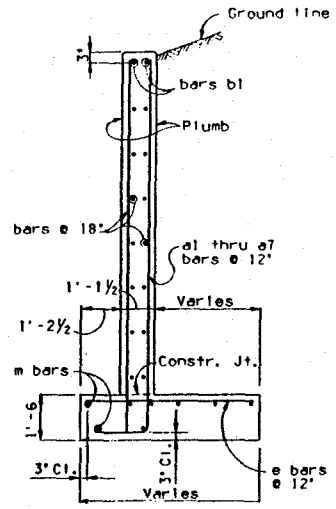
DESIGN APPROVED	ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION STANDARD DRAWINGS	REVISION
R.C. Bradley		7-88
APPROVED FOR DISTRIBUTION E.T. Wadlin	MISCELLANEOUS DETAILS FOR STANDARD BOX CULVERTS	STANDARD NO. B-01.10

R.C. Bradley

F7



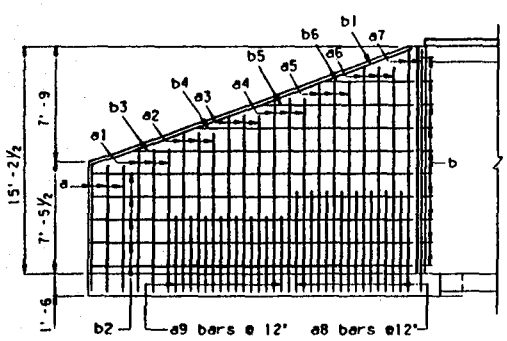
PART PLAN



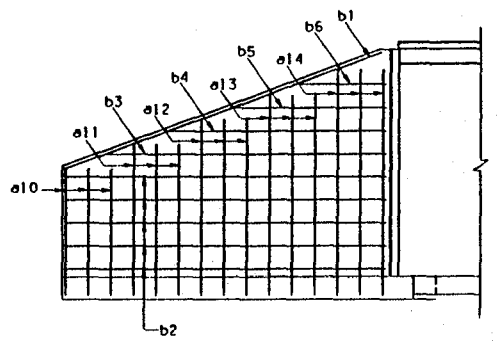
SECTION B-B

BARREL STEEL LIST					
FILL		TABLE I 0' to 5'	TABLE II 5' to 10'	TABLE III 10' to 15'	TABLE IV 15' to 20'
Slab (T)		14½"	17"	20"	22"
Walls (W)		12"	13"	14"	15"
Bars aa (spa)		12"	11"	10½"	6"
Bars cc (No.)		56	56	56	56
Bars ee	Size	#10	#9	#10	#10
	Spacing	9"	6"	7"	6½"
	Length	17'-8	17'-10	18'-0	19'-4
Bars gg (No.)		38	24	24	24
Bars hh	Size	#7	#8	#7	#7
	Spacing	9"	8½"	8½"	8½"
	Length	12'-10	13'-10	13'-4	13'-9"
	F	4'-1	4'-10	4'-1	4'-4
BARREL QUANTITIES					
Steel #/LF		439	541	511	570
Conc. CY/LF		2.687	3.074	3.524	3.972

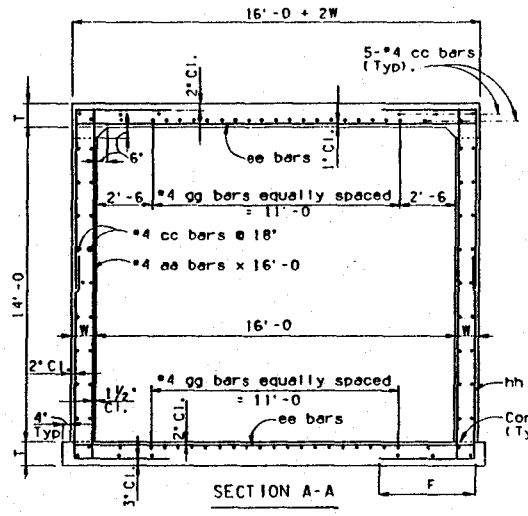
HEAD WALL STEEL LIST									
Mark	Bend	Size	No.	Lgth.	Mark	Bend	Size	No.	Lgth.
a	A	#5	6	10'-9	b	B	#4	20	2'-9
a1	A	#5	6	11'-9	b1	str.	#6	4	22'-9
a2	A	#5	6	12'-9	b2	str.	#4	20	21'-6
a3	A	#6	6	13'-9	b3	str.	#4	4	18'-6
a4	A	#6	6	14'-9	b4	str.	#4	4	14'-6
a5	A	#6	6	16'-0	b5	str.	#4	4	10'-6
a6	A	#6	6	17'-0	b6	str.	#4	4	6'-0
a7	A	#7	4	18'-3	e	str.	#5	8	3'-9
a8	str.	#8	16	7'-3	e1	str.	#5	8	4'-6
a9	str.	#6	16	5'-3	e2	str.	#6	8	5'-3
a10	str.	#4	6	8'-9	e3	str.	#7	8	6'-0
a11	str.	#4	6	10'-3	e4	str.	#8	8	6'-9
a12	str.	#4	6	11'-9	e5	str.	#9	6	7'-3
a13	str.	#4	6	13'-3	CUPB				
a14	str.	#4	6	15'-0	h	str.	#8	4	17'-6
m	str.	#4	16	22'-6	j	J	#4	12	4'-4
HEAD WALL QUANTITIES									
Steel									3173 Lbs
Conc.									41.5 CY



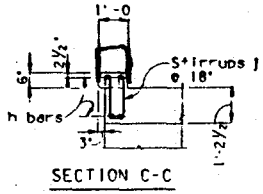
WING ELEVATION
(Back Face Reinf.)



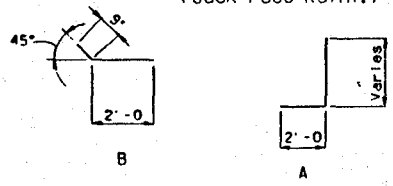
WING ELEVATION
(Front Face Reinf.)



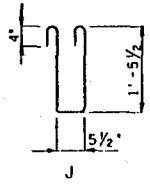
SECTION A-A



SECTION C-C

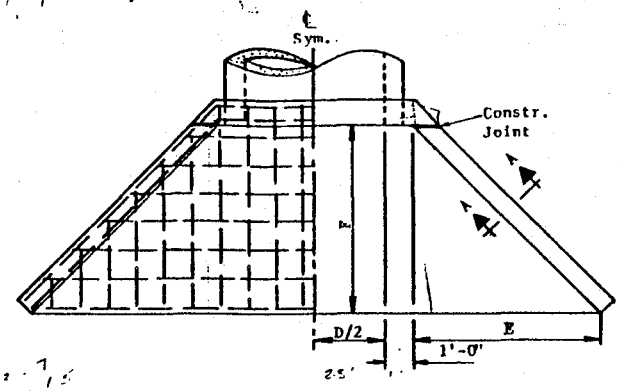


BENDS

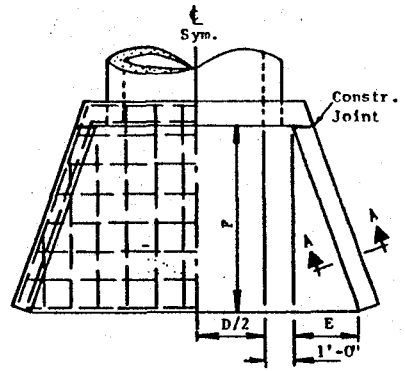


NOTE:
For General Notes and Miscellaneous Details, see Std. B-01.10.
Use Table No. 1 next to headwall.

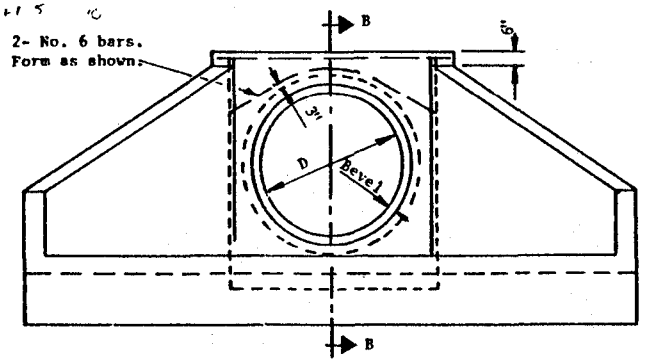
	DESIGN APPROVED	ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION STANDARD DRAWINGS	REVISION 7-88
	APPROVED FOR DISTRIBUTION	16' x 14' EQUIPMENT PASS	STANDARD NO. B-03.10



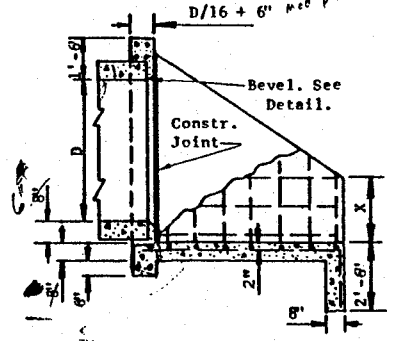
INLET HEADWALL



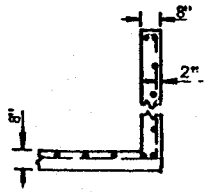
OUTLET HEADWALL



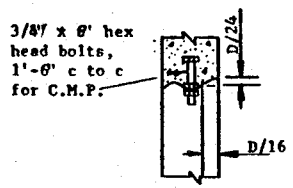
INLET HEADWALL FACE ELEV.-OUTLET SIMILAR



SECTION B-B



SECTION A-A



BEVEL DETAIL

D	Type	Dimensions F	Dimensions E	Dimensions X	Conc. (C.Y.) C.M.P.	Conc. (C.Y.) R.C.P.	Reinf. Steel (Lbs.)
	1 1/2:1 Embankment Slope						
42"	1(Inlet)	5'-2"	5'-2"	1'-9"	4.55	4.45	275
	2(Outlet)	5'-2"	1'-11"	1'-9"	3.53	3.45	213
48"	3(Inlet)	5'-8"	5'-8"	1'-11"	5.32	5.20	321
	4(Outlet)	5'-8"	2'-1"	1'-11"	4.12	4.03	249
54"	5(Inlet)	6'-2"	6'-2"	2'-1"	6.14	6.01	370
	6(Outlet)	6'-2"	2'-3"	2'-1"	4.75	4.65	287
60"	7(Inlet)	6'-8"	6'-8"	2'-3"	7.03	6.88	424
	8(Outlet)	6'-8"	2'-5"	2'-3"	5.43	5.31	328
66"	9(Inlet)	7'-2"	7'-2"	2'-5"	7.98	7.81	481
	10(Outlet)	7'-2"	2'-7"	2'-5"	6.16	6.02	372
72"	11(Inlet)	7'-8"	7'-8"	2'-7"	8.99	8.80	542
	12(Outlet)	7'-8"	2'-9"	2'-7"	6.94	6.78	419
78"	13(Inlet)	8'-2"	8'-2"	2'-9"	10.07	9.85	608
	14(Outlet)	8'-2"	3'-0"	2'-9"	7.78	7.61	469
84"	15(Inlet)	8'-8"	8'-8"	2'-11"	11.20	10.96	676
	16(Outlet)	8'-8"	3'-2"	2'-11"	8.66	8.47	522
	4:1 Embankment Slope						
42"	17(Inlet)	8'-8"	8'-8"	3'-0"	7.88	7.70	475
	18(Outlet)	8'-8"	3'-2"	3'-0"	5.59	5.46	337
48"	19(Inlet)	8'-8"	8'-8"	3'-6"	8.47	8.28	511
	20(Outlet)	8'-8"	3'-2"	3'-6"	6.10	5.97	368
54"	21(Inlet)	8'-8"	8'-8"	4'-0"	9.07	8.87	548
	22(Outlet)	8'-8"	3'-2"	4'-0"	6.63	6.48	400
60"	23(Inlet)	9'-4"	9'-4"	4'-4"	10.39	10.16	627
	24(Outlet)	9'-4"	3'-5"	4'-4"	7.60	7.43	458
66"	25(Inlet)	9'-8"	9'-8"	4'-9"	11.42	11.17	689
	26(Outlet)	9'-8"	3'-6"	4'-9"	8.39	8.20	506
72"	27(Inlet)	9'-8"	9'-8"	5'-3"	12.11	11.84	731
	28(Outlet)	9'-8"	3'-6"	5'-3"	8.99	8.80	542
78"	29(Inlet)	10'-0"	10'-0"	5'-8"	13.22	12.93	798
	30(Outlet)	10'-0"	3'-8"	5'-8"	9.88	9.66	596
84"	31(Inlet)	10'-8"	10'-8"	6'-0"	14.81	14.48	893
	32(Outlet)	10'-8"	3'-11"	6'-0"	11.00	10.76	664

GENERAL NOTES

1. All concrete shall be Class B
2. All rebars shall be No. 4 except 2-formed bars over pipe. Bar spacing shall be 1'-0" c to c.
3. High point of headwall shall not project more than 3" above slope.
4. For skewed pipe dimensions, see Std. C-14.21
5. Bevel is required only on inlet headwalls. Bell end of concrete pipe may replace bevel.

DESIGN APPROVED

APPROVED FOR DISTRIBUTION

STATE OF ARIZONA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DRAWINGS

HEADWALL, NORMAL TO PIPE
42" - 84" PIPE

REV 1/83

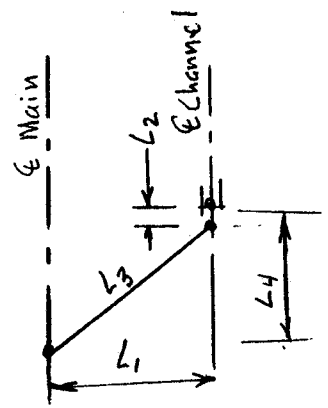
DRAWING NO C-14.20

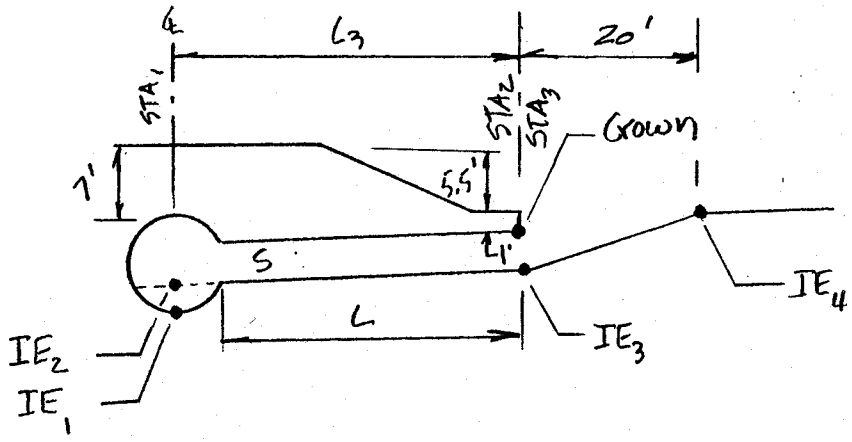
F9

Salt River Pima - Maricopa Indian Community
96th Street Storm Drain
Connector Pipe Profile

TECH\3182\INLET.W
06/11/92
BJF

	Inlet No.	Units	1	2	3	4	5	6
Main Pipe Diameter	D1	ft	9	9	9	9.5	10	10
Connector Pipe Dia.	D2	ft	5.5	5.5	5.5	5.5	5.5	5.5
Centerline Offset	L1	ft	44	44	44	44	35	38
Inlet Pipe Stub Out	L2	ft	8	8	8	8	8	8
Connector Center Line	L3 = L2+L1/@COS(45)	ft	70	70	70	70	57	62
Connector Pipe Length	L = L3-D1/2/@COS(45)	ft	64	64	64	63	57	55
Main Pipe Slope	s1	ft/ft	0.00405	0.00405	0.00405	0.00405	0.00475	0.00475
Length to Station	L4 = L1 + L2	ft	52	52	52	52	43	46
Main Line IE	IE1	ft	1303.11	1301.50	1300.00	1296.16	1293.52	1290.99
Connector IE @ Main CL	IE2 = IE1+(D1-D2)/2	ft	1304.86	1303.25	1301.75	1298.16	1295.77	1293.24
Inlet IE = Connector IE	IE3 = IE1+D1+7-5.5-1-D2+S1*L4	ft	1307.32	1305.71	1304.21	1300.87	1298.72	1296.21
Ramp IE = Channel FL	IE4 = IE3+1+D2+20*S1	ft	1313.90	1312.29	1310.79	1307.45	1305.32	1302.80
Inlet Crown EL	CROWN = IE3+D2	FT	1312.82	1311.21	1309.71	1306.37	1304.22	1301.71
Connector Pipe Slope	S = (IE3-IE2)/L3*100	%	3.5151	3.5151	3.5151	3.8723	5.1829	4.7879
CL Spur Station	STA1	FT	14852	14452	14082	13253	12753	12219
1/4 Bend Station	STA2 = STA1+L1	FT	14896	14496	14126	13297	12788	12257
Inlet Station	STA3 = STA1+L4	FT	14904	14504	14134	13305	12796	12265





Salt River Pima - Maricopa Indian Community
96th Street Storm Drain
Connector Pipe Profile

TECH\3182\INLET.WQ1
05/04/92
BJF

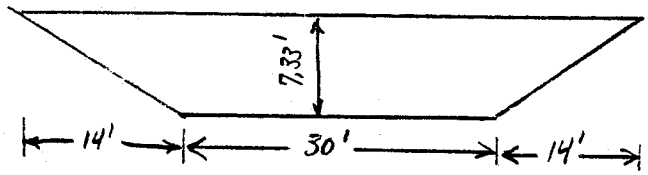
Inlet No.	Units	1	2	3	4	5	6
D1	ft	9	9	9	9.5	10	10
D2	ft	5.5	5.5	5.5	5.5	5.5	5.5
L1	ft	44	44	44	44	44	38
L2	ft	8	8	8	8	8	8
L3	ft	70	70	70	70	~~70~~ 68	62
L	ft	64	64	64	63	~~56~~ 58	55
s1	ft/ft	0.00405	0.00405	0.00405	0.00405	0.00475	0.00475
l4	ft	52	52	52	52	52	46
IE1	ft	1303.11	1301.50	1300.00	1296.16	1293.52	1290.99
IE2	ft	1304.86	1303.25	1301.75	1298.16	1295.77	1293.24
IE3	ft	1307.32	1305.71	1304.21	1300.87	1298.77	1296.21
IE4	ft	1313.90	1312.29	1310.79	1307.45	1305.36	1302.80
CROWN	FT	1312.82	1311.21	1309.71	1306.37	1304.27	1301.71
S	%	3.5151	3.5151	3.5151	3.8723	4.2814	4.7879
STA1	FT	14852	14452	14082	13253	12753	12219
STA2	FT	14896	14496	14126	13297	12797	12257
STA3	FT	14904	14504	14134	13305	12805	12265

96th ST. STORM DRAIN
EXCAVATION CALCULATIONS

1. OUTFALL CHANNEL

CROSS SECTIONAL AREA:

$44' \times 7.33' = 323$ SF

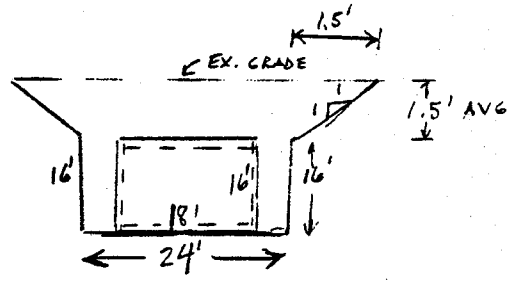


STA. 10+00E to STA 44+00 = 3400 LF

TOTAL EXCAVATION = 3400 LF X 323 SF
= 1,098,200 C.F. IN-PLACE
= 40,680 C.Y. IN-PLACE

2. CONDUIT TRENCHING

a. 16'x14' CONCRETE BOX CONDUIT:
CROSS SECTIONAL AREA



$24' \times 16' + 25.5' \times 1.5' = 422$ S.F.

STA. 61+71N to STA 67+00 = 530 L.F.

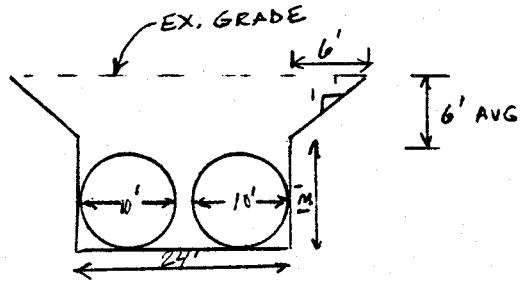
TOTAL EXCAVATION = 530 LF X 422 SF
= 223,660 CF IN-PLACE
= 8290 CY IN PLACE

96th ST.
EXCAVATION

b. DOUBLE 10' ø C.I.P.P.:

CROSS SECTIONAL AREA

$24' \times 13' + 30' \times 6' = 492$ S.F.



STA. 67+00N to STA. 127+53N =
6053 L.F.

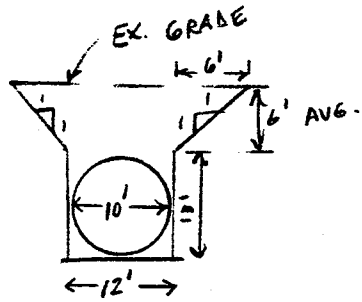
TOTAL EXCAVATION = 6053 LF × 492 SF
= 2,978,100 C.F. IN-PLACE
= 110,300 C.Y. IN-PLACE

c. SINGLE 10' ø C.I.P.P.:

CROSS SECTIONAL AREA

$12' \times 13' + 6' \times 18' = 264$ S.F.

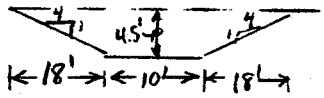
STA. 127+53 to STA. 148+75 = 2122 LF



TOTAL EXCAVATION = 2122 LF × 264 SF
= 560,208 C.F. IN-PLACE
= 20,750 CY IN-PLACE

3. INTERCEPTOR CHANNEL

a. CROSS SECTIONAL AREA



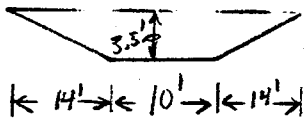
$10' \times 4.5' + 18' \times 4.5' = 126$ SF

STA. 62+50N to STA. 148+75N = 8625 LF

TOTAL EXCAVATION = 8625 LF × 126 SF
= 1,086,750 CF IN-PLACE
= 40,250 CY IN-PLACE

b. CROSS SECTIONAL AREA

$24' \times 3.5' = 84$ SF



STA. 148+75 to STA. 207+74 =
5900 LF

TOTAL EXCAVATION = 5900 LF × 84 SF
= 495,600 C.F. IN-PLACE
= 18,350 C.Y. IN-PLACE

TOTAL EXCAVATION = 238,620 C.Y. IN-PLACE

CHANNEL EXC. = 99,280 C.Y.
CONDUIT EXC. = 139,340 C.Y.

MJC

96th ST. STORM DRAIN
FILL CALCULATIONS

1. TRENCH BACKFILL TO EX. GRADE

a. 16' x 14' BOX CONDUIT:

8290 C.Y. EXCAVATION − (18' x 16' x 530 LF)/27 = 2640 C.Y. IN-PLACE FILL

(6')(16')(530 LF) = 50,880 CF = 1885 C.Y. (STRUCTURAL)

2640 − 1885 = 755 C.Y. (NON-STRUCTURAL)

b. DOUBLE 10' ø C.I.P.P.: (12' O.D.)

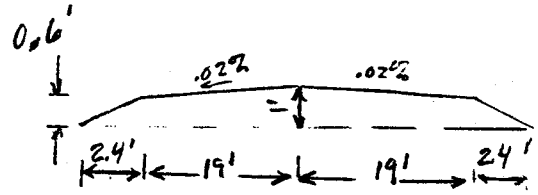
110,300 C.Y. EXCAVATION − (2(π x 6²) x 6053 LF)/27 = 59,600 C.Y. IN-PLACE FILL

c. SINGLE 10' ø C.I.P.P.: (12' O.D.)

20,750 C.Y. EXCAVATION − (π x 6² x 2122 LF)/27 = 11,860 C.Y. IN-PLACE FILL

2. ROAD FILL

a. CROSS SECTIONAL AREA:



$$A = (2.4')(0.6') + 2(19')\frac{(1' + 0.6')}{2}$$

$$= 32 \text{ S.F.}$$

STA. 73+94N to STA. 207+74N = 13,380 L.F.

TOTAL FILL = 13,380 L.F. x 32 S.F.

= 428,160 C.F. IN-PLACE

= 15,850 C.Y. IN-PLACE

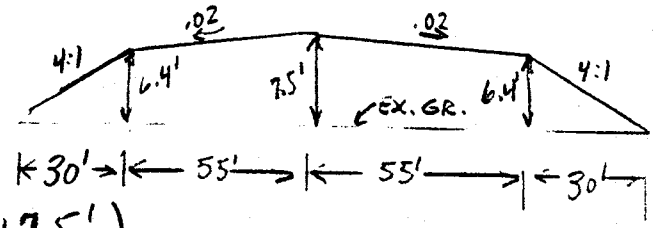
96th St.
FILL

3182.2
5-5-92
p.2

MJC

2. b. AVERAGE END AREA METHOD:

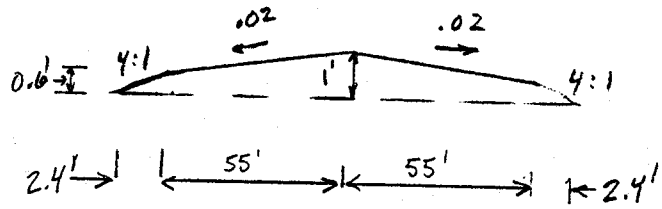
A_1



$$A_1 = 2(\tfrac{1}{2})(30')(6.4') + 2(55')\left(\frac{6.4' + 7.5'}{2}\right)$$

$$= 957 \text{ S.F.}$$

A_2



$$A_2 = (0.6')(2.4') + 2(55')\left(\frac{1' + 0.6'}{2}\right)$$

$$= 90 \text{ S.F.}$$

$$\text{FILL} = \tfrac{1}{2}(A_1 + A_2) \times \ell$$

ℓ = STA. 63+95N to STA. 73+94

ℓ = 1000 L.F.

$$= \tfrac{1}{2}(957 \text{ SF} + 90 \text{ SF})(1000 \text{ LF})$$

$$= 523{,}500 \text{ C.F. IN-PLACE}$$

$$= \underline{19{,}390 \text{ C.Y. IN-PLACE}}$$

TOTAL FILL = <u>109,340 C.Y. IN-PLACE</u>

ROAD FILL = 35,240 C.Y. IN-PLACE

TRENCH BACKFILL = 72,215 C.Y. IN-PLACE (NON-STRUCTURAL)

= 1885 C.Y. IN-PLACE (STRUCTURAL)

96th ST

QUANTITY CALCULATIONS

3/82.2
5-5-92
1.1
MJC

1. - 4" GUNITE LINING:

STA. 38+80E to STA. 10+00E = 2880 LF

$30' + 2(15.7') + 1' = 62.4'$

$62.4' \times 2880' = \underline{19970}$ S.Y.

STA 42+00E to sta 62+00N

$\frac{1}{2}(200' \times 200') = 20{,}000$ SF

$= \underline{2200}$ S.Y.

TOTAL = 22,170 S.Y.

2. MAINT RAMP (6" PCC):

$30' \times 320' = 960$ SF

$16' \times 80' = \underline{1280}$ SF

2240 SF

250 S.Y.

3 CONCRETE APRONS

51' across × 35' long × 6 ea = 10,710 S.F.

LESS RAMP AREAS (STRUCTURAL) =

$(10' \times 20') \times 6$ each = 1200 SF

TOTAL = 10,710 − 1200 = 9,510 SF

4. GEOTEXTILE FABRIC

a. $(1.5' + 3' + 3.4' + 2') \times 2$ sides $\times 3600$ LF

$= 70,950$ S.F. ~ OUTFALL CHANNEL

b. $(2(3') + 2(1')) \times 21$ LF $\times$ 2 sides $\times$ 6 ea

$= 2016$ SF ~ INLET STRUCTURES

c. $(2(2.5') + 2(2') + 2') \times 101$ LF $\times$ 2 sides

$= 2232$ SF ~ OUTLET

TOTAL = 75200 SF

5. AGGREGATE - DRAINAGE MATERIAL:

a. 3600 LF $\times$ 1.5' $\times$ 3' $\times$ ½ $\times$ 2 sides = 16,200 CF
OUTFALL CHANNEL

b. $(3' \times 1') \times 21$ LF $\times$ 2 sides $\times$ 6 ea = 756 CF
- INLETS

c. $(2.5' \times 2') \times 101$ LF $\times$ 2 sides = 1010 CF
- OUTLET

TOTAL 17,966 CF $\times$ $145 \frac{lb}{CF} \times \frac{ton}{2000\ lb}$ = 1300 tons

6. A.C. A-1½ MIX (ROAD CROSSINGS)

V = 115 LF x 24' wide x 5 each x .17' deep
= 2350 CF

2350 CF x 145 lb/CF x ton/2000 lb = 170 tons

7. SELECT FILL OR A.B.C. FOR A.C.

V = 115 LF x 24' wide x 5 each x .33' deep
= 4700 CF

4700 CF x 145 lb/CF x ton/2000 lb = 340 tons

8. CUTOFF WALLS

2 x 3600 LF CHANNEL = 7200 LF

[2(35') + 2(53')] x 6 each inlets = 1056 LF

[2(24') + 2(115')] x 5 road crossings = 1390 LF

TOTAL = 9650 LF

96th St
QUANTITY CALCS

3182.2
5-5-92
p.4
MJC

9. GRADE MAINT, ROAD + COMPACT

3300 LF X 20' wide = 66,000 SF
= 7340 S.Y.

4 DRYWELLS
741 LF 6" PVC DRAIN PIPE
2 CATCH BASINS

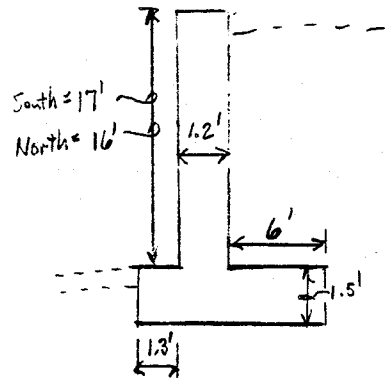
96th Street Storm Drain

STRUCTURAL CONCRETE CALCULATIONS

3182.2
5-6-92
p. 1
MJC

1. Outlet Structure - Wing Walls: ADOT 8-04.36

A. CROSS SECTIONAL AREAS:



— @ 16' x 14' CBC

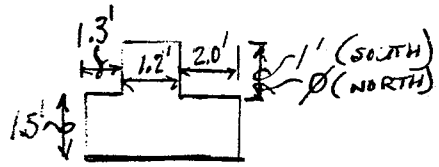
CROSS SECTIONAL AREA ⇒

(SOUTH) = (17')(1.2') + (1.5')(8.5')
= 33.2 S.F.

(NORTH) = (16')(1.2') + (1.5)(8.5)
= 32.0 S.F.

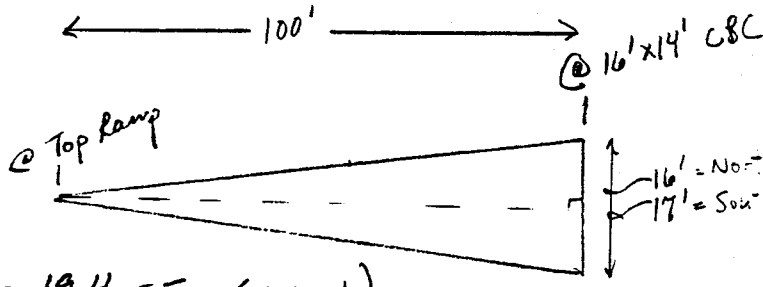
— @ Top of Ramp

CROSS SECTIONAL AREA



(SOUTH) = (4.5)(1.5') + (1')(1.2')
= 8.0 S.F.

(NORTH) = (4.5)(1.5')
= 6.8 S.F.



B. AVERAGE END AREA METHOD

Average cross sectional area ⇒

A = (6.8 SF + 32.0 SF)/2 = 19.4 SF (NORTH)

V = 19.4 SF x 100 LF = 1,940 CF = 72 C.Y. (NORTH)

A = (8.0 S.F. + 33.2 SF)/2 = 20.6 SF (SOUTH)

V = 20.6 SF x 100 LF = 2,060 CF = 76 C.Y. (SOUTH)

TOTAL = 72 + 76 = 148 C.Y.

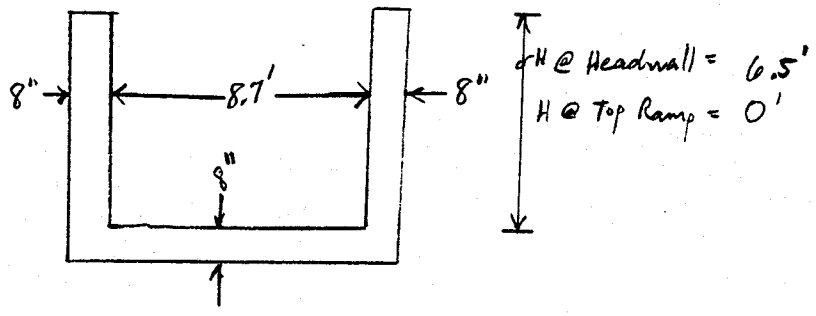
G.

96th St
STRUCTURAL CONC. CALCS.

3182.2
5-6-92
p.2
MJC

2. Inlet Structure

a. Wing Walls and Floor:



AVG. CROSS SECTIONAL AREA =

$$\left(\tfrac{8''}{12}\right)(8.7') + 2\left(\tfrac{8''}{12}\right)\left(\frac{0+6.5}{2}\right)$$

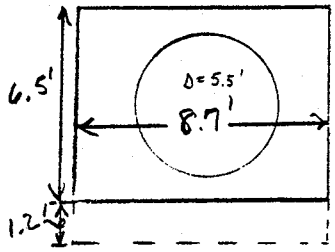
$= 10.1$ SF

$V = 10.1$ SF $\times$ 20 L.F. $=$ 205 CF

b. Headwall:

$A = (7.7')(8.7') - \pi(2.75)^2$

$= 43.2$ S.F.

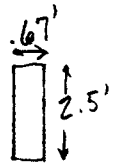


$W = D/16 + 6''$ ADOT C-14.
$= 66/16 + 6''$
$= 11''$ use $12'' = 1'$

$V = 43.2$ SF $\times 1'$ (w)

$= 43$ CF

c. Cut off Wall



$V = (.67')(2.5')(10'\,w)$

$= 17$ CF

TOTAL $V = (205 \text{ CF} + 43 \text{ CF} + 17 \text{ CF}) \times 6$ INLETS

$= 1590$ CF $=$ 60 C.Y.

96th St.

STRUCTURAL CONC. CALCS.

Junction Box #1

Floor:

$V = (3')(20')(23' \text{ AVG } w)$

$= 1380 \text{ CF}$

Top:

$V = (1.5')(20')(23' \text{ AVG } w)$

$= 690 \text{ CF}$

Sides:

$V = 2(18' \text{ AVG } H)(20')(1.0' t)$

$= 720 \text{ CF}$

Ends

$V = 4(1.0')(18' \text{ AVG } H)(1.0' t)$

$= 72 \text{ CF}$

TOTAL = 2860 CF = 106 C.Y.

Junction Box #2

Floor:

$V = (3')(20')(22' \text{ AVG } w)$
$= 1320 \text{ CF}$

Top:

$V = (1.5')(20')(22' \text{ AVG } w)$
$= 660 \text{ CF}$

Sides:

$V = 2(16' H)(20' w)(1' t)$
$= 640 \text{ CF}$

Ends:

$V = 4(1.0')(16' H)(1.0' t)$
$= 64 \text{ CF}$

TOTAL = 2684 CF = 100 C.Y.

STRUCTURAL CONCRETE COSTS

Lump Sum Items

3182.2
5-6-92
p.1

1. Headwall & Wingwalls for 66" Dia Pipe
FDOT C-14.20

60 CY (Total) x $240/cy

Lump Sum = $14,400

2. Storm Drain Junction Structures

JB 1 = 106 cy
JB 2 = 100 cy

206 cy x $240/cy

Total Lump Sum = $49,440

3. Wingwalls for 16' x 14' Outlet
FDOT B-03.10 (mod)

148 cy x $240/cy

Total Lump Sum = $35,520

SALT RIVER PIMA - MARICOPA INDIAN COMMUNITY
96th Street Street Storm Drain and Arizona Canal Outfall Channel
Pre-Final (95%) Quantities Take Off and Cost Estimate

EKA#3182.2
05/07/92
CEA
TECH\3182\96THCST1

ITEM DESCRIPTION	TOTAL QUANTITY	UNIT	UNIT COST	TOTAL COST
Channel Excavation	99,280	C.Y.	$2.50	$248,200
Trench Excavation	139,340	C.Y.	$2.50	$348,350
Roadway Fill (In-Place)	35,240	C.Y.	$0.50	$17,620
Trench Backfill (In-Place)	72,215	C.Y.	$1.00	$72,220
Structure Backfill (For Concrete Box Conduit)	1,885	C.Y.	$10.00	$18,850
Export soil (Total Excavation - Roadway Fill - Non-Structural)	129,280	C.Y.	$5.00	$646,400
16' x 14' Concrete Box Conduit	530	L.F.	$550.00	$291,500
10' Dia. Cast-in-Place Storm Drain Pipe	12,600	L.F.	$140.00	$1,764,000
9' Dia. Cast-in-Place Storm Drain Pipe	1,620	L.F.	$115.00	$186,300
Plug for 9' Dia. Pipe (MAG 427)	1	EA	$600.00	$600
66" Dia. Rubber Gasket Reinforced Concrete Pipe and Fittings (Cl. IV)	366	L.F.	$190.00	$69,540
Headwall & Wingwalls for 66" Dia. Pipe, ADOT C-14.20 (Mod.)	1	L.S.	$14,400.00	$14,400
12" Dia. CMP Storm Drain Pipe	37	L.F.	$15.00	$560
Storm Drain Junction Structures (2 each)	1	L.S.	$49,440.00	$49,440
Wingwalls for 16'x14' outlet , ADOT B-03.10 (Mod.)	1	L.S.	$35,520.00	$35,520
Trash rack for outlet structure, COP P-1563, Modified	1	EACH	$5,200.00	$5,200
4" Gunite Lining	22,170	S.Y.	$18.00	$399,060
Maintenance Ramp, 6" P.C.C. w/6"x6" w.w.f. (10 ga.)	2,250	S.F.	$3.20	$7,200
Manhole	6	EACH	$2,000.00	$12,000
Concrete Apron, 4" P.C.C. w/6"x6" w.w.f. (10 ga.)	9,510	S.F.	$4.00	$38,040
Trash rack for inlet structure, COP P-1563, Modified	6	EACH	$3,400.00	$20,400
Geotextile fabric for subdrain	75,200	S.F.	$0.50	$37,600
Aggregate for subdrain fill	1,300	TON	$12.00	$15,600
Asphalt Concrete Surface Course (2", A 1-1/2)	170	TON	$24.00	$4,080
Select Fill or Aggregate Base for roadways (4")	340	TON	$20.00	$6,800
Cutoff wall, MAG 552	9,650	L.F.	$15.00	$144,750
Remove tree	73	EACH	$50.00	$3,650
Remove/relocate power pole & down guy, by SRP	4	EACH	$10,000.00	$40,000
Barbed Wire Fence w/Gates ADOT C-12.10	6,640	L.F.	$5.00	$33,200
Drywell w/connector & catch basin	4	EACH	$4,000.00	$16,000
Grade and Compact 20' Maintenance Road	7,340	S.Y.	$3.00	$22,020
Grade 1' deep roadside drainage ditch	3,300	L.F.	$2.00	$6,600
Survey marker, MAG 120-1, Type B	5	EACH	$1,000.00	$5,000
	Sub-total, Construction			$4,580,700
	10% Contingencies			$458,070
	Total Construction			$5,038,770

3182

EVANS, KUHN & ASSOCIATES, INC.

GEORGE L. EVANS, P.E.
JOHN D. KUHN, JR., P.E.

CONSULTING ENGINEERS
727 East Bethany Home Road, Suite D-225
Phoenix, Arizona 85014
(602) 241-0782
FAX NUMBER (602) 248-9158

May 24, 1991

Salt River Pima - Maricopa Indian Community
10005 East Osborn Road
Scottsdale, Arizona 85256

Attn: Darrell Krull

Re: SRP-MIC Drainage Study
96th Street Storm Drain

Dear Mr. Krull:

Enclosed are three alternative 96th Street drainage channel and conduit sections for your review and comment. Shown on the sections are a typical channel and accompanying underground conduit, probable costs per linear foot of construction, and right-of-way widths available for future roadway construction.

It should be noted that both the channel and the underground conduit are generalized and taken as constant for these analyses, although both drainage elements will vary in the final design. Also, the underground conduit is shown as an 11.5' x 11.5' box and was sized to convey the flows at a slope equal to the average energy grade slope and is an increase over the 10.5' x 10.5' box displayed in our Preliminary Study submitted to the Community on April 25, 1991. The increased size addresses the oversized conduits needed for the submerged outfall conditions discussed at our meeting of May 15, 1991.

We would like to meet with you and your staff as soon as possible to discuss these alternatives. This will allow us to complete the study portion of this project.

Very truly yours,

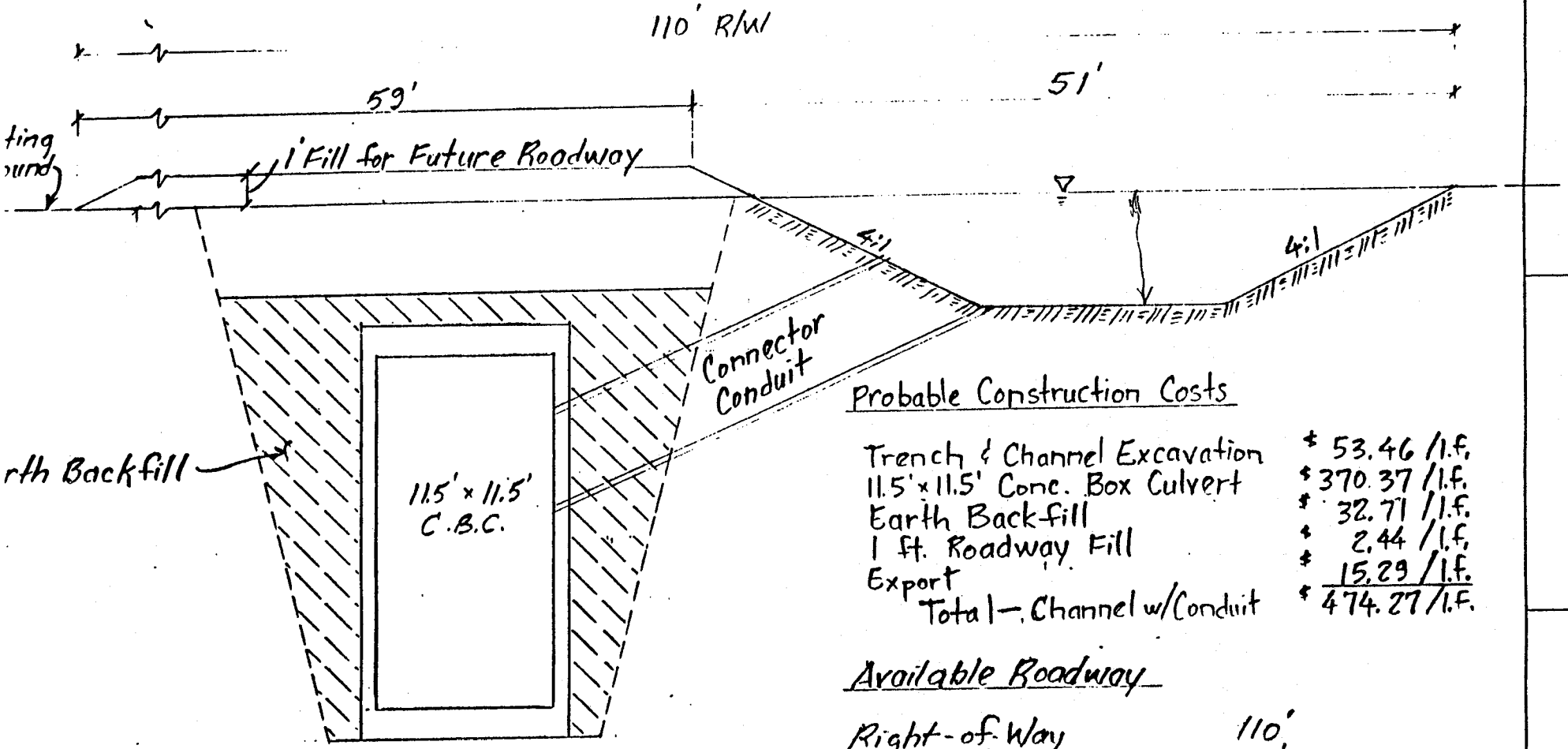
EVANS, KUHN & ASSOCIATES, INC.

Clyde E. Anderson, P.E.
Project Engineer

Enclosure

3182PC1.105/kyd

H1



Alternative 1 – Earth Channel
no scale

Probable Construction Costs

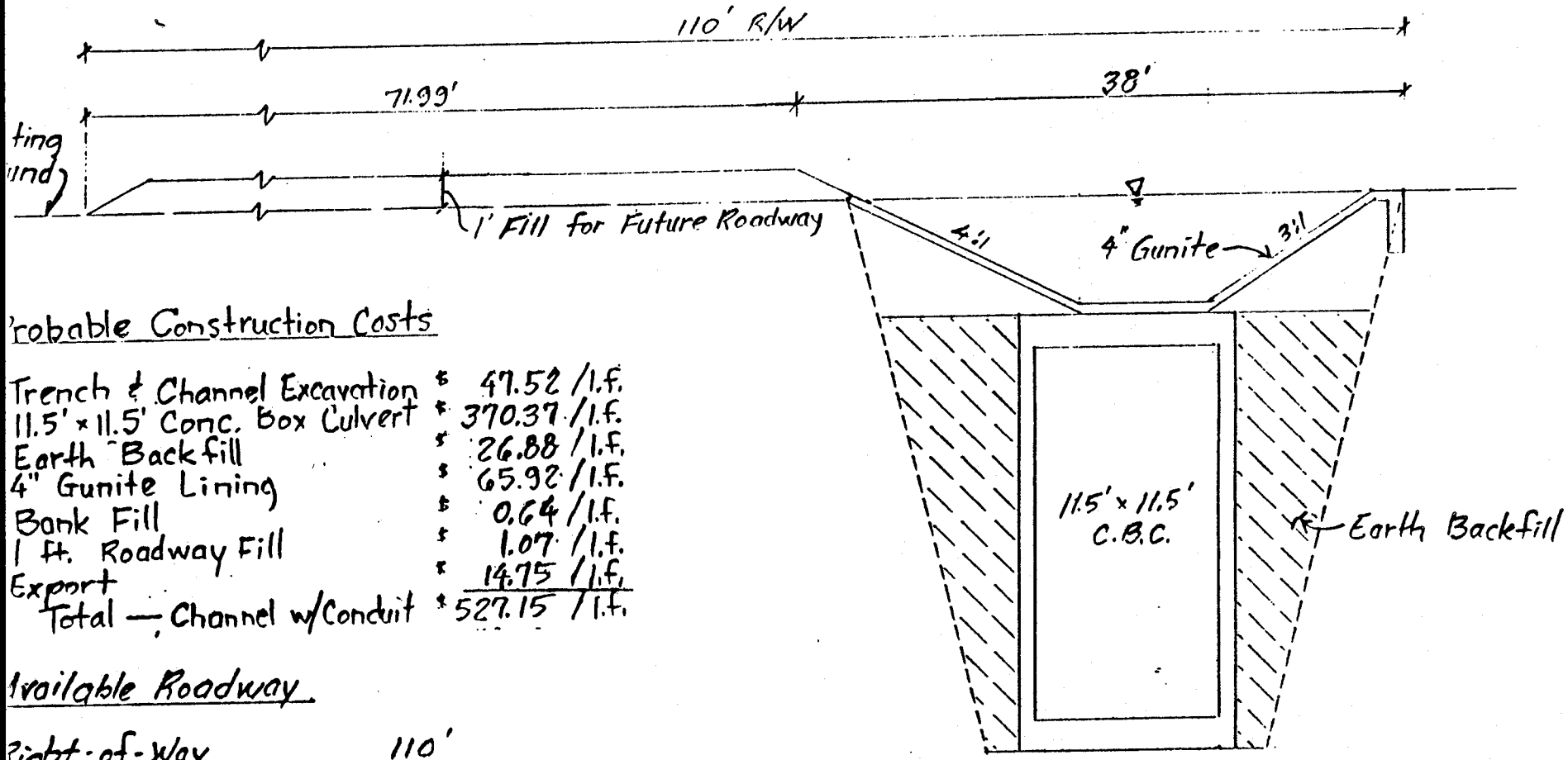
Trench & Channel Excavation	$ 53.46 /l.f.
11.5' x 11.5' Conc. Box Culvert	$ 370.37 /l.f.
Earth Backfill	$ 32.71 /l.f.
1 ft. Roadway Fill	$ 2.44 /l.f.
Export	$ 15.29 /l.f.
Total – Channel w/Conduit	$ 474.27 /l.f.

Available Roadway

Right-of-Way	110'	
-Channel	-51'	
	59'	
-Shoulders (2×6')	-12'	
	47'	
-Existing Power Poles	-17'	
	30'	-- 2 Lanes
+ Relocate Power Poles	+15'	
	45'	-- 3 Lanes

Annual Maintenance for

H2



Alternative 2 - Gunite Channel
no scale

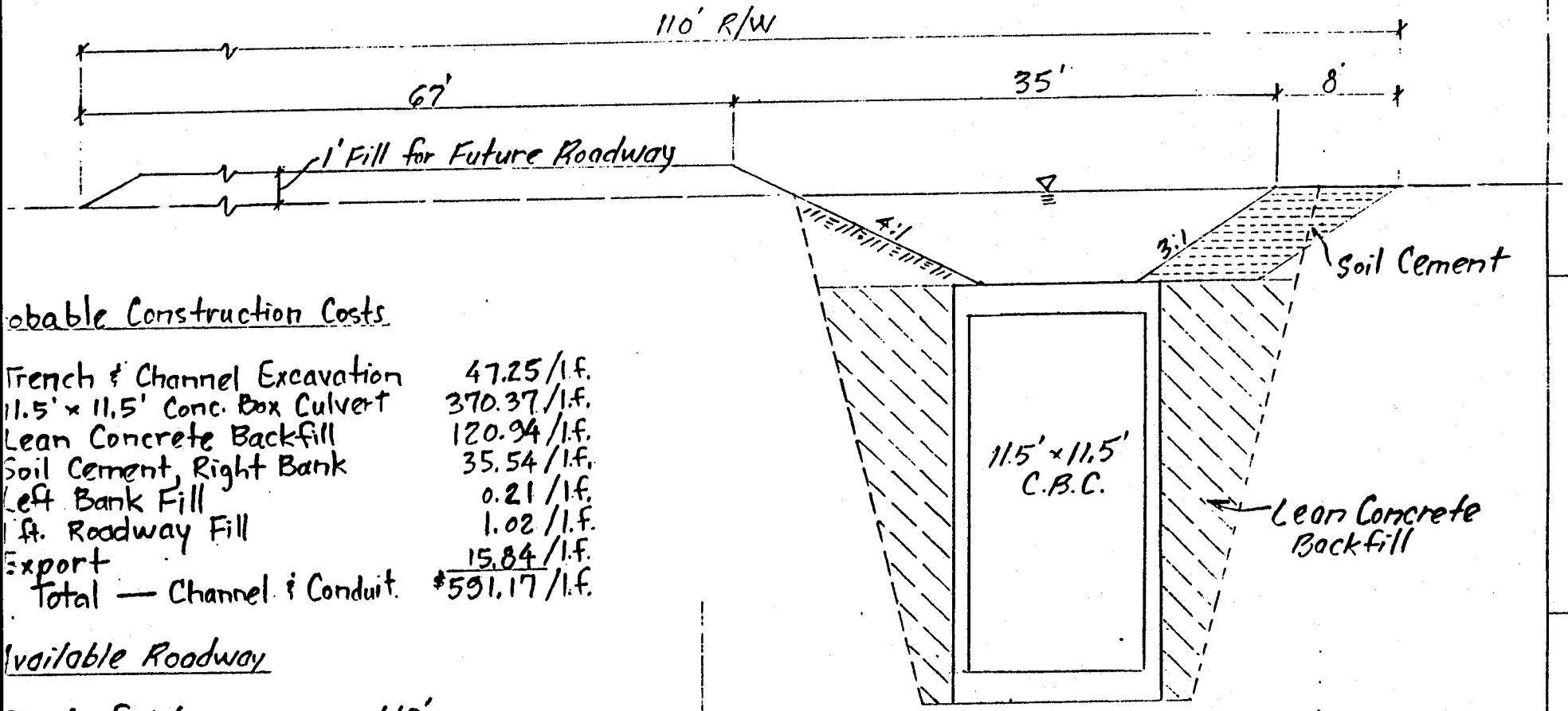
Probable Construction Costs

Trench & Channel Excavation	$ 47.52 /l.f.
11.5' x 11.5' Conc. Box Culvert	$ 370.37 /l.f.
Earth Backfill	$ 26.88 /l.f.
4" Gunite Lining	$ 65.92 /l.f.
Bank Fill	$ 0.64 /l.f.
1 ft. Roadway Fill	$ 1.07 /l.f.
Export	$ 14.75 /l.f.
Total — Channel w/Conduit	$ 527.15 /l.f.

Available Roadway

Right-of-Way	110'
Channel	-40
	70
Shoulders (2x6')	-12
	58
Existing Power Poles	-17
	41' -- 3 Lanes
Relocate Power Poles	+15
	56' -- 4 Lanes

Annual Maintenance for 2½ miles of channel ≈ $35,000/yr.



Alternative 3 - Composite Channel
no scale

obable Construction Costs

Trench & Channel Excavation	47.25/l.f.
11.5' x 11.5' Conc. Box Culvert	370.37/l.f.
Lean Concrete Backfill	120.94/l.f.
Soil Cement, Right Bank	35.54/l.f.
Left Bank Fill	0.21/l.f.
1 ft. Roadway Fill	1.02/l.f.
Export	15.84/l.f.
Total — Channel & Conduit	$591.17/l.f.

Available Roadway

Right-of-Way	110'
Channel	-43'
	67'
Shoulders (2x6')	-12'
	55'
Existing Power Poles	-17'
	38' -- 3 Lanes
Relocate Power Poles	+15'
	51' -- 4 Lanes

Annual Maintenance for [illegible] ≈ $20,000/yr

pry.

EVANS, KUHN & ASSOCIATES, INC.

GEORGE L. EVANS, P.E.
JOHN D. KUHN, JR., P.E.

CONSULTING ENGINEERS
727 East Bethany Home Road, Suite 225
Phoenix, Arizona 85014
(602) 241-0782
FAX NUMBER (602) 248-9158

June 27, 1991

Salt River Pima-Maricopa Indian Community
10005 East Osborn Road
Scottsdale, Arizona 85256

Attn: Darrell Krull

Re: SRP-MIC Drainage Study
96th Street Drainage Channel and
Arizona Canal Floodplain

Dear Mr. Krull:

Enclosed please find four alternative sections for a full flow channel in 96th Street.

In accordance with our current instructions, the underground conduit has been deleted from these alternatives. Included with the channel alternatives are probable construction costs, available roadway analysis, estimated annual maintenance costs and a table summarizing costs and available roadway. Also enclosed are two outfall channel/floodplain fill alternatives, a preliminary floodplain map displaying the existing and proposed 100-year floodplain, and a preliminary grading plan.

Please review these materials at your earliest convenience. We look forward to your comments and a decision adopting a design alternative.

Please feel free to contact this office if your require additional information.

Very truly yours,

EVANS, KUHN & ASSOCIATES, INC.

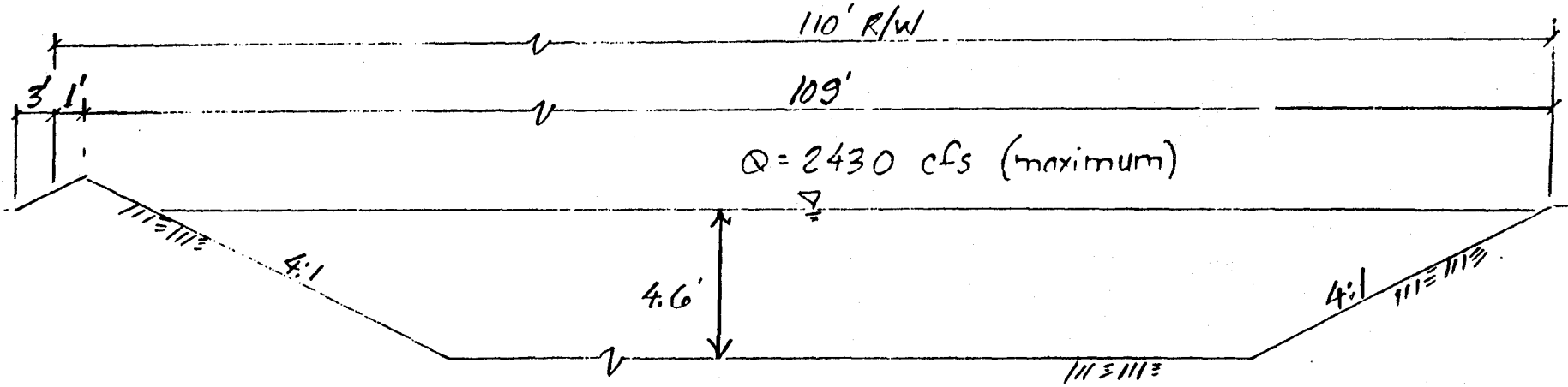
Clyde E. Anderson

Clyde E. Anderson, P.E.
Project Engineer

Enclosures

3182PC1.106/kyd

H5



Probable Construction Costs

Channel Excavation	$ 34.93 /L.F.
1' Roadway Fill	$ 0.05 /L.F.
	$ 34.98 /L.F.

Available Roadway

Right-of-Way	110'
- Channel	-109'
	1'

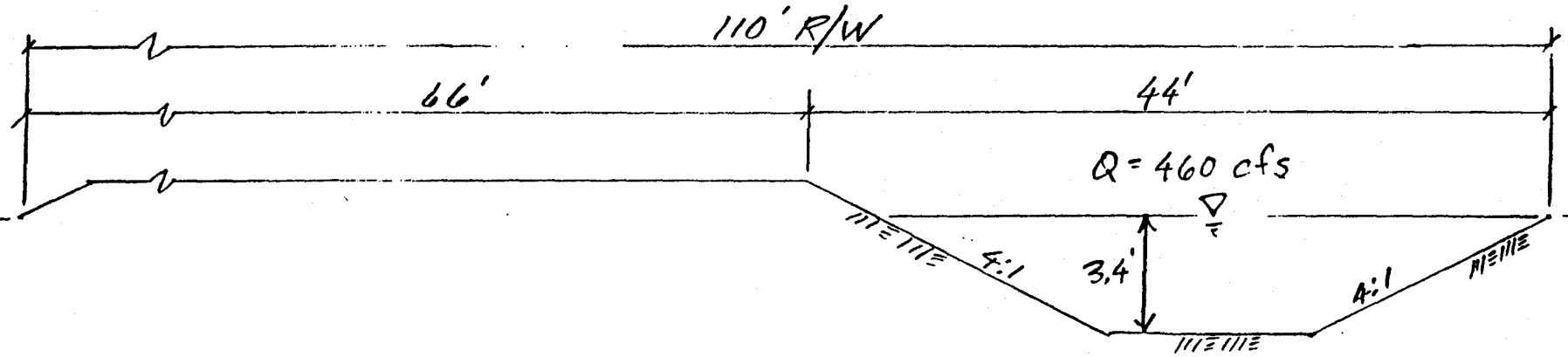
Alternative 1-A -- Earth Channel
Station 61+60 to 139+60

Station 61+60 ≡ Arizona Canal, north bank

Station 139+60 ≡ ¼ mile South of Via de Ventura

Annual Maintenance for 7½ miles of Channel ≈ $8500

2.2815 SRP-MIC 9676 Street S.D. 6-25-91



Probable Construction Costs

Channel Excavation	$ 8.14 /L.F.
1' Roadway Fill	$ 1.24 /L.F.
	$ 9.38 /L.F

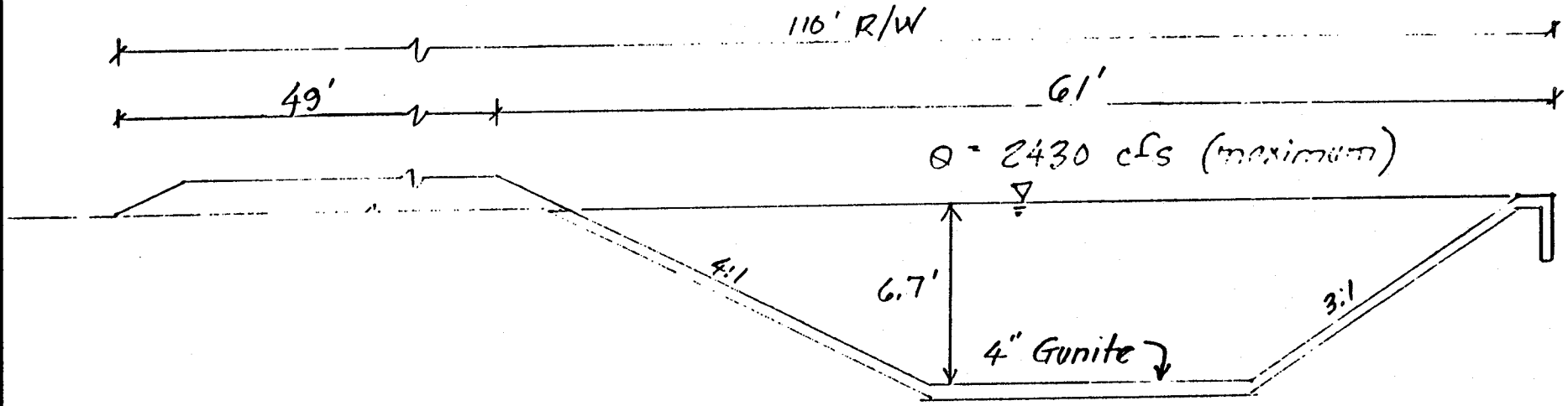
Available Roadway

Right-of-Way	110'	
- Channel	-44'	
	66'	
- Shoulders (2 @ 6')	-12'	
	54'	
- Existing Power Poles	-17'	
	37'	- 3 Lanes
+ Relocate Power Poles	+15'	
	52'	- 4 Lanes

Alternative 1-A -- Earth Channel
Station 139+60 to 207+75

Station 139+60 ≡ ¼ mile south of Via de Ventura

Station 207+75 ≡ Doubletree Ranch Road



Probable Construction Costs

Channel Excavation	$ 18.91 /L.F.
4" Gunite Lining	$ 106.88 /L.F.
1' Roadway Fill	$ 1.00 /L.F.
	126.79 /L.F.

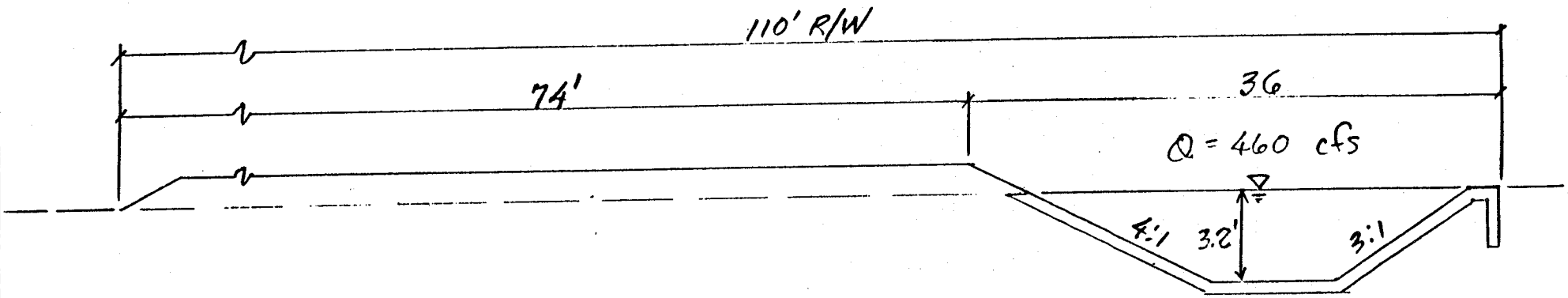
Alternative 2-A -- Gunite Channel
Station 61+60 to 139+60

Station 61+60 = Arizona Canal, north bank

Station 139+60 = ¼ mile south of Via de Ventura

Available Roadway

Right-of-Way	110'
- Channel	- 51'
	49
- Shoulders (2 @ 6')	- 12'
	37
- Existing Power Poles	- 17'
	20 — 2 Lanes
+ Relocate Power Poles	+ 15'
	35' — 3 Lanes



Probable Construction Costs

Channel Excavation	$ 5.87 /L.F.
4" Gunite Lining	$ 58.78 /L.F.
1' Roadway Fill	$ 1.43 /L.F.
	$ 66.09 /L.F.

Alternative 2-A -- Gunite Channel

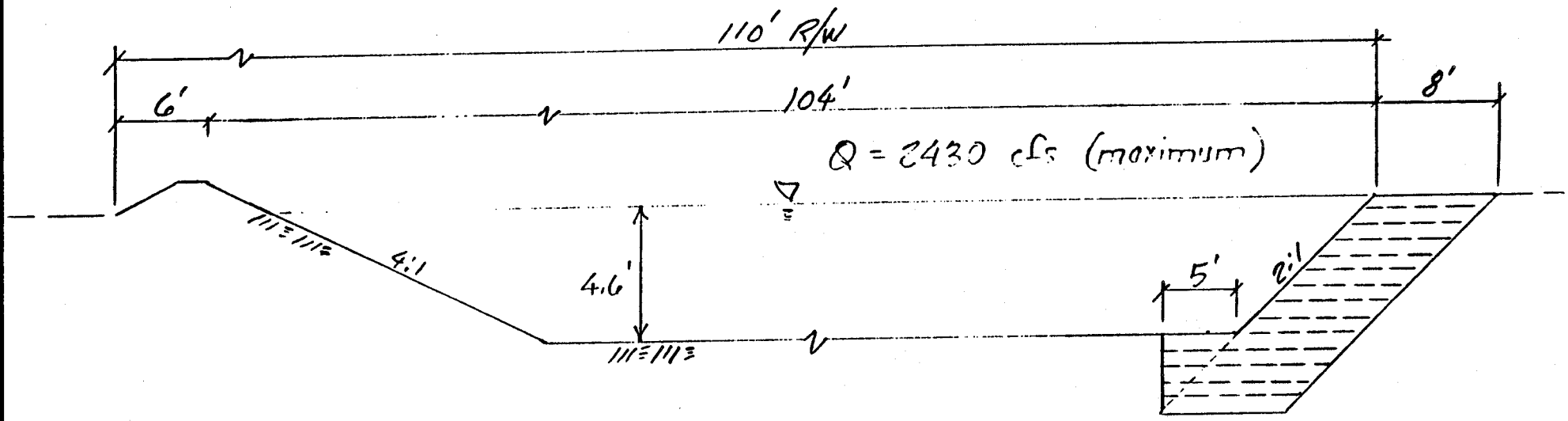
Station 139+60 to 207+75

Station 139+60 = 1/4 mile South of Via de Ventura

Station 207+75 = Doubletree Ranch Road

Available Roadway

Right-of-Way	110'	
-Channel	-36'	
	74'	
-Shoulders (2 @ 6')	-12'	
	62'	
-Existing Power Poles	-17'	
	45'	- 3 Lanes
+Relocate Power Poles	+15'	
	60'	- 5 Lanes



Probable Construction Costs

Channel Excavation	$ 41.83 /L.F.
8' Wide Soil Cement	$ 84.54 /L.F.
1' Roadway Fill	$ 0.16 /L.F.
	126.53 /L.F.

Alternative 3-A -- Composite Channel

Station 61+60 to 139+60

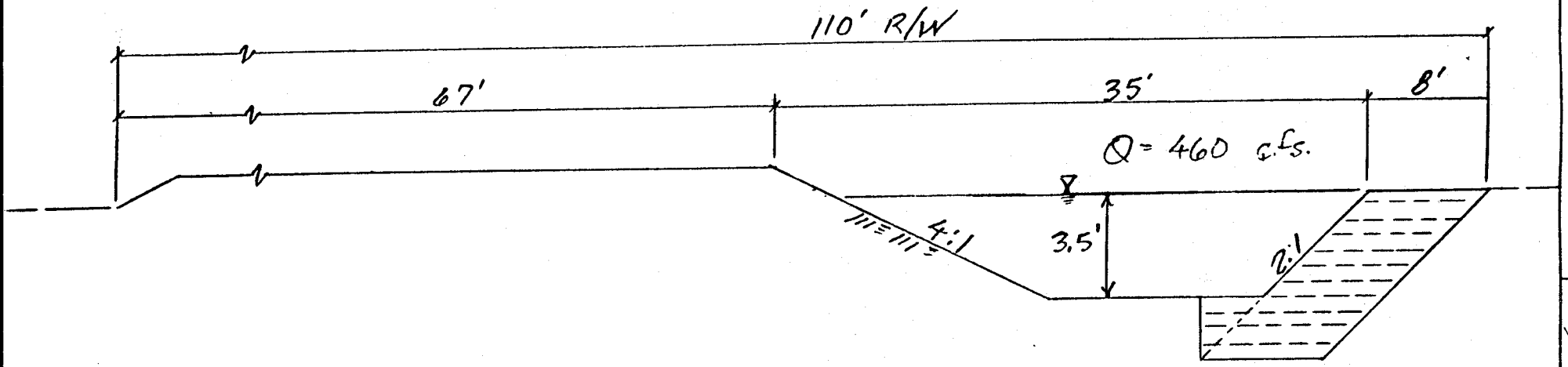
Station 61+60 ≡ Arizona Canal, north bank

Station 139+60 ≡ 1/4 mile south of Via de Ventura

Available Roadway

Right-of-Way	110'
- Channel	-104'
	6'
- Shoulders (2 @ 6')	-12'
	-6'
- Existing Power Poles	-17'
	-23'
+ Relocate Power Poles	+15'
	-8

H 10



Probable Construction Costs

Channel Excavation	$ 13.45 / L.F.
8' Wide Soil Cement	$ 66.44 / L.F.
1' Roadway Fill	$ 1.19 / L.F.
	$ 81.07 / L.F.

Alternative 3-A -- Composite Channel

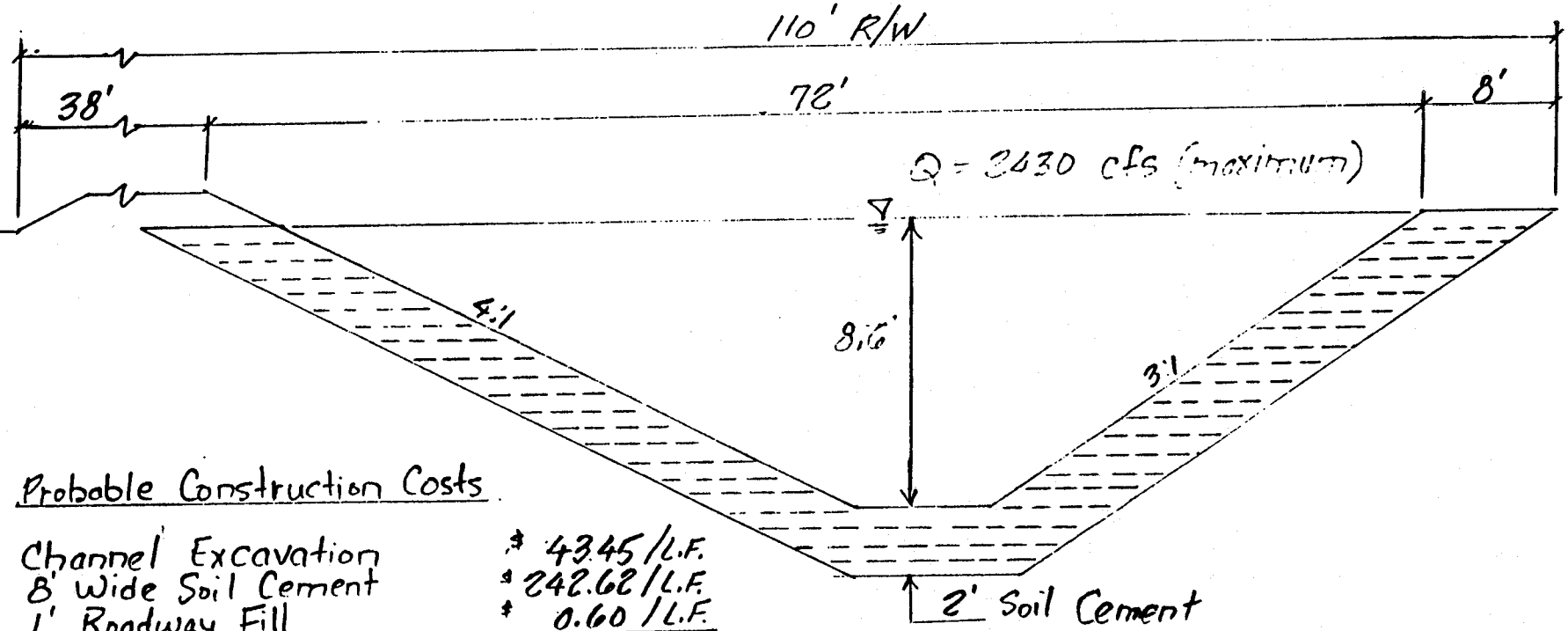
Station 139+60 to 207+75

Station 139+60 ≡ ¼ mile south of Via de Ventura

Station 207+75 ≡ Doubletree Ranch Road

Available Roadway

Right-of-Way	110'	
- Channel	-43'	
	67'	
- Shoulders (2 @ 6')	-12'	
	55'	
- Existing Power Poles	-17'	
	38'	- 3 Lanes
+ Relocate Power Poles	+15'	
	53'	- 4 Lanes



Probable Construction Costs

Channel Excavation	$ 43.45 /L.F.
8' Wide Soil Cement	$ 242.62 /L.F.
1' Roadway Fill	$ 0.60 /L.F.
	$ 286.67 /L.F.

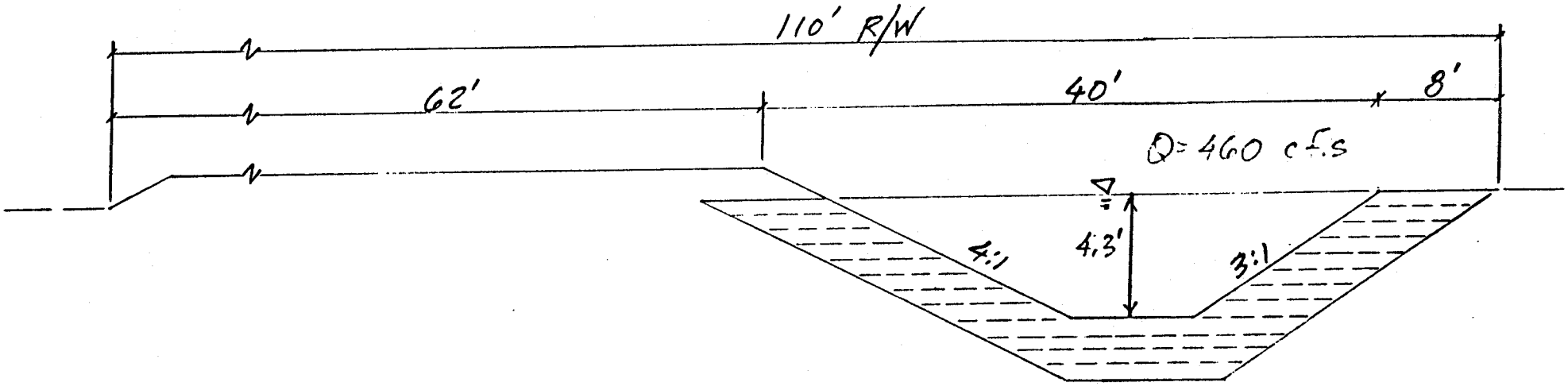
Alternative 4-A -- Soil Cement Channel
Station 61+60 to 139+60

Station 61+60 ≡ Arizona Canal, north bank

Station 139+60 ≡ ¼ mile south of Via de Ventura

Available Roadway

Right-of-Way	110'
− Channel	−80'
	30'
− Shoulders (2@ 6')	−12'
	18'
− Existing Power Poles	−17'
	1'
+ Relocate Power Poles	+15'
	16' — 1 Lane



Probable Construction Costs

Channel Excavation	$ 17.21	/L.F.
8' Soil Cement	$ 142.14	/L.F.
1' Roadway Fill	$ 1.15	/L.F.
	$ 160.50	/L.F.

Alternative 4-A -- Soil Cement Channel
Station 139+60 to 207+75

Station 139+60 ≡ ¼ mile south of Via de Ventura

Station 207+75 ≡ Doubletree Ranch Road

Available Roadway

Right-of-Way	110'	
- Channel	-48'	
	62'	
- Shoulders (2 @ 6')	-12'	
	50'	
- Existing Power Poles	-17'	
	33'	- 3 Lanes
+ Relocate Power Poles	+15'	
	48'	- 4 Lanes

96th Street Storm Drain — EKA31B2
Station 61+60 to Station 139+60 — 6/28/91
Probable Construction Costs — CEA
Summary

Alternative	Unit Construction Cost	Number of Roadway Lanes
1-A	$34.98	0
2-A	$126.78	2
3-A	$126.53	0
4-A	$286.67	0

96th Street Storm Drain — EKA31B2
Station 139+60 to Station 207+75 — 6/28/91
Probable Construction Costs — CEA
Summary

Alternative	Unit Construction Cost	Number of Roadway Lanes
1-A	$9.38	3
2-A	$66.09	3
3-A	$81.07	3
4-A	$160.50	3

96th Street Storm Drain — EKA31B2
Station 61+60 to Station 207+75 — 6/28/91
Probable Operation & Maintenance Costs — CEA
Summary

Alternative	Annual O&M Costs
1-A	$8,520.00
2-A	$3,120.00
3-A	$6,816.00
4-A	$2,000.00

96th Street Storm Drain System
Estimated Channel Maintenance Costs

EKA 3182
6/28/91
CEA

	Alternative 1-A Earth Channel	Alternative 2-A Gunite Channel	Alternative 3-A Composite Channel	Alternative 4-A Soil Cement Channel
P1 = Downstream Channel Wetted Perimeter	106.0 l.f.	60.0 l.f.	92.0 l.f.	n/a
A1 = Area of Wetted Perimeter = P1/9	11.78 s.y.	6.67 s.y.	10.22 s.y.	n/a
AG' = Area Graded Each Day	25000 s.y./day	n/a s.y./day	25000 s.y./day	n/a
AGL = LF Graded Each Day = AG'/A1	2123 l.f./day	n/a l.f./day	2446 l.f./day	n/a
L1 = Length of Channel 1	7800 l.f.	7800 l.f.	7800 l.f.	n/a
T1' = Days to Grade Channel 1 = L1/AGL	3.67 days	n/a days	3.19 days	n/a
AG" = Area Repaired Each Day	n/a s.f./day	250 s.f./day	n/a s.f./day	n/a
LF" = L.F. Repaired per Day = AG"/P1	n/a l.f./day	4.17 l.f./day	n/a l.f./day	n/a
T1" = Days to Repair Reach @ 5 Days Total = (L1xA1x5))/L1xA1+L2xA2)	n/a days	3.52 days	n/a days	n/a
P2 = Upstream Channel Wetted Perimeter	40.0 l.f.	29.0 l.f.	29.0 l.f.	n/a
A2 = Area of Wetted Perimeter = P2/9	4.44 s.y.	3.22 s.y.	3.22 s.y.	n/a
AG = Area Graded Each Day	25000 s.y./day	n/a s.y./day	25000 s.y./day	n/a
AGL = LF Graded Each Day = AG/A2	5625 l.f./day	n/a l.f./day	7759 l.f./day	n/a
L2 = Length of Channel 2	6815 l.f.	6815 l.f.	6815 l.f.	n/a
T2' = Days to Grade Channel 2 = L2/AGL	1.21 days	n/a days	0.88 days	n/a
AG" = Area Repaired Each Day	n/a s.f./day	250 s.f./day	n/a s.f./day	n/a
LF" = L.F. Repaired per Day = AG"/P1	n/a l.f./day	8.62 l.f./day	n/a l.f./day	n/a
T2" = Days to Repair Reach @ 5 Days Total = (L2xA2x5))/L1xA1+L2xA2)	n/a days	1.48 days	n/a days	n/a
TGr = Total Days to Grade Channel = T1'+T2'	4.89 days	n/a days	4.07 days	n/a
TRe = Total Days to Repair Channel = T1"+T2"	n/a days	5.00 days	n/a days	n/a
T' = Number of Days to Grade = TGr+.xx	5.00 days	n/a days	4.00 days	n/a
T" = Number of Days to Repair = TRe+.yy	n/a days	5.00 days	n/a days	n/a
Gr = Cost of Grader per Day	$400.00 /day	n/a /day	$400.00 /day	n/a
Op = Cost of Equipment Operator per Day	$168.00 /day	n/a /day	$168.00 /day	n/a
Ch = Cost of Grading per Day = Gr+Op	$568.00 /day	n/a /day	$568.00 /day	n/a
C1 = Total Cost of Grading = 3xT'xCh	$8,520.00	n/a	$6,816.00	n/a
Br = Cost of Bricklayer per Day	n/a /day	$160.00 /day	n/a /day	n/a
Hlp = Cost of Helper per Day	n/a /day	$112.00 /day	n/a /day	n/a
Mat = Cost of Materials per Day	n/a /day	$40.00 /day	n/a /day	n/a
Gun = Cost of Repairs per Day = Br+Hlp+Mat	n/a /day	$312.00 /day	n/a /day	n/a
C2 = Total Cost to Repair 2 Times/Year	n/a	$3,120.00	n/a	$2,000.00 per year, Weed Control

EVANS, KUHN & ASSOCIATES, INC.
CONSULTING ENGINEERS

PROJECT TITLE: SRP-MIC Drainage	BY: KM	CHECK: CA	EKA# 3182	SHT. 1 of
DESCRIPTION: Outfall Channel, Typical Sections			DATE: 6/25/91	

FILL CONDITION #1 -- Balanced Earthwork, Levee

NO SCALE

Estimated Earthwork

Excavation	
Outfall Channel	27200
96th St. (max.)	126000
	153,200
Shrinkage (30%)	45,000
	107,200
Levee Fill	52,200
* Additional	55,000

FILL CONDITION #2

NO SCALE

Estimated Earthwork

Excavation	
Outfall Channel	27200
96th St. (max.)	126000
Floodplain	56000
	209200
Shrinkage (30%)	62800
	146400
1' Levee Fill	46100
250' Pad Fill	72200
	118300

Proj

EVANS, KUHN & ASSOCIATES, INC.

GEORGE L. EVANS, P.E.
JOHN D. KUHN, JR., P.E.

CONSULTING ENGINEERS
727 East Bethany Home Road, Suite D-225
Phoenix, Arizona 85014
(602) 241-0782
FAX NUMBER (602) 248-9158

July 12, 1991

Salt River Pima-Maricopa Indian Community
10005 East Osborn Road
Scottsdale, Arizona 85256

Attn: Darrell Krull, P.E.

Re: SRP-MIC Drainage Study
96th Street Drainage Channel and
Arizona Canal Outfall Channel
EKA #3182

Dear Mr. Krull:

Enclosed herewith are the additional channel section alternatives and cost data you requested for 96th Street and the Arizona Canal outfall channel.

The Outfall Channel alternatives will reduce the 100-year floodplain width by approximately 1000 feet. This would be accomplished by constructing either a levee 3 feet above the 100-year flood elevation or a 200' to 300' wide pad one foot above the 100-year flood elevation.

The earth channel alternatives for 96th Street incorporate a concrete lined low-flow channel which significantly increases the capacity. Channel widths are less than 80' and provide a minimum 30' dry width adjacent to the west channel bank. It is our understanding that the Salt River Project electric poles will be relocated to an alignment approximately 2' inside the west right-of-way line. The remaining 28' width could be used as a two lane service and access road. The concrete lining is very susceptable to scour damage. Therefore we have added cut-off walls at all edges and construction joints.

At this time it appears that an earth channel is the most attractive alternative. Discussions with our soils engineer indicates that soil cement lining will be more expensive than previously anticipated. Cut material in 96th Street will probably not be usable for soil cement. Also, the Community has repeatedly indicated that gunite is aesthetically undesirable. If we remove gunite and soil cement alternatives from further consideration, we are left with the following four alternatives:

H 17

1. Flows in the upper reach of 96th Street will be conveyed in an earth channel for all alternatives. The probable construction cost to be added to the lower reach alternatives is,

Unit Cost (per foot)	$10.50
+ 15%	1.50
	12.00 per ft.
x Reach Length	6,800 feet
Upper Reach Cost	$81,600

2. Enclosed with this letter is Alternative 1-B, a 76' wide earth channel and 34' roadway which allows for 2 traffic lanes. Probable construction cost is,

Unit Cost (per foot)	$ 74.00
+ 15% for Miscellaneous Structures	11.00
	$ 85.00 per ft.
x Reach Length	7800 feet
	$663,000
+ Upper Reach Cost	$ 81,600
	$744,600

3. Our letter of June 27, 1991 included Alternative 1A (copy enclosed) a 109' wide earth channel and no roadway. This alternative is not acceptable because there is no available roadway width. Probable construction cost is,

Unit Cost (per foot)	$ 35.00
+ 15% for Miscellaneous Structures	5.00
	$ 40.00 per foot
x Reach Length	7800 feet
	$312,000
+ Upper Reach Cost	$ 81,600
	$393,600

4. Our letter dated May 24, 1991 included alternatives for the lower reach of 96th Street which consisted of an underground conduit in conjunction with a low flow channel. Alternative 1 utilized a 51' wide earth channel and a 59' roadway which would accommodate 4 traffic lanes. A copy of Alternative #1 is enclosed. Probable construction cost is,

Unit Cost (per foot)	$ 475.00
+ 15% for Miscellaneous Structures	71.00
	$ 546.00 per ft.
x Reach Length	7800 ft.
	$4,258,800
+ Upper Reach Cost	$ 81,600
	$4,340,400

H 18

The choice appears to be between Alternative 1 and Alternative 1-B. If the Community chooses to construct the earth channel now and the underground conduit later, the cost would be approximately $663,000 plus $4,261,800 or $4,921,800. Therefore, it is our conclusion that the Community would be further ahead to construct the underground conduit at this time.

Please review these materials at your earliest convenience. We would like to meet with you and your staff next week to further discuss these alternatives.

Please reel free to contact this office if your require additional information.

Very truly yours,

EVANS, KUHN & ASSOCIATES, INC.

Clyde E. Anderson, P.E.
Project Engineer

Enclosures

3182PC1.107/kyd

H19

96th Street Storm Drain — EKA3182
Station 61+60 to Station 139+60 — 7/18/91
Probable Construction Costs — CEA
Summary

Alternative	Unit Construction Cost	Maintenance Road Width/ Lanes
1-A	$34.98	0'/0
2-A	$126.78	47'/3
3-A	$126.53	4'/0
4-A	$286.67	36'/3
1-B	$65.62	32'/2
1-C	$74.75	32'/2
1-D	$77.61	28'/2

96th Street Storm Drain — EKA3182
Station 139+60 to Station 207+75 — 7/18/91
Probable Construction Costs — CEA
Summary

Alternative	Unit Construction Cost	Number of Roadway Lanes
1-A	$9.38	3
2-A	$66.09	3
3-A	$81.07	3
4-A	$160.50	3

96th Street Storm Drain — EKA3182
Station 61+60 to Station 207+75 — 7/18/91
Probable Operation & Maintenance Costs — CEA
Summary

Alternative	Annual O&M Costs
1-A	$8,520.00
2-A	$3,120.00
3-A	$6,816.00
4-A	$2,000.00
1-B	$5,904.00
1-C	$6,528.00
1-D	$6,528.00

H 2(

Arizona Canal Outfall Channel — EKA3182
Station 99+00 to Station 132+00, — 7/18/91
ADOT Stations — CEA

Summary of Probable Construction Costs

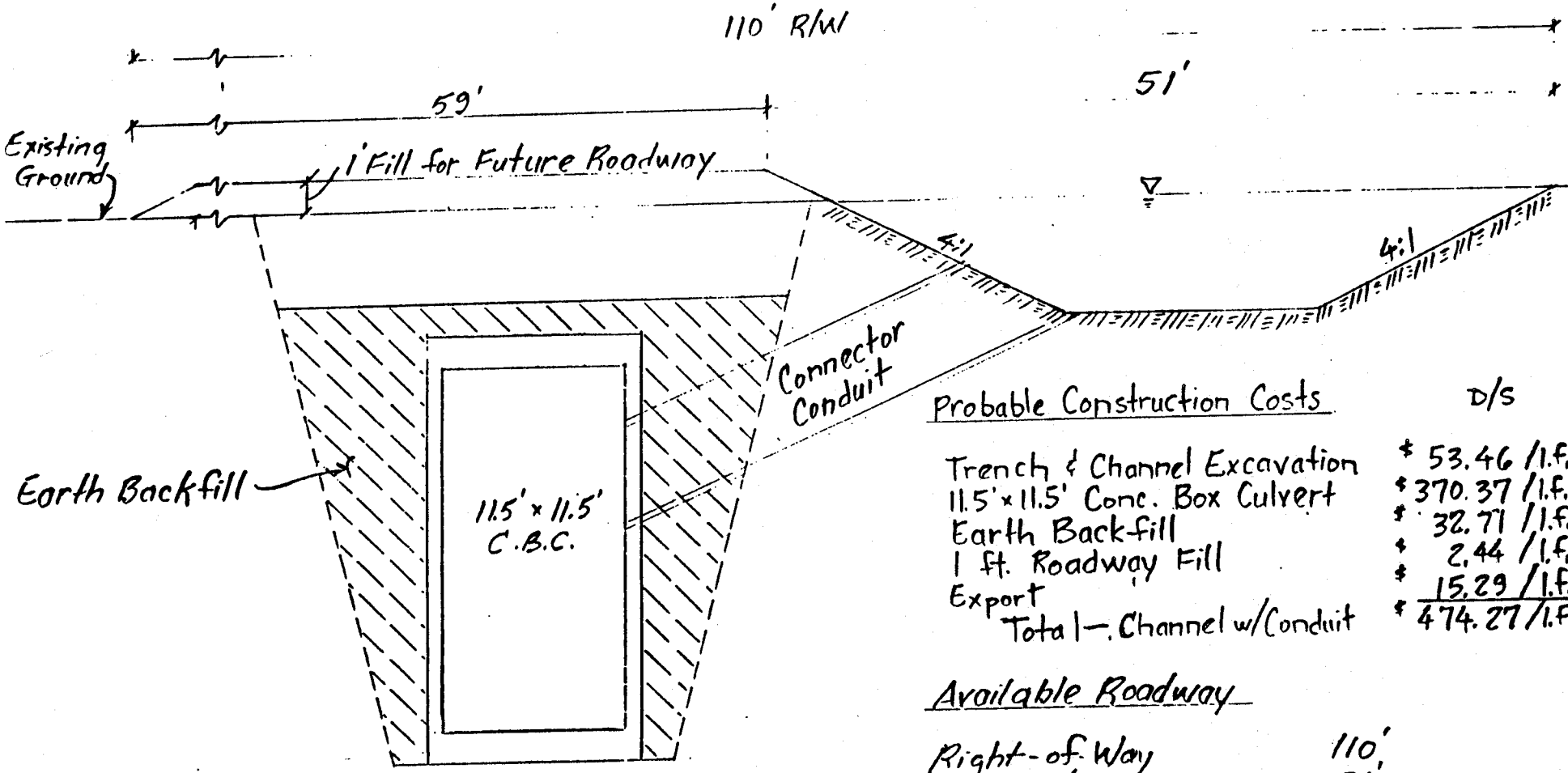
Alternative	Unit Construction Cost	Number of Roadway Lanes
1	$355.87	n/a
1(Option)	$363.05	n/a
2	$442.95	n/a

* Note: 1(Option) includes additional fill in the existing floodplain.

Arizona Canal Outfall Channel — EKA3182
Station 99+00 to Station 132+00, — 7/18/91
ADOT Stations — CEA

Summary of Probable O & M Costs (Channel Only)

Alternative	Annual O&M Costs
1	$5,616.00
1(Option)	$5,616.00
2	$5,616.00



Alternative 1 – Earth Channel
no scale

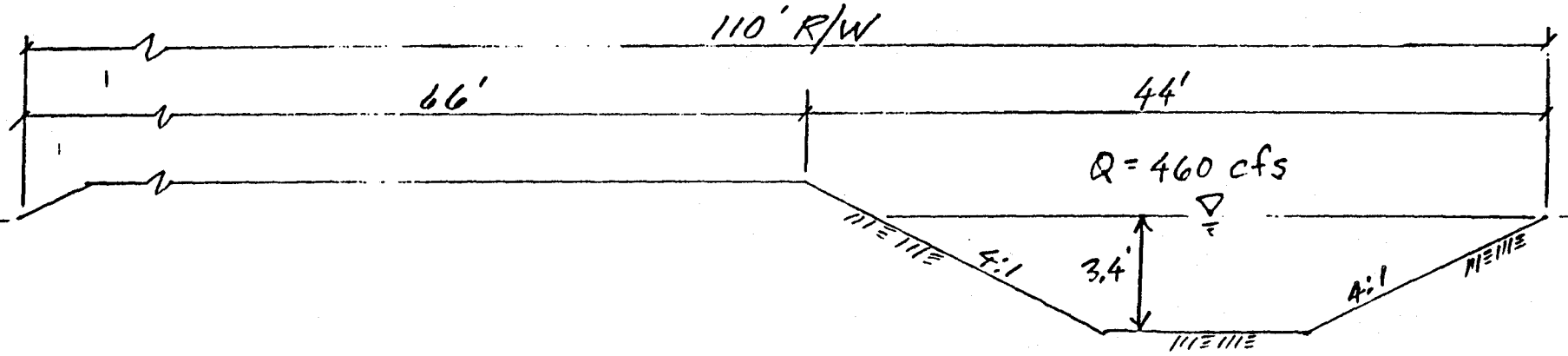
Probable Construction Costs	D/S	U/S
Trench & Channel Excavation	$ 53.46 /l.f.	8.59
11.5' x 11.5' Conc. Box Culvert	$ 370.37 /l.f.	—
Earth Backfill	$ 32.71 /l.f.	—
1 ft. Roadway Fill	$ 2.44 /l.f.	1.37
Export	$ 15.29 /l.f.	—
Total – Channel w/Conduit	$ 474.27 /l.f.	$9.96

Available Roadway

Right-of-Way	110'	
-Channel	-51'	
	59'	
-Shoulders (2x6')	-12'	
	47'	
-Existing Power Poles	-17'	
	30'	-- 2 Lanes
+ Relocate Power Poles	+15'	
	45'	-- 3 Lanes

Annual Maintenance for

7182.2 SRP-MIC 96th St. S.D. 6-7-9



Probable Construction Costs

Channel Excavation	$ 8.14 /L.F.
1' Roadway Fill	$ 1.24 /L.F.
	$ 9.38 /L.F

Alternative 1-A -- Earth Channel
Station 139+60 to 207+75

Available Roadway

Right-of-Way	110'	
- Channel	-44'	
	66'	
- Shoulders (2 @ 6')	-12'	
	54'	
- Existing Power Poles	-17'	
	37'	- 3 Lanes
+ Relocate Power Poles	+15'	
	52'	- 4 Lanes

Station 139+60 ≡ 1/4 mile south of Via de Ventura

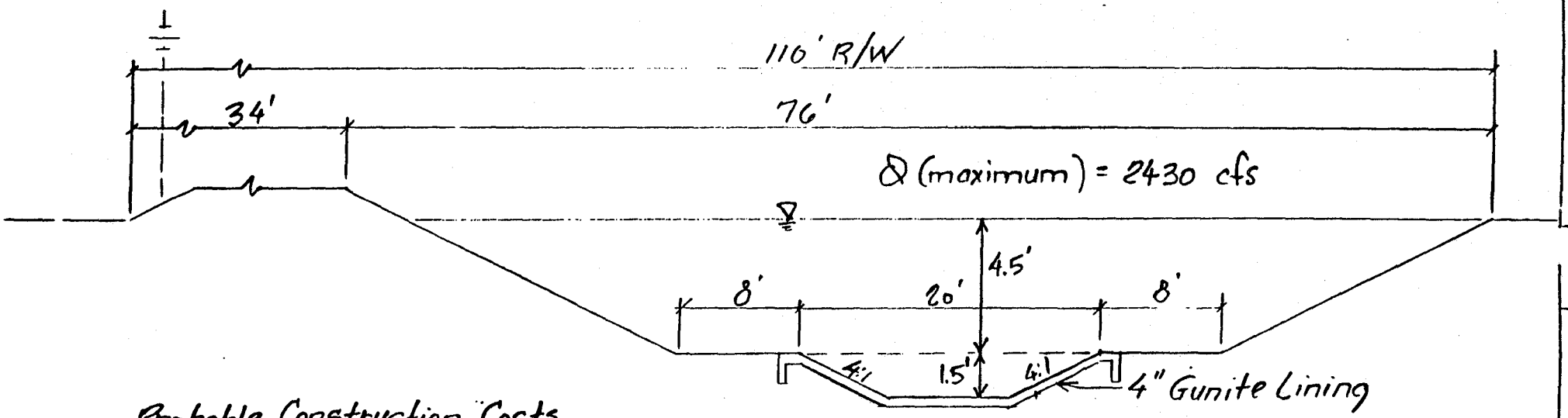
Station 207+75 ≡ Doubletree Ranch Road

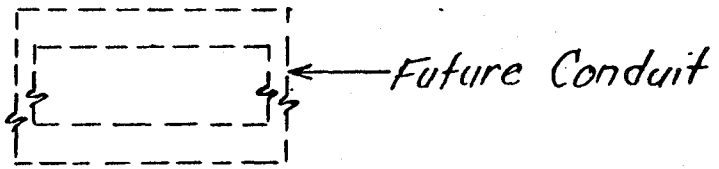
SRP-MIC

9th Street S.D.

6-25-91

H 2:





Probable Construction Costs

Channel Excavation	$ 25.06/l.f.
4" Gunite Lining	$ 48.00/l.f.
1' Roadway Fill	$ 0.56/l.f.
	$ 73.62/l.f.

Available Roadway

Right-of-Way	110'
-Channel	-76'
	34'
-Existing Power Poles	-17'
	17'
+Relocated Power Poles	+15'
	32'

Alternative 1-B, Earth Channel w/Low Flow Gunite Channel

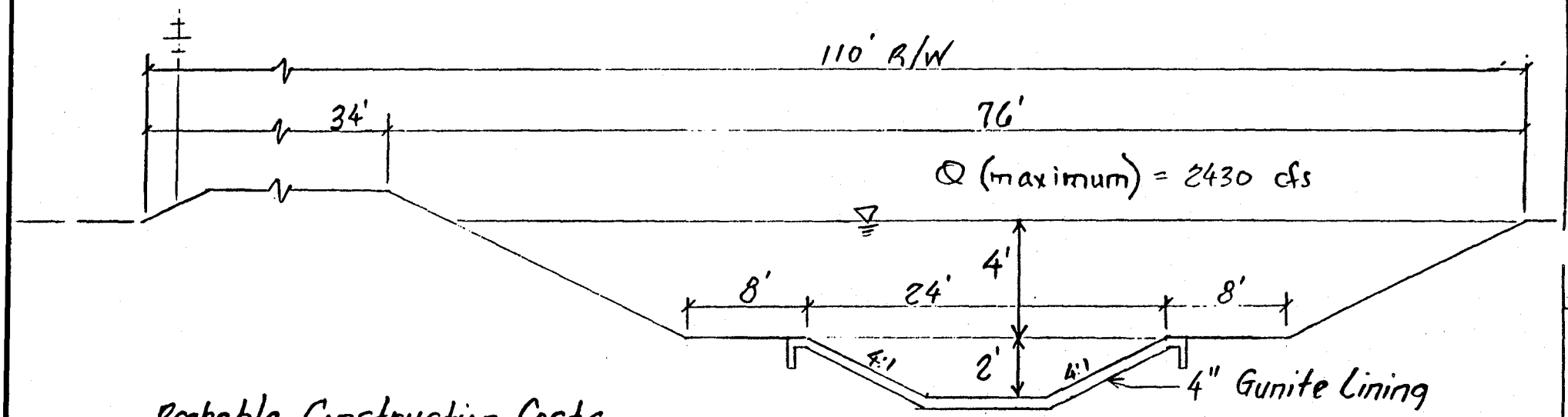
Sta. 61+60 to Sta. 139+60

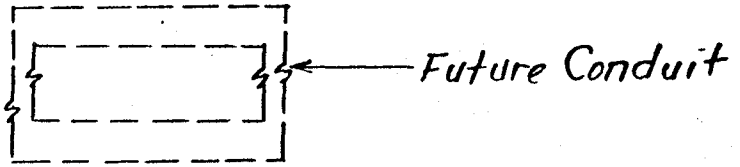
Sta. 61+60 ≡ Arizona Canal, north R/W

Sta. 139+60 ≡ 1/4 mile south of Via de Ventura

3182.2 SRP-MIC 96TH STREET S.D. 7-25-91

H 24





Probable Construction Costs

Channel Excavation	$ 25.19 /l.f.
4" Gunite Lining	$ 57.00 /l.f.
1' Roadway Fill	$ 0.56 /l.f.
	$ 82.75 /l.f.

Available Roadway

Right-of-Way	110'
-Channel	-76'
	34'
-Existing Power Poles	-17'
	17'
+Relocated Power Poles	+15'
	32'

Alternative 1-C, Earth Channel w/Low Flow Gunite Channel

Sta. 61+60 to Sta. 139+60

Sta. 61+60 = Arizona Canal, north R/W

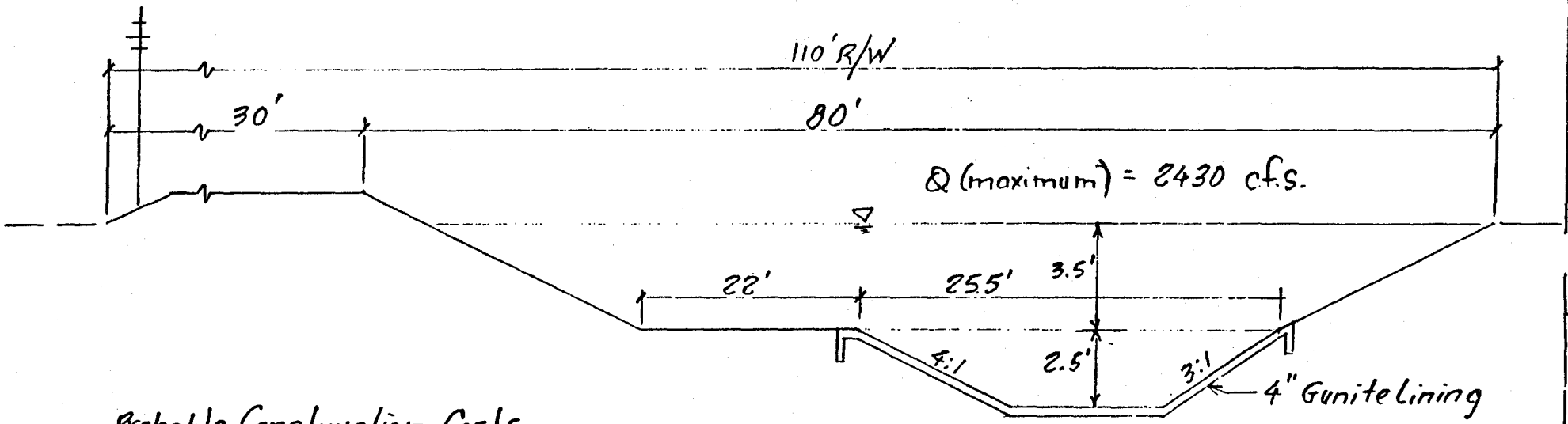
Sta. 139+60 = 1/4 mile south of Via de Ventura

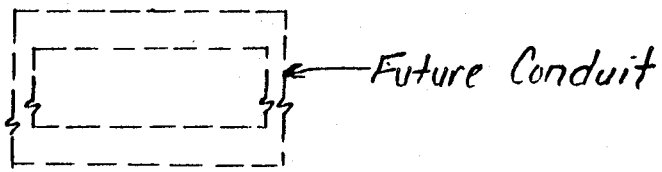
3182.2'. SRP-M/C

96TH STREET S.D.

725-91/C

14 25





Probable Construction Costs

Channel Excavation	$ 24.62/L.F
4" Gunite Lining	$ 60.43/L.F
1' Roadway Fill	$ 0.56/L.F
	$ 85.61/L.F.

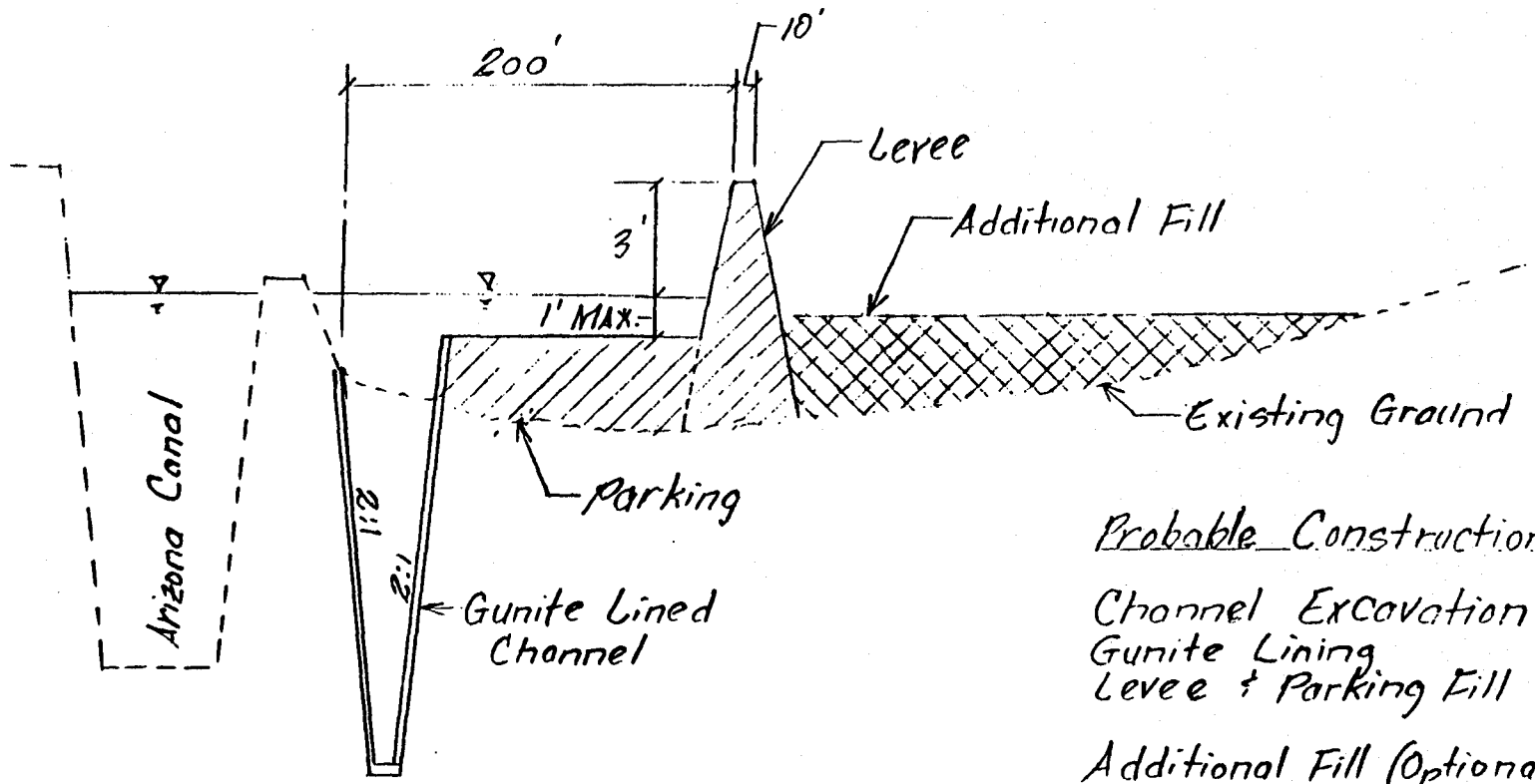
Available Roadway

Right-of-Way	110'
-Channel	-80'
	30'
-Existing Power Poles	-17'
	13'
+Relocated Power Poles	+15'
	28'

Alternative 1-D, Earth Channel W/Low Flow Gunite Channel
Sta 61+60 to Sta 139+60

Sta 61+60 = Arizona Canal, north R/W

Sta 139+60 = 1/4 mile south of Via de Ventura



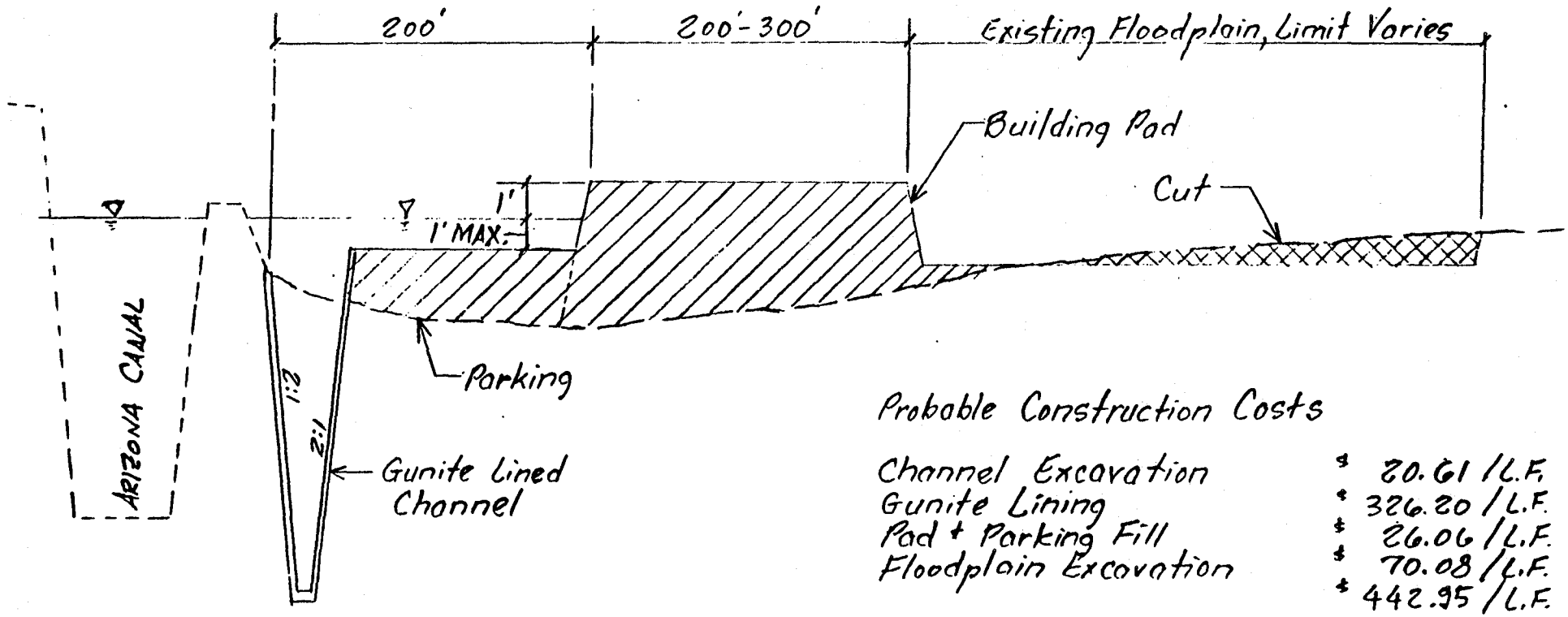
Probable Construction Costs

Channel Excavation	$ 20.61 /L.F.
Gunite Lining	$ 326.20 /L.F.
Levee & Parking Fill	$ 9.06 /L.F.
	$ 355.87 /L.F.
Additional Fill (Optional)	$ 7.18 /L.F.
	$ 363.05 /L.F.

Arizona Canal Outfall Channel & Floodplain Fill
Alternative 1 -- 10' Levee, 3' Above 100-year Flood
96th Street to Pima Freeway

3182.2. SRP-MIC AZ. CANAL OUTFALL CHANNEL 7-25-91/C

H27



Probable Construction Costs

Channel Excavation	$ 20.61 /L.F.
Gunite Lining	$ 326.20 /L.F.
Pad + Parking Fill	$ 26.06 /L.F.
Floodplain Excavation	$ 70.08 /L.F.
	$ 442.95 /L.F.

Arizona Canal Outfall Channel + Floodplain Fill
Alternative 2-- 200' to 300' Building Pad, 1' Above 100-year Flood
96th Street to Pima Freeway

3182.2. CRP. MIC AZ. CANAL OUTFALL CHANNEL 7-25-91

H 2 E

96th Street Storm Drain Channel and Arizona Canal Outfall Channel
Estimated Channel Maintenance Costs

EKA31B2
7/18/91
CEA

	Alternative 1-B Downstream Channel	Alternative 1-C Downstream Channel	Alternative 1-D Downstream Channel	Alternatives 1 & 2 Outfall Channel
P1 = Earth Channel Wetted Perimeter	53.0 l.f.	49.0 l.f.	50.9 l.f.	n/a
A1 = Area of Wetted Perimeter = P1/9	5.89 s.y.	5.44 s.y.	5.66 s.y.	n/a
AG' = Area Graded Each Day	25000 s.y./day	25000 s.y./day	25000 s.y./day	n/a
AGL = LF Graded Each Day = AG'/A1	4245 l.f./day	4592 l.f./day	4420 l.f./day	n/a
L1 = Length of Channel 1	7800 l.f.	7800 l.f.	7800 l.f.	n/a
T1' = Days to Grade Channel 1 = L1/AGL	1.84 days	1.70 days	1.76 days	n/a
AG" = Area Repaired Each Day	n/a	n/a	n/a	n/a
LF" = L.F. Repaired per Day = AG"/P1	n/a	n/a	n/a	n/a
T1" = Days to Repair Reach	n/a	n/a	n/a	n/a
P2 = Gunite Channel Wetted Perimeter	20.4 l.f.	24.5 l.f.	26.2 l.f.	45.8 l.f.
A2 = Area of Wetted Perimeter = P2/9	2.27 s.y.	2.72 s.y.	2.91 s.y.	5.09 s.y.
AG = Area Graded Each Day	n/a	n/a	n/a	n/a
AGL = LF Graded Each Day = AG/A2	n/a	n/a	n/a	n/a
L2 = Length of Channel 2	7800 l.f.	7800 l.f.	7800 l.f.	7800 l.f.
T2' = Days to Grade Channel 2 = L2/AGL	n/a	n/a	n/a	n/a
AG" = Area Repaired Each Day	40000 s.f./day	40000 s.f./day	40000 s.f./day	40000 s.f./day
LF" = L.F. Repaired per Day = AG"/P1	1960.78 l.f./day	1632.65 l.f./day	1526.72 l.f./day	873.36 l.f./day
T2" = Days to Repair Reach	3.98 days	4.78 days	5.11 days	8.93 days
TGr = Total Days to Grade Channel = T1'+T2'	1.84 days	1.70 days	1.76 days	n/a
TRe = Total Days to Repair Channel = T1"+T2"	3.98 days	4.78 days	5.11 days	8.93 days
T' = Number of Days to Grade = TGr+.xx	2.00 days	2.00 days	2.00 days	n/a
T" = Number of Days to Repair = TRe+.yy	4.00 days	5.00 days	5.00 days	9.00 days
Gr = Cost of Grader per Day	$400.00 /day	$400.00 /day	$400.00 /day	n/a
Op = Cost of Equipment Operator per Day	$168.00 /day	$168.00 /day	$168.00 /day	n/a
Ch = Cost of Grading per Day = Gr+Op	$568.00 /day	$568.00 /day	$568.00 /day	n/a
C1 = Total Cost of Grading 2 Times/Year = 3xT'xCh	$3,408.00 /year	$3,408.00 /year	$3,408.00 /year	n/a
Mas = Cost of Mason per Day	$160.00 /day	$160.00 /day	$160.00 /day	$160.00 /day
Hlp = Cost of Helper per Day	$112.00 /day	$112.00 /day	$112.00 /day	$112.00 /day
Mat = Cost of Materials per Day	$40.00 /day	$40.00 /day	$40.00 /day	$40.00 /day
Gun = Cost of Repairs per Day = Mas+Hlp+Mat	$312.00 /day	$312.00 /day	$312.00 /day	$312.00 /day
C2 = Total Cost to Repair 2 Times/Year = GunxT"x2	$2,496.00 /year	$3,120.00 /year	$3,120.00 /year	$5,616.00 /year
	$5,904.00 /year	$6,528.00 /year	$6,528.00 /year	$5,616.00 /year

PF

EVANS, KUHN & ASSOCIATES, INC.

GEORGE L. EVANS, P.E.
JOHN D. KUHN, JR., P.E.

CONSULTING ENGINEERS
727 East Bethany Home Road, Suite D-225
Phoenix, Arizona 85014
(602) 241-0782
FAX NUMBER (602) 248-9158

November 14, 1991

Ms. Nona Baheshone
Salt River Pima-Maricopa Indian Community
10005 East Osborn Road
Scottsdale, Arizona 85256

Re: 96th Street Storm Drain
and Outfall Channel
EKA #3182.2

Dear Ms. Baheshone:

Attached herewith is an updated summary of the probable project costs for the 96th Street Storm Drain and Outfall Channel. This update incorporates more specific information based on the design work done since our last correspondence in July.

Our conclusions remain the same. It is our opinion that the underground conduit should be constructed in 96th Street as originally conceived during the Pima Freeway right-of-way negotiations. The probable project cost is $6,471,662. If an interim channel is constructed now, the total project cost would be $7,053,211. Constructing the interim channel will increase the cost approximately $581,549 and will exceed the Community budget of $6.4 million.

We will anxiously await your determination of the chosen alternative and proceed accordingly.

If you have any questions or wish to discuss this matter further, please call us.

Very truly yours,

EVANS, KUHN & ASSOCIATES, INC.

Bruce J. Friedhoff

Bruce J. Friedhoff, P.E.
Project Manager

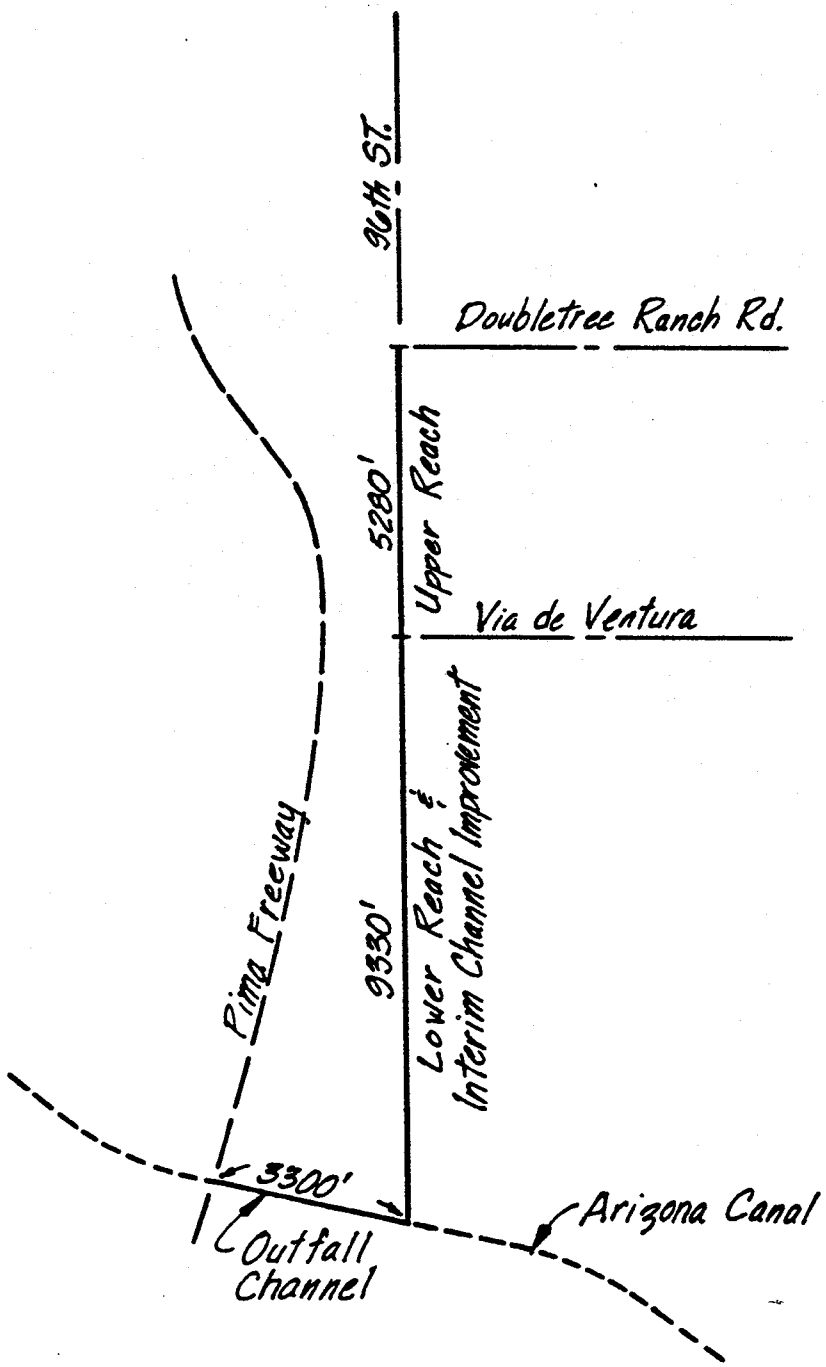
Attachments

31822PC1.111/ADMIN2/kyd

H30

SALT RIVER PIMA - MARICOPA INDIAN COMMUNITY

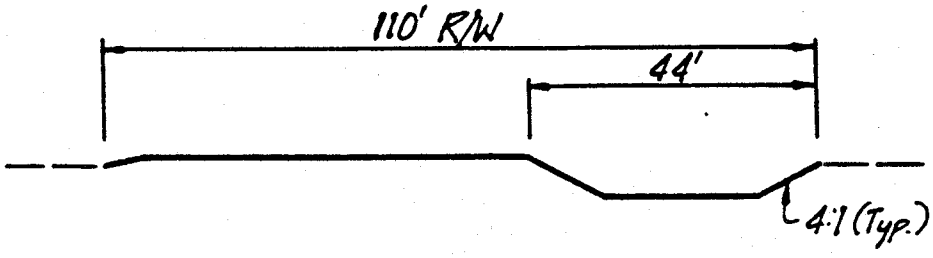
96TH STREET STORM DRAIN AND OUTFALL CHANNEL



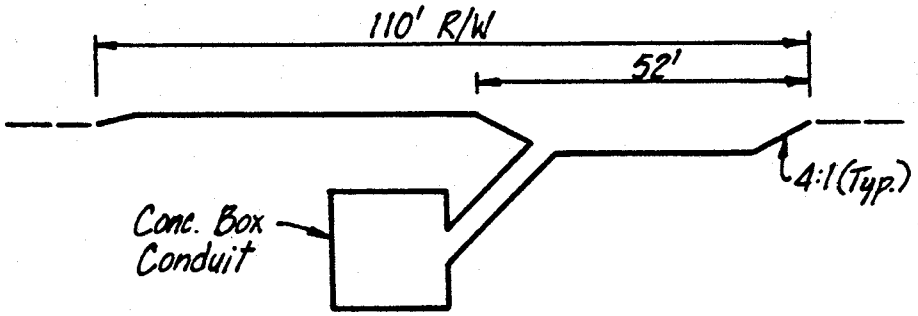
96th Street Storm Drain
and
Arizona Canal Outfall Channel

SALT RIVER PIMA - MARICOPA INDIAN COMMUNITY

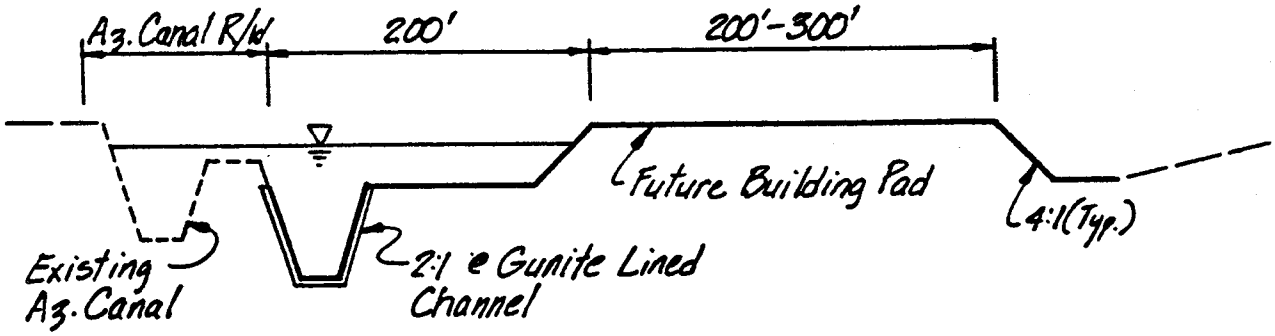
96TH STREET STORM DRAIN AND OUTFALL CHANNEL
TYPICAL SECTIONS



Upper Reach



Lower Reach

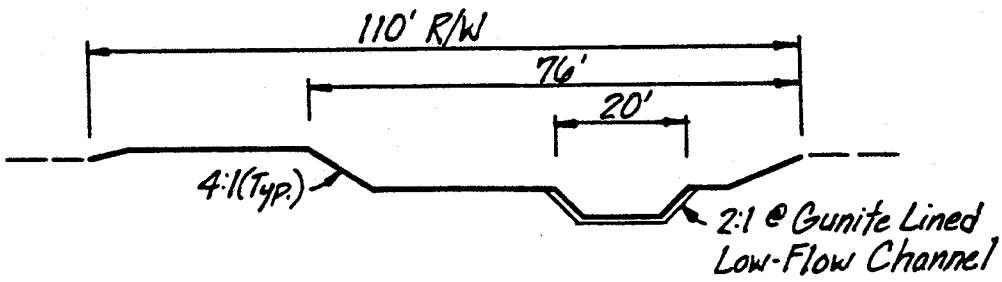


Outfall Channel

SALT RIVER PIMA - MARICOPA INDIAN COMMUNITY

96TH STREET STORM DRAIN AND OUTFALL CHANNEL

TYPICAL SECTION



Interim Channel

SALT RIVER PIMA - MARICOPA INDIAN COMMUNITY

96TH STREET STORM DRAIN AND OUTFALL CHANNEL
COST WITHOUT INTERIM CHANNEL
NOVEMBER 14, 1991

Upper Reach			
Earth Channel		$42,553	
Roadway Embankment		$6,532	$49,084
Lower Reach			
Earth Channel		$103,667	
Roadway Embankment		$10,367	
Conduit		$4,238,755	
Structures		$211,938	$4,564,726
Outfall Channel			
Earth Channel		$166,222	
Embankment		$69,422	
Gunite Lining		$579,329	$814,973
Total Construction Cost			$5,428,784
Contingency	10.00%		$542,878
Engineering and Administration Costs			$500,000
Total Project Cost			$6,471,662
Right-of-Way Requirement			6.82 acres
Operation and Maintenance			$8,485 per year

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SALT RIVER PIMA - MARICOPA INDIAN COMMUNITY

96TH STREET STORM DRAIN AND OUTFALL CHANNEL
COST WITH INTERIM CHANNEL
NOVEMBER 14, 1991

Upper Reach			
Earth Channel		$42,553	
Roadway Embankment		$6,532	$49,084
Lower Reach			
Fill Interim Channel		$24,880	
Roadway Embankment		$3,801	
Conduit		$4,238,755	
Structures		$211,938	$4,479,374
Interim Channel			
Earth Channel		$228,067	
Roadway Embankment		$5,874	
Gunite Lining		$380,091	$614,033
Outfall Channel			
Earth Channel		$166,222	
Embankment		$69,422	
Gunite Lining		$579,329	$814,973
Total Construction Cost			$5,957,464
Contingency	10.00%		$595,746
Engineering and Administration Costs			$500,000
Total Project Cost			$7,053,211
Right-of-Way Requirement			6.82 acres
Operation and Maintenance			$8,485 per year

proj

EVANS, KUHN & ASSOCIATES, INC.

GEORGE L. EVANS, P.E.
JOHN D. KUHN, JR., P.E.

CONSULTING ENGINEERS
727 East Bethany Home Road, Suite D-225
Phoenix, Arizona 85014
(602) 241-0782
FAX NUMBER (602) 248-9158

January 7, 1992

Ms. Nona Baheshone
Salt River Pima-Maricopa Indian Community
10005 East Osborn Road
Scottsdale, Arizona 85256

Re: 96th Street Storm Drain
Value Engineering Work Session #1
EKA #3182.2

Dear Ms. Baheshone:

A work session was conducted at 9:a.m. in this office on January 6, 1992, for the purpose of continuing discussion on the contracting process to be used for the 96th Street Storm Drain and to begin the value engineering process. Salt River Sand & Rock was not able to attend this meeting.

The following items were discussed:

ACTION	ITEMS
EKA	1. Preliminary construction plans were finished and distributed to the Community and SRS&R on December 27, 1991. Preliminary specifications and cost estimates are approximately 10 percent complete and will be finished next Monday.
EKA	2. The partnering agreement is still being reviewed by team members. Further discussions will take place following value engineering plan review.
EKA	3. Value engineering plan review will be deferred to next Monday when SRS&R can participate.
EKA	4. The Community would like EKA to obtain 3 proposals for geotechnical and structural engineering services for consideration by the Community. These services are required for construction of the storm drain and are included in the project budget.
EKA	5. Soil borings will need to be located on a map in order to obtain permits from allotment owners.

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SRP-MIC	6.	Land appraisals are due in from BIA in approximately 3 weeks. Right-of-way acquisition constitutes a significant federal action and may require an environmental assessment for the outfall channel between the Pima Freeway and 96th Street. BIA approval for the construction contract may also be required.
SRP-MIC/ EKA	7.	Contractor documents should be based on the standard "638" construction contract modified to fit the special requirements of the Community.
SRP-MIC	8.	The excess earthwork (spoil) is estimated to be approximately 150,000 cu. yds. ADOT has tentatively agreed to accept this material in the Pima Freeway. There may also be a possibility that ADOT will pay for a portion of the cost of transporting this material from 96th Street to the freeway. ADOT is reportedly planning to pay $3.50/cu. yd. for import material from SRS&R.
EKA	9.	The Community objects to ADOT's change in drainage design of the outfall channel which proposes to block the flow of water and restrict development of upstream allotments. While ADOT has agreed to re-study the design, the Community is concerned that the original intent agreed to during right-of-way negotiations remain intact.
INFO	10.	Value engineering review will continue next Monday at 9:00 a.m. at EKA.

Please inform me if your meeting notes differ from those herein or call me concerning any questions you may have.

Very truly yours,

EVANS, KUHN & ASSOCIATES, INC.

Bruce J. Friedhoff

Bruce J. Friedhoff, P.E.
Project Manager

Distribution: Mr. Earl Pearson, SRP-MIC
Ms. Nona Baheshone, SRP-MIC
Mr. Richard Wilks, Shea & Wilks
Mr. Jim Carmichael, Phoenix Cement Co.
Mr. Dennis Wilcox, SRS&R
Mr. Wayne Hills, SRS&R

31822PC1.201/ADMIN2/kyd

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EVANS, KUHN & ASSOCIATES, INC.

GEORGE L. EVANS, P.E.
JOHN D. KUHN, JR., P.E.

CONSULTING ENGINEERS
727 East Bethany Home Road, Suite D-225
Phoenix, Arizona 85014
(602) 241-0782
FAX NUMBER (602) 248-9158

January 8, 1992

Mr. Wayne Hill
Salt River Sand & Rock
P.O. Box 728
Mesa, Arizona 85211-0728

Re: 96th Street Storm Drain
Cast-In-Place Concrete Pipe (CIP) Alternative
EKA #3182

Dear Mr. Hill:

As we discussed in our meeting yesterday, we took another look at the possibility of using CIP in place of the proposed concrete box conduit (CBC).

Attached herewith is the result of our optimization analysis for CIP performed in the same manner as for the CBC. It is our opinion that the CIP may cost $590,000 more than the CBC and would require a large amount of right-of-way.

Please review and see if you concur so that we can discuss at next week's meeting. Call me if you have any questions.

Very truly yours,

EVANS, KUHN & ASSOCIATES, INC.

Bruce J. Friedhoff

Bruce J. Friedhoff, P.E.
Project Manager

Attachment

cc: Ms. Nona Baheshone - SRP-MIC

3182PC1.201/ADMIN2/kyd

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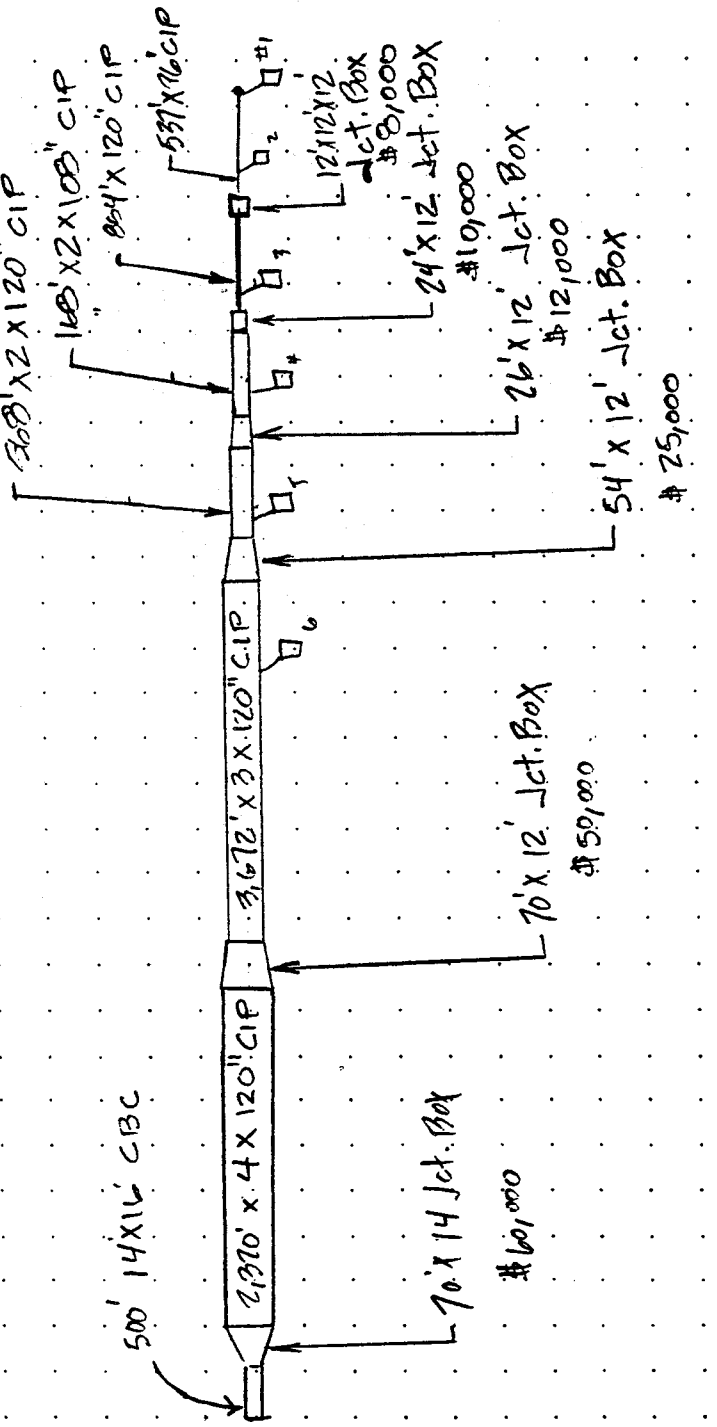
EVANS KUHN AND ASSOCIATES, INC.

TITLE: 96th street
JOB NO.: 3182
SUBJECT: CIP Alternative
DATE: 1/7/92
TASK:
BY: BJF



Cost for CIP

CIP	$4,625,000
Jct. Box	165,000
Total	$4,790,000
CBC Cost	- 4,200,000
Additional Cost For CIP	$590,000

N

Plan View

Checked By : ——

Page 1 of 1

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EVANS, KUHN & ASSOCIATES, INC.

GEORGE L. EVANS, P.E.
JOHN D. KUHN, JR., P.E.

CONSULTING ENGINEERS
727 East Bethany Home Road, Suite D-225
Phoenix, Arizona 85014
(602) 241-0782
FAX NUMBER (602) 248-9158

January 15, 1992

Ms. Nona Baheshone
Salt River Pima-Maricopa Indian Community
10005 East Osborn Road
Scottsdale, Arizona 85256

Re: 96th Street Storm Drain
Value Engineering Work Session #2
EKA #3182.2

Dear Ms. Baheshone:

A work session was conducted at 9:a.m. in this office on January 13, 1992, for the purpose of discussing design/construction options for the 96th Street Storm Drain.

The following items were discussed:

ACTION	ITEMS
EKA/SRS&R	1. Preliminary cost estimate is complete. Engineer's estimate is approximately $5.3 million. Contractor estimate is approximately $4.0 million plus the outlet structure.
EKA	2. Draft technical specifications are being typed and will be ready for distribution next week.
EKA	3. Seven engineering consultants have been contacted to submit proposals for structural and geotechnical design next Friday, January 17, 1992. Structural design for cast-in-place pipe is included in the scope of work.
EKA	4. Soil boring locations will be prepared this week and submitted to the Community with the proposals on Friday.
INFO	5. Clarification: <u>All</u> right-of-way acquisition constitutes a federal action and may require an environmental <u>review</u>.
EKA	6. The standard "638" general condition documents were furnished. Draft general conditions will be ready for review in two weeks for the next meeting.

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EKA 7. ADOT has started re-design of the drainage outfall with the constraint that the proposed improvements should not block the flow of water or restrict development of upstream allotments.

SRS&R 8. ADOT will not pay for "dirt". ADOT is willing to pay for transportation. Continue discussions with Mr. Chuck Cowan, Director, ADOT.

EKA 9. The cast-in-place pipe alternative will require 4 - 120" diameter conduits and could reduce the cost. The savings is in not having to purchase $1.4 million worth of reinforcing steel. The existing power lines conflict with the CIP alternative and would need to be relocated. Because the Community is now considering acquisition of a drainage easement it may be possible to shift the location of the storm drain facilities 25 to 50 feet east. This alternative would have several advantages:

a. There would be no conflict with the existing power line.

b. There would be enough width for a 5 lane roadway to be constructed in its ultimate location without having to relocate inlets. Future costs would be reduced.

c. The drainage channel would be constructed in its ultimate location. Future costs would be reduced.

d. The number of property owners affected by the drainage easement would be reduced.

Evaluate for the next meeting.

EKA 10. The 16' x 14' outlet structure was selected for sediment storage and removal. If a large 2 cu. yd. "Bobcat" were used, the outlet could possibly be reduced in size. Evaluate using an equipment height of 8 feet.

EKA 11. Evaluate storm drain using double boxes at the downstream end and CIP at the upstream end.

SRP-MIC 12. A 25 percent progress payment retention may be acceptable in-place-of a contractor bond (1 1/2% of contract price).

EKA 13. The Community plans to extend a bridge crossing over the Arizona Canal and floodway. Discussions with BIA indicate that it would be good to acquire the right-of-way for the bridge crossing at this time. Revise right-of-way requirements to include 25'-50' shift and bridge crossing.

EKA 14. Replace gunite around inlets with loose rock rip-rap and filter fabric. Using rock rip-rap on the outfall channel increases the friction value and will require an additional 70' of right-of-way and $118,000 in construction cost. Therefore do not change.

INFO 15. Following our meeting we contacted ADOT and were informed that ADOT has modified the design storm from a 24 to a 12-hour storm. This resulted in lower design flows in the outfall channel and should also decrease the design flow in 96th Street. We will re-run our hydrologic model and include the new results with our next design evaluations.

Please inform us if your notes differ from those herein or call us concerning any questions you may have. The next meeting will be at 9:00 a.m. on January 27, 1992, at Evans, Kuhn & Associates.

Very truly yours,

EVANS, KUHN & ASSOCIATES, INC.

Bruce J. Friedhoff

Bruce J. Friedhoff, P.E.
Project Manager

Distribution: Mr. Earl Pearson, SRP-MIC
Mr. Gordon Bluth, SRS&R
Mr. Richard Wilks, Shea & Wilks
Mr. James Carmichael, Phoenix Cement Co.
Mr. Vern Wilson, SRS&R
Mr. Wayne Hills, SRS&R
Mr. LaMar Thomas Sr., SRS&R
Mr. Clyde Anderson, EKA
Mr. Bruce J. Friedhoff, EKA

31822PC2.201/ADMIN2/kyd

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EVANS, KUHN & ASSOCIATES, INC.

GEORGE L. EVANS, P.E.
JOHN D. KUHN, JR., P.E.

CONSULTING ENGINEERS
727 East Bethany Home Road, Suite D-225
Phoenix, Arizona 85014
(602) 241-0782
FAX NUMBER (602) 248-9158

January 21, 1992

Ms. Nona Baheshone
Salt River Pima-Maricopa Indian Community
10005 East Osborn Road
Scottsdale, Arizona 85256

Re: 96th Street Storm Drain
Value Engineering Analysis
EKA #3182.2

Dear Ms. Baheshone:

Enclosed herewith for your review are results from our analysis of Mr. Hills' proposal to use cast-in-place pipe in lieu of the concrete box conduit.

The analysis also includes the decreased design flows proposed by ADOT, the alternative design sections suggested at last week's meeting, and the proposed right-of-way requirements for the bridge crossing.

Please call me concerning any items you may want to discuss before next Monday's meeting.

Very truly yours,

EVANS, KUHN & ASSOCIATES, INC.

Bruce J. Friedhoff

Bruce J. Friedhoff, P.E.
Project Manager

Distribution: Mr. Earl Pearson, SRP-MIC
Mr. Richard Wilks, Shea & Wilks
Mr. Wayne Hills, SRS&R
Mr. James Carmichael, Phoenix Cement Co.
Mr. Gordon Bluth, SRS&R

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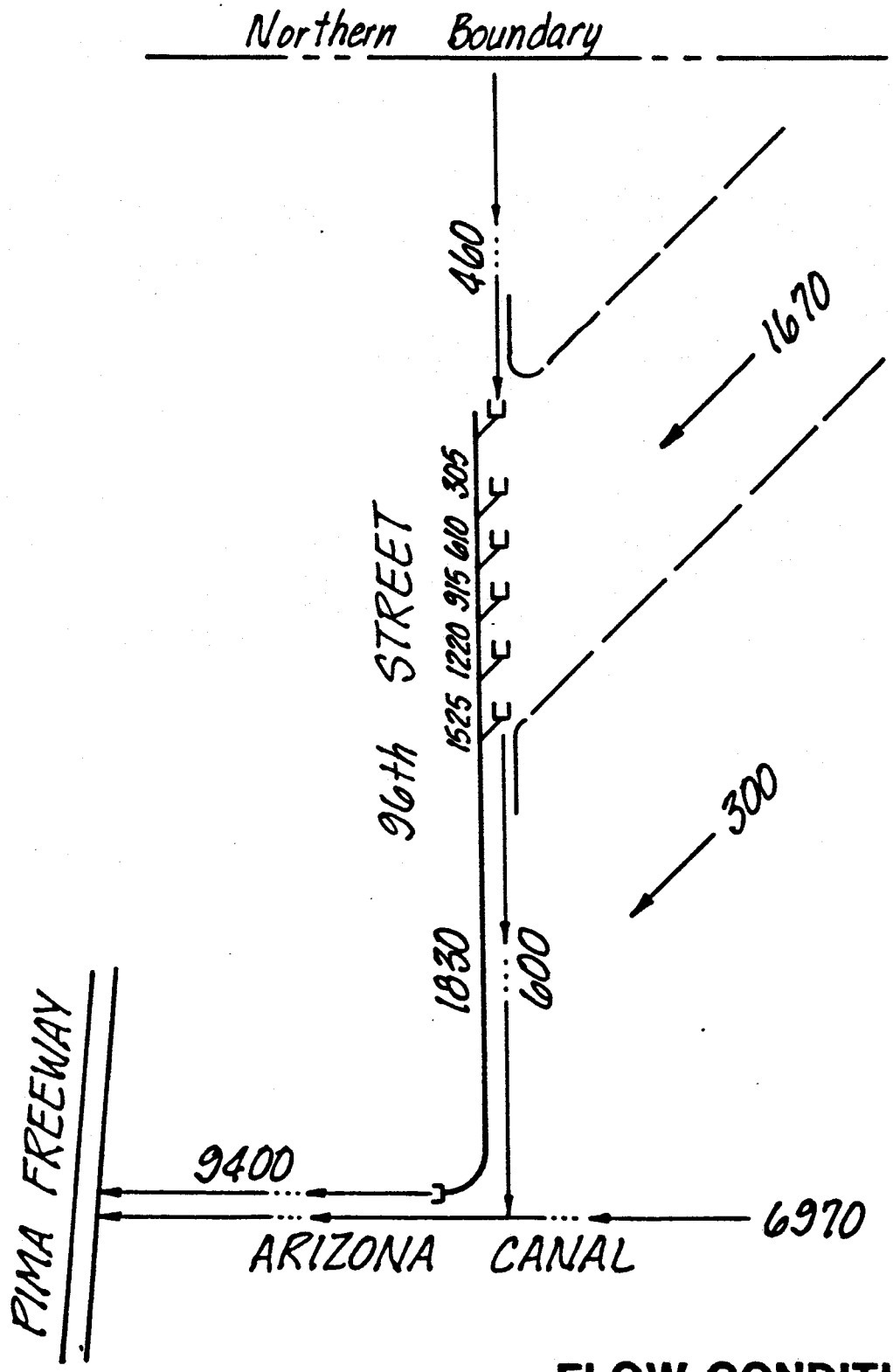
SALT RIVER PIMA - MARICOPA INDIAN COMMUNITY
96TH STREET STORM DRAIN AND OUTFALL CHANNEL
CONSTRUCTION COST COMPARISON ($MILLION)
JANUARY 22, 1992

Flow Condition	CIPP	CBC
No. 1	$4.0	$5.3
No. 2	$4.2	$4.7
No. 3	$4.6	$5.0

SALT RIVER PIMA - MARICOPA INDIAN COMMUNITY



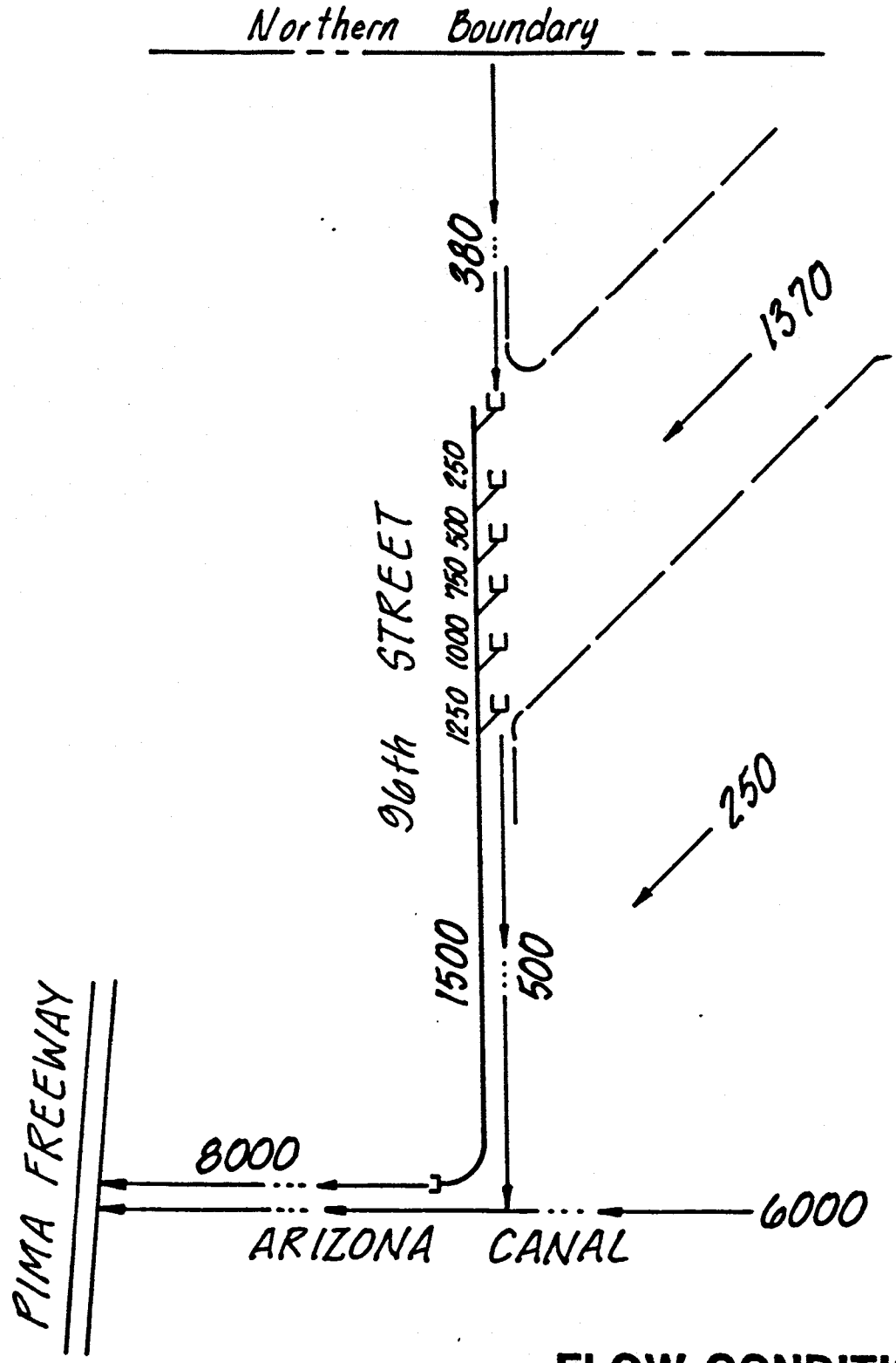
FLOW CONDITION #1

Evans, Kuhn & Associates, Inc.

100 Year Design Flows

H45

SALT RIVER PIMA - MARICOPA INDIAN COMMUNITY



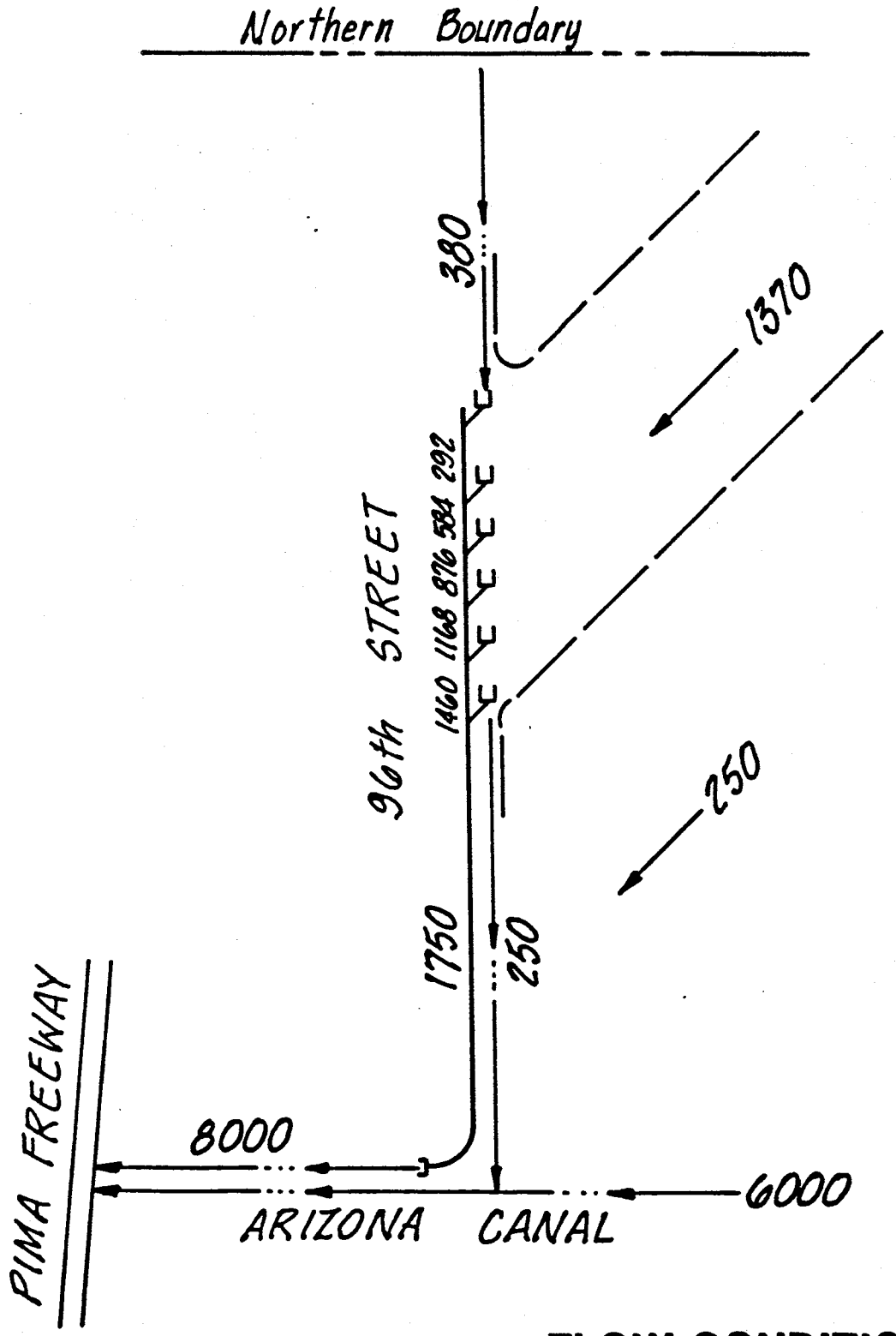
FLOW CONDITION #2

Evans, Kuhn & Associates, Inc.

100 Year Design Flows

H46

SALT RIVER PIMA - MARICOPA INDIAN COMMUNITY



FLOW CONDITION #3

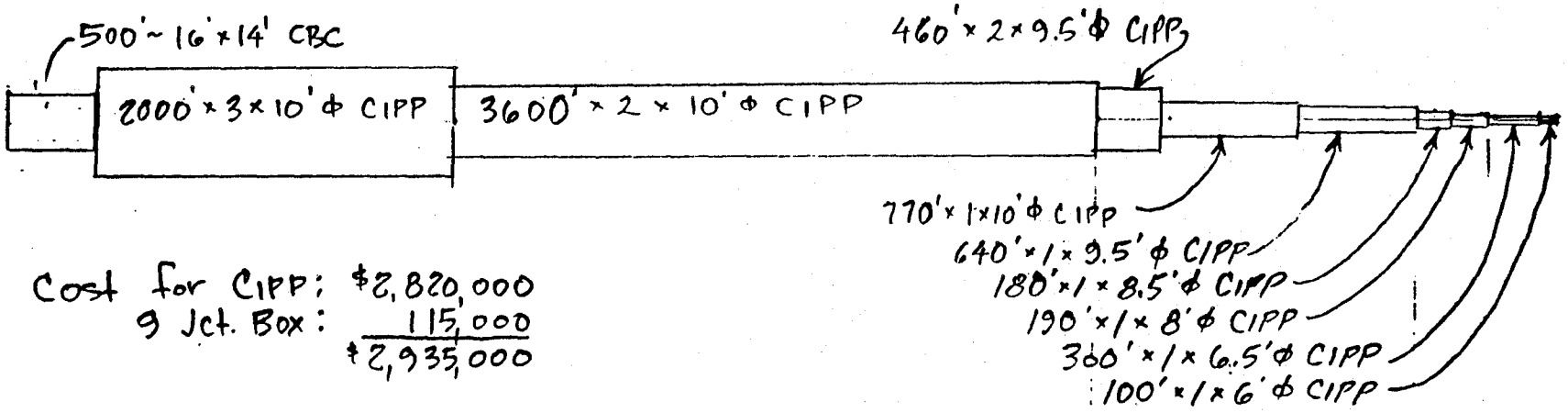
Evans, Kuhn & Associates, Inc.

100 Year Design Flows

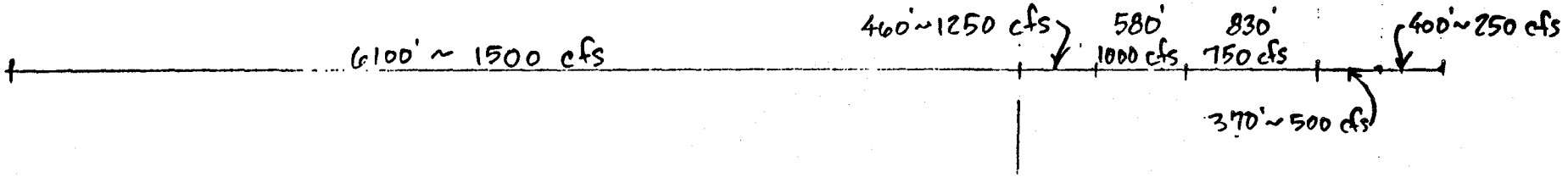
H47

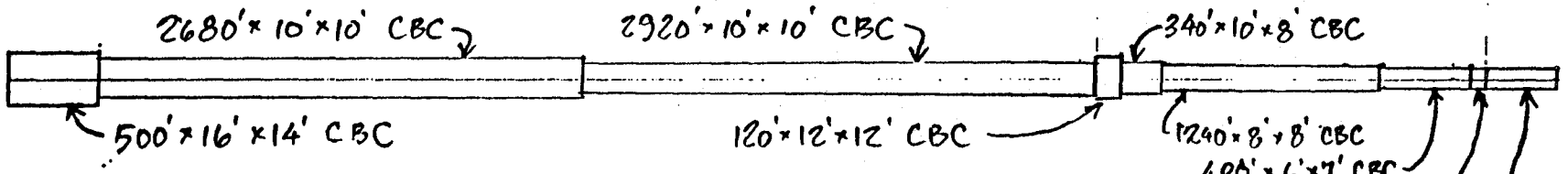
SCP-MIC

FLOW CONDITION #2



Cost for CIPP: $2,820,000
9 Jct. Box: 115,000
$2,935,000





Cost for CBC: $3,315,000
7 Jct. Box: 90,000
$3,405,000

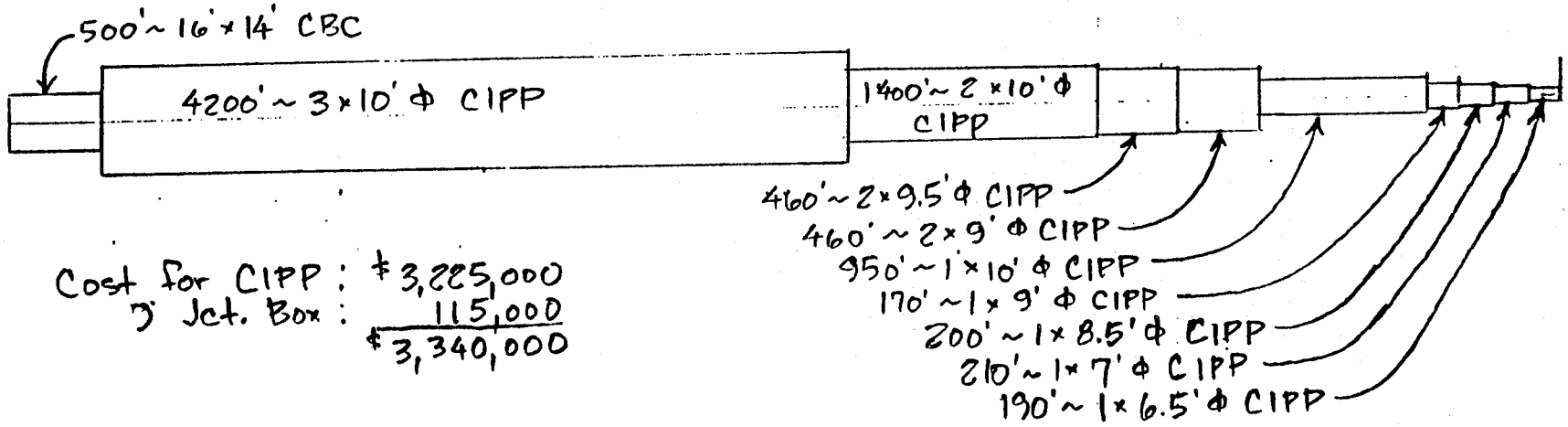
96th St. S.D. Alt.

CA/BJF 1-21-92

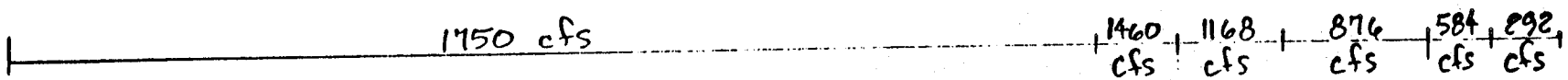
3182/E

SRP-MIC (96th St. S.D. Alt. (CA/DF 1-21-92 3182/E

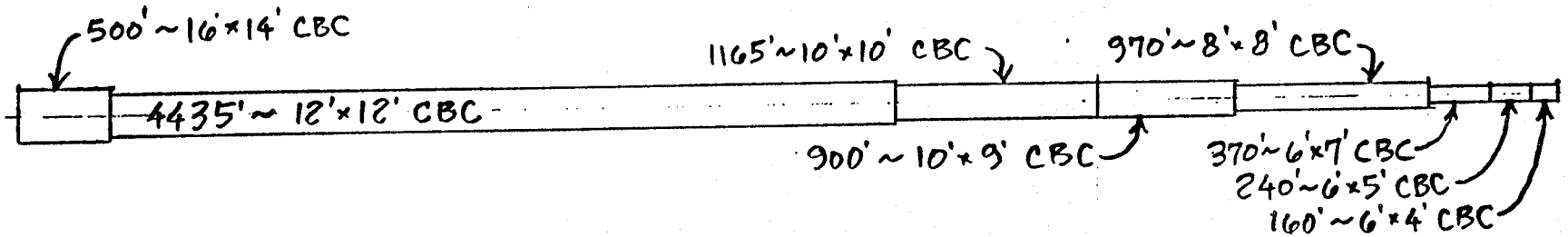
FLOW CONDITION #3



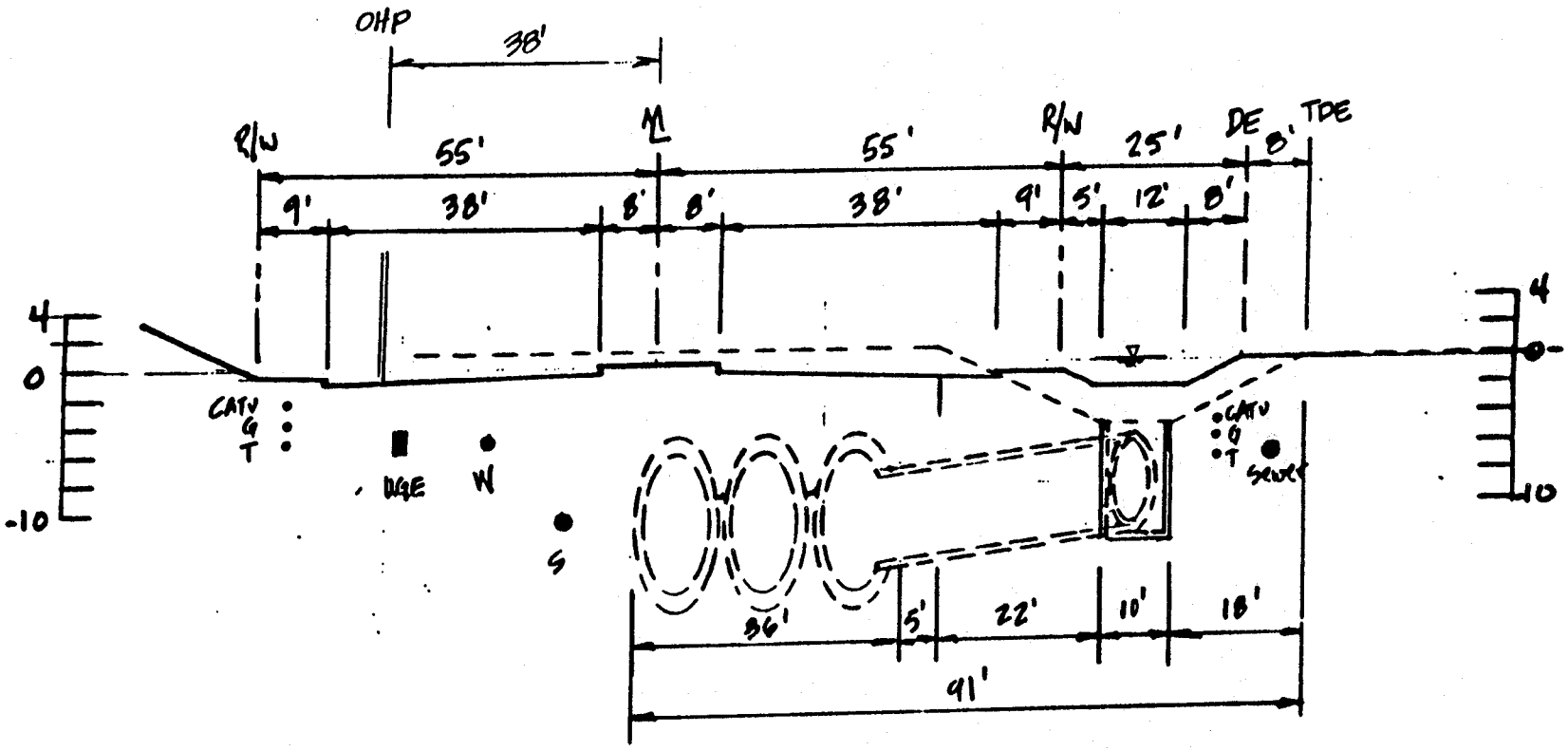
Cost for CIPP: $3,225,000
7 Jct. Box: 115,000
$3,340,000



Cost for CBC: $3,585,000
7 Jct. Box: 90,000
$3,675,000



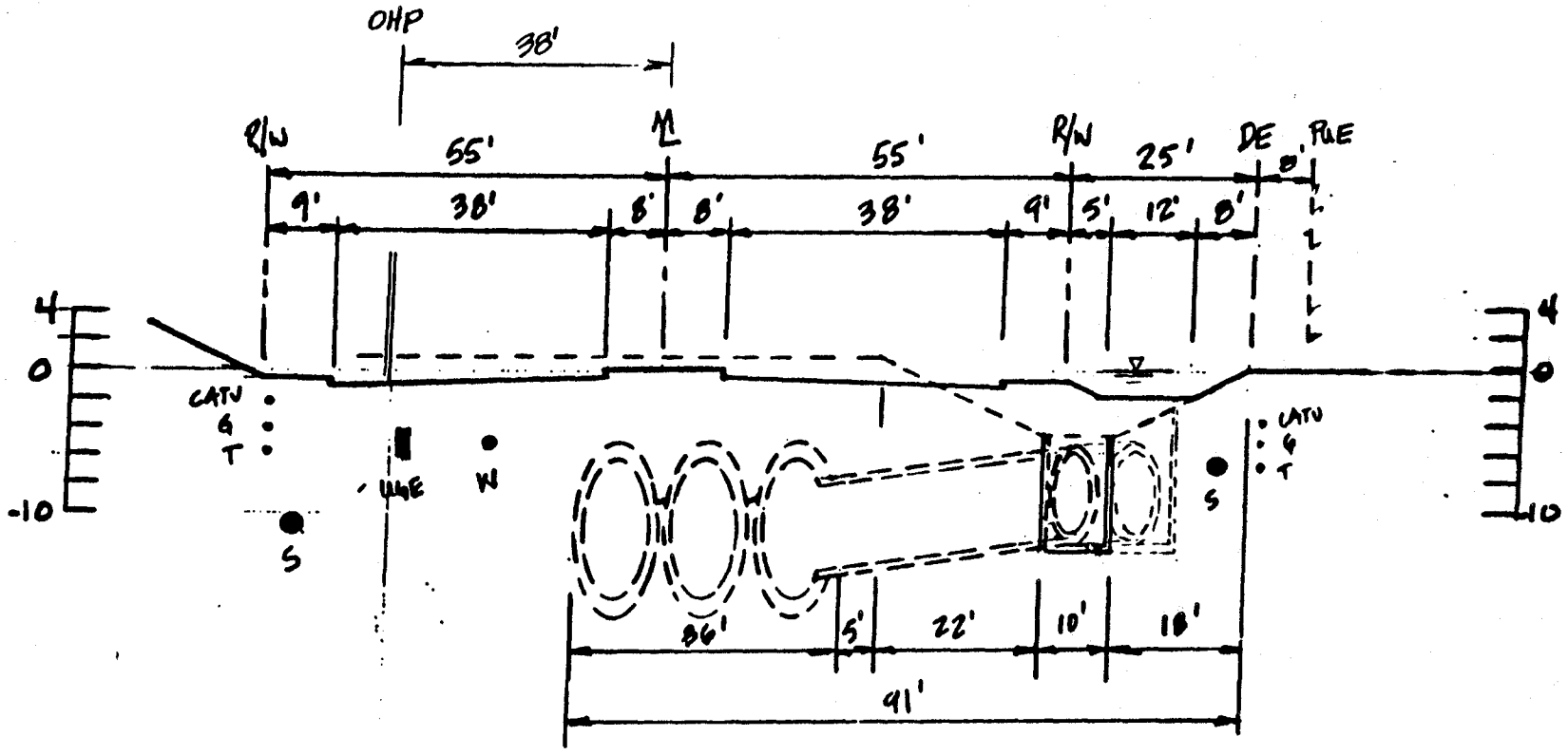
SALT RIVER PIMA - MARICOPA INDIAN COMMUNITY



ALTERNATE A
TYPICAL SECTION
96th ST. Storm Drain

Evans, Kuhn & Associates, Inc.

SALT RIVER PIMA - MARICOPA INDIAN COMMUNITY



ALTERNATE B
TYPICAL SECTION
96th ST. Storm Drain

Evans, Kuhn & Associates, Inc.

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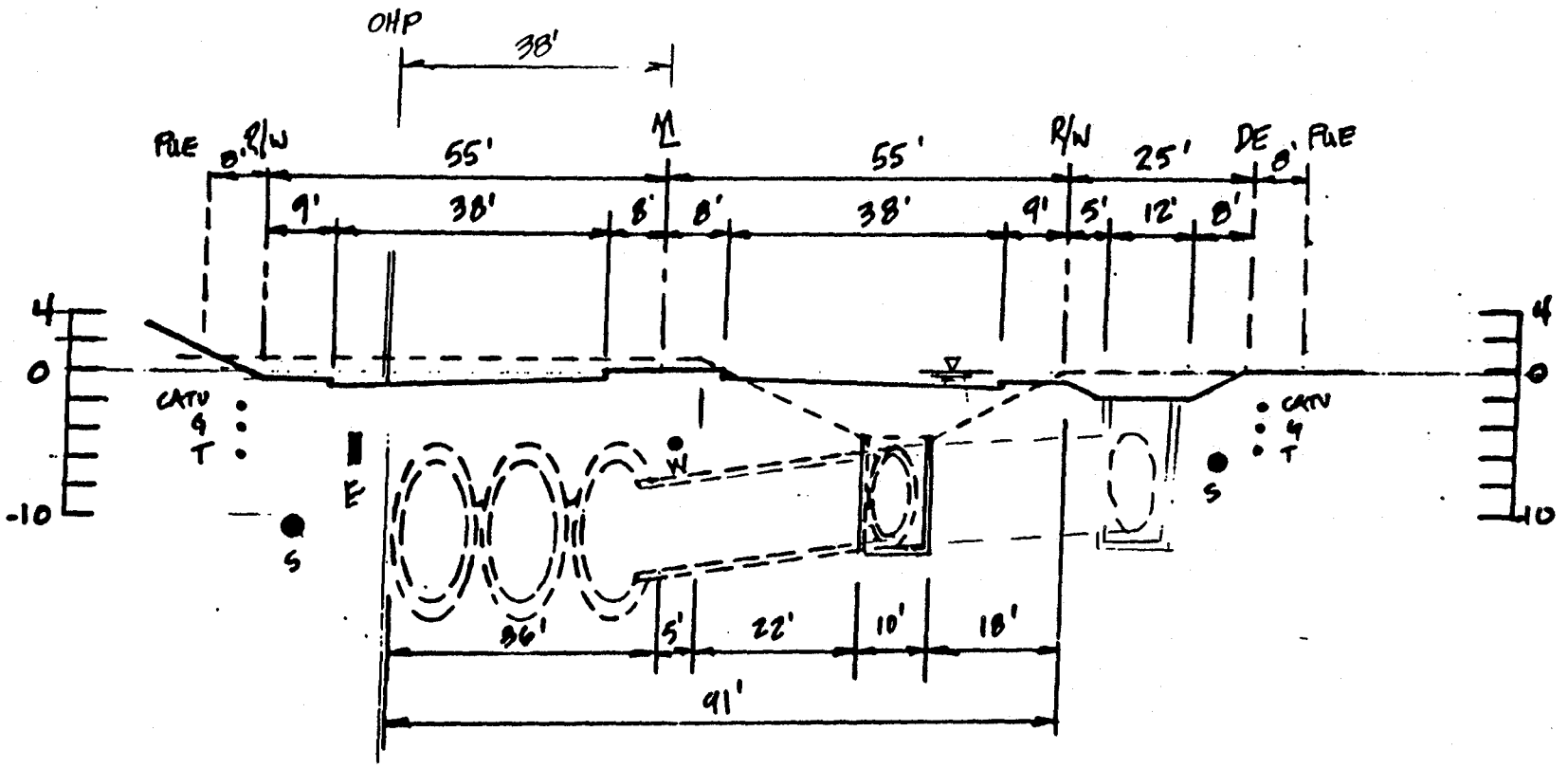
SALT RIVER PIMA - MARICOPA INDIAN COMMUNITY



ALTERNATE C
TYPICAL SECTION
96th ST. Storm Drain

Evans, Kuhn & Associates, Inc.

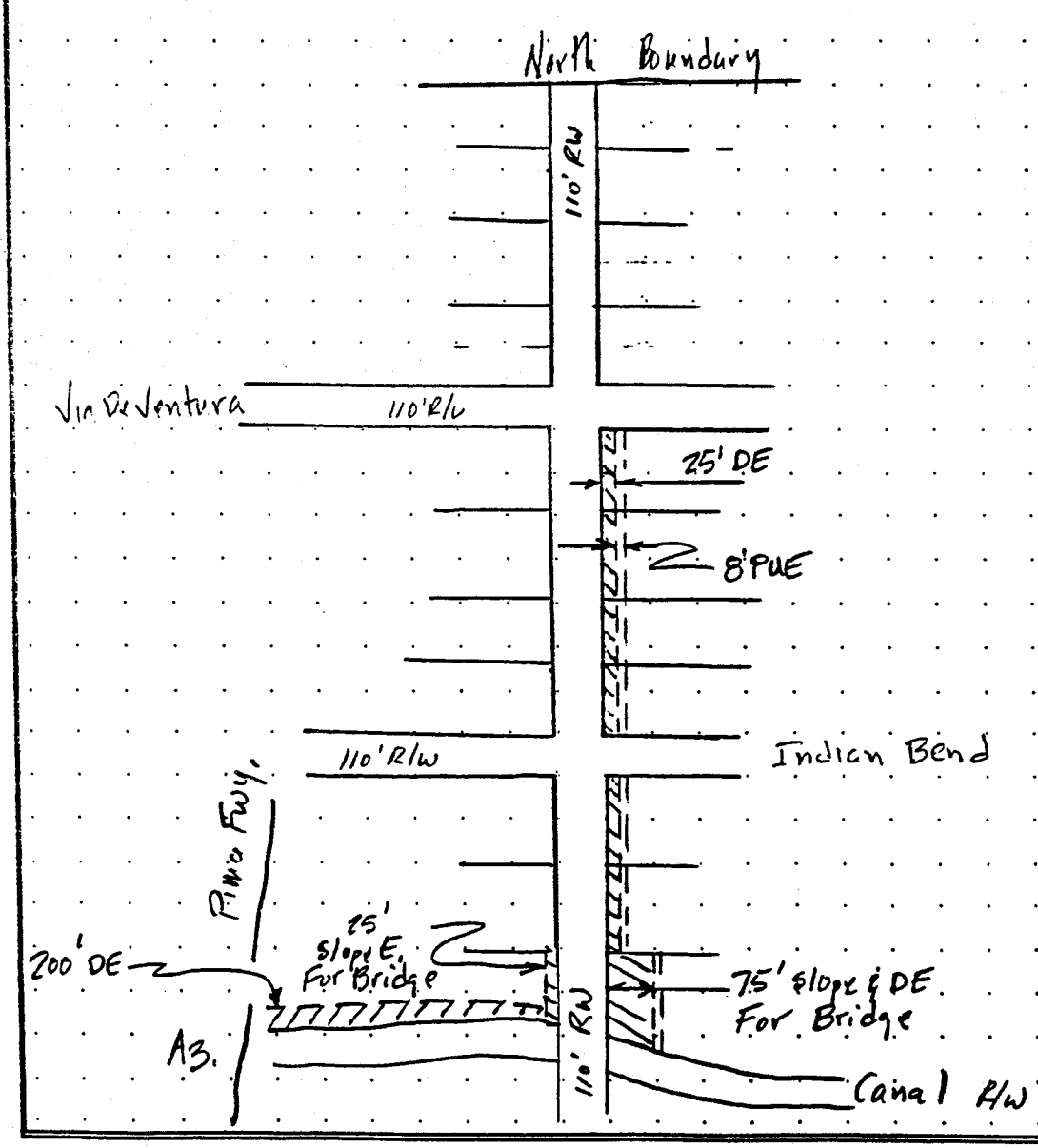
H52

EVANS KUHN AND ASSOCIATES, INC.

TITLE: 96th Street Storm Drain — JOB NO.: 3182

SUBJECT: Right-of-Way — DATE: 1-17-92

TASK: Delineate Slope, Drainage Easements and Public Utility Easements — BY: BJF



Checked By: _____

Page 1 of 1

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3182.2
PF ✓

EVANS, KUHN & ASSOCIATES, INC.

GEORGE L. EVANS, P.E.
JOHN D. KUHN, JR., P.E.

CONSULTING ENGINEERS
727 East Bethany Home Road, Suite D-225
Phoenix, Arizona 85014
(602) 241-0782
FAX NUMBER (602) 248-9158

January 29, 1992

Ms. Nona Baheshone
Salt River Pima - Maricopa Indian Community
10005 East Osborn Road
Scottsdale, Arizona 85256

Re: 96th Street Storm Drain
Detention Basin Alternative
EKA# 3182.2

Dear Ms. Baheshone:

At our last project meeting we suggested the possibility of constructing a detention basin on Community property at the northeast corner of Indian Bend Road and 96th Street intersection. The objective was to use the volume of the detention basin to decrease the pipe size and construction cost from Indian Bend Road to the Arizona Canal.

The results of our analysis are attached herewith and indicate that the combined cost of $3.0 million for right-of-way, basin excavation, and outlet pipe would exceed the $2.9 million cost for pipe alone. The detention basin would require approximately 8 acres and would be 13 feet deep. Costs were based on the following:

$1.50 per diameter inch for CIPP
$2.50 per cubic yard for basin excavation
$2.00 per square foot for right-of-way

H54

It may be cost effective to use the detention basin alternative if (1) ADOT were to construct the basin using the detention basin as a borrow pit for roadway fill or (2) if the Community could donate the required right-of-way. Incidental benefits to the Community could include groundwater recharge of stormwater and sediment storage. The basin would require maintenance to control weeds, erosion and vectors.

If you have any questions or need additional information, please don't hesitate to call.

Very truly yours,

EVANS, KUHN & ASSOCIATES, INC.

Bruce J. Friedhoff

Bruce J. Friedhoff, P.E.
Project Manager

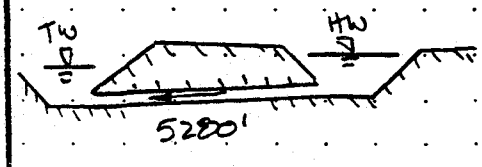
Attachment

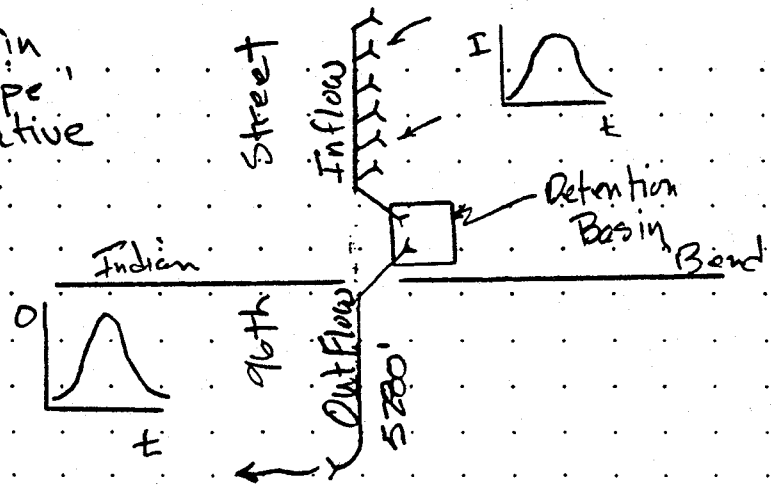
31822PC2.201/ADMIN1/dma

EVANS KUHN AND ASSOCIATES, INC.

TITLE: 96th Street Storm Drain — JOB NO.: 3182.2
SUBJECT: Detention Basin Alternatives — DATE: 1/29/92
TASK: ⓐ Indian Bend Road — BY: BJF

Compute Detention Basin Surface Area Outlet Pipe Size and Cost Alternative To System w/o Basin.





Summary of Results

Outlet Size	Depth of Basin	Top Area (Ac.)	Bottom Area (Ac)	Cost ($1000)
3 x 120"	0	0	0	$2,851
2 x 120"	13	8	6	$2,991
1 x 120"	13	16	13	$3,123
3 x 108"	13	7	4	$3,453
2 x 108"	13	11	8	$3,226
3 x 96"	13	10	8	$3,666

Checked By: BJF

H56

LEVEL POOL ROUTING

PROJECT NAME: 96TH STREET STORM DRAIN
JOB NUMBER: 3182
INPUT FILE: TRIAL1.LPR
OUTPUT FILE: TRIAL1.PRN
DATE: 01-29-1992
BY: BJF

Outlet Pipe Length = 5280 feet
Outlet Pipe N-value = .0165
Unit Cost for Pipe = 1.5 $/dia-in/lf
Unit Cost for Right-of-Way = 2 $/sq-ft
Unit Cost for Detention Basin Excavation = 2.5 $/cy
Detention Basin Depth = 13 feet
Detention Basin Side Slopes (z:1) = 4
Fixed Tailwater Level = 1287 feet
Basin Bottom Level = 1287 feet
Basin Top Level = 1300 feet
Starting Water Level = 1287 feet
Freeboard Level = 4 feet
Starting Top of Basin Surface Area = 10 acres
Number of Time Increments = 40
Accuracy of Estimate = .1 feet

Inflow Hydrograph Data

TIME (HRS)	INFLOW (CFS)
0.58	0.00
1.25	200.00
6.08	200.00
6.67	1970.00
7.50	808.00
8.25	481.00
10.83	299.00

Pipe Size	Detention Basin Top (Acres)	Basin Area Bottom (Acres)	Maximum Water Surface Level (feet)	Maximum Outflow (cfs)	Cost ($1000)
2 x 120	8	6	1296.03	1085	$2,991

K	TIME	LEVEL	INFLOW	OUTFLOW
1.00	0.26	1287.00	51.00	0.00
2.00	0.51	1287.43	127.49	236.26
3.00	0.77	1287.31	200.00	199.57
4.00	1.03	1287.31	200.00	199.84
5.00	1.28	1287.31	200.00	199.96
6.00	1.54	1287.31	200.00	199.96
7.00	1.79	1287.31	200.00	199.96

H57

8.00	2.05	1287.31	200.00	199.96
9.00	2.31	12[illegible].31	200.00	199.96
10.00	2.56	12[illegible].31	200.00	199.96
11.00	2.82	1287.31	200.00	199.96
12.00	3.07	1287.31	200.00	199.96
13.00	3.33	1287.31	200.00	199.96
14.00	3.59	1287.31	200.00	199.96
15.00	3.84	1287.31	200.00	199.96
16.00	4.10	1287.31	200.00	199.96
17.00	4.36	1287.31	200.00	199.96
18.00	4.61	1287.31	200.00	199.96
19.00	4.87	1287.31	200.00	199.96
20.00	5.13	1287.31	200.00	199.96
21.00	5.38	1287.31	200.00	199.96
22.00	5.64	1287.74	356.25	310.55
23.00	5.89	1289.66	1125.00	589.16
24.00	6.15	1293.00	1893.75	884.82
25.00	6.41	1295.22	1646.83	1035.51
26.00	6.66	1296.03	1288.08	1085.45
27.00	6.92	1295.76	929.33	1069.43
28.00	7.17	1294.92	734.06	1016.64
29.00	7.43	1293.90	622.34	948.86
30.00	7.69	1292.73	510.61	865.07
31.00	7.94	1291.62	466.98	776.61
32.00	8.20	1290.69	447.91	694.13
33.00	8.46	1289.94	428.84	619.30
34.00	8.71	1289.35	409.78	553.33
35.00	8.97	1288.89	390.71	496.72
36.00	9.22	1288.55	371.64	449.14
37.00	9.48	1288.28	352.57	409.45
38.00	9.74	1288.08	333.50	376.09
39.00	9.99	1287.92	314.43	347.43
40.00	10.25	1287.79	295.36	321.89

1 x 120

16 13 1296.07 544 $3,123

K	TIME	LEVEL	INFLOW	OUTFLOW
1.00	0.26	1287.03	51.00	28.99
2.00	0.51	1287.14	127.49	66.94
3.00	0.77	1287.31	200.00	100.91
4.00	1.03	1287.46	200.00	122.42
5.00	1.28	1287.58	200.00	137.12
6.00	1.54	1287.67	200.00	148.06
7.00	1.79	1287.75	200.00	156.55
8.00	2.05	1287.82	200.00	163.34
9.00	2.31	1287.87	200.00	168.87
10.00	2.56	1287.92	200.00	173.43
11.00	2.82	1287.96	200.00	177.22
12.00	3.07	1288.00	200.00	180.42
13.00	3.33	1288.03	200.00	183.12
14.00	3.59	1288.05	200.00	185.42
15.00	3.84	1288.08	200.00	187.39
16.00	4.10	1288.10	200.00	189.08
17.00	4.36	1288.11	200.00	190.53
18.00	4.61	1288.13	200.00	191.78

H58

19.00	4.87	1288.14	200.00	192.86
20.00	5.13	12[illegible].15	200.00	193.78
21.00	5.38	12[illegible].16	200.00	194.59
22.00	5.64	1288.36	356.25	210.83
23.00	5.89	1289.58	1125.00	290.10
24.00	6.15	1291.81	1893.75	396.04
25.00	6.41	1293.72	1646.83	468.08
26.00	6.66	1294.96	1288.08	509.65
27.00	6.92	1295.63	929.33	530.55
28.00	7.17	1295.93	734.06	539.91
29.00	7.43	1296.07	622.34	544.08
30.00	7.69	1296.05	510.61	543.45
31.00	7.94	1295.95	466.98	540.41
32.00	8.20	1295.83	447.91	536.67
33.00	8.46	1295.68	428.84	532.25
34.00	8.71	1295.52	409.78	527.15
35.00	8.97	1295.33	390.71	521.38
36.00	9.22	1295.13	371.64	514.94
37.00	9.48	1294.90	352.57	507.81
38.00	9.74	1294.66	333.50	500.01
39.00	9.99	1294.41	314.43	491.53
40.00	10.25	1294.13	295.36	482.34

3 x 108

7 4 1296.05 1230 $3.453

K	TIME	LEVEL	INFLOW	OUTFLOW
1.00	0.26	1287.00	51.00	0.00
2.00	0.51	1287.55	127.49	302.40
3.00	0.77	1287.18	200.00	173.38
4.00	1.03	1287.27	200.00	211.23
5.00	1.28	1287.23	200.00	196.97
6.00	1.54	1287.24	200.00	200.98
7.00	1.79	1287.24	200.00	199.60
8.00	2.05	1287.24	200.00	200.11
9.00	2.31	1287.24	200.00	200.06
10.00	2.56	1287.24	200.00	199.91
11.00	2.82	1287.24	200.00	200.01
12.00	3.07	1287.24	200.00	200.01
13.00	3.33	1287.24	200.00	200.01
14.00	3.59	1287.24	200.00	200.01
15.00	3.84	1287.24	200.00	200.01
16.00	4.10	1287.24	200.00	200.01
17.00	4.36	1287.24	200.00	200.01
18.00	4.61	1287.24	200.00	200.01
19.00	4.87	1287.24	200.00	200.01
20.00	5.13	1287.24	200.00	200.01
21.00	5.38	1287.24	200.00	200.01
22.00	5.64	1287.79	356.25	364.16
23.00	5.89	1289.85	1125.00	690.70
24.00	6.15	1293.47	1893.75	1040.58
25.00	6.41	1295.60	1646.83	1199.53
26.00	6.66	1296.05	1288.08	1230.39
27.00	6.92	1295.27	929.33	1176.02
28.00	7.17	1293.89	734.06	1073.88
29.00	7.43	1292.45	622.34	954.85

30.00	7.69	1291.00	510.61	818.08
31.00	7.94	12[illegible].82	466.98	686.25
32.00	8.20	12[illegible].02	447.91	581.55
33.00	8.46	1288.53	428.84	505.47
34.00	8.71	1288.23	409.78	453.24
35.00	8.97	1288.04	390.71	417.06
36.00	9.22	1287.91	371.64	389.75
37.00	9.48	1287.80	352.57	366.73
38.00	9.74	1287.71	333.50	345.45
39.00	9.99	1287.63	314.43	324.95
40.00	10.25	1287.55	295.36	304.68

x 108

11 8 1296.03 819 $3.226

K	TIME	LEVEL	INFLOW	OUTFLOW
1.00	0.26	1287.00	51.00	0.00
2.00	0.51	1287.17	127.49	112.36
3.00	0.77	1287.31	200.00	151.71
4.00	1.03	1287.40	200.00	173.03
5.00	1.28	1287.46	200.00	184.09
6.00	1.54	1287.49	200.00	190.37
7.00	1.79	1287.51	200.00	194.10
8.00	2.05	1287.52	200.00	196.35
9.00	2.31	1287.53	200.00	197.73
10.00	2.56	1287.53	200.00	198.60
11.00	2.82	1287.53	200.00	199.13
12.00	3.07	1287.54	200.00	199.45
13.00	3.33	1287.54	200.00	199.65
14.00	3.59	1287.54	200.00	199.79
15.00	3.84	1287.54	200.00	199.86
16.00	4.10	1287.54	200.00	199.92
17.00	4.36	1287.54	200.00	199.95
18.00	4.61	1287.54	200.00	199.95
19.00	4.87	1287.54	200.00	199.95
20.00	5.13	1287.54	200.00	199.95
21.00	5.38	1287.54	200.00	199.95
22.00	5.64	1287.83	356.25	248.70
23.00	5.89	1289.44	1125.00	426.30
24.00	6.15	1292.29	1893.75	627.39
25.00	6.41	1294.49	1646.83	746.15
26.00	6.66	1295.67	1288.08	802.95
27.00	6.92	1296.03	929.33	819.32
28.00	7.17	1295.90	734.06	813.39
29.00	7.43	1295.56	622.34	797.79
30.00	7.69	1295.03	510.61	772.68
31.00	7.94	1294.43	466.98	743.13
32.00	8.20	1293.84	447.91	713.09
33.00	8.46	1293.27	428.84	682.58
34.00	8.71	1292.71	409.78	651.64
35.00	8.97	1292.18	390.71	620.30
36.00	9.22	1291.66	371.64	588.62
37.00	9.48	1291.17	352.57	556.63
38.00	9.74	1290.70	333.50	524.39
39.00	9.99	1290.26	314.43	491.96
40.00	10.25	1289.84	295.36	459.40

H60

3 x 96

10 (8 1296.00 (96 $3.666

K	TIME	LEVEL	INFLOW	OUTFLOW
1.00	0.26	1287.00	51.00	0.00
2.00	0.51	1287.20	127.49	132.02
3.00	0.77	1287.30	200.00	164.71
4.00	1.03	1287.38	200.00	183.06
5.00	1.28	1287.41	200.00	191.40
6.00	1.54	1287.43	200.00	195.51
7.00	1.79	1287.44	200.00	197.64
8.00	2.05	1287.44	200.00	198.74
9.00	2.31	1287.45	200.00	199.34
10.00	2.56	1287.45	200.00	199.64
11.00	2.82	1287.45	200.00	199.81
12.00	3.07	1287.45	200.00	199.89
13.00	3.33	1287.45	200.00	199.94
14.00	3.59	1287.45	200.00	199.94
15.00	3.84	1287.45	200.00	199.94
16.00	4.10	1287.45	200.00	199.94
17.00	4.36	1287.45	200.00	199.94
18.00	4.61	1287.45	200.00	199.94
19.00	4.87	1287.45	200.00	199.94
20.00	5.13	1287.45	200.00	199.94
21.00	5.38	1287.45	200.00	199.94
22.00	5.64	1287.77	356.25	262.89
23.00	5.89	1289.48	1125.00	470.09
24.00	6.15	1292.47	1893.75	698.18
25.00	6.41	1294.68	1646.83	827.85
26.00	6.66	1295.79	1288.08	885.43
27.00	6.92	1296.00	929.33	896.07
28.00	7.17	1295.70	734.06	880.78
29.00	7.43	1295.18	622.34	854.38
30.00	7.69	1294.48	510.61	816.79
31.00	7.94	1293.72	466.99	774.20
32.00	8.20	1293.00	447.91	731.66
33.00	8.46	1292.33	428.84	689.32
34.00	8.71	1291.70	409.78	647.33
35.00	8.97	1291.12	390.71	605.86
36.00	9.22	1290.58	371.64	565.09
37.00	9.48	1290.09	352.57	525.20
38.00	9.74	1289.65	333.50	486.34
39.00	9.99	1289.26	314.43	448.64
40.00	10.25	1288.91	295.36	412.25

H61

LEVEL POOL ROUTING

PROJECT NAME: 96TH STREET STORM DRAIN
JOB NUMBER: 3182
INPUT FILE: TRIAL2.LPR
OUTPUT FILE: TRIAL2.PRN
DATE: 01-29-1992
BY: BJF

Outlet Pipe Length = 5280 feet
Outlet Pipe N-value = .0165
Unit Cost for Pipe = 1.5 $/dia-in/lf
Unit Cost for Right-of-Way = 2 $/sq-ft
Unit Cost for Detention Basin Excavation = 2.5 $/cy
Detention Basin Depth = 15 feet
Detention Basin Side Slopes (z:1) = 4
Fixed Tailwater Level = 1287 feet
Basin Bottom Level = 1285 feet
Basin Top Level = 1300 feet
Starting Water Level = 1285 feet
Freeboard Level = 4 feet
Starting Top of Basin Surface Area = 10 acres
Number of Time Increments = 40
Accuracy of Estimate = .1 feet

Inflow Hydrograph Data

TIME (HRS)	INFLOW (CFS)
0.58	0.00
1.25	200.00
6.08	200.00
6.67	1970.00
7.50	808.00
8.25	481.00
10.83	289.00

Pipe Size	Detention Top (Acres)	Basin Area Bottom (Acres)	Maximum Water Surface Level (feet)	Maximum Outflow (cfs)	Cost ($1000)
2 x 120	8	5	1296.03	1085	$3.037

K	TIME	LEVEL	INFLOW	OUTFLOW
1.00	0.26	1285.15	51.00	0.00
2.00	0.51	1285.60	127.49	0.00
3.00	0.77	1286.33	200.00	0.00
4.00	1.03	1287.08	200.00	102.77
5.00	1.28	1287.31	200.00	200.44
6.00	1.54	1287.31	200.00	200.08
7.00	1.79	1287.31	200.00	200.00

H-62

8.00	2.05	1287.31	200.00	200.00
9.00	2.31	1287.31	200.00	200.00
10.00	2.56	1287.31	200.00	200.00
11.00	2.82	1287.31	200.00	200.00
12.00	3.07	1287.31	200.00	200.00
13.00	3.33	1287.31	200.00	200.00
14.00	3.59	1287.31	200.00	200.00
15.00	3.84	1287.31	200.00	200.00
16.00	4.10	1287.31	200.00	200.00
17.00	4.36	1287.31	200.00	200.00
18.00	4.61	1287.31	200.00	200.00
19.00	4.87	1287.31	200.00	200.00
20.00	5.13	1287.31	200.00	200.00
21.00	5.38	1287.31	200.00	200.00
22.00	5.64	1287.74	356.25	310.55
23.00	5.89	1289.66	1125.00	589.16
24.00	6.15	1293.00	1893.75	884.81
25.00	6.41	1295.22	1646.83	1035.50
26.00	6.66	1296.03	1288.08	1085.44
27.00	6.92	1295.76	929.33	1069.42
28.00	7.17	1294.92	734.06	1016.63
29.00	7.43	1293.90	622.34	948.85
30.00	7.69	1292.73	510.61	865.07
31.00	7.94	1291.62	466.98	776.61
32.00	8.20	1290.69	447.91	694.13
33.00	8.46	1289.94	428.84	619.30
34.00	8.71	1289.35	409.78	553.33
35.00	8.97	1288.89	390.71	496.72
36.00	9.22	1288.55	371.64	449.14
37.00	9.48	1288.28	352.57	409.45
38.00	9.74	1288.08	333.50	376.09
39.00	9.99	1287.92	314.43	347.43
40.00	10.25	1287.79	295.36	321.89

1 x 120

16 12 1296.07 544 $3.213

K	TIME	LEVEL	INFLOW	OUTFLOW
1.00	0.26	1285.07	51.00	0.00
2.00	0.51	1285.27	127.49	0.00
3.00	0.77	1285.60	200.00	0.00
4.00	1.03	1285.95	200.00	0.00
5.00	1.28	1286.30	200.00	0.00
6.00	1.54	1286.64	200.00	0.00
7.00	1.79	1286.99	200.00	0.00
8.00	2.05	1287.24	200.00	87.90
9.00	2.31	1287.40	200.00	114.55
10.00	2.56	1287.53	200.00	131.62
11.00	2.82	1287.64	200.00	143.95
12.00	3.07	1287.72	200.00	153.37
13.00	3.33	1287.79	200.00	160.81
14.00	3.59	1287.85	200.00	166.81
15.00	3.84	1287.90	200.00	171.75
16.00	4.10	1287.95	200.00	175.86
17.00	4.36	1287.99	200.00	179.28
18.00	4.61	1288.02	200.00	182.17

19.00	4.87	1288.04	200.00	184.63
20.00	5.13	12[illegible].07	200.00	186.72
21.00	5.38	12[illegible].09	200.00	188.50
22.00	5.64	1288.30	356.25	206.07
23.00	5.89	1289.53	1125.00	287.42
24.00	6.15	1291.78	1893.75	394.74
25.00	6.41	1293.70	1646.83	467.38
26.00	6.66	1294.95	1288.08	509.23
27.00	6.92	1295.62	929.33	530.27
28.00	7.17	1295.93	734.06	539.69
29.00	7.43	1296.07	622.34	543.89
30.00	7.69	1296.05	510.61	543.27
31.00	7.94	1295.95	466.98	540.22
32.00	8.20	1295.82	447.91	536.47
33.00	8.46	1295.68	428.84	532.04
34.00	8.71	1295.51	409.78	526.92
35.00	8.97	1295.32	390.71	521.13
36.00	9.22	1295.12	371.64	514.66
37.00	9.48	1294.89	352.57	507.52
38.00	9.74	1294.65	333.50	499.69
39.00	9.99	1294.39	314.43	491.17
40.00	10.25	1294.12	295.36	481.94

3 x 108

7 4 1296.05 1230 $3.489

K	TIME	LEVEL	INFLOW	OUTFLOW
1.00	0.26	1285.20	51.00	0.00
2.00	0.51	1285.77	127.49	0.00
3.00	0.77	1286.70	200.00	0.00
4.00	1.03	1287.06	200.00	96.07
5.00	1.28	1287.48	200.00	282.28
6.00	1.54	1287.24	200.00	198.52
7.00	1.79	1287.24	200.00	200.42
8.00	2.05	1287.24	200.00	199.91
9.00	2.31	1287.24	200.00	200.01
10.00	2.56	1287.24	200.00	200.01
11.00	2.82	1287.24	200.00	200.01
12.00	3.07	1287.24	200.00	200.01
13.00	3.33	1287.24	200.00	200.01
14.00	3.59	1287.24	200.00	200.01
15.00	3.84	1287.24	200.00	200.01
16.00	4.10	1287.24	200.00	200.01
17.00	4.36	1287.24	200.00	200.01
18.00	4.61	1287.24	200.00	200.01
19.00	4.87	1287.24	200.00	200.01
20.00	5.13	1287.24	200.00	200.01
21.00	5.38	1287.24	200.00	200.01
22.00	5.64	1287.79	356.25	364.07
23.00	5.89	1289.85	1125.00	690.58
24.00	6.15	1293.47	1893.75	1040.40
25.00	6.41	1295.60	1646.83	1199.36
26.00	6.66	1296.05	1288.08	1230.25
27.00	6.92	1295.27	929.33	1175.94
28.00	7.17	1293.89	734.06	1073.87
29.00	7.43	1292.45	622.34	954.89

H64

30.00	7.69	1291.00	510.61	818.18
31.00	7.94	12[illegible].82	466.98	686.38
32.00	8.20	12[illegible].02	447.91	581.69
33.00	8.46	1288.53	428.84	505.57
34.00	8.71	1288.23	409.78	453.33
35.00	8.97	1288.04	390.71	417.11
36.00	9.22	1287.91	371.64	389.78
37.00	9.48	1287.80	352.57	366.70
38.00	9.74	1287.71	333.50	345.48
39.00	9.99	1287.63	314.43	324.92
40.00	10.25	1287.55	295.36	304.68

2×108

11 8 1296.03 819 43.292

K	TIME	LEVEL	INFLOW	OUTFLOW
1.00	0.26	1285.10	51.00	0.00
2.00	0.51	1285.41	127.49	0.00
3.00	0.77	1285.91	200.00	0.00
4.00	1.03	1286.43	200.00	0.00
5.00	1.28	1286.94	200.00	0.00
6.00	1.54	1287.26	200.00	140.08
7.00	1.79	1287.38	200.00	167.63
8.00	2.05	1287.44	200.00	181.16
9.00	2.31	1287.48	200.00	188.67
10.00	2.56	1287.50	200.00	193.07
11.00	2.82	1287.52	200.00	195.73
12.00	3.07	1287.52	200.00	197.34
13.00	3.33	1287.53	200.00	198.35
14.00	3.59	1287.53	200.00	198.97
15.00	3.84	1287.53	200.00	199.36
16.00	4.10	1287.54	200.00	199.58
17.00	4.36	1287.54	200.00	199.74
18.00	4.61	1287.54	200.00	199.83
19.00	4.87	1287.54	200.00	199.90
20.00	5.13	1287.54	200.00	199.95
21.00	5.38	1287.54	200.00	199.95
22.00	5.64	1287.83	356.25	248.70
23.00	5.89	1289.44	1125.00	426.30
24.00	6.15	1292.29	1893.75	627.39
25.00	6.41	1294.49	1646.83	746.15
26.00	6.66	1295.67	1288.08	802.95
27.00	6.92	1296.03	929.33	819.32
28.00	7.17	1295.90	734.06	813.39
29.00	7.43	1295.56	622.34	797.79
30.00	7.69	1295.03	510.61	772.68
31.00	7.94	1294.43	466.98	743.13
32.00	8.20	1293.84	447.91	713.09
33.00	8.46	1293.27	428.84	682.58
34.00	8.71	1292.71	409.78	651.64
35.00	8.97	1292.18	390.71	620.30
36.00	9.22	1291.66	371.64	588.62
37.00	9.48	1291.17	352.57	556.63
38.00	9.74	1290.70	333.50	524.39
39.00	9.99	1290.26	314.43	491.96
40.00	10.25	1289.84	295.36	459.40

H65

3 x 96

10 7 1296.00 96 $3.726

K	TIME	LEVEL	INFLOW	OUTFLOW
1.00	0.26	1285.11	51.00	0.00
2.00	0.51	1285.45	127.49	0.00
3.00	0.77	1286.00	200.00	0.00
4.00	1.03	1286.58	200.00	0.00
5.00	1.28	1287.15	200.00	114.49
6.00	1.54	1287.31	200.00	166.42
7.00	1.79	1287.38	200.00	183.80
8.00	2.05	1287.41	200.00	191.77
9.00	2.31	1287.43	200.00	195.73
10.00	2.56	1287.44	200.00	197.75
11.00	2.82	1287.44	200.00	198.82
12.00	3.07	1287.45	200.00	199.40
13.00	3.33	1287.45	200.00	199.67
14.00	3.59	1287.45	200.00	199.83
15.00	3.84	1287.45	200.00	199.92
16.00	4.10	1287.45	200.00	199.94
17.00	4.36	1287.45	200.00	199.94
18.00	4.61	1287.45	200.00	199.94
19.00	4.87	1287.45	200.00	199.94
20.00	5.13	1287.45	200.00	199.94
21.00	5.38	1287.45	200.00	199.94
22.00	5.64	1287.77	356.25	262.89
23.00	5.89	1289.48	1125.00	470.09
24.00	6.15	1292.47	1893.75	698.18
25.00	6.41	1294.68	1646.83	827.85
26.00	6.66	1295.79	1288.08	885.43
27.00	6.92	1296.00	929.33	896.07
28.00	7.17	1295.70	734.06	880.78
29.00	7.43	1295.18	622.34	854.38
30.00	7.69	1294.48	510.61	816.79
31.00	7.94	1293.72	466.98	774.20
32.00	8.20	1293.00	447.91	731.66
33.00	8.46	1292.33	428.84	689.32
34.00	8.71	1291.70	409.78	647.33
35.00	8.97	1291.12	390.71	605.86
36.00	9.22	1290.58	371.64	565.09
37.00	9.48	1290.09	352.57	525.20
38.00	9.74	1289.65	333.50	486.34
39.00	9.99	1289.26	314.43	448.64
40.00	10.25	1288.91	295.36	412.25

H66

L E V E L P O O L R O U T I N G

PROJECT NAME: 96TH STREET STORM DRAIN
JOB NUMBER: 3182
INPUT FILE: TRIAL3.LPR
OUTPUT FILE: TRIAL3.PRN
DATE: 01-29-1992
BY: BJF

Outlet Pipe Length = 5280 feet
Outlet Pipe N-value = .0165
Unit Cost for Pipe = 1.5 $/dia-in/lf
Unit Cost for Right-of-Way = 2 $/sq-ft
Unit Cost for Detention Basin Excavation = 2.5 $/cy
Detention Basin Depth = 20 feet
Detention Basin Side Slopes (z:1) = 4
Fixed Tailwater Level = 1287 feet
Basin Bottom Level = 1280 feet
Basin Top Level = 1300 feet
Starting Water Level = 1280 feet
Freeboard Level = 4 feet
Starting Top of Basin Surface Area = 10 acres
Number of Time Increments = 40
Accuracy of Estimate = .1 feet

Inflow Hydrograph Data

TIME (HRS)	INFLOW (CFS)
0.58	0.00
1.25	200.00
6.08	200.00
6.67	1970.00
7.50	808.00
8.25	481.00
10.83	289.00

Pipe Size	Detention Top (Acres)	Basin Area Bottom (Acres)	Maximum Water Surface Level (feet)	Maximum Outflow (cfs)	Cost ($1000)
2 x 120	8	4	1296.03	1085	$3.140

K	TIME	LEVEL	INFLOW	OUTFLOW
1.00	0.26	1280.18	51.00	0.00
2.00	0.51	1280.72	127.49	0.00
3.00	0.77	1281.57	200.00	0.00
4.00	1.03	1282.45	200.00	0.00
5.00	1.28	1283.31	200.00	0.00
6.00	1.54	1284.14	200.00	0.00
7.00	1.79	1284.95	200.00	0.00

8.00	2.05	1285.73	200.00	0.00
9.00	2.31	12[illegible].50	200.00	0.00
10.00	2.56	12[illegible].22	200.00	169.05
11.00	2.82	1287.29	200.00	194.92
12.00	3.07	1287.30	200.00	198.85
13.00	3.33	1287.31	200.00	199.72
14.00	3.59	1287.31	200.00	199.96
15.00	3.84	1287.31	200.00	199.96
16.00	4.10	1287.31	200.00	199.96
17.00	4.36	1287.31	200.00	199.96
18.00	4.61	1287.31	200.00	199.96
19.00	4.87	1287.31	200.00	199.96
20.00	5.13	1287.31	200.00	199.96
21.00	5.38	1287.31	200.00	199.96
22.00	5.64	1287.74	356.25	310.55
23.00	5.89	1289.66	1125.00	589.16
24.00	6.15	1293.00	1893.75	884.82
25.00	6.41	1295.22	1646.83	1035.51
26.00	6.66	1296.03	1288.08	1085.45
27.00	6.92	1295.76	929.33	1069.43
28.00	7.17	1294.92	734.06	1016.64
29.00	7.43	1293.90	622.34	948.86
30.00	7.69	1292.73	510.61	865.07
31.00	7.94	1291.62	466.98	776.61
32.00	8.20	1290.69	447.91	694.13
33.00	8.46	1289.94	428.84	619.30
34.00	8.71	1289.35	409.78	553.33
35.00	8.97	1288.89	390.71	496.72
36.00	9.22	1288.55	371.64	449.14
37.00	9.48	1288.28	352.57	409.45
38.00	9.74	1288.08	333.50	376.09
39.00	9.99	1287.92	314.43	347.43
40.00	10.25	1287.79	295.36	321.89

1 x 120

16 10 1296.01 542 $3.337

K	TIME	LEVEL	INFLOW	OUTFLOW
1.00	0.26	1280.08	51.00	0.00
2.00	0.51	1280.32	127.49	0.00
3.00	0.77	1280.71	200.00	0.00
4.00	1.03	1281.12	200.00	0.00
5.00	1.28	1281.53	200.00	0.00
6.00	1.54	1281.93	200.00	0.00
7.00	1.79	1282.33	200.00	0.00
8.00	2.05	1282.73	200.00	0.00
9.00	2.31	1283.12	200.00	0.00
10.00	2.56	1283.51	200.00	0.00
11.00	2.82	1283.89	200.00	0.00
12.00	3.07	1284.27	200.00	0.00
13.00	3.33	1284.65	200.00	0.00
14.00	3.59	1285.03	200.00	0.00
15.00	3.84	1285.40	200.00	0.00
16.00	4.10	1285.77	200.00	0.00
17.00	4.36	1286.13	200.00	0.00
18.00	4.61	1286.50	200.00	0.00

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19.00	4.87	1286.86	200.00	0.00
20.00	5.13	12[illegible].14	200.00	67.23
21.00	5.38	12[illegible].34	200.00	104.96
22.00	5.64	1287.69	356.25	150.40
23.00	5.89	1289.07	1125.00	259.73
24.00	6.15	1291.47	1893.75	381.87
25.00	6.41	1293.50	1646.83	460.63
26.00	6.66	1294.83	1288.08	505.29
27.00	6.92	1295.53	929.33	527.62
28.00	7.17	1295.86	734.06	537.62
29.00	7.43	1296.01	622.34	542.11
30.00	7.69	1295.99	510.61	541.54
31.00	7.94	1295.89	466.98	538.42
32.00	8.20	1295.76	447.91	534.57
33.00	8.46	1295.61	428.84	530.00
34.00	8.71	1295.44	409.78	524.72
35.00	8.97	1295.25	390.71	518.74
36.00	9.22	1295.04	371.64	512.06
37.00	9.48	1294.81	352.57	504.67
38.00	9.74	1294.56	333.50	496.56
39.00	9.99	1294.29	314.43	487.75
40.00	10.25	1294.01	295.36	478.20

3 x 108

7 3 1296.05 1230 $3,569

K	TIME	LEVEL	INFLOW	OUTFLOW
1.00	0.26	1280.24	51.00	0.00
2.00	0.51	1280.94	127.49	0.00
3.00	0.77	1282.05	200.00	0.00
4.00	1.03	1283.17	200.00	0.00
5.00	1.28	1284.25	200.00	0.00
6.00	1.54	1285.28	200.00	0.00
7.00	1.79	1286.28	200.00	0.00
8.00	2.05	1287.24	200.00	200.77
9.00	2.31	1287.24	200.00	199.75
10.00	2.56	1287.24	200.00	200.06
11.00	2.82	1287.24	200.00	199.91
12.00	3.07	1287.24	200.00	200.01
13.00	3.33	1287.24	200.00	200.01
14.00	3.59	1287.24	200.00	200.01
15.00	3.84	1287.24	200.00	200.01
16.00	4.10	1287.24	200.00	200.01
17.00	4.36	1287.24	200.00	200.01
18.00	4.61	1287.24	200.00	200.01
19.00	4.87	1287.24	200.00	200.01
20.00	5.13	1287.24	200.00	200.01
21.00	5.38	1287.24	200.00	200.01
22.00	5.64	1287.79	356.25	364.10
23.00	5.89	1289.85	1125.00	690.62
24.00	6.15	1293.47	1893.75	1040.48
25.00	6.41	1295.60	1646.83	1199.44
26.00	6.66	1296.05	1288.08	1230.31
27.00	6.92	1295.27	929.33	1175.97
28.00	7.17	1293.89	734.06	1073.87
29.00	7.43	1292.45	622.34	954.86

30.00	7.69	1291.00	510.61	818.13
31.00	7.94	12[illegible].82	466.98	686.32
32.00	8.20	12[illegible].02	447.91	581.62
33.00	8.46	1288.53	428.84	505.51
34.00	8.71	1288.23	409.78	453.29
35.00	8.97	1288.04	390.71	417.06
36.00	9.22	1287.91	371.64	389.75
37.00	9.48	1287.80	352.57	366.73
38.00	9.74	1287.71	333.50	345.48
39.00	9.99	1287.63	314.43	324.95
40.00	10.25	1287.55	295.36	304.68

2 x 108

11 7 1296.03 819 $3,444

K	TIME	LEVEL	INFLOW	OUTFLOW
1.00	0.26	1280.12	51.00	0.00
2.00	0.51	1280.47	127.49	0.00
3.00	0.77	1281.04	200.00	0.00
4.00	1.03	1281.64	200.00	0.00
5.00	1.28	1282.22	200.00	0.00
6.00	1.54	1282.80	200.00	0.00
7.00	1.79	1283.36	200.00	0.00
8.00	2.05	1283.92	200.00	0.00
9.00	2.31	1284.47	200.00	0.00
10.00	2.56	1285.01	200.00	0.00
11.00	2.82	1285.55	200.00	0.00
12.00	3.07	1286.07	200.00	0.00
13.00	3.33	1286.59	200.00	0.00
14.00	3.59	1287.10	200.00	87.21
15.00	3.84	1287.30	200.00	149.97
16.00	4.10	1287.40	200.00	172.19
17.00	4.36	1287.45	200.00	183.62
18.00	4.61	1287.49	200.00	190.10
19.00	4.87	1287.51	200.00	193.93
20.00	5.13	1287.52	200.00	196.24
21.00	5.38	1287.53	200.00	197.66
22.00	5.64	1287.82	356.25	247.58
23.00	5.89	1289.44	1125.00	425.88
24.00	6.15	1292.29	1893.75	627.22
25.00	6.41	1294.49	1646.83	746.06
26.00	6.66	1295.67	1288.08	802.89
27.00	6.92	1296.03	929.33	819.27
28.00	7.17	1295.90	734.06	813.34
29.00	7.43	1295.56	622.34	797.73
30.00	7.69	1295.03	510.61	772.62
31.00	7.94	1294.43	466.98	743.06
32.00	8.20	1293.84	447.91	713.01
33.00	8.46	1293.27	428.84	682.50
34.00	8.71	1292.71	409.78	651.55
35.00	8.97	1292.17	390.71	620.22
36.00	9.22	1291.66	371.64	588.53
37.00	9.48	1291.17	352.57	556.54
38.00	9.74	1290.70	333.50	524.30
39.00	9.99	1290.25	314.43	491.87
40.00	10.25	1289.84	295.36	459.30

H10

3 x 96

10 6 1296.00 46 43.863

K	TIME	LEVEL	INFLOW	OUTFLOW
1.00	0.26	1280.13	51.00	0.00
2.00	0.51	1280.53	127.49	0.00
3.00	0.77	1281.16	200.00	0.00
4.00	1.03	1281.83	200.00	0.00
5.00	1.28	1282.47	200.00	0.00
6.00	1.54	1283.11	200.00	0.00
7.00	1.79	1283.74	200.00	0.00
8.00	2.05	1284.35	200.00	0.00
9.00	2.31	1284.96	200.00	0.00
10.00	2.56	1285.55	200.00	0.00
11.00	2.82	1286.13	200.00	0.00
12.00	3.07	1286.71	200.00	0.00
13.00	3.33	1287.09	200.00	88.90
14.00	3.59	1287.29	200.00	162.12
15.00	3.84	1287.37	200.00	181.99
16.00	4.10	1287.41	200.00	190.89
17.00	4.36	1287.43	200.00	195.26
18.00	4.61	1287.44	200.00	197.51
19.00	4.87	1287.44	200.00	198.69
20.00	5.13	1287.45	200.00	199.29
21.00	5.38	1287.45	200.00	199.62
22.00	5.64	1287.77	356.25	262.77
23.00	5.89	1289.48	1125.00	470.05
24.00	6.15	1292.47	1893.75	698.17
25.00	6.41	1294.68	1646.83	827.84
26.00	6.66	1295.79	1288.08	885.42
27.00	6.92	1296.00	929.33	896.07
28.00	7.17	1295.70	734.06	880.77
29.00	7.43	1295.18	622.34	854.38
30.00	7.69	1294.48	510.61	816.79
31.00	7.94	1293.72	466.98	774.20
32.00	8.20	1293.00	447.91	731.66
33.00	8.46	1292.33	428.84	689.31
34.00	8.71	1291.70	409.78	647.32
35.00	8.97	1291.12	390.71	605.86
36.00	9.22	1290.58	371.64	565.09
37.00	9.48	1290.09	352.57	525.20
38.00	9.74	1289.65	333.50	486.33
39.00	9.99	1289.26	314.43	448.62
40.00	10.25	1288.91	295.36	412.22

H71

proj

EVANS, KUHN & ASSOCIATES, INC.

GEORGE L. EVANS, P.E.
JOHN D. KUHN, JR., P.E.

CONSULTING ENGINEERS
727 East Bethany Home Road, Suite D-225
Phoenix, Arizona 85014
(602) 241-0782
FAX NUMBER (602) 248-9158

January 30, 1992

Ms. Nona Baheshone
Salt River Pima - Maricopa Indian Community
10005 East Osborn Road
Scottsdale, Arizona 85256

Re: 96th Street Storm Drain
Value Engineering Work Session #3
EKA# 3182.3

Dear Ms. Baheshone:

A work session was conducted in this office on January 27, 1992, for the purpose of discussing design/construction options for the 96th Street Storm Drain.

The following items were discussed:

ACTION	ITEMS
EKA	1. Draft technical specifications are complete and have been provided to the Community and Salt River Sand and Rock. Draft general conditions are complete and provided to the Community. Additional specifications for load testing and hydraulic testing of CIPP will be provided as soon as possible.
INFO	2. According to P.L. 93-638, bonding in the amount of at least 40% of the total contract is required for fixed price contracts for Indian-owned enterprises when the contract amount is $1 million to $5 million. We recommend that the Community require bonding of 100% of the contract amount.
EKA/SRP-MIC	3. The Community has been provided the structural and geotechnical engineering consultants proposals along with EKA's recommendations. EKA will direct the Community's approved geotechnical engineering consultant to proceed as soon as necessary allotment access permits are obtained.

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EKA	4.	EKA has re-run the hydrology to conform with ADOT's modified design storm. The resulting flow is approximately 2000 cfs in the 96th Street storm drain system. Four conduit alternatives were provided to the Community for consideration. The double box/CIPP combination discussed during that session was evaluated and found to be more expensive than the four alternatives. The Community approved the CIPP option for flow condition No. 2.
EKA	5.	Three alternate typical sections were reviewed and Alternate C was selected with the following revisions: A. Lower the conduit 2 feet to provide protection in the event of channel erosion; and B. Shift the conduit 8 feet east to eliminate the need to relocate the overhead power/poles.
EKA	6.	EKA will provide the Community with preliminary analysis concerning a proposed detention facility to be located within the SRP-MIC allotment at the northeast corner of the Indian Bend Road. The Community will review the desirability of using this allotment for public facilities.
SRP-MIC	7.	EKA provided preliminary slope and drainage easements for the 96th Street bridge north of the Arizona Canal. Preliminary right-of-way requirements south of the canal cannot be determined until the Community provides EKA with topographic survey data south of the canal.

Please inform us if your notes differ from those herein or call us concerning any questions you may have. The next meeting will be scheduled when appropriate.

Very truly yours,

EVANS, KUHN & ASSOCIATES, INC.

Clyde E. Anderson

Clyde E. Anderson, P.E.
Project Engineer

cc: Mr. Earl Pearson - SRP-MIC
Mr. Richard Wilks - Shea & Wilks
Mr. Wayne Hills - SRS&R
Mr. Gordon Bluth - SRS&R
Mr. Vern Wilson - SRS&R
Mr. LaMar Thomas, Sr. - SRS&R
Mr. James Carmichael - Phoenix Cement Company
Mr. Bruce J. Friedhoff - EKA
Mr. Clyde E. Anderson - EKA

31823ITE.201/ADMIN1/dma

EVANS, KUHN & ASSOCIATES, INC.
727 East Bethany Home Road, Suite D-225
PHOENIX, ARIZONA 85014

(602) 241-0782

LETTER OF TRANSMITTAL

DATE 2-14-92	JOB NO. 3182.2
ATTENTION Bob Ward	
RE: SRP-MIC Arizona Canal Detention Basin Outlet	

TO Bob Ward
706 West Gentry Cir.
Mesa, Arizona 85213

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☒ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1	2-17-92	3	Detention Basin Outlet Calculation

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☒ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for corrections ☐ Return _____ corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19 _____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS _____

COPY TO _____

SIGNED: Ryan Schultz
Ryan Schultz

If enclosures are not as noted, kindly notify us at once.

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To: Mr. Bob Ward

Salt River Pima-Maricopa Indian Community — 3182h2b1.wo1
Arizona Canal Detention Basin Outlet — 02/17/92

The drainage outfall design proposed by ADOT will require that the outfall channel be changed to a detention basin. In order to drain the detention basin an outlet pipe is proposed. This outlet pipe would be installed below the Arizona Canal and would drain south to the proposed 60 inch storm drain near Mc Donald Drive.

Compute the required detention volume, average release rate, and discharge rating curve. The discharge rating curve will be used by ADOT in HEC-1 and HEC-2 analysis to size the outfall channel from Pima Road to the Pima Freeway.

Detention Basin Volume

Outfall Channel West of Outlet	=	840.000 cu ft
Ramp	=	60.000 cu ft
Conduit	=	450.000 cu ft
Interceptor Channel East of Outlet	=	40.000 cu ft
Total	=	1,390.000 cu ft
Detention Volume Used for Design	=	1,400,000 cu ft

Average Release Rate

Detention Volume Used for Design	=	1,400.000 cu ft
Detention Time	/	24 hrs
	/	3,600 sec/hr
Average Release Rate	=	16 cfs

Discharge Rating Curve

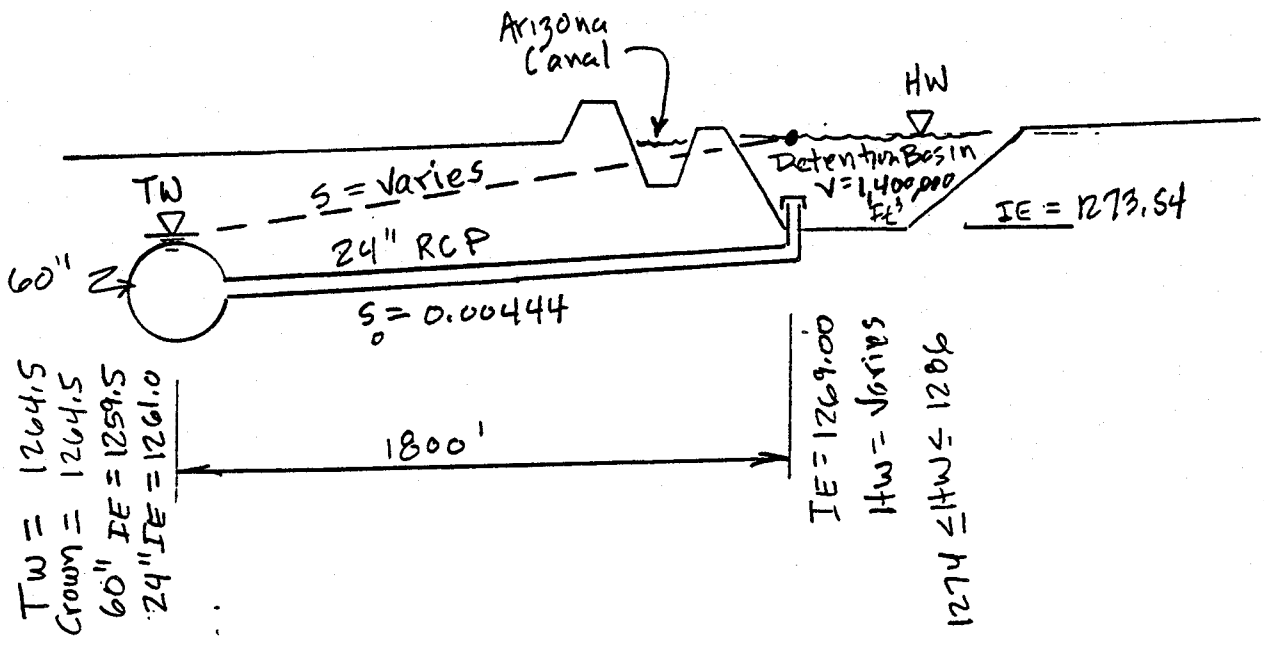
n = Friction n-value	=	0.012
l = Length of pipe	=	1,800 ft
L = Developed Length of pipe = 1.2 * l	=	2,160 ft
tw = Tailwater elevation at outlet	=	1264.5 ft

Use For Design

Pipe Diameter (Inches) =		12	18	24	30	36
hw (feet)	delta h (feet)	s (ft/ft)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)	Flow (cfs)
1274	9.5	0.00440	2.6	7.6	16.3	29.5	48.1
1275	10.5	0.00486	2.7	7.9	17.1	31.1	50.5

H 75

1276	11.5	0.00532	2.8	8.3	17.9	32.5	54.9
1277	12.5	0.00579	2.9	8.7	18.7	33.9	55.1
1278	13.5	0.00625	3.1	9.0	19.4	35.2	57.3
1279	14.5	0.00671	3.2	9.3	20.1	36.5	59.4
1280	15.5	0.00718	3.3	9.6	20.8	37.7	61.4
1281	16.5	0.00764	3.4	10.0	21.5	38.9	63.4
1282	17.5	0.00810	3.5	10.3	22.1	40.1	65.3
1283	18.5	0.00856	3.6	10.5	22.7	41.2	67.1
1284	19.5	0.00903	3.7	10.8	23.3	42.3	68.9
1285	20.5	0.00949	3.8	11.1	23.9	43.4	70.6
1286	21.5	0.00995	3.8	11.4	24.5	44.5	72.3

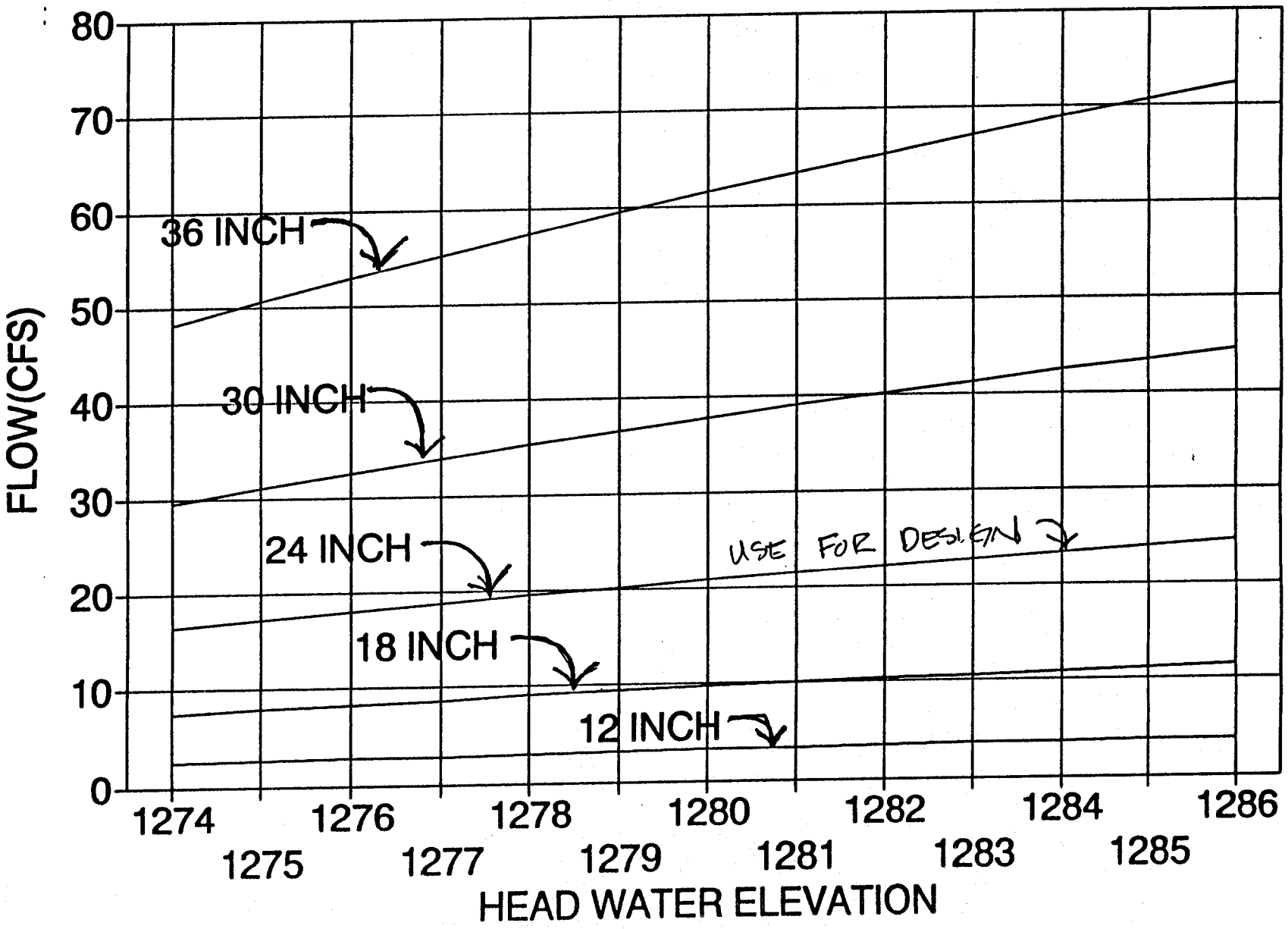


Re: MKE 30% Design

2550+58.97 IE = 1259.5

H76

ARIZONA CANAL DETENTION BASIN
PIPE OUTLET RATING CURVES



SALT RIVER PIMA – MARICOPA INDIAN COMMUNITY

Salt River Pima - Maricopa Indian Community
96th Street Storm Drain
Hydraulic Computations for Conduit and Channel

TECH3182\CIPPHGL.WQ1
05/05/92
BJF

CONDUIT DESIGN DATA

Conduit No.	Station	Length (Ft)	Conduit SPAN (ft)	Conduit RISE (ft)	CIPP DIAMETE (ft)	No. of Conduits	Type of Conduit	Conduit Thickness (in)	Conduit Flow (cfs)	Flow per Conduit (Cfs)	Conduit N-Value	Top of Road (Elev)	Crown (Elev)
GB1	6171											1280.90	1278.90
1 BOX	6700	529	16	14	NA	1	CBC	20	1500	1500	0.0120		
2 GB2	7400	700	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1289.50	1279.43
3	7470	70	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1288.12	1280.12
4 GB	7802	332	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1288.48	1280.55
5	8400	598	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1290.19	1283.19
6	8600	200	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1292.13	1285.13
7	8700	100	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1292.78	1285.78
8	8970	270	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1293.11	1286.11
9	9200	230	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1293.99	1286.99
10	9400	200	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1294.73	1287.73
11	9600	200	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1295.36	1288.36
12	9800	200	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1296.03	1289.03
GB3	9900	100	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1296.68	1289.68
14	10200	300	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1297.01	1290.01
15	10400	200	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1298.43	1291.43
16	10470	70	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1299.02	1292.02
17	10800	330	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1299.73	1292.71
18	11000	200	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1301.27	1294.27
19	11200	200	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1302.22	1295.22
20	11400	200	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1303.16	1296.16
21	11600	200	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1304.11	1297.11
22	11800	200	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1305.06	1298.06
23	11970	170	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1306.01	1299.01
24 INLET#6	12219	249	NA	NA	NA	10	2 CIPP	12	1500	750	0.0156	1306.81	1299.81
25	12500	281	NA	NA	NA	10	2 CIPP	12	1250	625	0.0156	1307.99	1300.99
26 INLET#5	12753	253	NA	NA	NA	10	2 CIPP	12	1250	625	0.0156	1309.32	1302.32
27 GB4	12933	180	NA	NA	NA	10	1 CIPP	12	1000	500	0.0156	1310.52	1303.52
28 INLET#4	13253	320	NA	NA	NA	10	1 CIPP	12	1000	1000	0.0156	1311.37	1304.37
29	13470	217	NA	NA	NA	9	1 CIPP	12	750	750	0.0156	1312.66	1305.66
30	13600	130	NA	NA	NA	9	1 CIPP	12	750	750	0.0156	1313.53	1306.53
31	13800	200	NA	NA	NA	9	1 CIPP	12	750	750	0.0156	1314.06	1307.06
32 INLET#3	14082	282	NA	NA	NA	9	1 CIPP	12	750	750	0.0156	1314.87	1307.87
33 INLET#2	14452	370	NA	NA	NA	9	1 CIPP	12	500	500	0.0156	1316.00	1309.00
34 INLET#1	14852	400	NA	NA	NA	9	1 CIPP	12	250	250	0.0156	1317.49	1310.49
35 GB5	14900	48	NA	NA	NA	NA	NA	NA	NA	NA	NA	1319.11	1312.11
36 GB6	18254	3354	NA	NA	NA	NA	NA	NA	NA	NA	NA	1319.30	NA
37 GB7	20700	2446	NA	NA	NA	NA	NA	NA	NA	NA	NA	1335.09	NA
												1349.20	NA

CONDUIT DESIGN HYDRAULICS

Conduit No.	A (sq ft)	P (ft)	R (ft)	v (Fps)	hv (Ft)	Ke Minor Loss	he (Ft)	a (Ft/Ft)	hl (Ft)	Station	Conduit EGL (Elev)	Conduit HGL (Elev)
GB1									Starting	6171.00	1286.97	1286.53
1	224.00	60.00	3.73	6.70	0.70	1.00	0.70	0.00050	0.27	6171.00	1287.87	1286.53
BOX						1.50	1.19			6700.00	1287.93	1287.24
2 GB2	78.54	31.42	2.50	9.55	1.42			0.00295	2.06	6700.00	1288.12	1286.71
						1.00	0.00			7400.00	1290.18	1288.77
3	78.54	31.42	2.50	9.55	1.42			0.00295	0.21	7400.00	1290.18	1288.77
						1.00	0.00			7470.00	1290.39	1288.97
4	78.54	31.42	2.50	9.55	1.42			0.00295	0.98	7470.00	1290.38	1288.97
						1.00	0.00			7802.00	1291.37	1289.95
5	78.54	31.42	2.50	9.55	1.42			0.00295	1.76	7802.00	1291.37	1289.95
						1.00	0.00			8400.00	1293.13	1291.71
6	78.54	31.42	2.50	9.55	1.42			0.00295	0.59	8400.00	1293.13	1291.71
						1.00	0.00			8600.00	1293.72	1292.30
7	78.54	31.42	2.50	9.55	1.42			0.00295	0.29	8600.00	1293.72	1292.30
						1.00	0.00			8700.00	1294.01	1292.60
8	78.54	31.42	2.50	9.55	1.42			0.00295	0.80	8700.00	1294.01	1292.60
						1.00	0.00			8970.00	1294.81	1293.39
9	78.54	31.42	2.50	9.55	1.42			0.00295	0.68	8970.00	1294.81	1293.39
						1.00	0.00			9200.00	1295.49	1294.07
10	78.54	31.42	2.50	9.55	1.42			0.00295	0.59	9200.00	1295.49	1294.07
						1.00	0.00			9400.00	1296.08	1294.66
11	78.54	31.42	2.50	9.55	1.42			0.00295	0.59	9400.00	1296.08	1294.66
						1.00	0.00			9600.00	1296.68	1295.25
12	78.54	31.42	2.50	9.55	1.42			0.00295	0.59	9600.00	1296.68	1295.25
						1.00	0.00			9800.00	1297.25	1295.84
13	78.54	31.42	2.50	9.55	1.42			0.00295	0.29	9800.00	1297.25	1295.84
GB3										9900.00	1297.55	1296.13
14	78.54	31.42	2.50	9.55	1.42			0.00295	0.88	9900.00	1297.55	1296.13
						1.00	0.00			10200.00	1298.43	1297.02
15	78.54	31.42	2.50	9.55	1.42			0.00295	0.59	10200.00	1298.43	1297.02
						1.00	0.00			10400.00	1299.02	1297.61
16	78.54	31.42	2.50	9.55	1.42			0.00295	0.21	10400.00	1299.02	1297.61
						1.00	0.00			10470.00	1299.23	1297.81
17	78.54	31.42	2.50	9.55	1.42			0.00295	0.97	10470.00	1299.23	1297.81
						1.00	0.00			10800.00	1300.20	1298.78
18	78.54	31.42	2.50	9.55	1.42			0.00295	0.59	10800.00	1300.20	1298.78
						1.00	0.00			11000.00	1300.79	1299.37
19	78.54	31.42	2.50	9.55	1.42			0.00295	0.59	11000.00	1300.79	1299.37
						1.00	0.00			11200.00	1301.38	1299.96
20	78.54	31.42	2.50	9.55	1.42			0.00295	0.59	11200.00	1301.38	1299.96
						1.00	0.00			11400.00	1301.97	1300.55
21	78.54	31.42	2.50	9.55	1.42			0.00295	0.59	11400.00	1301.97	1300.55
						1.00	0.00			11600.00	1302.56	1301.14
22	78.54	31.42	2.50	9.55	1.42			0.00295	0.59	11600.00	1302.56	1301.14
						1.00	0.00			11800.00	1303.15	1301.73
23	78.54	31.42	2.50	9.55	1.42			0.00295	0.50	11800.00	1303.15	1301.73
						1.00	0.00			11970.00	1303.65	1302.23
24 INLET#6	78.54	31.42	2.50	9.55	1.42			0.00295	0.73	11970.00	1303.65	1302.23
						0.50	0.02			12219.00	1304.38	1302.96
25	78.54	31.42	2.50	7.96	0.98			0.00205	0.57	12219.00	1304.40	1303.42
						1.50	0.53			12500.00	1304.98	1303.99
26 INLET#5	78.54	31.42	2.50	7.96	0.98			0.00205	0.52	12500.00	1304.98	1303.99
						1.00	0.00			12753.00	1305.49	1304.51
27 GB4	78.54	31.42	2.50	12.73	2.52			0.00524	0.94	12753.00	1306.02	1304.51
						1.00	0.00			12933.00	1306.97	1304.45
28 INLET#4	78.54	31.42	2.50	12.73	2.52			0.00524	1.68	12933.00	1306.97	1304.45
						0.50	0.01			13253.00	1308.64	1306.13
29	63.62	26.27	2.25	11.79	2.16			0.00517	1.12	13253.00	1308.65	1306.49
						1.00	0.00			13470.00	1309.77	1307.61
30	63.62	26.27	2.25	11.79	2.16			0.00517	0.67	13470.00	1309.77	1307.61
						1.00	0.00			13600.00	1310.44	1308.28
31	63.62	26.27	2.25	11.79	2.16			0.00517	1.03	13600.00	1310.44	1308.28
						1.00	0.00			13800.00	1311.48	1309.32
32 INLET#3	63.62	26.27	2.25	11.79	2.16			0.00517	1.46	13800.00	1311.48	1309.32
						0.50	0.12			14082.00	1312.93	1310.77
33 INLET#2	63.62	26.27	2.25	7.86	0.96			0.00230	0.85	14082.00	1313.05	1310.77
						0.50	0.12			14452.00	1313.90	1312.94
34 INLET#1	63.62	26.27	2.25	3.93	0.24			0.00057	0.23	14452.00	1314.02	1313.78
						0.50	0.12			14852.00	1314.25	1314.01
35 GB5	NA	NA	NA	NA	NA				NA	14852.00	1314.37	1314.37
						NA	NA			NA	NA	NA
36 GB6	NA	NA	NA	NA	NA				NA	NA	NA	NA
						NA	NA			NA	NA	NA
37 GB7	NA	NA	NA	NA	NA				NA	NA	NA	NA
						NA	NA			NA	NA	NA

CONDUIT DESIGN ANALYSIS

No.	Station	Length	Conduit Crown (Elev)	Top of Pipe (Elev)	Conduit Slope (Ft/Ft)	Conduit Invert (Elev)	Road (Elev)	Road - EGL (ft)	Road - HGL (ft)	HGL - Crown (ft)	Cover (ft)	Excess Capacity (cfs)
GB1	6171		1278.90	1280.57		1264.90	1280.90	-8.67	-5.73	7.73	0.33	
1	6171	529.00	1278.90	1280.57	0.00100	1264.90	1280.90	-8.77	-6.07	8.07	0.33	
BOX	6700		1279.43	1280.43		1265.43	1289.50	1.37	2.25	7.81	9.07	
2	6700	700.00	1279.43	1280.43	0.00099	1269.43	1289.50	1.38	2.79	7.28	9.07	
GB2	7400		1280.12	1281.12		1270.12	1288.12	-2.06	-0.65	6.65	7.00	
3	7400	70.00	1280.12	1281.12	0.00614	1270.12	1288.12	-2.06	-0.65	6.65	7.00	
	7470		1280.55	1281.55		1270.55	1288.48	-1.91	-0.49	8.42	6.93	
4	7470	332.00	1280.55	1281.55	0.00795	1270.55	1288.48	-1.91	-0.49	8.42	6.93	
	7802		1283.19	1284.19		1273.19	1290.19	-1.18	0.24	6.76	6.00	
5	7802	598.00	1283.19	1284.19	0.00325	1273.19	1290.19	-1.18	0.24	6.76	6.00	
	8400		1285.13	1286.13		1275.13	1292.13	-1.00	0.42	6.58	6.00	
6	8400	200.00	1285.13	1286.13	0.00325	1275.13	1292.13	-1.00	0.42	6.58	6.00	
	8600		1285.78	1286.78		1275.78	1292.78	-0.93	0.48	6.52	6.00	
7	8600	100.00	1285.78	1286.78	0.00325	1275.78	1292.78	-0.93	0.48	6.52	6.00	
	8700		1286.11	1287.11		1276.11	1293.11	-0.90	0.51	6.49	6.00	
8	8700	270.00	1286.11	1287.11	0.00325	1276.11	1293.11	-0.90	0.51	6.49	6.00	
	8970		1286.99	1287.99		1276.99	1293.99	-0.82	0.59	6.41	6.00	
9	8970	230.00	1286.99	1287.99	0.00325	1276.99	1293.99	-0.82	0.59	6.41	6.00	
	9200		1287.73	1288.73		1277.73	1294.73	-0.75	0.66	6.34	6.00	
10	9200	200.00	1287.73	1288.73	0.00325	1277.73	1294.73	-0.75	0.66	6.34	6.00	
	9400		1288.36	1289.36		1278.36	1295.36	-0.69	0.72	6.28	6.00	
11	9400	200.00	1288.36	1289.36	0.00325	1278.36	1295.36	-0.69	0.72	6.28	6.00	
	9600		1289.03	1290.03		1279.03	1296.03	-0.63	0.79	6.21	6.00	
12	9600	200.00	1289.03	1290.03	0.00325	1279.03	1296.03	-0.63	0.79	6.21	6.00	
	9800		1289.68	1290.68		1279.68	1296.68	-0.57	0.85	6.15	6.00	
13	9800	100.00	1289.68	1290.68	0.00325	1279.68	1296.68	-0.57	0.85	6.15	6.00	
GB3	9900		1290.01	1291.01		1280.01	1297.01	-0.54	0.88	6.12	6.00	
14	9900	300.00	1290.01	1291.01	0.00473	1280.01	1297.01	-0.54	0.88	6.12	6.00	
	10200		1291.43	1292.43		1281.43	1298.43	-0.40	1.41	5.59	6.00	
15	10200	200.00	1291.43	1292.43	0.00473	1281.43	1298.43	-0.40	1.41	5.59	6.00	
	10400		1292.38	1293.38		1282.38	1299.38	0.36	1.77	5.23	6.00	
16	10400	70.00	1292.38	1293.38	0.00473	1282.38	1299.38	0.36	1.77	5.23	6.00	
	10470		1292.71	1293.71		1282.71	1299.71	0.46	1.90	5.10	6.00	
17	10470	330.00	1292.71	1293.71	0.00473	1282.71	1299.71	0.46	1.90	5.10	6.00	
	10800		1294.27	1295.27		1284.27	1301.27	1.07	2.49	4.51	6.00	
18	10800	200.00	1294.27	1295.27	0.00473	1284.27	1301.27	1.07	2.49	4.51	6.00	
	11000		1295.22	1296.22		1285.22	1302.22	1.43	2.84	4.16	6.00	
19	11000	200.00	1295.22	1296.22	0.00473	1285.22	1302.22	1.43	2.84	4.16	6.00	
	11200		1296.16	1297.16		1286.16	1303.16	1.79	3.20	3.80	6.00	
20	11200	200.00	1296.16	1297.16	0.00473	1286.16	1303.16	1.79	3.20	3.80	6.00	
	11400		1297.11	1298.11		1287.11	1304.11	2.14	3.56	3.44	6.00	
21	11400	200.00	1297.11	1298.11	0.00473	1287.11	1304.11	2.14	3.56	3.44	6.00	
	11600		1298.06	1299.06		1288.06	1305.06	2.50	3.92	3.08	6.00	
22	11600	200.00	1298.06	1299.06	0.00473	1288.06	1305.06	2.50	3.92	3.08	6.00	
	11800		1299.01	1300.01		1289.01	1306.01	2.86	4.28	2.72	6.00	
23	11800	170.00	1299.01	1300.01	0.00473	1289.01	1306.01	2.86	4.28	2.72	6.00	
	11970		1299.81	1300.81		1289.81	1306.81	3.16	4.58	2.42	6.00	
24 INLET#6	11970	249.00	1299.81	1300.81	0.00473	1289.81	1306.81	3.16	4.58	2.42	6.00	
	12219		1300.99	1301.99		1290.99	1307.99	3.61	5.02	1.98	6.00	
25	12219	281.00	1300.99	1301.99	0.00473	1290.99	1307.99	3.59	4.57	2.43	6.00	
	12500		1302.32	1303.32		1292.32	1309.32	4.34	5.33	1.67	6.00	
26	12500	253.00	1302.32	1303.32	0.00473	1292.32	1309.32	4.34	5.33	1.67	6.00	
	12753		1303.52	1304.52		1293.52	1310.52	5.03	6.01	0.99	6.00	
27	12753	180.00	1303.52	1304.52	0.00473	1293.52	1310.52	4.49	7.01	-0.01	6.00	
	12933		1304.37	1305.37		1294.37	1311.37	4.40	6.92	0.08	6.00	
28	12933	320.00	1304.37	1305.37	0.00403	1294.37	1311.37	4.40	6.92	0.08	6.00	
	13253		1305.66	1306.66		1295.66	1312.66	4.62	6.54	0.46	6.00	
29	13253	217.00	1305.66	1306.66	0.00403	1295.66	1312.66	4.62	6.17	0.83	6.00	
	13470		1306.53	1307.53		1296.53	1313.53	3.76	5.92	1.08	6.00	
30	13470	130.00	1306.53	1307.53	0.00403	1296.53	1313.53	3.76	5.92	1.08	6.00	
	13600		1307.06	1308.06		1296.06	1314.06	3.62	5.77	1.23	6.00	
31	13600	200.00	1307.06	1308.06	0.00403	1296.06	1314.06	3.62	5.77	1.23	6.00	
	13800		1307.87	1308.87		1296.87	1314.87	3.38	5.55	1.45	6.00	
32	13800	282.00	1307.87	1308.87	0.00403	1296.87	1314.87	3.38	5.55	1.45	6.00	
INLET#3	14082		1309.00	1310.00		1300.00	1316.00	3.07	5.23	1.77	6.00	
33	14082	370.00	1309.00	1310.00	0.00403	1300.00	1316.00	2.85	3.91	3.09	6.00	
INLET#2	14452		1310.49	1311.49		1301.49	1317.49	3.59	4.55	2.45	6.00	
34	14452	400.00	1310.49	1311.49	0.00403	1301.49	1317.49	3.47	3.71	3.29	6.00	
INLET#1	14852		1312.11	1313.11		1303.11	1319.11	4.85	5.09	1.91	6.00	
35	14852	48.00	1312.11	1313.11	NA	NA	1319.11	NA	NA	NA	NA	
GB5	NA		NA	NA		NA	NA	NA	NA	NA	NA	
36	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
GB6	NA		NA	NA		NA	NA	NA	NA	NA	NA	
37	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	
GB7	NA		NA	NA		NA	NA	NA	NA	NA	NA	

CHANNEL DESIGN

Channel No.	Station (Ft)	Length (ft)	Bottom Width (ft)	Water Depth (ft)	Side Slope (z:1)	N-Value	Flow (Cfs)	Top of Road (Elev)	Design HGL (Elev)	Top Width (ft)	P (ft)	a (sq ft)	R (ft)	e (ft/ft)	V (fps)	Design Capacity (cfs)	Excess Capacity (cfs)
GB1	6171		0					1280.90	1279.90								
1	6700	529	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00320	5.41	682	182
BOX								1280.50	1288.50								
2	7400	700	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00320	5.41	682	182
GB2								1288.12	1287.12								
3	7470	70	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00320	5.41	682	182
								1288.48	1287.48								
4	7802	332	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00515	6.87	865	365
								1290.19	1289.19								
5	8400	598	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00325	5.46	688	188
								1292.13	1291.13								
6	8600	200	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00325	5.46	688	188
								1292.78	1291.78								
7	8700	100	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00325	5.46	688	188
								1293.11	1292.11								
8	8970	270	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00325	5.46	688	188
								1293.99	1292.99								
9	9200	230	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00325	5.46	688	188
								1294.73	1293.73								
10	9400	200	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00325	5.46	688	188
								1295.36	1294.36								
11	9600	200	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00325	5.46	688	188
								1296.03	1295.03								
12	9800	200	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00325	5.46	688	188
								1296.68	1295.68								
13	9900	100	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00325	5.46	688	188
GB3								1297.01	1296.01								
14	10200	300	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00473	6.59	830	330
								1298.43	1297.43								
15	10400	200	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00473	6.59	830	330
								1299.38	1298.38								
16	10470	70	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00473	6.59	830	330
								1299.71	1298.71								
17	10800	330	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00473	6.59	830	330
								1301.27	1300.27								
18	11000	200	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00473	6.59	830	330
								1302.22	1301.22								
19	11200	200	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00473	6.59	830	330
								1303.16	1302.16								
20	11400	200	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00473	6.59	830	330
								1304.11	1303.11								
21	11600	200	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00473	6.59	830	330
								1305.06	1304.06								
22	11800	200	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00473	6.59	830	330
								1306.01	1305.01								
23	11970	170	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00473	6.59	830	330
								1306.81	1305.81								
24 INLET#6	12219	249	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00473	6.59	830	330
								1307.99	1306.99								
25	12500	281	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00473	6.59	830	330
								1309.32	1308.32								
26	12753	253	10	4.50	4	0.030	500.00			50.00	47.11	126.00	2.67	0.00473	6.59	830	330
								1310.52	1309.52								
27	12933