FINAL DRAINAGE REPORT
FOR
CHAPEL HILLS BOX CULVERT

JR Engineering, Ltd.

JR Engineering, Ltd.
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Colorado Springs, Colorado 80919
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FOR
CHAPEL HILLS BOX CULVERT

March 1997
Revised October 1997
Revised February 1998

Prepared For:

LP47, LLC dba LA PLATA INVESTMENTS
7150 Campus Drive, Suite 365
Colorado Springs, CO 80920
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Prepared By:

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Job No. 8716.14

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DRAINAGE REPORT STATEMENT

ENGINEER'S STATEMENT:
The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

COLORADO REGISTERED KYLE R. CAMPBELL 29794 PROFESSIONAL ENGINEER

Kyle R. Campbell, Colorado P.E. #29794 — Date: 3.5.98
For and On Behalf of JR Engineering, Ltd.

DEVELOPER'S STATEMENT:
I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: LP47, LLC dba La Plata Investments

By: _____
Bob Ingels

Title: _____

Address: 7150 Campus Drive, Suite 365

Colorado Springs, CO 80920

CITY OF COLORADO SPRINGS ONLY:
Filed in accordance with Section 15-3-906 of the Code of the City of Colorado Springs, 1980, as amended.

_____ — March 9, 1998
City Engineer — Date

Conditions:

FINAL DRAINAGE REPORT
FOR CHAPEL HILLS BOX CULVERT

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APPENDIX

FINAL DRAINAGE REPORT
FOR CHAPEL HILLS BOX CULVERT

PURPOSE

This document is the Final Hydraulic Report for the Chapel Hills Box Culvert at Pine Creek. The purpose of this report is to identify the impacts that the proposed box culvert would have on the flows within Pine Creek. This report will analyze the ability of the proposed box culvert to convey the developed flows as established by the approved Pine Creek Drainage Basin Planning Study and its amendments, and analyze channel treatment requirements up and down stream of the box culvert.

GENERAL DESCRIPTION

The Chapel Hills Box Culvert at Pine Creek is located in Section 28, Township 12 South, Range 66 West of the Sixth Principal Meridian in the City of Colorado Springs, County of El Paso. The site is bounded by the Pine Creek Golf Course with the 17th tee to the northeast, the 11th green to the southeast, the 12th tee to the southwest, and the 16th green to the northwest.

The 4 cell box culvert is proposed to be dual purpose in that it provides a 2 cell lower channel to handle storms of approximately 2-year frequency and adjacent cells 2.75 feet higher to serve as a golf cart passages under Chapel Hills Drive on each side of the flow channel. Both levels convey stormwater in storms greater than 5-year frequency.

Golf cart paths approach the channel to pass under Chapel Hills Drive through the box culverts, no cart path crossings of the channel are proposed.

Rip-rap channel lining is proposed for the short transition areas at the upstream and downstream ends of the box culvert. Due to concerns by the U. S. Army Corps of Engineers about removal of vegetation that may support the Prebel's Jumping Mouse proposed channel treatment has been minimized.

HYDROLOGY

The Pine Creek Drainage Basin has been extensively studied before by Obering, Wurth & Associates. Reference is made to the previous submittal, dated October 1988, entitled "Pine Creek Drainage Basin - Drainage Basin Planning Study", and the Amendment No. 1, dated July 1992. The design flow used for the channel analysis is 1800 cfs downstream of Chapel Hills Drive and 1330 cfs upstream of the Chapel Hills Drive Box Culvert. These figures are consistent with the DBPS Amendment No. 1.

HYDRAULICS

Topography for this project was obtained from the City BIS Department. The digital FIMS map reflects the 1995 update and therefore represents the most current conditions. For example, the FIMS map shows the Chapel Hills Drive temporary embankment.

To analyze the flow characteristics of the channel and the impact the box culvert has on the channel, JR Engineering, Ltd. used HEC-RAS (River Analysis System), Version 1.2, developed by the US Army Corp of Engineers.

The roughness coefficients were selected from Table 10.2 of the Drainage Criteria Manual. Due to impact on possible mouse habitat, the channel protection has been limited as indicated on the attached plan. It is proposed that approximately 50 feet of channel upstream of the box and approximately 75 feet down stream will receive rip-rap treatment. A plunge pool/energy dissipater with grouted rip-rap is proposed at the box outlet. It is anticipated that due to the study area being within the golf course and its proximity to Chapel Hills Drive, the channel will be well maintained. The following "n" values were used:

n = 0.035 for areas intended to receive rip-rap, channel and overbank areas likely to have grass and low weeds.
n = 0.050 for overbank areas where heavy vegetation may develop
n = 0.015 for smooth concrete surfaces
n = 0.075 for main channel native condition
n = 0.085 for overbank native condition

Portions of the lower channel cells of the box culvert are proposed to be stone lined, thus an "n" value of 0.035 was used for these areas.
The same roughness coefficients were used for the 2-year, 5-year, and 100-year storm events. The results of the HEC-RAS analysis are included in the appendix.

At Chapel Hills Drive, the 4 cell box culvert was modeled with 2 lower cells to carry the low flows approximately a 2-year event and 2 upper cells to serve as golf cart paths and carry a portion larger discharges. The depth of flow through the box ranges from 2.4 feet for the 2-year storm to 4.5 feet for the 100-year storm. The exit velocities out of the box are 12.29 fps and 8.38 fps (sta. 160) for the 100-year and 2-year events respectively.

Review of the results of the HEC-RAS analysis may be summarized as follows:

Stations 185 through 240 upstream of the proposed box culvert are proposed to be left undisturbed. Velocities generated during a 2-year frequency storm in this reach range from 3.00 fps at Station 210 to 5.82 fps at Station 185 (just upstream of the proposed rip-rap). Velocities generated during a 100-year frequency storm in this reach range from 5.4 fps at Station 210 to 9.14 fps at Station 185.

Stations 170 through 180 upstream of the proposed box culvert are scheduled to receive rip-rap. Calculated velocities for a 100-year frequency storm in this reach range from 12 fps to 15 fps.

Stations through 142 through 160 downstream of the proposed box culvert incorporate a plunge pool/energy dissipater and are scheduled to receive rip-rap and grouted rip-rap. Note that the two (2) storm drain outlets are proposed to discharge into the grouted rip-rap plunge pool/energy dissipater at the proposed box culvert outlet. Calculated velocities generated by a 100-year frequency storm range from 20.72 fps at Station 155 to 5.08 fps at Station 152. At the downstream end of the rip-rap treatment (Station 142), velocities are predicted to be 6.15 fps and 9.85 fps for the 2-year and 100-year events respectively. The channel bottom downstream of Station 142 is heavily vegetated with willows that are expected to aid in resisting erosion from high velocities. The downstream edge of the rip-rap lining will be thickened to 6-feet to provide protection form potential

future downstream degradation of the channel.

Stations 105 through 132 are proposed to be left undisturbed. Calculated velocities generated during a 2-year frequency storm range from 4.72 fps to 6.38 fps. Calculated velocities generated during a 100-year storm range from 8.52 fps to 12.2 fps.

FLOOD PLAIN STATEMENT

Portions of this project lie within the Pine Creek 100-year flood limits and thus requires a Floodplain Development Permit. The permit application and supporting analysis have been submitted for revision of the existing permit.

RECOMMENDATIONS

As a result of this study, our analysis indicates that the installation of the box culvert at Chapel Hills will not adversely effect the surrounding properties. The 100-year storm event is passed through the box culvert without any overtopping of the road and the exit velocities at the downstream end are manageable. Channel protection, to include both rip-rap and grouted rip-rap, will be required as part of the improvement plans for the box culvert. Analysis of the proposed treatment is included in the appendix of this report. The areas to be treated and related details are shown on the attached plans.

The proposed improvements have been designed to minimize hydraulic effects on the upstream and downstream channel.

However, it should be noted that the 100-year frequency storm HEC-RAS analysis predicts velocities on the high side of the acceptable range upstream and downstream of the proposed improvements. Some channel erosion may occur in these areas during severe storms. These areas are to be maintained by the owners of the golf course. Frequent monitoring of the channel should be done so that if erosion occurs it can be treated before significant damage is done to the vegetative channel lining.

Increases in the peak rates of storm water runoff due to upstream development will be limited by future detention ponds presently under study.

It is, therefore, determined that the installation of the Chapel Hills Drive Box Culvert at Pine Creek will not adversely affect surrounding developments.

CONSTRUCTION COST

A bid of approximately $125,000 has been received for construction of the box culvert.

MAINTENANCE

The drainage way, protective rip-rap areas, and the cart paths within the study zone will continue to be owned and maintained by the golf course.

In addition, the proposed box culvert structure is to be maintained by the City, along with the necessary improvements for the road deck. A private maintenance agreement is currently being prepared to address the specific issues related to the channel and box culvert.

REVISED BY:

John R. Bessette
Project Engineer
Land Development
For and On Behalf of JR Engineering, Ltd.

Vance S. Fossinger, P.E.
Project Engineer
Land Development
For and On Behalf of JR Engineering, Ltd.

/vb/871614/drainag2.rpt

REFERENCES

1. "Pine Creek Drainage Basin - Drainage Basin Planning Study," Obering, Wurth & Associates, dated October 1988.

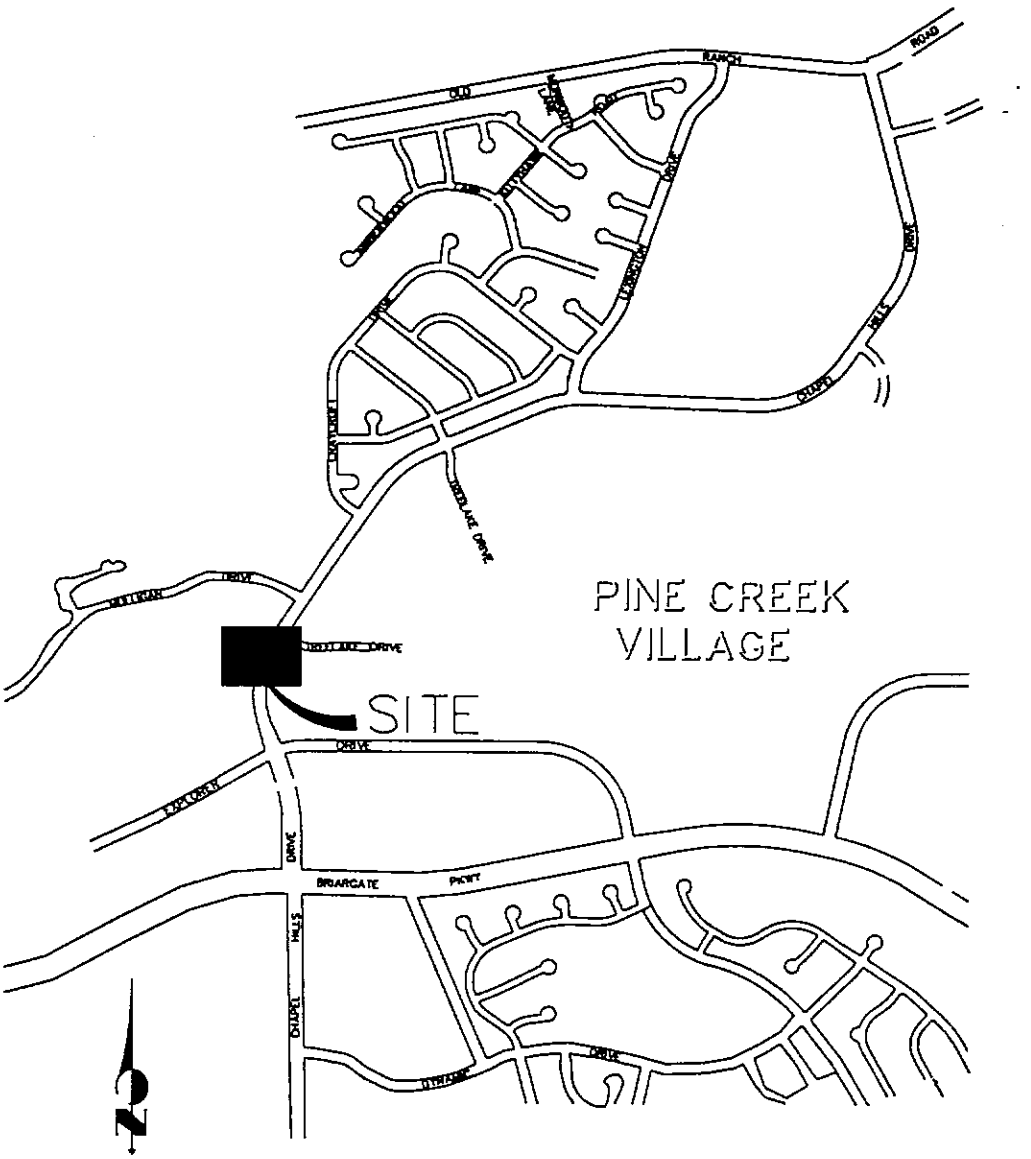
2. "Amendment No. 1 to Pine Creek Drainage Basin Planning Study," Obering, Wurth & Associates, dated July 1992.

3. "Master Development Drainage Plan for Briargate Business Campus in Pine Creek Basin," JR Engineering, Ltd., dated October 1996.

4. City of Colorado Springs/County of El Paso Drainage Criteria Manual, dated October, 1991.

APPENDIX

VICINITY MAP



VICINITY MAP
N.T.S.

FLOODPLAIN MAPS

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

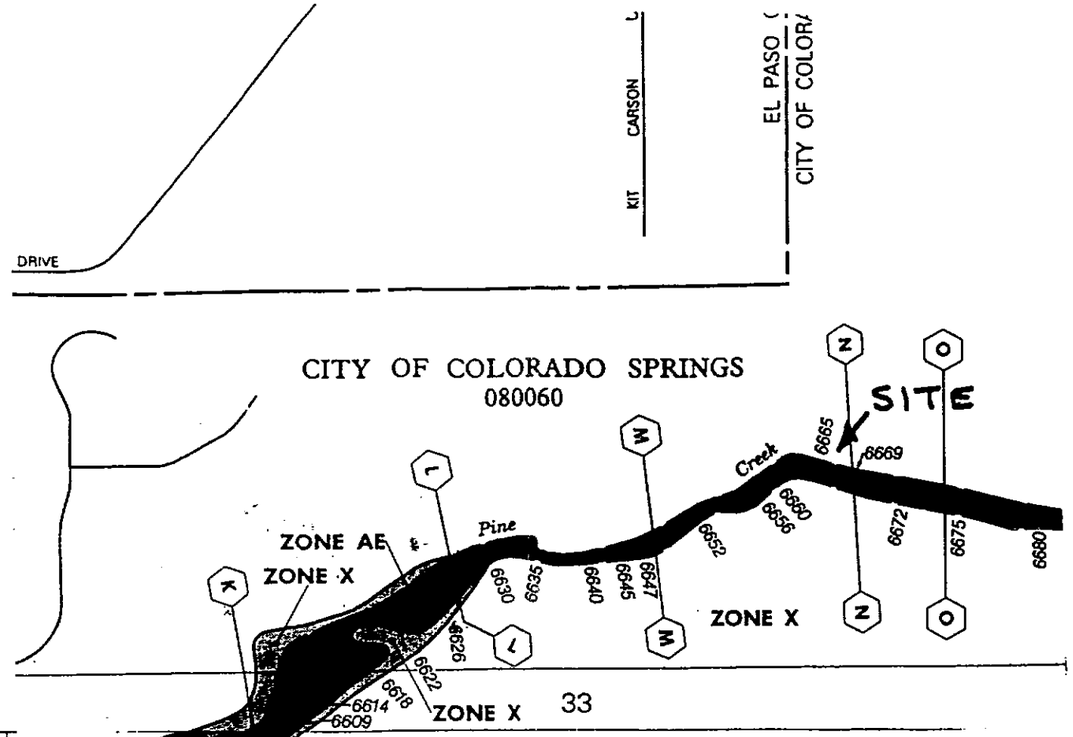
PANEL 506 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0506	F
EL PASO COUNTY UNINCORPORATED AREAS	080059	0506	F

MAP NUMBER
08041C0506 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency



NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 508 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0508	F
EL PASO COUNTY UNINCORPORATED AREAS	080059	0508	F

MAP NUMBER
08041C0508 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

CITY OF COLORADO SPRINGS
080060

ZONE X

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 66 WEST AND TOWNSHIP 13 SOUTH, RANGE 66 WEST.

CHANNEL PROTECTION

PINE CREEK

CHANNEL PROTECTION

Station	Proposed	Storm Frequency 2-year (fps)	100-year (fps)
240	———	3.49	6.43
230	↑	4.36	7.25
210	To Remain	3.00	5.40
185	Undisturbed	5.82	9.14
180	——↓——	8.66	12.01
175	↑	11.78	14.60
172	Proposed Rip-rap Protection	11.66	15.05
170	——↓——	8.25	14.41

BOX CULVERT

160	———	8.38	12.29
155	↑	2.69	20.72
152	Grouted Rip-rap	2.26	5.08
145	& Rip-pap	4.45	5.92
142	——↓——	6.15	9.85
132	↑	4.81	12.70
122	To Remain	6.38	9.81
115	Undisturbed	5.35	8.72
110		4.72	8.52
105	——↓——	5.84	10.64

CHANNEL PROTECTION STATION 170 TO 180 (Limits of Construction)

Average Velocity: 14 fps: $S_S = 2.5$ minimum

Average Slope: $\frac{6}{60} = 10\%$

Estimate Rip-rap size based on Colorado Springs Drainage Criteria Manuel – Table 10-6

$$\frac{VS^{0.17}}{(S_S - 1)^{0.66}} = \frac{(14)(.68)}{1.31} = 7.28$$

$7.28 > 6.4$ for Type VH Rock

Note that Rip-rap will be toed against the retaining walls along the cart paths and the inlet cutoff wall of the box culvert. Thus, channel slope should not carry the weight as expressed in the Drainage Criteria Manuel formula above.

Check exhibit 16-1 and 16-2 of the S.C.S. Engineering Field Manuel.
Assume Limestone Rock source: $S = 2.67$ Unit wt. 165 lb/cu ft +/-
Vaverage = 14 fps Max stone size 30" dia
$Wt = 0.523\ d^3\ (165) = 1350$ lb
Wt range 75% of rock 325 to 1300 lb (19"-30" dia)

More than 50% of Type H is less than 18" dia therefore use: Type VH to provide 75% > 18" dia

CHANNEL PROTECTION STATION 160 TO 142 (Limits of Construction)
To Include Plunge Pool/Energy Dissipater And Storm Drain Outlets:

Flows from Chapel Hill Drive, Briargate Parkway to Old Ranch Road

Sanitary and Storm Sewer Plans

A) 43" x 68" Ellip. RCP: Q = 325 cfs, V = 20 fps (assuming full pipe)

B) 34" x 53" Ellip. RCP: Q = 170 cfs, V = 17 fps (assuming full pipe)

Channel Velocities:

Highest: Sta. 155, 20.7 fps
Average: 11 fps
Average Slope: $\frac{1}{75} = 0.013 = S$
$S_S = 2.67$

$\frac{VS^{0.17}}{(S_S - 1)^{0.66}}$ = 5.6 to 6.4 for Type VH Rip-rap, per Colorado Springs Drainage Manuel Table 10-6

$\frac{(20)(0.48)}{1.4} = 6.83 > 6.4$

Therefore, use Type VH Rip-rap and Grout Critical Area as shown on the plans.

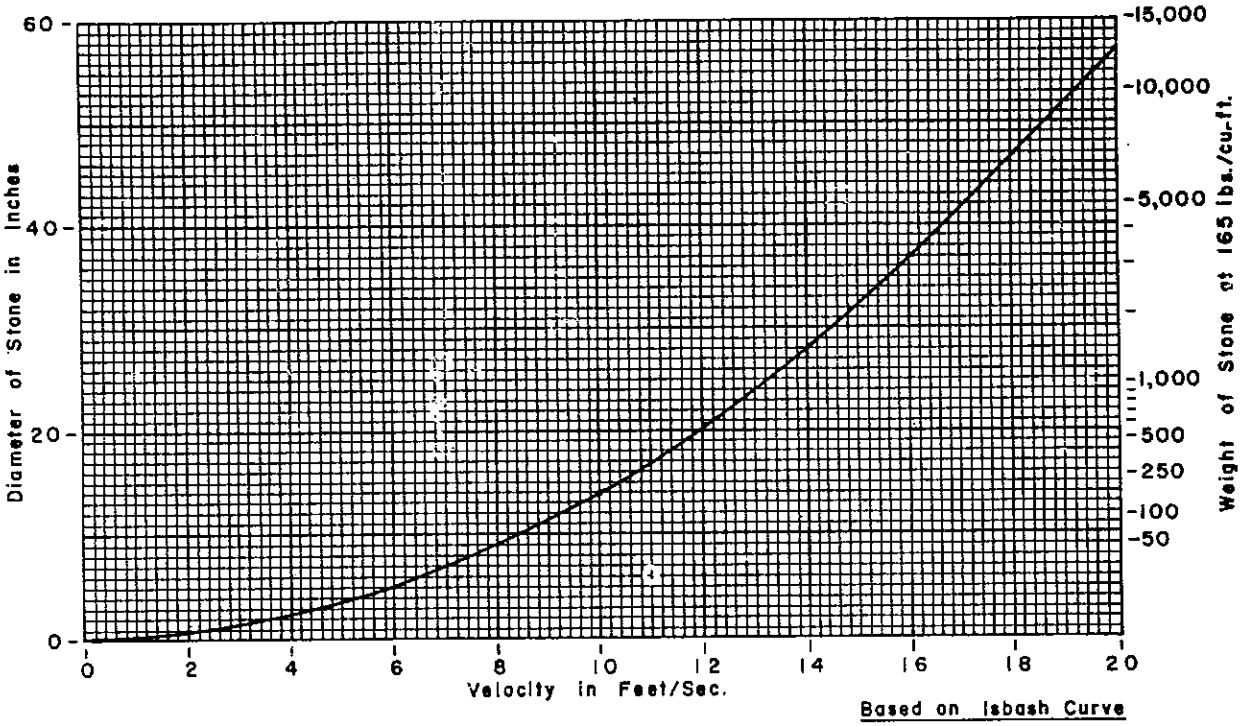


Exhibit 16-1 Maximum stone size for riprap

Maximum weight of stone required	Minimum and maximum range in weight of stones	Weight range of 75 percent of stones
(lbs.)	(lbs.)	(lbs.)
150	25 - 150	50 - 150
200	25 - 200	50 - 200
250	25 - 250	50 - 250
400	25 - 400	100 - 400
600	25 - 600	150 - 600
800	25 - 800	200 - 800
1000	50 -1000	250 -1000
1300	50 -1300	325 -1300
1600	50 -1600	400 -1600
2000	75 -2000	600 -2000
2700	100 -2700	800 -2700

Exhibit 16-2. Gradation of riprap

SUMMARY TABLES

HEC-RAS Plan: Plan 17 Reach: PINE CREEK 2/18/98 2 YEAR

River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
240	315.00	66.00	69.59		69.78	0.012318	3.49	90.16	43.90	0.43
230	315.00	66.00	68.27		68.56	0.026866	4.36	72.48	47.86	0.61
210	315.00	64.00	66.69	65.67	66.83	0.009165	3.00	106.68	59.30	0.37
185	315.00	64.00	65.32	65.32	65.85	0.082105	5.82	54.10	51.82	1.00
180	315.00	62.00	63.19	63.52	64.35	0.042654	8.66	36.35	36.77	1.54
175	315.00	59.50	60.69	61.32	62.85	0.079015	11.78	26.74	26.67	2.07
172	315.00	58.50	59.98	60.61	62.09	0.059435	11.66	27.02	21.99	1.85
170	315.00	58.00	60.38	60.43	61.44	0.012202	8.25	38.20	19.76	1.05
160	315.00	57.00	59.35	59.43	60.44	0.012820	8.38	37.61	19.76	1.07
155	315.00	54.00	58.04		58.15	0.000691	2.69	116.91	29.04	0.24
152	375.00	54.00	58.03		58.11	0.000903	2.26	166.13	68.01	0.25
145	375.00	56.00	57.76		58.07	0.007467	4.45	84.29	62.89	0.68
142	375.00	56.00	57.28	57.28	57.86	0.017384	6.15	60.99	52.57	1.20
132	375.00	55.00	56.83		57.18	0.034902	4.81	79.43	57.37	0.69
122	375.00	53.50	55.10	55.10	55.70	0.069513	6.38	62.59	54.20	1.00
115	375.00	52.00	53.74		54.18	0.040720	5.35	70.14	44.69	0.75
110	375.00	50.00	52.85		53.20	0.024137	4.72	80.40	44.41	0.60
105	375.00	49.60	51.66	51.44	52.19	0.047007	5.84	64.24	39.99	0.81

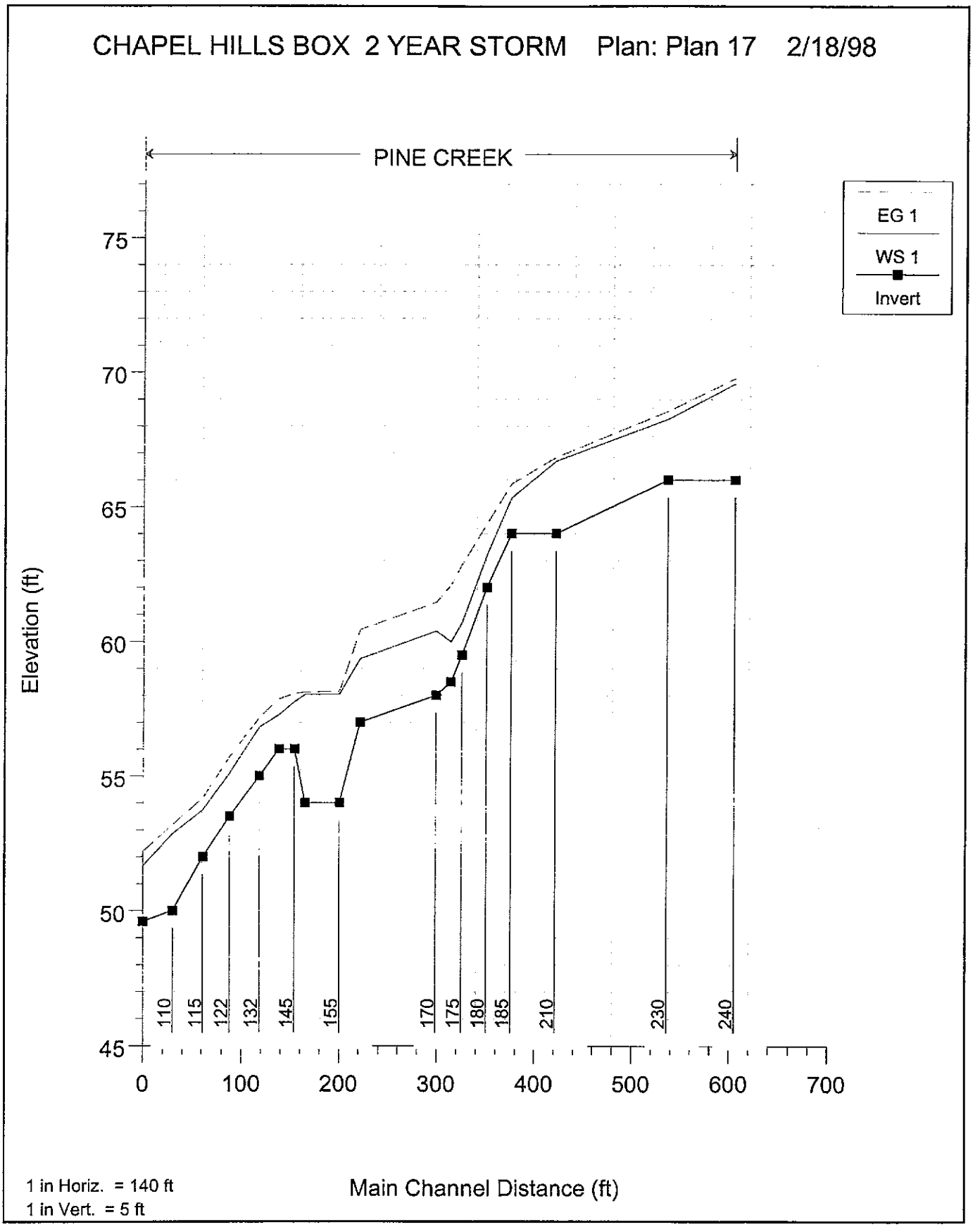
HEC-RAS Plan: Plan 18 Reach: PINE CREEK 2/23/98 5 YEAR

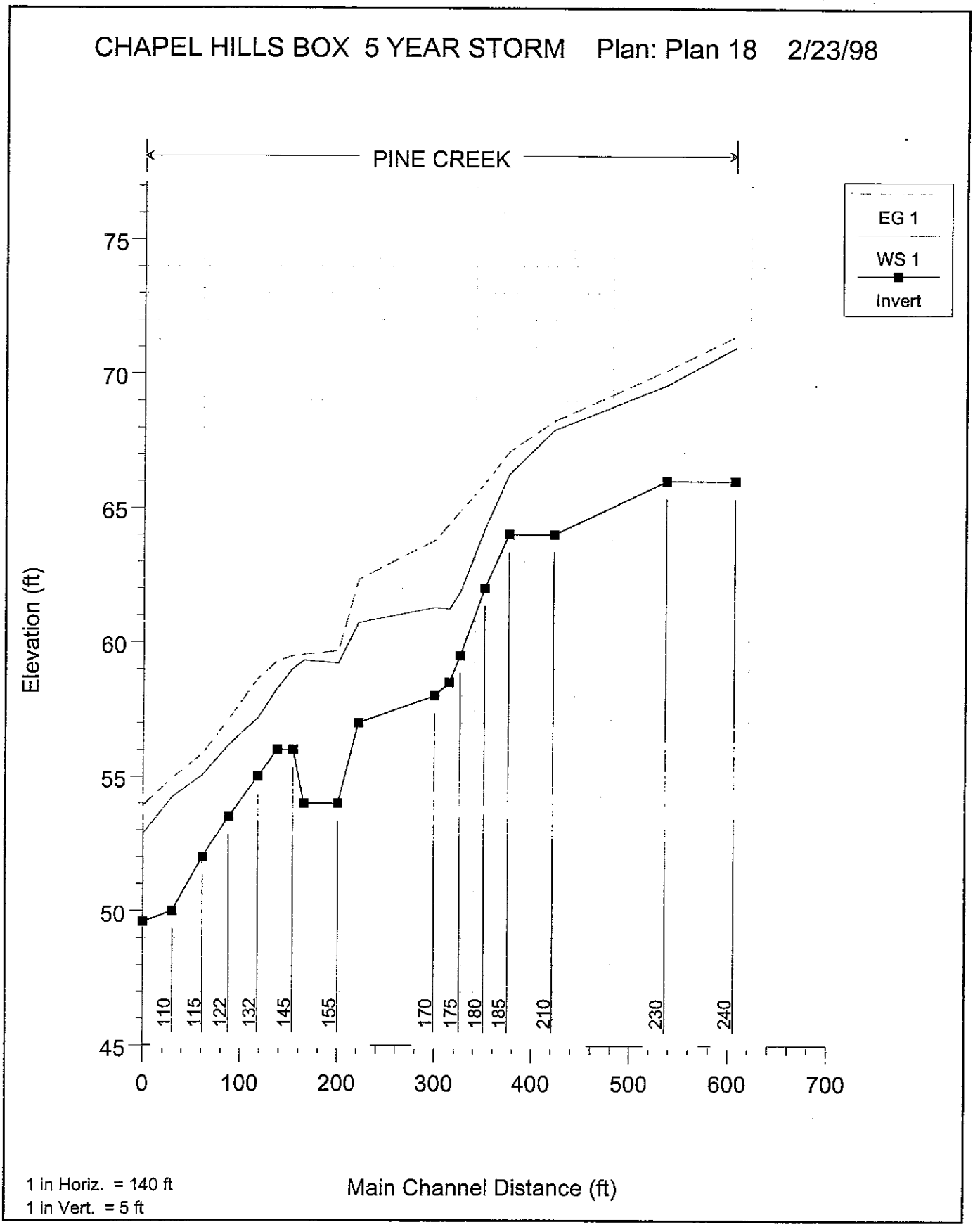
River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
240	815.00	66.00	70.97		71.39	0.014909	5.21	158.31	53.35	0.51
230	815.00	66.00	69.58		70.13	0.022590	6.00	141.49	57.07	0.62
210	815.00	64.00	67.90		68.23	0.011895	4.68	185.58	71.93	0.46
185	815.00	64.00	66.25	66.25	67.09	0.066404	7.28	111.19	75.24	1.01
180	815.00	62.00	64.20	64.72	65.91	0.030040	10.49	77.67	51.47	1.51
175	815.00	59.50	61.85	62.78	64.88	0.044675	13.97	58.33	27.85	1.70
172	815.00	58.50	61.23	62.36	64.40	0.040437	14.30	56.99	32.97	1.92
170	815.00	58.00	61.28	62.00	63.77	0.021908	12.68	64.30	35.74	1.67
160	815.00	57.00	60.72	61.00	62.33	0.011122	10.16	80.18	35.78	1.20
155	815.00	54.00	59.22		59.67	0.002016	5.39	151.27	29.08	0.42
152	950.00	54.00	59.32		59.54	0.001421	3.73	254.36	68.51	0.34
145	950.00	56.00	59.02		59.49	0.005648	5.47	173.71	76.94	0.64
142	950.00	56.00	58.28	58.28	59.30	0.014424	8.09	117.59	59.83	1.00
132	950.00	55.00	57.18	57.51	58.63	0.108647	9.77	99.96	59.65	1.27
122	950.00	53.50	56.18	56.18	57.15	0.054153	8.32	127.75	66.23	1.01
115	950.00	52.00	55.05		55.86	0.033955	7.23	134.18	53.35	0.76
110	950.00	50.00	54.25		54.94	0.023992	6.77	146.31	49.99	0.65
105	950.00	49.60	52.86	52.67	53.93	0.047074	8.29	115.76	45.45	0.89

HEC-RAS Plan: Plan 17 Reach: PINE CREEK 2/18/98 100 YEAR

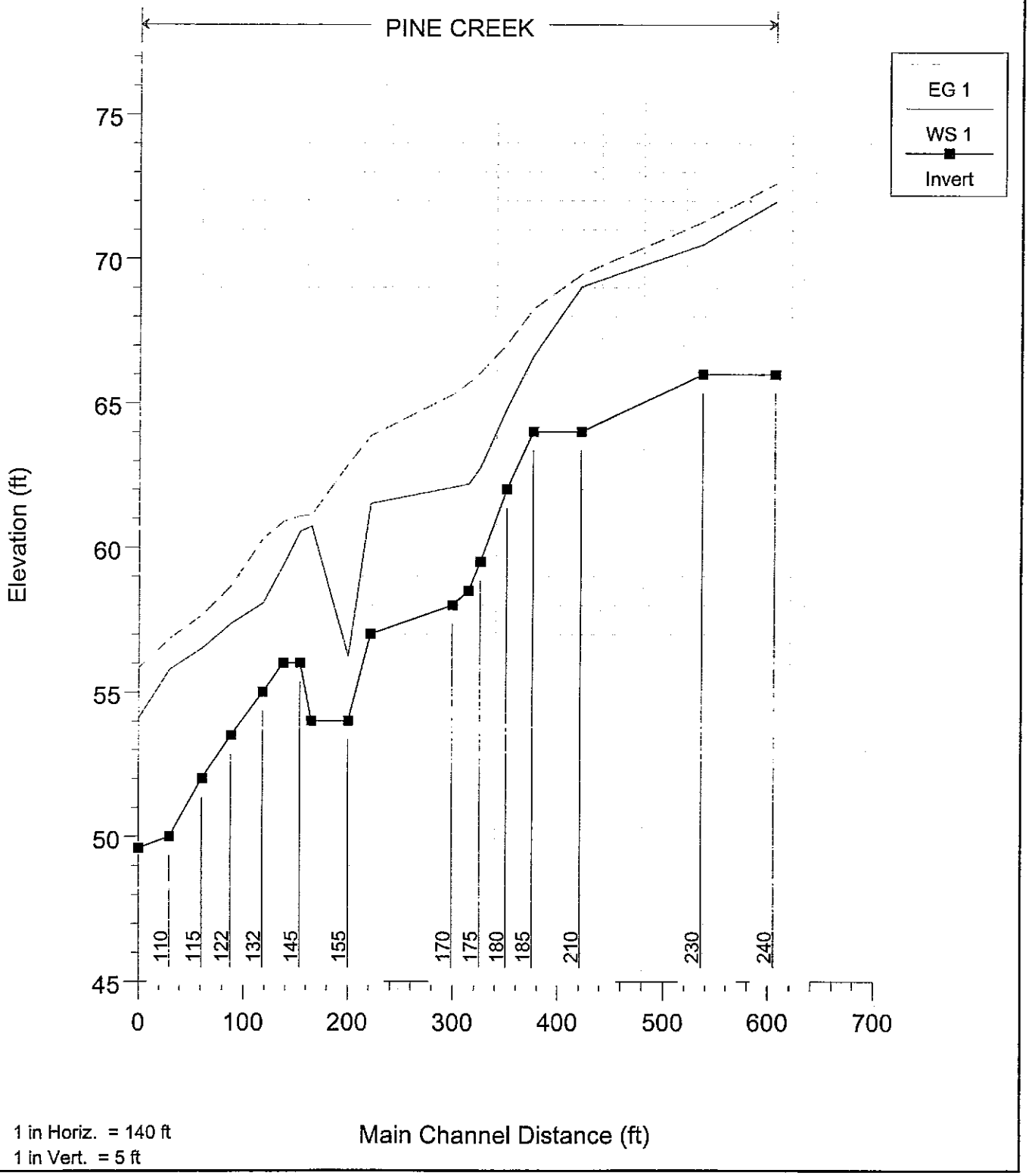
River Sta.	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
240	1330.00	66.00	71.97		72.60	0.015872	6.43	214.08	58.82	0.55
230	1330.00	66.00	70.49		71.28	0.022902	7.25	197.61	67.91	0.66
210	1330.00	64.00	69.02	67.46	69.45	0.010566	5.40	271.21	79.66	0.46
185	1330.00	64.00	66.61	66.61	68.25	0.083238	9.14	139.84	81.46	1.19
180	1330.00	62.00	64.80	65.50	67.04	0.030068	12.01	110.73	58.80	1.54
175	1330.00	59.50	62.75	63.72	66.06	0.041119	14.60	91.09	37.93	1.66
172	1330.00	58.50	62.18	63.23	65.70	0.025281	15.05	88.40	33.01	1.62
170	1330.00	58.00	62.06	62.97	65.28	0.019326	14.41	92.31	35.83	1.58
160	1330.00	57.00	61.50	61.98	63.85	0.012009	12.29	108.20	35.86	1.25
155	1330.00	54.00	56.22	58.02	62.88	0.086934	20.72	64.19	28.98	2.45
152	1800.00	54.00	60.72		61.12	0.001737	5.08	357.04	79.92	0.40
145	1800.00	56.00	60.53		61.08	0.003934	5.92	306.02	101.54	0.57
142	1800.00	56.00	59.38	59.38	60.88	0.011963	9.85	187.51	67.00	0.98
132	1800.00	55.00	58.06	58.63	60.29	0.100547	12.20	155.09	65.44	1.30
122	1800.00	53.50	57.36		58.66	0.044414	9.81	210.84	74.49	0.91
115	1800.00	52.00	56.52		57.66	0.028366	8.72	219.78	63.10	0.74
110	1800.00	50.00	55.78		56.85	0.022894	8.52	227.35	56.11	0.68
105	1800.00	49.60	54.10	54.03	55.83	0.047021	10.64	175.07	50.45	0.94

PROFILES


CHAPEL HILLS BOX 2 YEAR STORM Plan: Plan 17 2/18/98
PINE CREEK
EG 1
WS 1
Invert
Elevation (ft)
75
70
65
60
55
50
45
0
100
200
300
400
500
600
700
110
115
122
132
145
155
170
175
180
185
210
230
240
1 in Horiz. = 140 ft
1 in Vert. = 5 ft
Main Channel Distance (ft)


CHAPEL HILLS BOX 5 YEAR STORM Plan: Plan 18 2/23/98
PINE CREEK
EG 1
WS 1
Invert
Elevation (ft)
75
70
65
60
55
50
45
110
115
122
132
145
155
170
175
180
185
210
230
240
0
100
200
300
400
500
600
700
1 in Horiz. = 140 ft
1 in Vert. = 5 ft
Main Channel Distance (ft)

CHAPEL HILLS BOX 100 YEAR STORM Plan: Plan 17 2/18/98

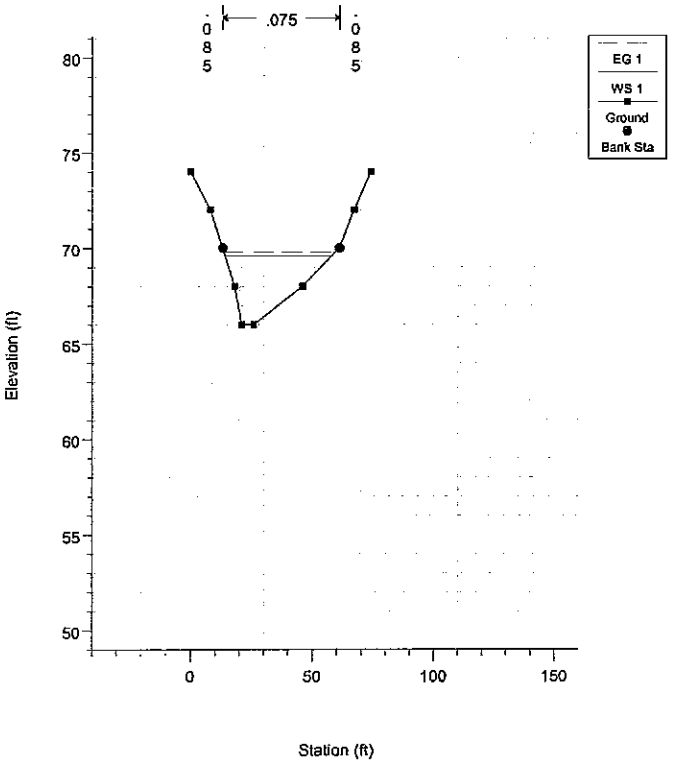


1 in Horiz. = 140 ft
1 in Vert. = 5 ft

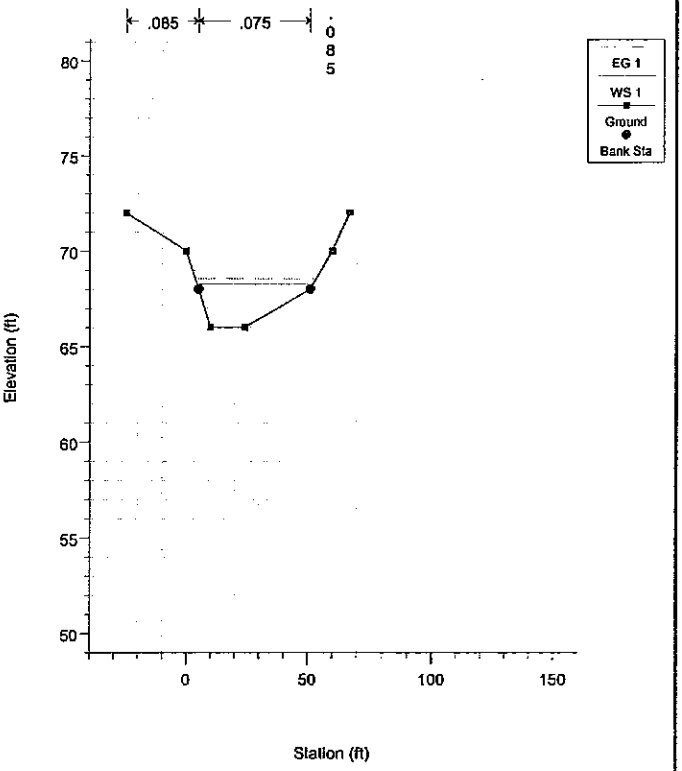
CROSS-SECTIONS

2 Year Storm

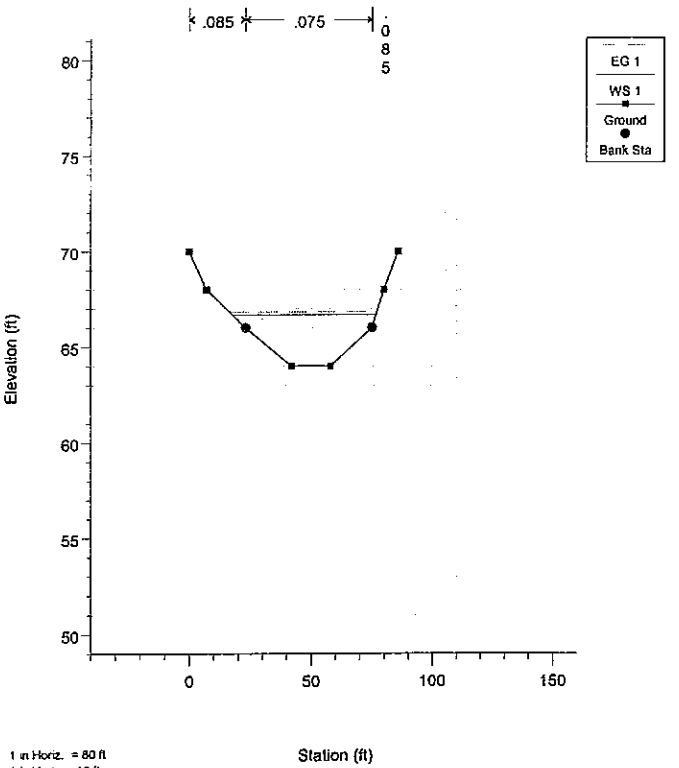
CHAPEL HILLS BOX 2 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 240



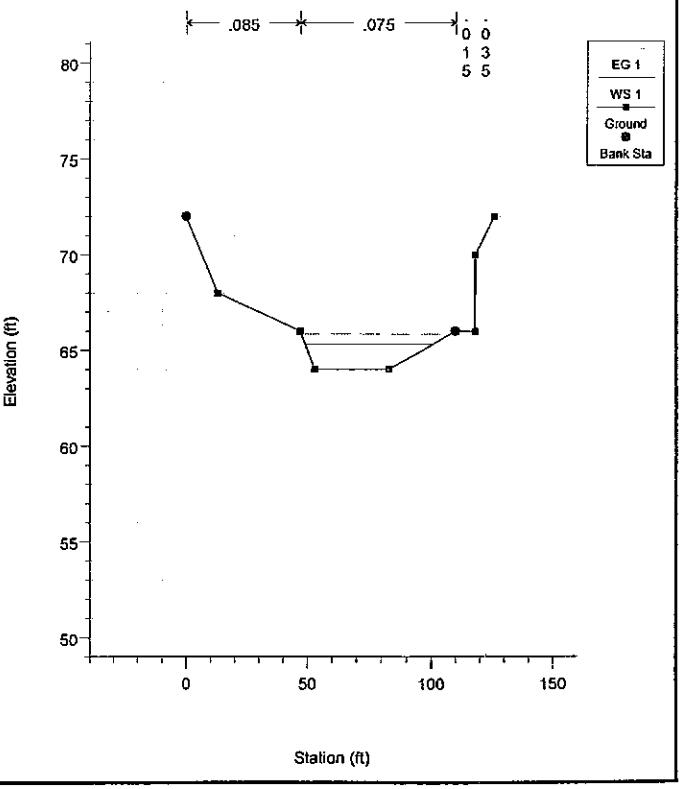
CHAPEL HILLS BOX 2 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 230



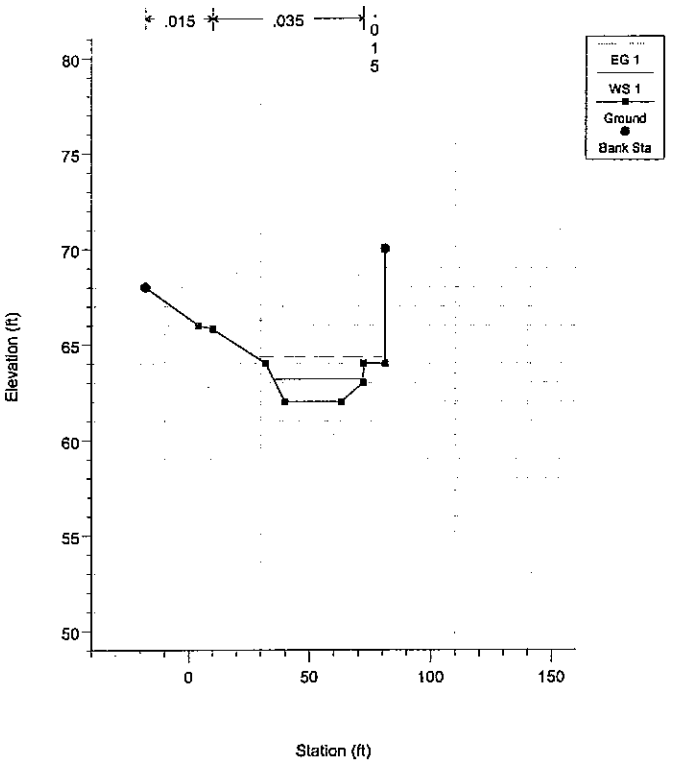
CHAPEL HILLS BOX 2 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 210



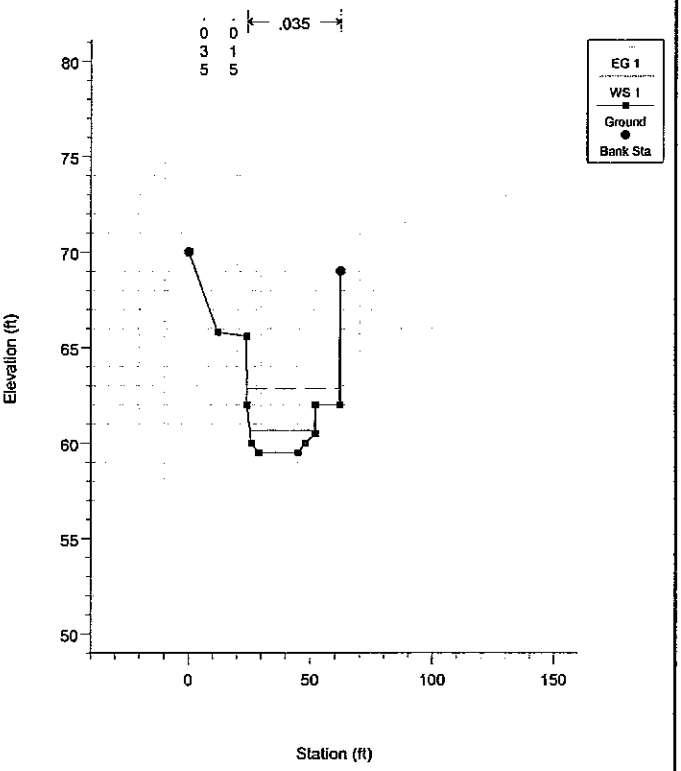
CHAPEL HILLS BOX 2 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 185



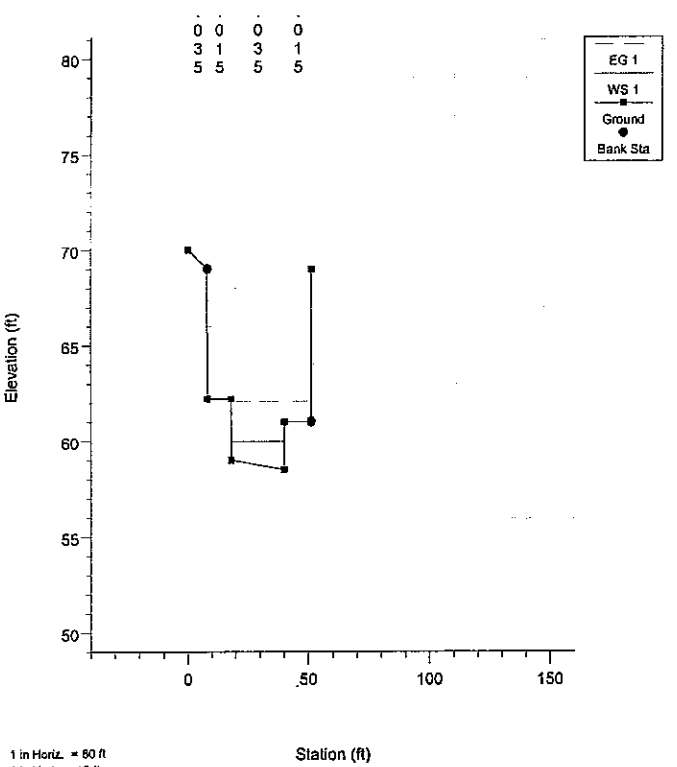
CHAPEL HILLS BOX 2 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 180



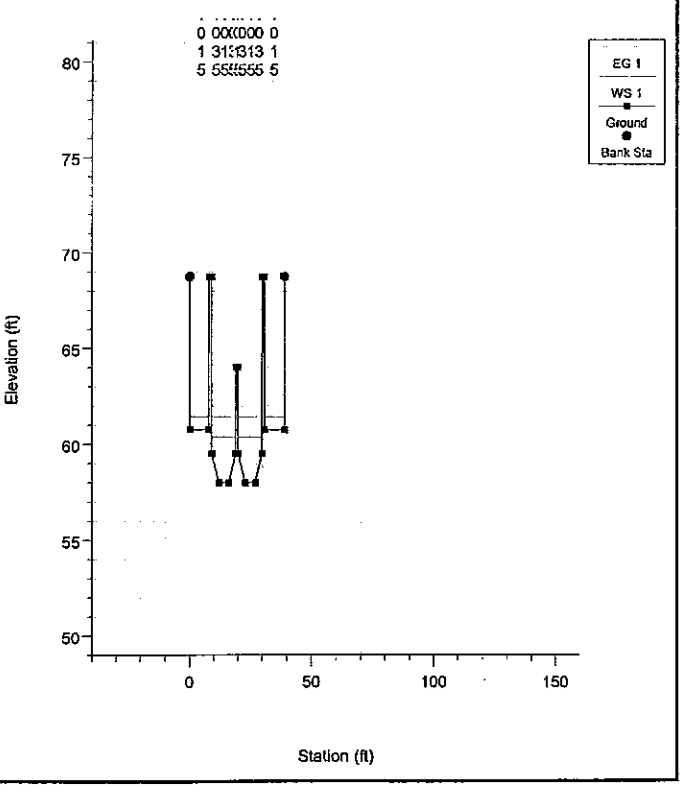
CHAPEL HILLS BOX 2 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 175



CHAPEL HILLS BOX 2 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 172

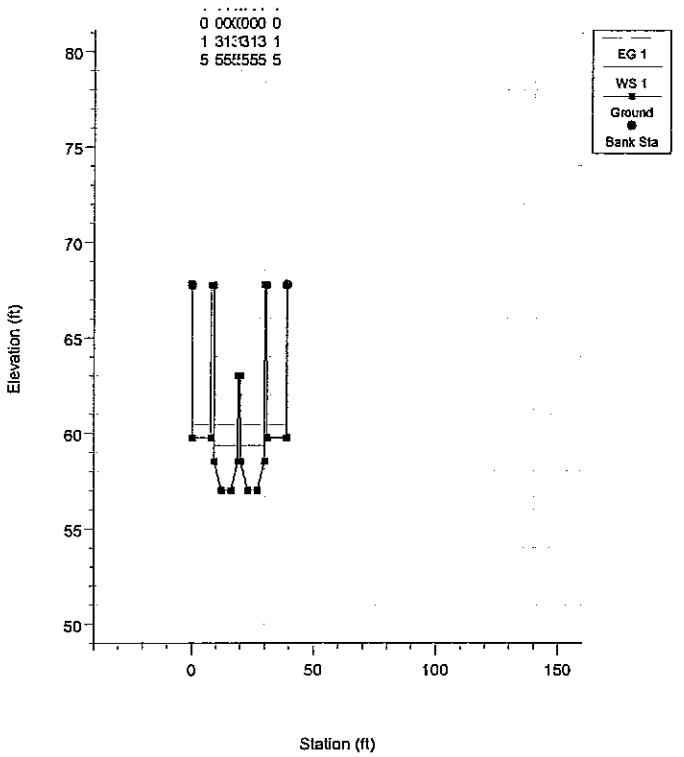


CHAPEL HILLS BOX 2 YEAR STORM Plan: Plan 17 2/18/98
BOX INLET Riv Sta = 170

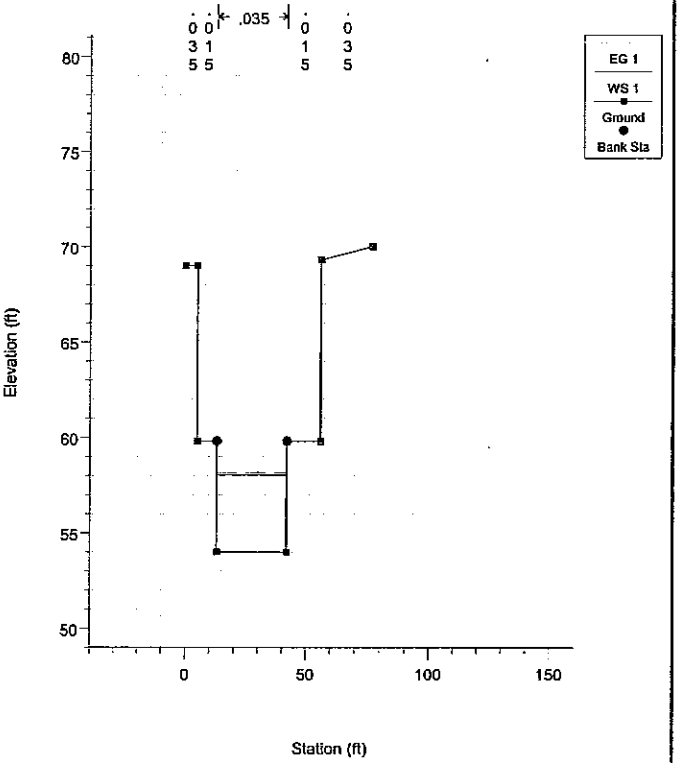


1 in Horiz. = 50 ft
1 in Vert. = 10 ft

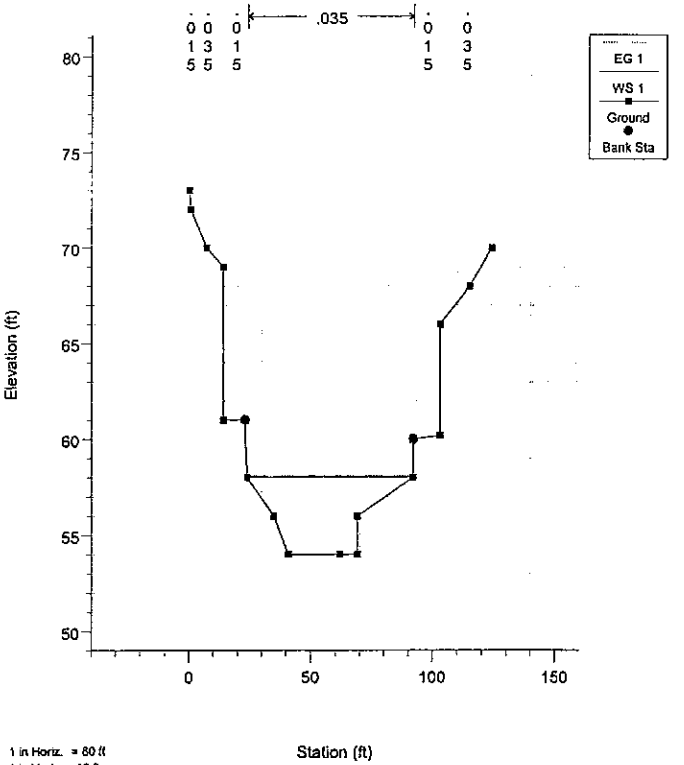
CHAPEL HILLS BOX 2 YEAR STORM Plan: Plan 17 2/18/98
BOX OUTLET Riv Sta = 160



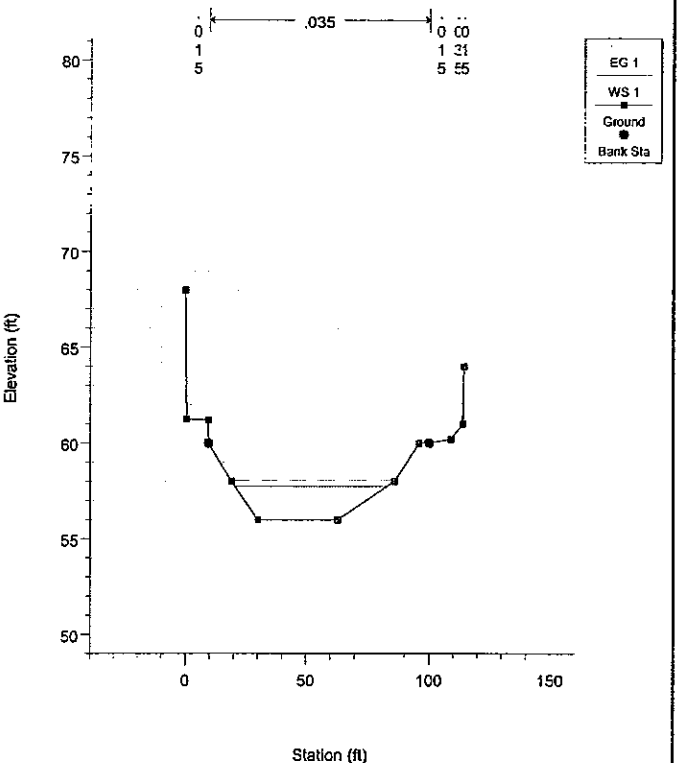
CHAPEL HILLS BOX 2 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 155



CHAPEL HILLS BOX 2 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 152

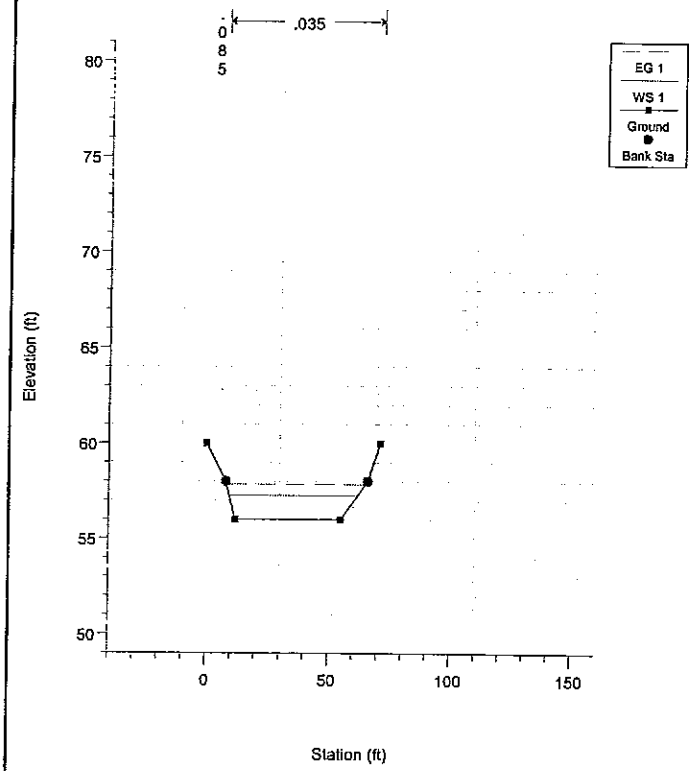


CHAPEL HILLS BOX 2 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 145

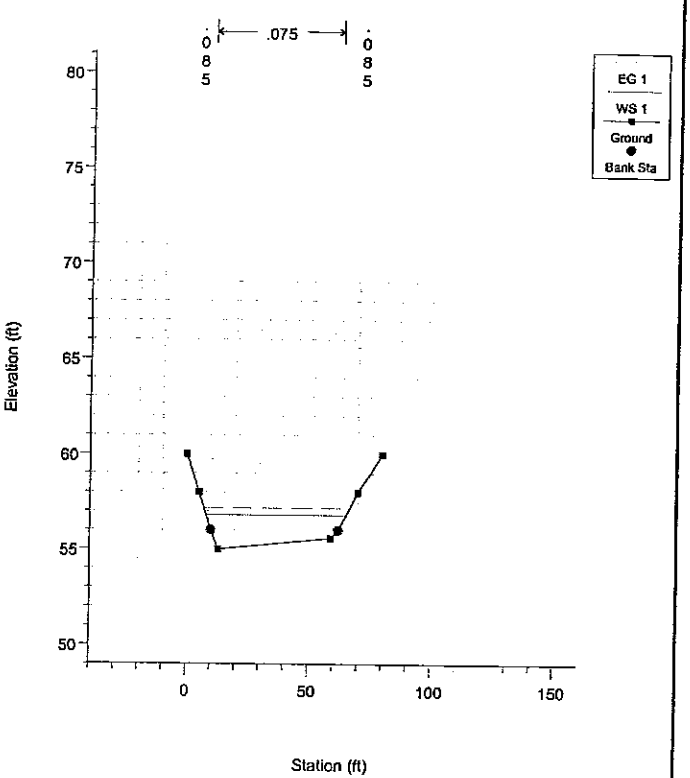


1 in Horiz. = 50 ft
1 in Vert. = 10 ft

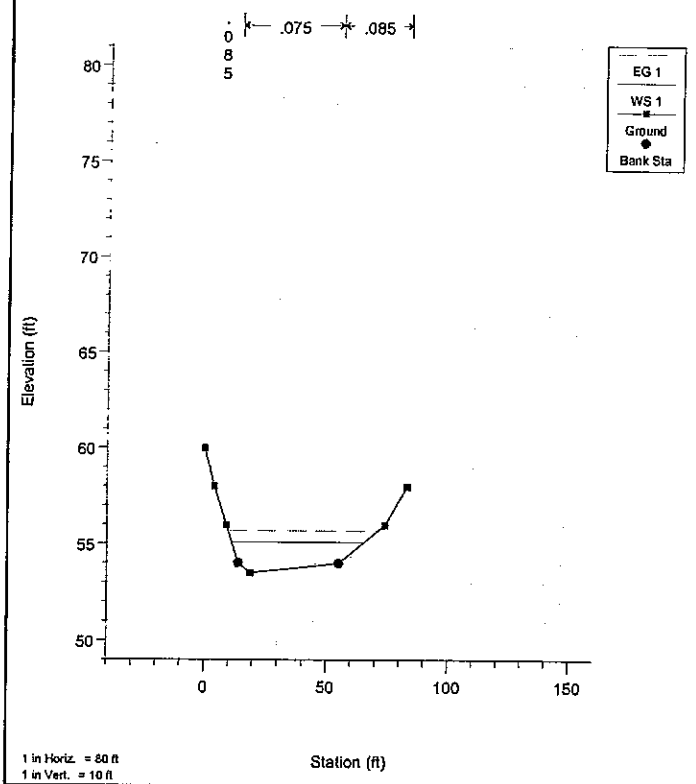
CHAPEL HILLS BOX 2 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 142



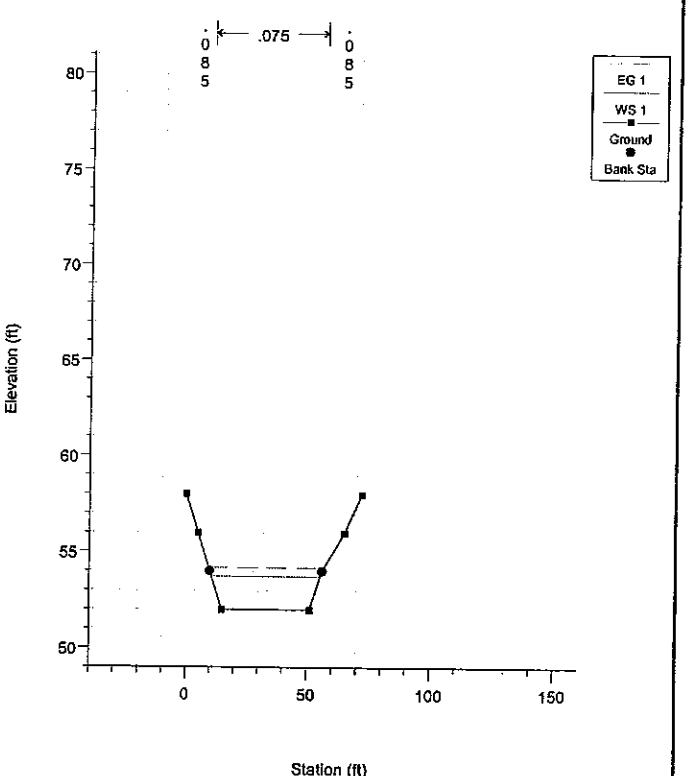
CHAPEL HILLS BOX 2 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 132



CHAPEL HILLS BOX 2 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 122

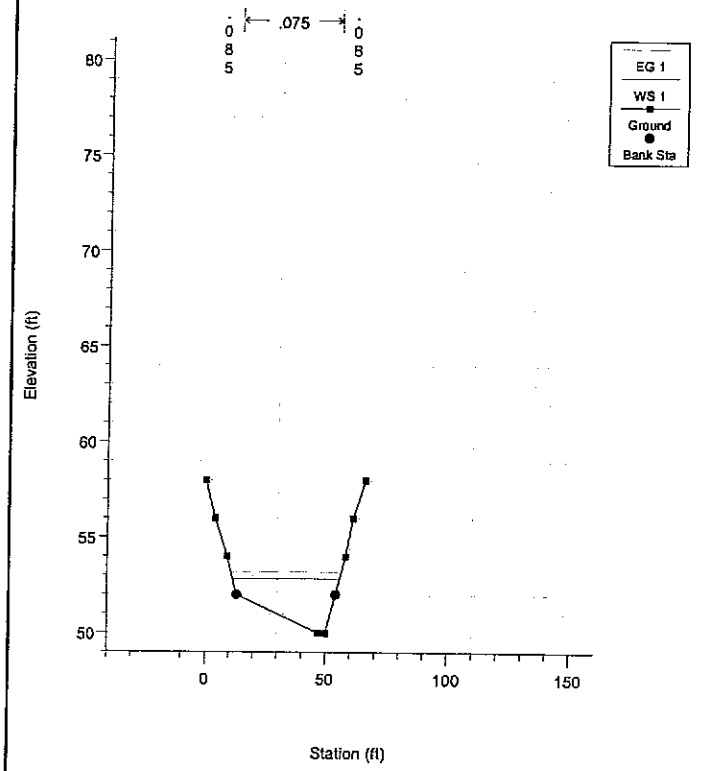


CHAPEL HILLS BOX 2 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 115

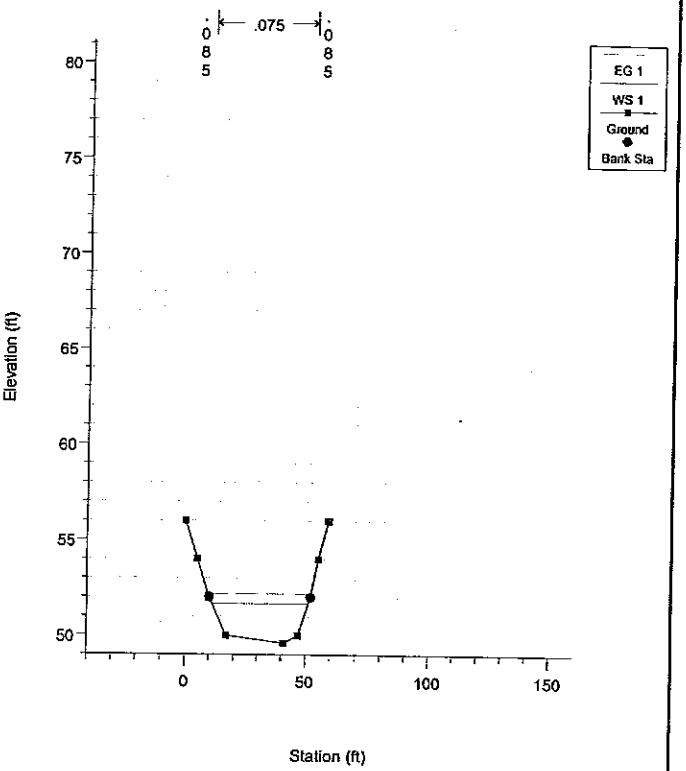


1 in Horiz. = 80 ft
1 in Vert. = 10 ft

CHAPEL HILLS BOX 2 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 110



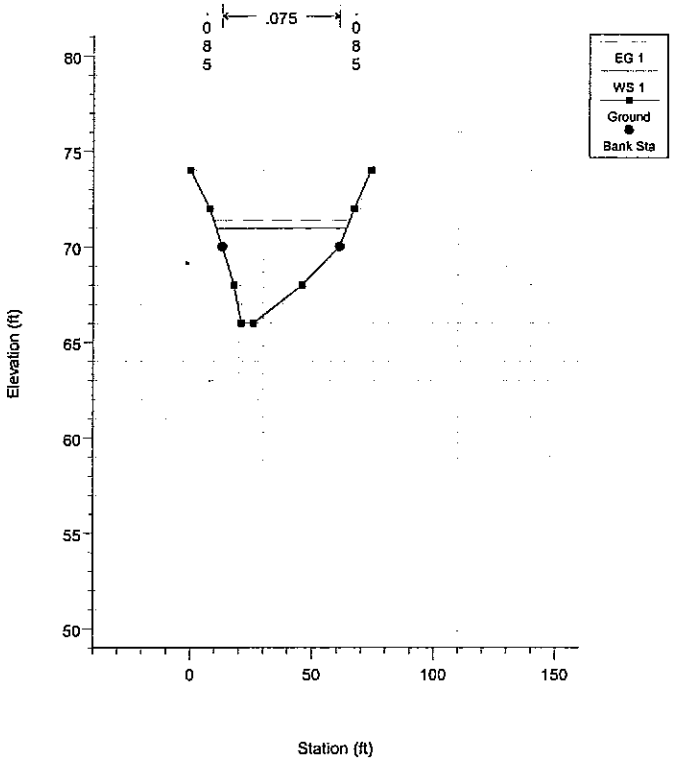
CHAPEL HILLS BOX 2 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 105



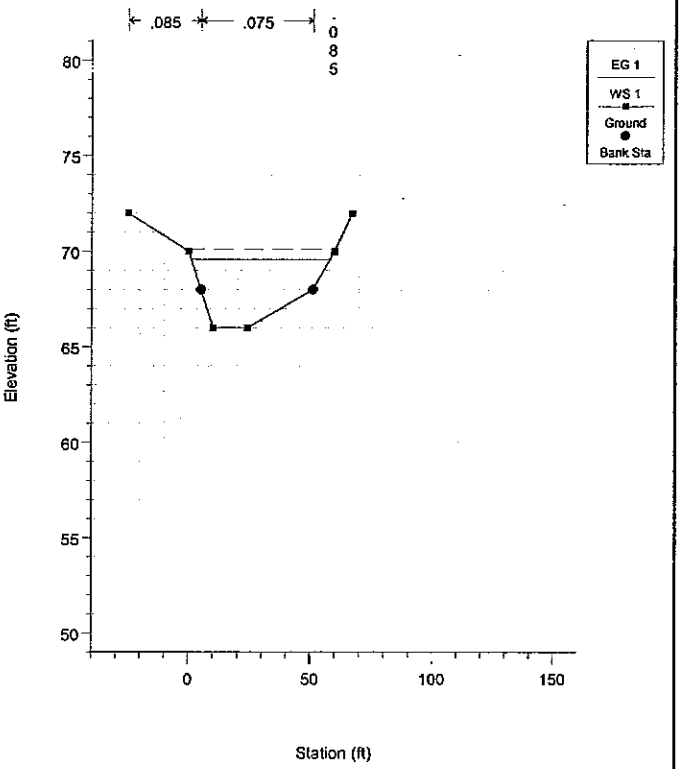
1 in Horiz. = 80 ft
1 in Vert. = 10 ft

5 Year Storm

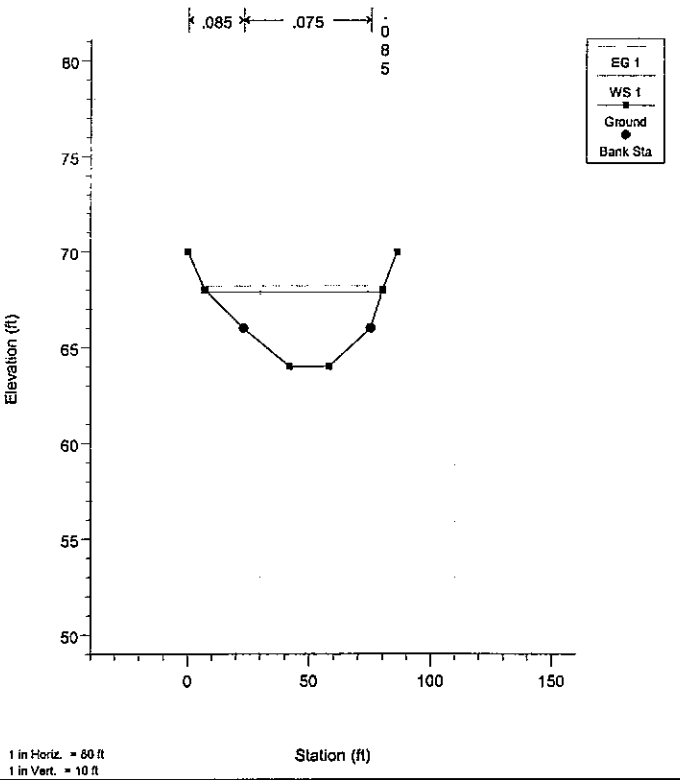
CHAPEL HILLS BOX 5 YEAR STORM Plan: Plan 18 2/23/98
PROPOSED COND. Riv Sta = 240



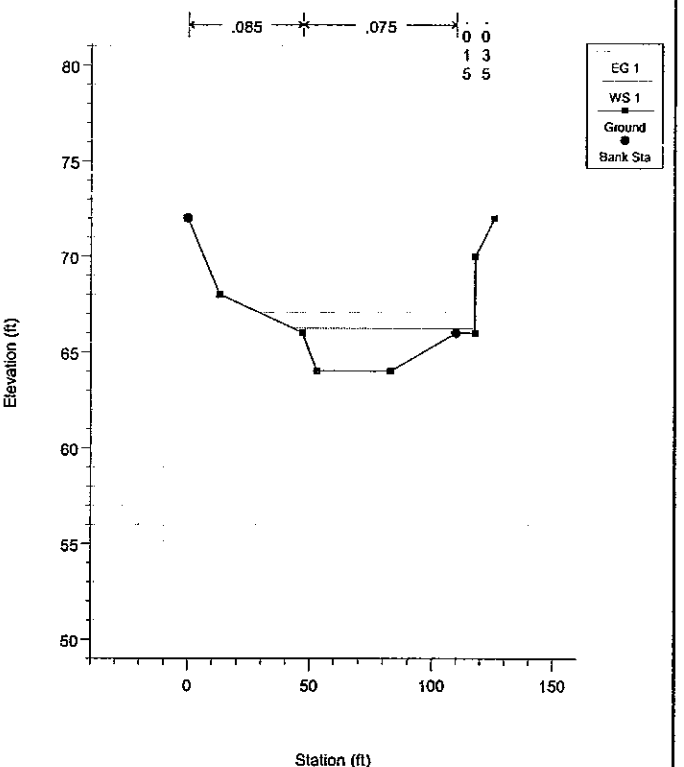
CHAPEL HILLS BOX 5 YEAR STORM Plan: Plan 18 2/23/98
PROPOSED COND. Riv Sta = 230



CHAPEL HILLS BOX 5 YEAR STORM Plan: Plan 18 2/23/98
PROPOSED COND. Riv Sta = 210

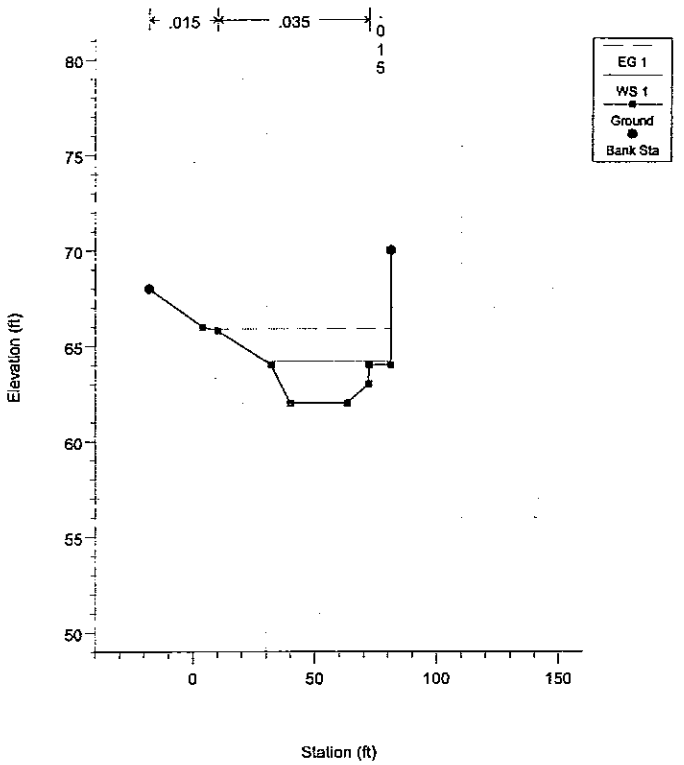


CHAPEL HILLS BOX 5 YEAR STORM Plan: Plan 18 2/23/98
PROPOSED COND. Riv Sta = 185

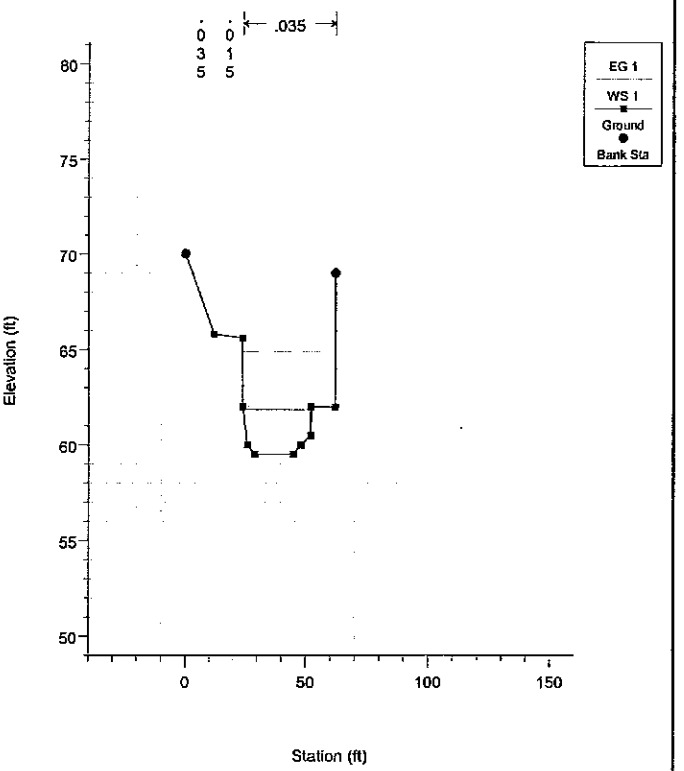


1 in Horiz. = 50 ft
1 in Vert. = 10 ft

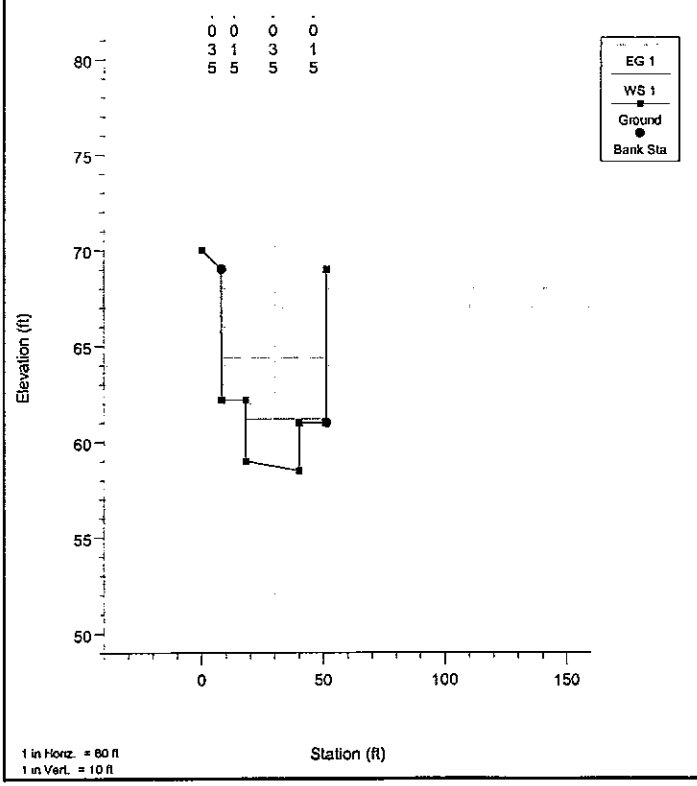
CHAPEL HILLS BOX 5 YEAR STORM Plan: Plan 18 2/23/98
PROPOSED COND. Riv Sta = 180



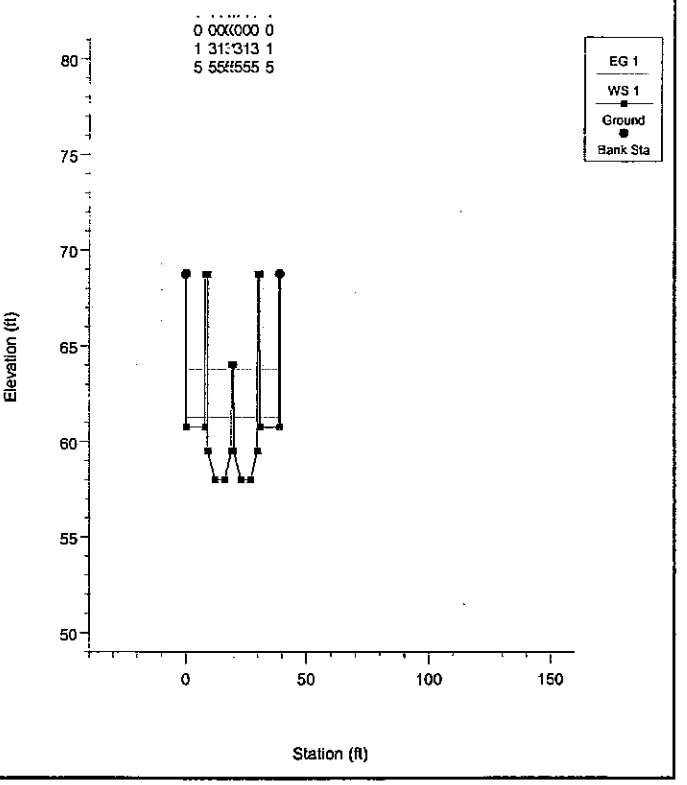
CHAPEL HILLS BOX 5 YEAR STORM Plan: Plan 18 2/23/98
PROPOSED COND. Riv Sta = 175



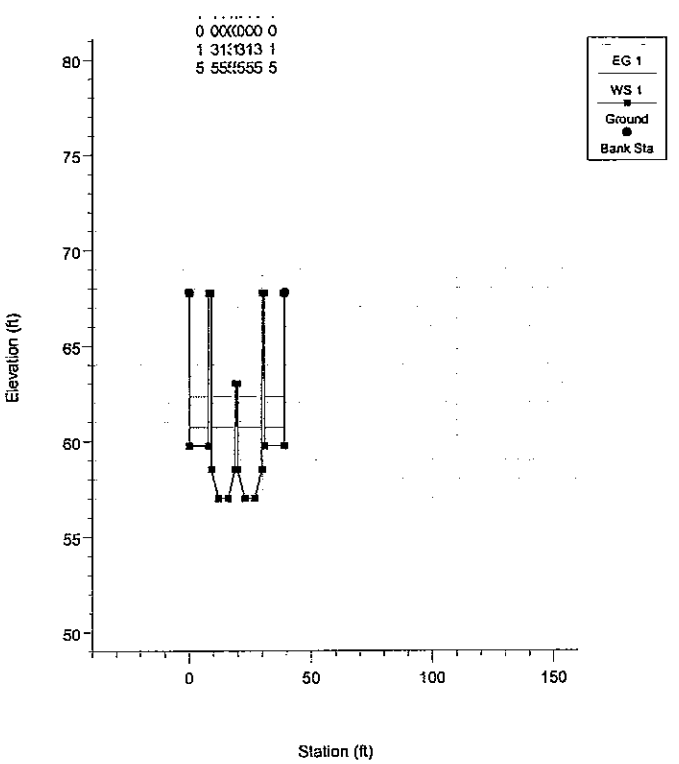
CHAPEL HILLS BOX 5 YEAR STORM Plan: Plan 18 2/23/98
PROPOSED COND. Riv Sta = 172



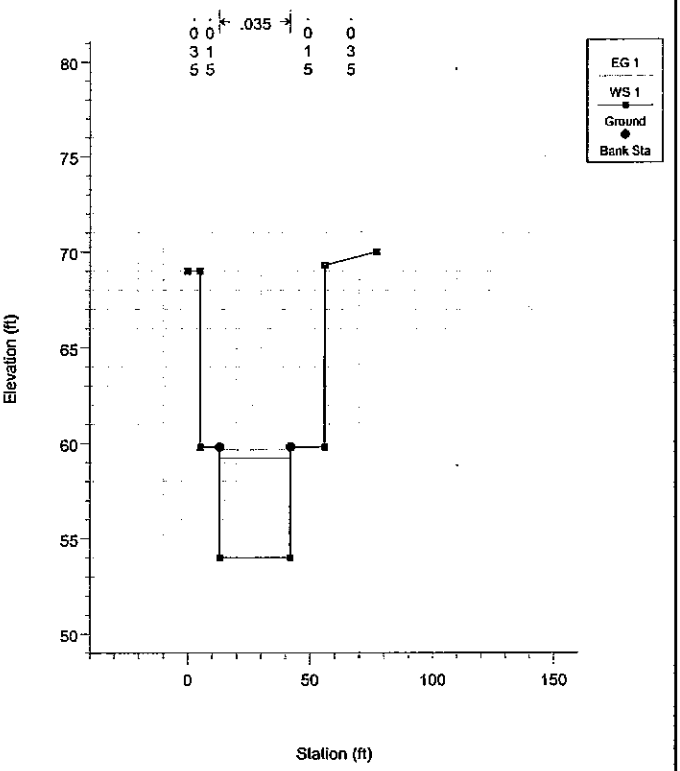
CHAPEL HILLS BOX 5 YEAR STORM Plan: Plan 18 2/23/98
BOX INLET Riv Sta = 170



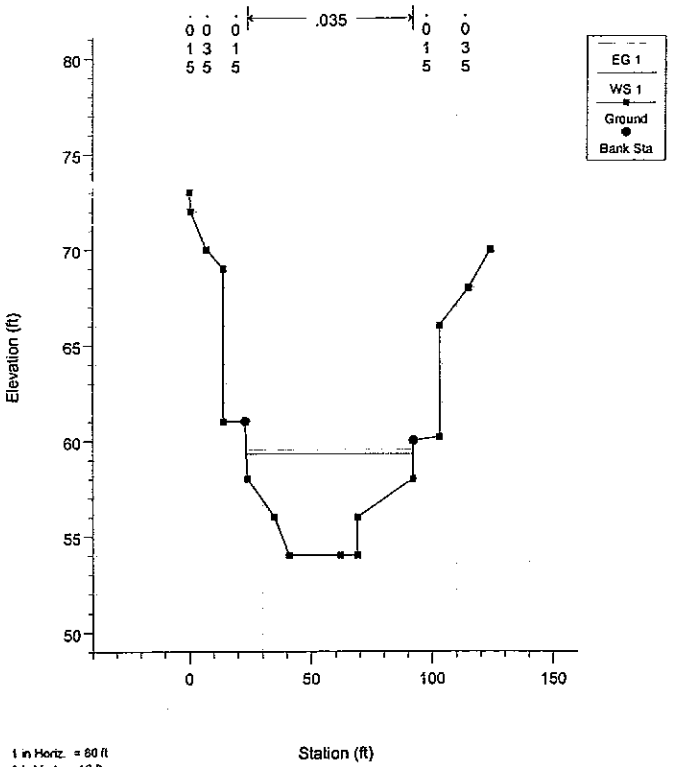
CHAPEL HILLS BOX 5 YEAR STORM Plan: Plan 18 2/23/98
BOX OUTLET Riv Sta = 160



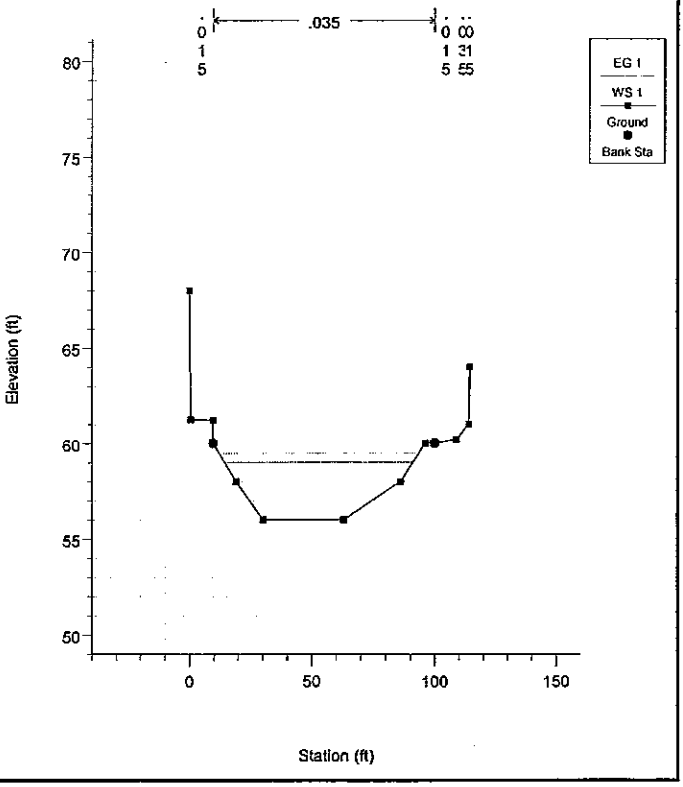
CHAPEL HILLS BOX 5 YEAR STORM Plan: Plan 18 2/23/98
PROPOSED COND. Riv Sta = 155



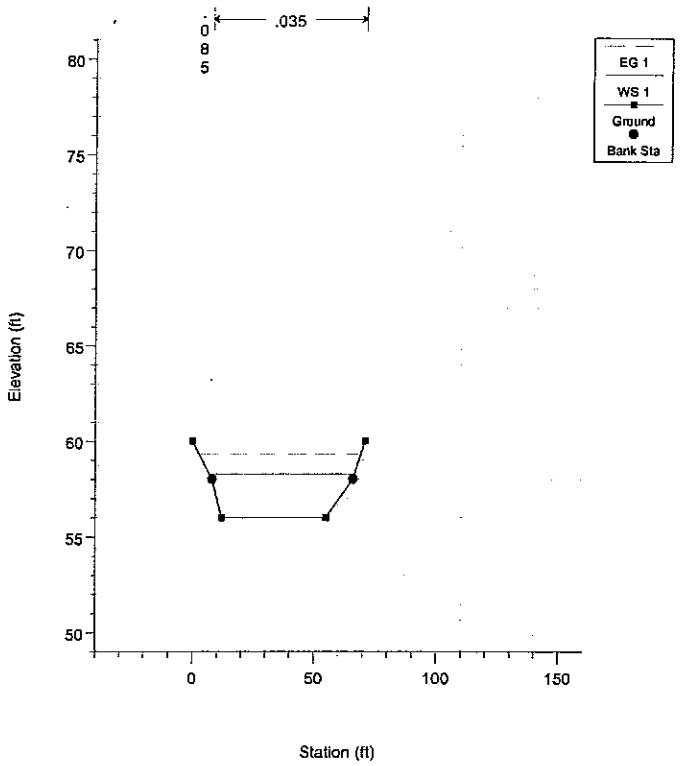
CHAPEL HILLS BOX 5 YEAR STORM Plan: Plan 18 2/23/98
PROPOSED COND. Riv Sta = 152



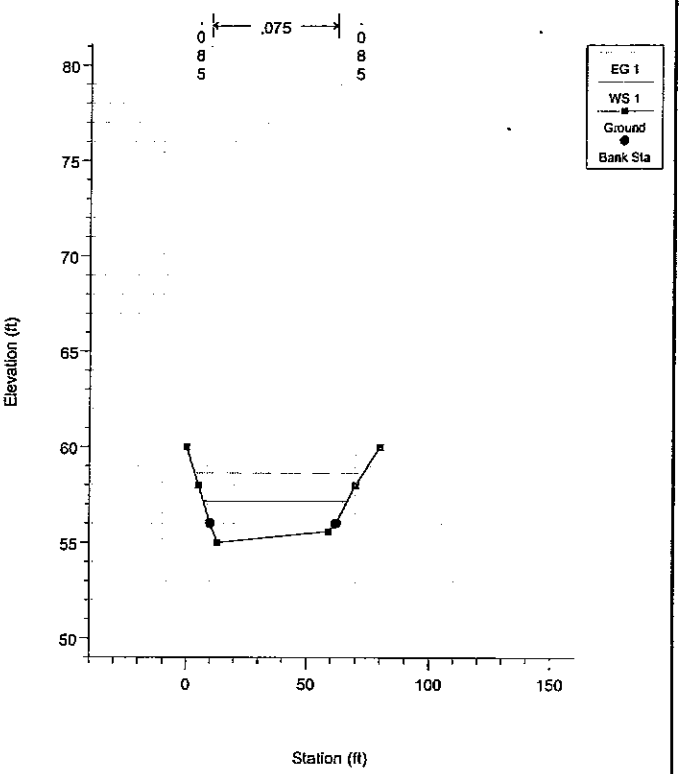
CHAPEL HILLS BOX 5 YEAR STORM Plan: Plan 18 2/23/98
PROPOSED COND. Riv Sta = 145



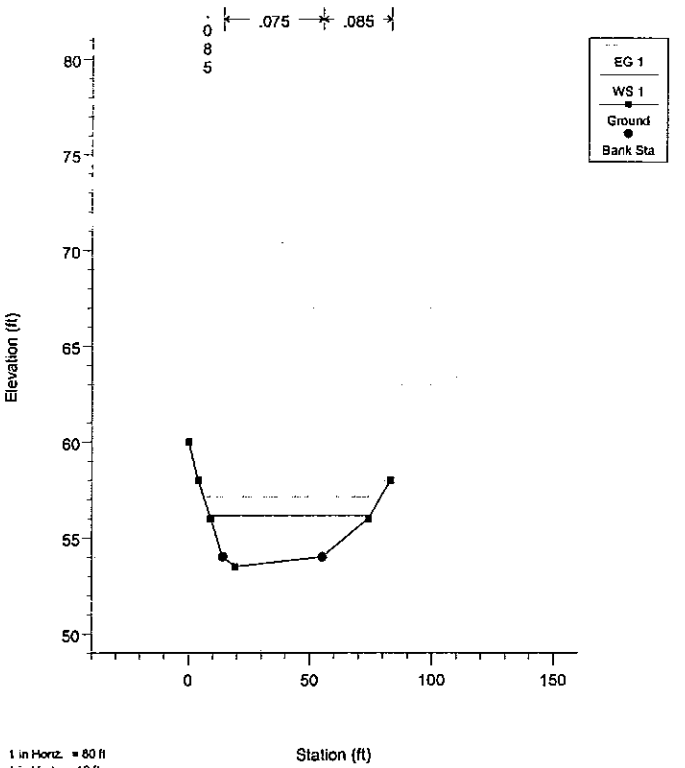
CHAPEL HILLS BOX 5 YEAR STORM Plan: Plan 18 2/23/98
PROPOSED COND. Riv Sta = 142



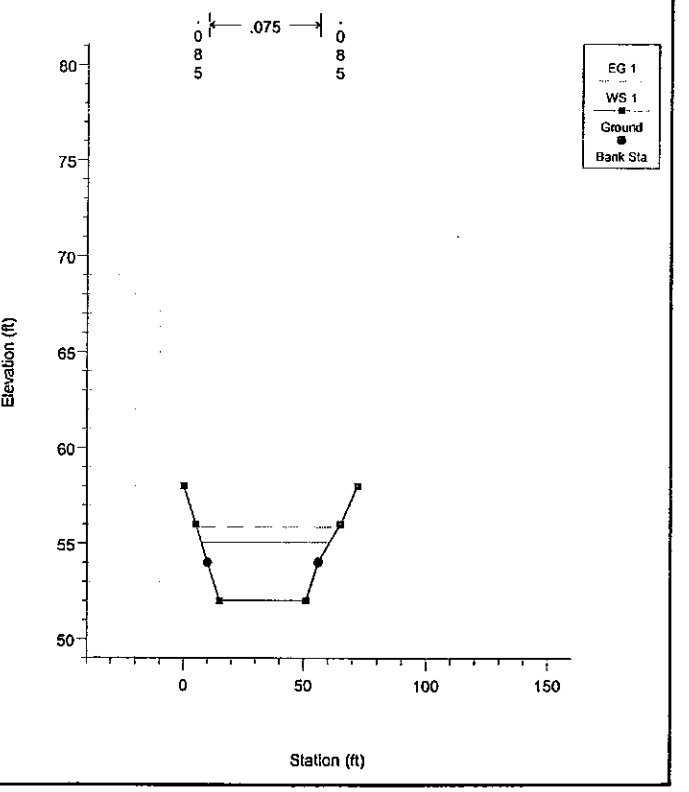
CHAPEL HILLS BOX 5 YEAR STORM Plan: Plan 18 2/23/98
PROPOSED COND. Riv Sta = 132

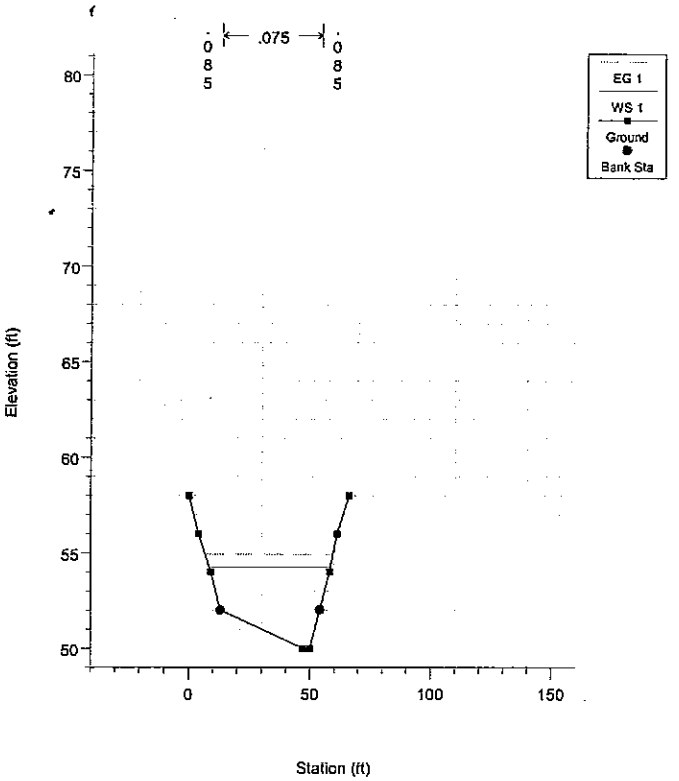


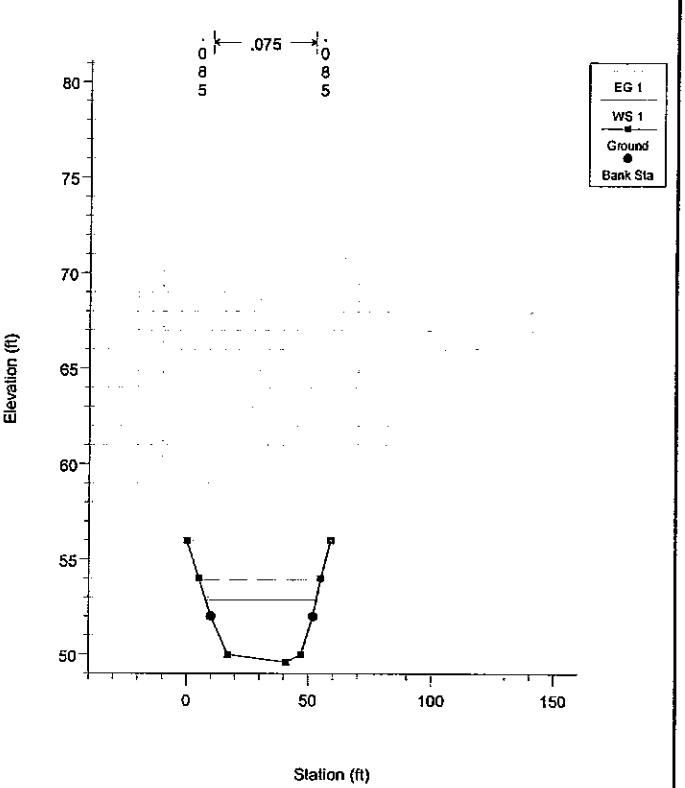
CHAPEL HILLS BOX 5 YEAR STORM Plan: Plan 18 2/23/98
PROPOSED COND. Riv Sta = 122



CHAPEL HILLS BOX 5 YEAR STORM Plan: Plan 18 2/23/98
PROPOSED COND. Riv Sta = 115



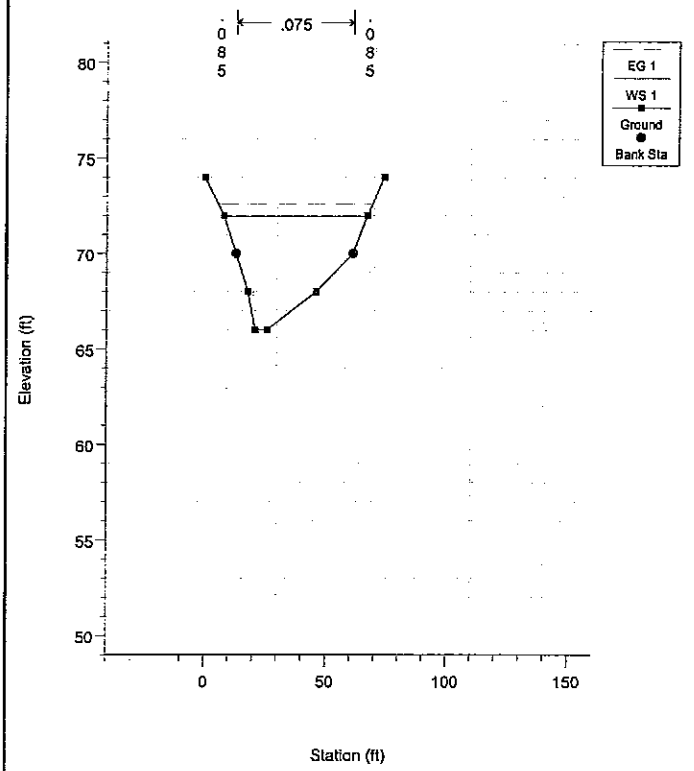




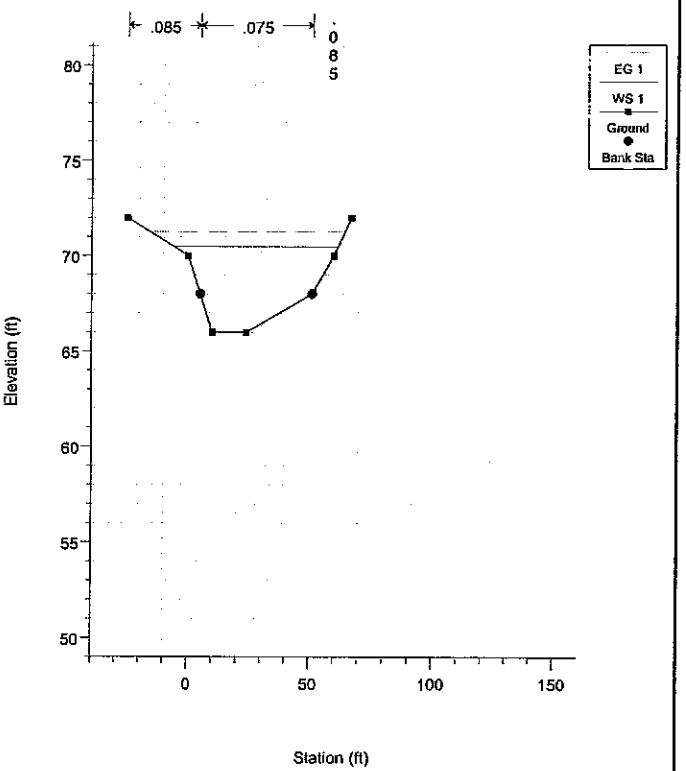
1 in Horiz. = 50 ft
1 in Vert. = 10 ft

100 Year Storm

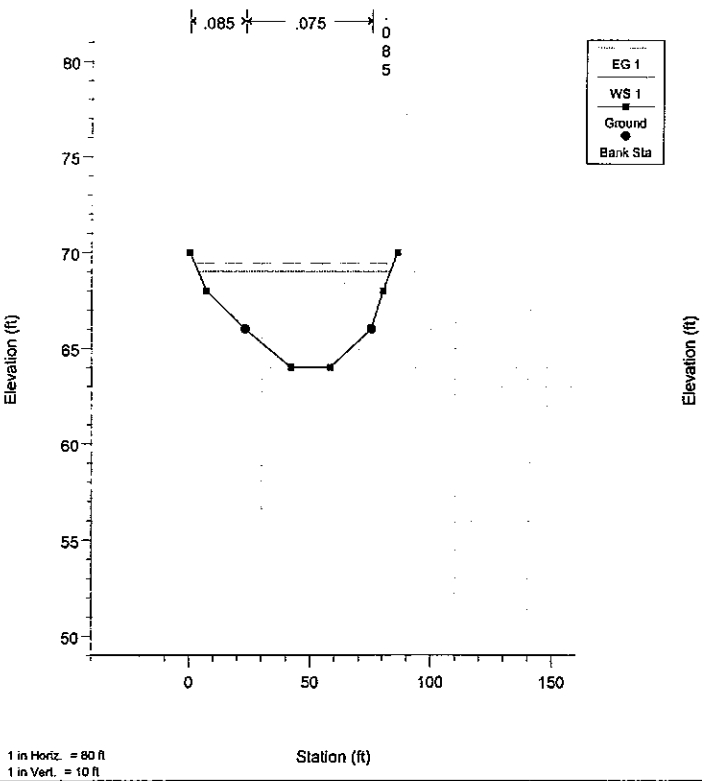
CHAPEL HILLS BOX 100 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 240



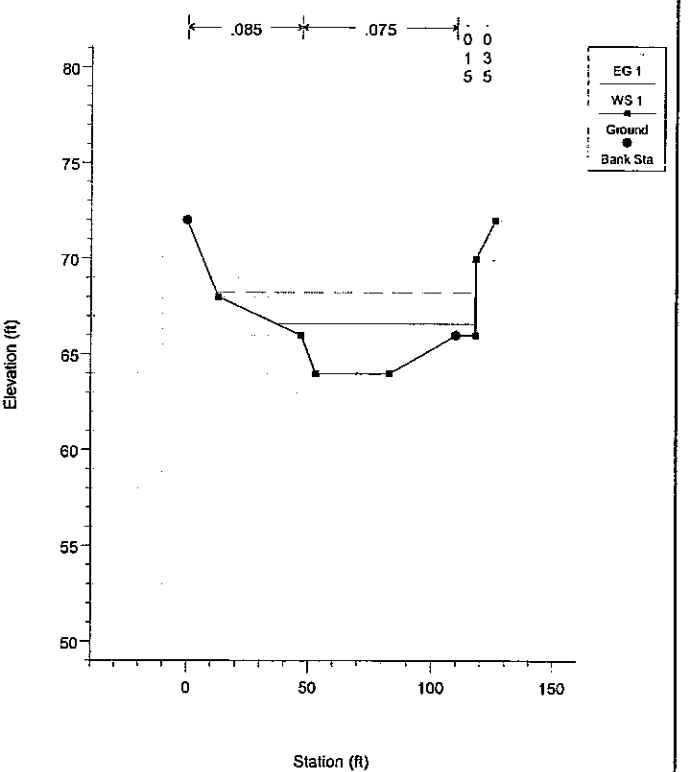
CHAPEL HILLS BOX 100 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 230



CHAPEL HILLS BOX 100 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 210

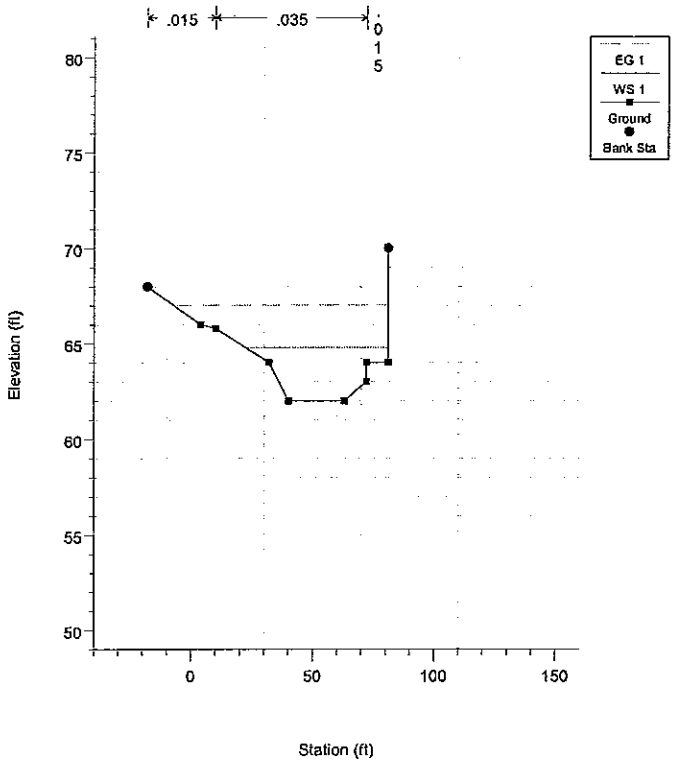


CHAPEL HILLS BOX 100 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 185

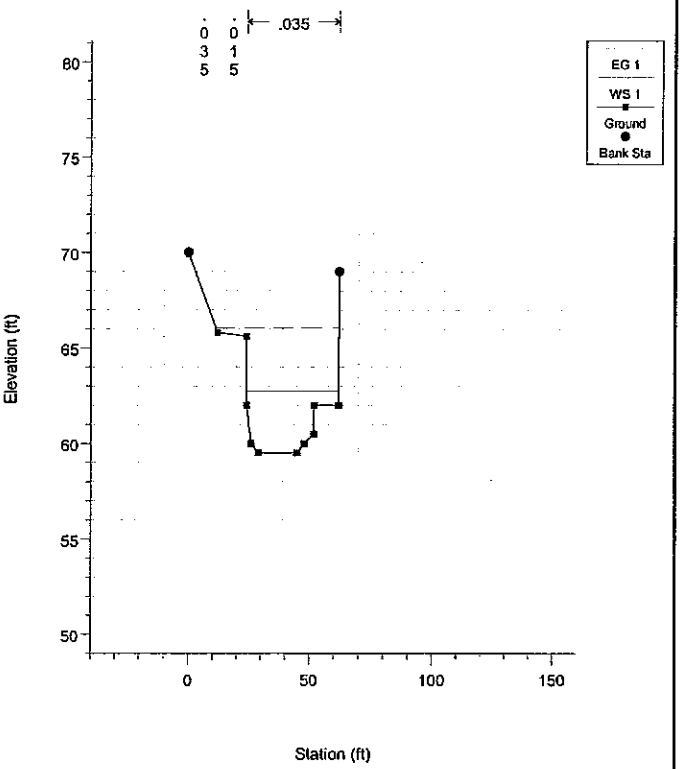


1 in Horiz. = 80 ft
1 in Vert. = 10 ft

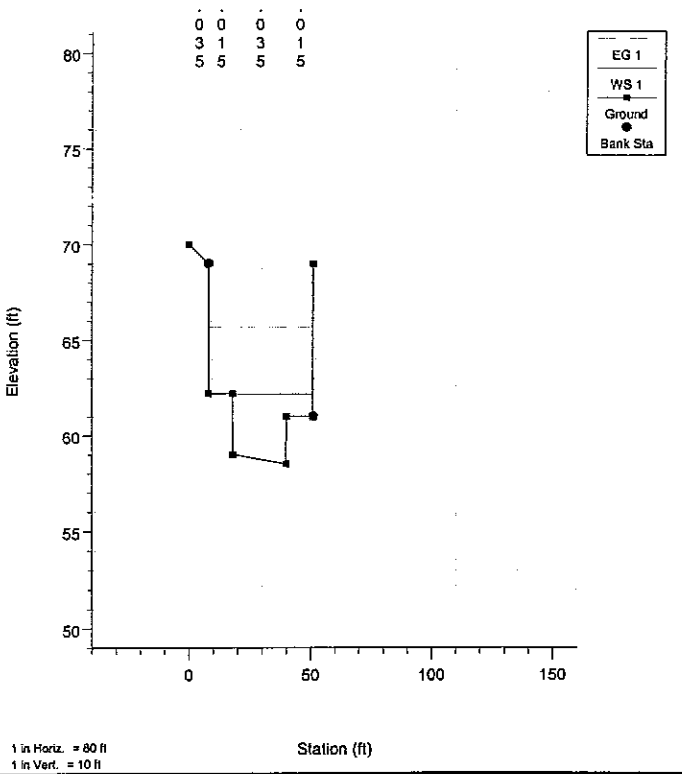
CHAPEL HILLS BOX 100 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 180



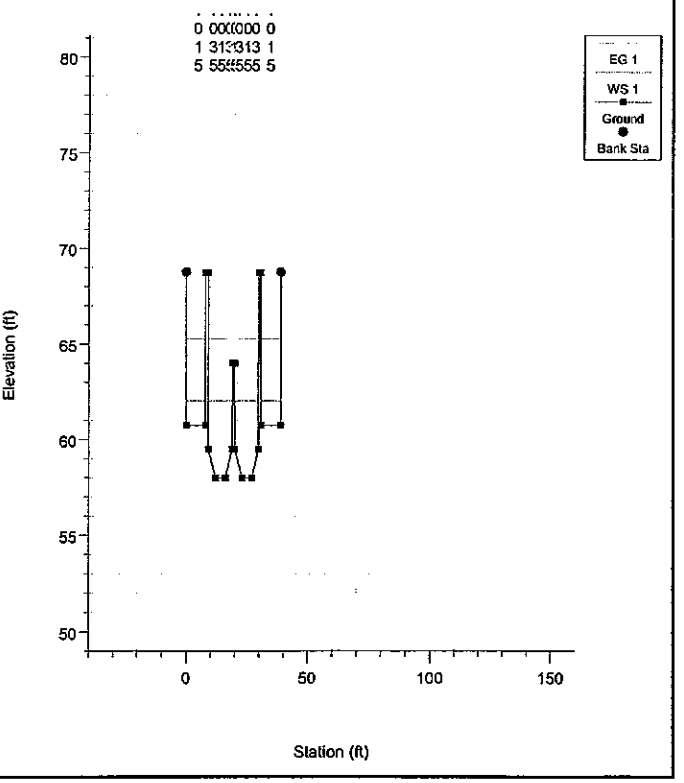
CHAPEL HILLS BOX 100 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 175



CHAPEL HILLS BOX 100 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 172

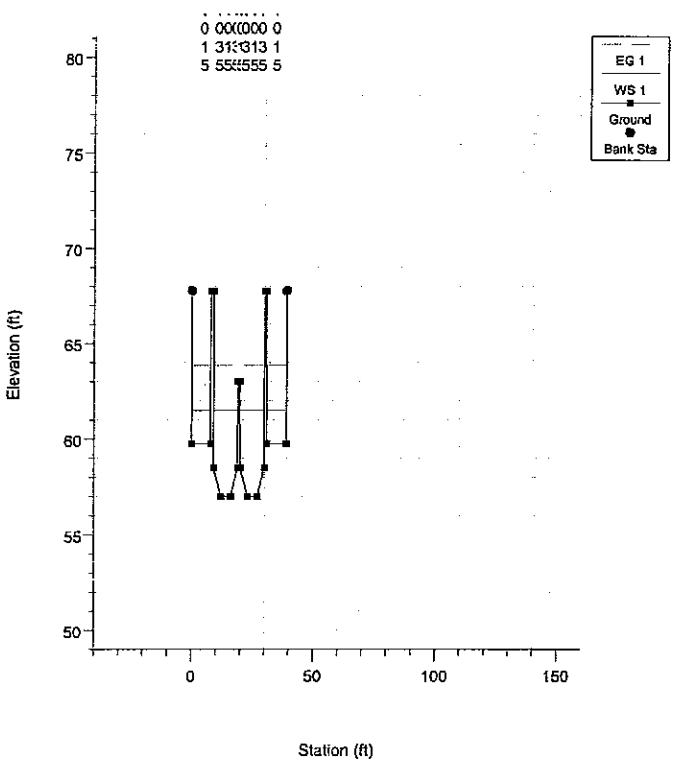


CHAPEL HILLS BOX 100 YEAR STORM Plan: Plan 17 2/18/98
BOX INLET Riv Sta = 170

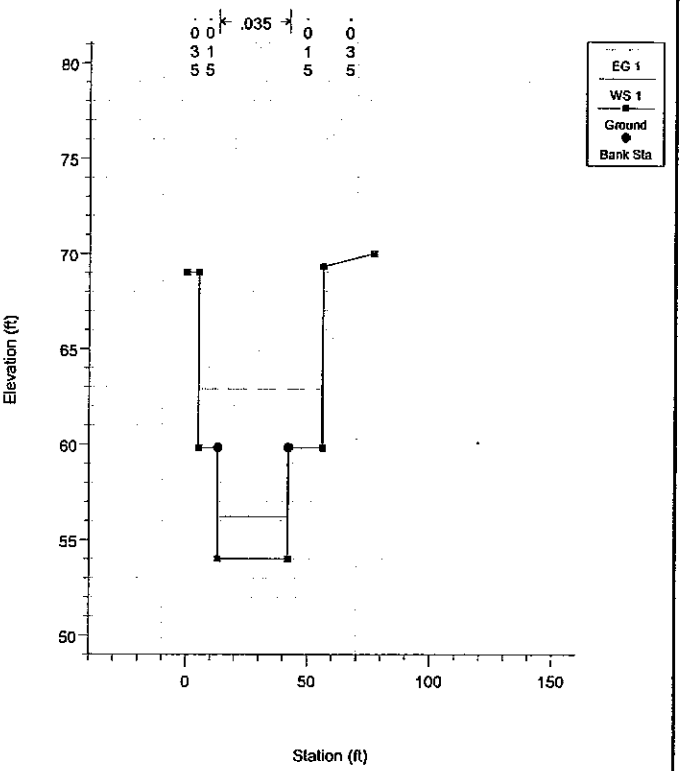


1 in Horiz. = 80 ft
1 in Vert. = 10 ft

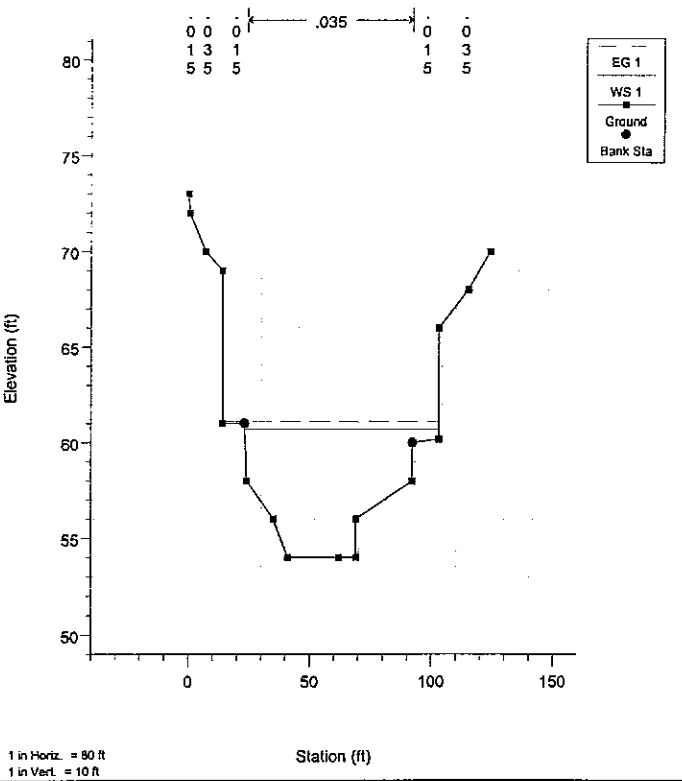
CHAPEL HILLS BOX 100 YEAR STORM Plan: Plan 17 2/18/98
BOX OUTLET Riv Sta = 160



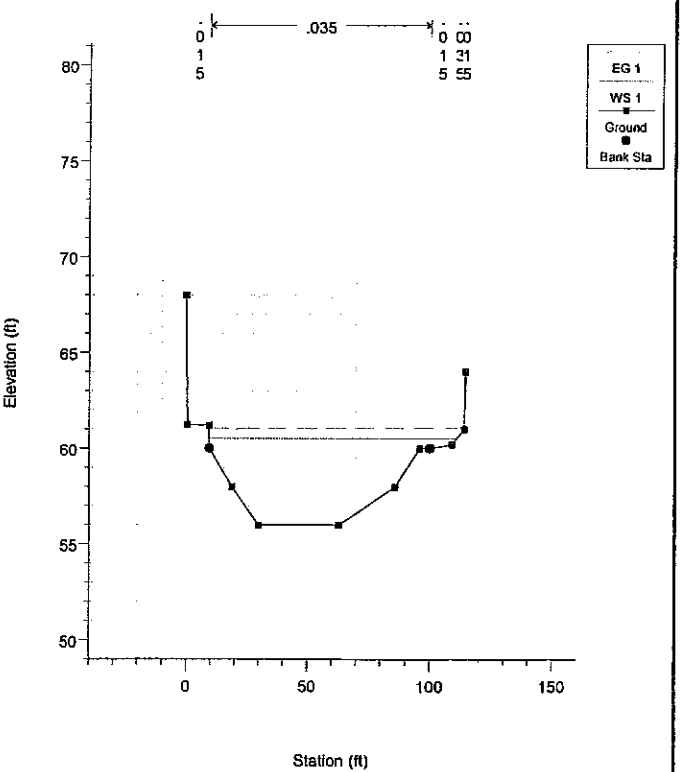
CHAPEL HILLS BOX 100 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 155



CHAPEL HILLS BOX 100 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 152

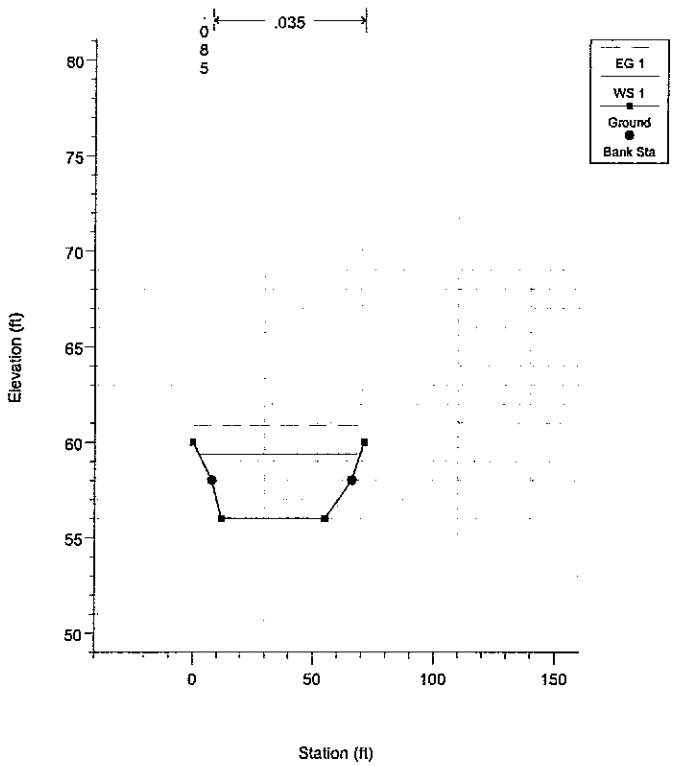


CHAPEL HILLS BOX 100 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 145

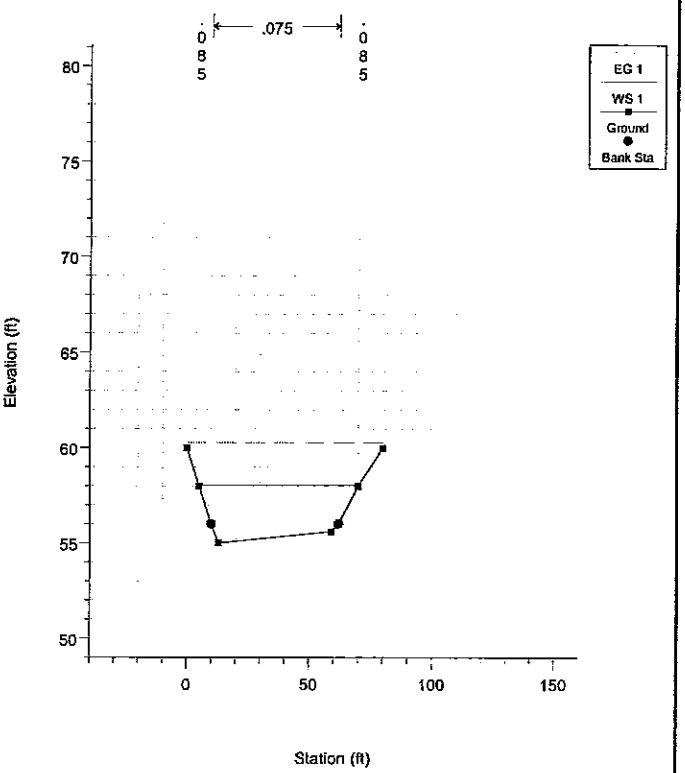


1 in Horiz. = 50 ft
1 in Vert. = 10 ft

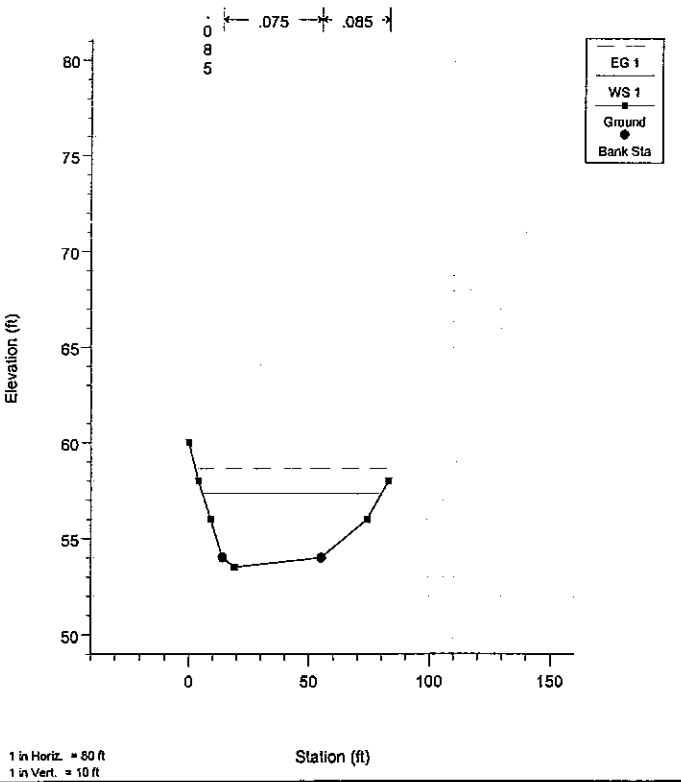
CHAPEL HILLS BOX 100 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 142



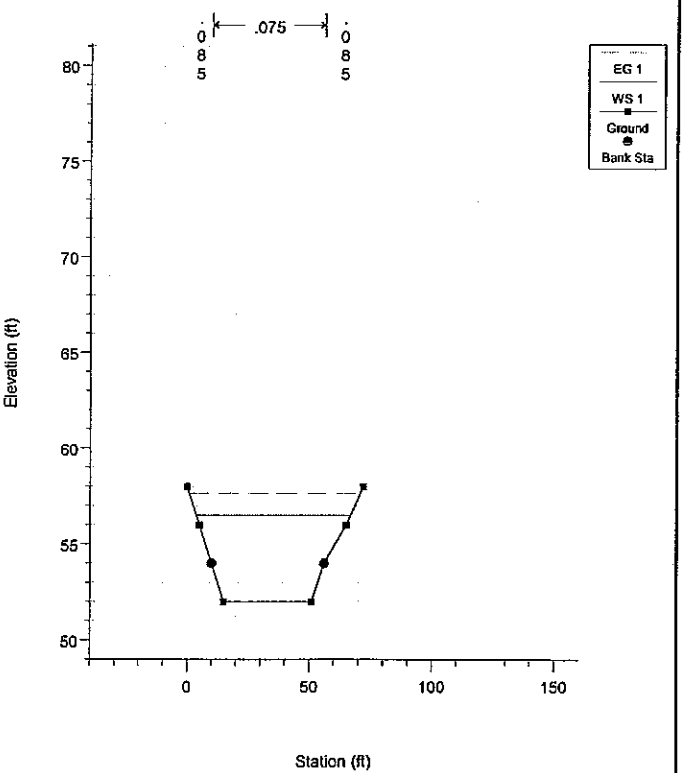
CHAPEL HILLS BOX 100 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 132



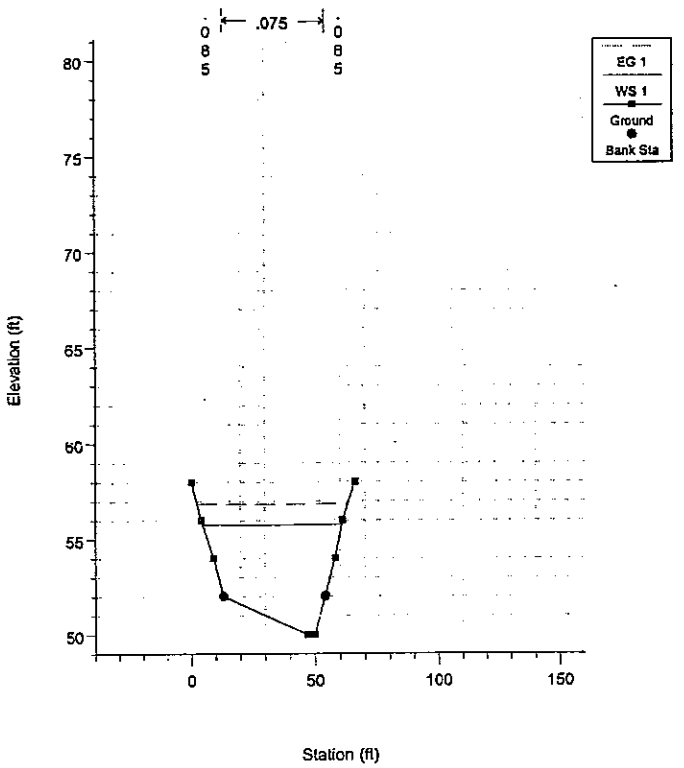
CHAPEL HILLS BOX 100 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 122



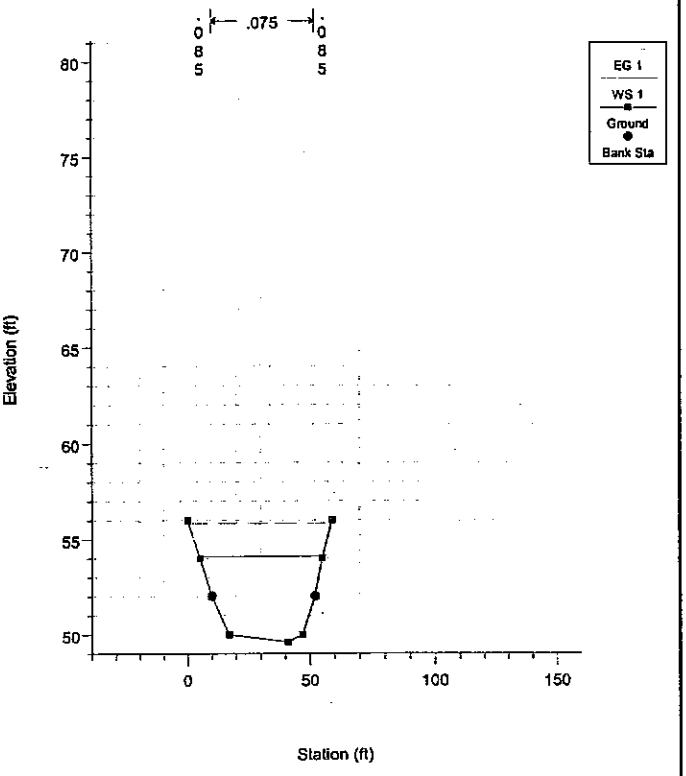
CHAPEL HILLS BOX 100 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 115



CHAPEL HILLS BOX 100 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 110



CHAPEL HILLS BOX 100 YEAR STORM Plan: Plan 17 2/18/98
PROPOSED COND. Riv Sta = 105



1 in Horiz. = 50 ft
1 in Vert. = 10 ft

HEC-RAS
INPUT/OUTPUT REPORT

2 Year Storm

HEC-RAS Version 1.2 April 1996
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```
X   X XXXXXX  XXXX     XXXX    XX    XXXX
X   X X     X  X    X  X   X X  X
X   X X     X       X  X  X  X  X
XXXXXXX XXXX   X    XXX XXXX   XXXXXX  XXXX
X   X X     X       X  X   X  X     X
X   X X     X  X    X  X  X  X     X
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****

PROJECT DATA
Project Title: CHAPEL HILLS BOX 2 YEAR STORM
Project File : chb98.prj
Run Date and Time: 2/18/98 11:34:48 AM

Project in English units

****

PLAN DATA

Plan Title: Plan 17
Plan File : x:\870000.all\871614\hydro\hecras\pcch98\chb98.p17

Geometry Title: Plan 17
Geometry File : x:\870000.all\871614\hydro\hecras\pcch98\chb98.p17

Flow Title : Plan 17
Flow File : x:\870000.all\871614\hydro\hecras\pcch98\chb98.p17

Plan Summary Information:
Number of: Cross Sections = 18 Mulitple Openings = 0
Culverts = 0 Inline Weirs = 0
Bridges = 0

Computational Information
Water surface calculation tolerance = .01
Critical depth calculaton tolerance = .01
Maximum number of interations = 20
Maximum difference tolerance = .3
Flow tolerance factor = .001

Computational Flow Regime: Mixed Flow

Encroachment Data: None

Flow Distribution Locations: None

****

FLOW DATA

Flow Title: 100 YEAR FEMA
Flow File : x:\870000.all\871614\hydro\hecras\pcch98\chb98.f02

Flow Data (cfs)

Reach	Riv Sta	PF#1
PINE CREEK	240	315
PINE CREEK	160	315
PINE CREEK	152	375

Boundary Conditions

Reach	Profile	Upstream	Downstream
PINE CREEK	1	Normal S = .025	Normal S = .047

****

GEOMETRY DATA

Geometry Title: chb98 prpsd
Geometry File : x:\870000.all\871614\hydro\hecras\pcch98\chb98.g02

CROSS SECTION INPUT Reach: PINE CREEK River Station: 240
Description: PROPOSED COND.

Station Elevation Data, num = 10

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	74	8	72	13	70	18	68	21	66
26	66	46	68	61	70	67	72	74	74

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.085	13	.075	61	.085

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
13	61	69	69	68	.1	.3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 230
Description: PROPOSED COND.

Station Elevation Data, num = 8

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-25	72	0	70	5	68	10	66	24	66
51	68	60	70	67	72				

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value

-25 .085 5 .075 51 .085

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
5 51 111 115 120 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 210
Description: PROPOSED COND.

Station Elevation Data, num = 8

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	70	7	68	23	66	42	64	58	64
75	66	80	68	86	70				

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.085	23	.075	75	.085

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
23 75 50 46 55 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 185
Description: PROPOSED COND.

Station Elevation Data, num = 9

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	72	13	68	47	66	53	64	83	64
110	66	118	66	118.1	70	126	72		

Manning's n Values, num = 4

Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value
0	.085	47	.075	110	.015	118.1	.035

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
0 110 25 25 28 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 180
Description: PROPOSED COND.

Station Elevation Data, num = 10

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-18	68	4	66	10	65.8	32	64	40	62
63	62	72	63	72.1	64	81	64	81.1	70

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
-18	.015	10	.035	72	.015

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
-18 81.1 20 25 18 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 175
Description: PROPOSED COND.

Station Elevation Data, num = 12

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	70	12	65.8	24	65.6	24.1	62	26	60

29 59.5 45 59.5 48 60 52 60.5 52.1 62
62 62 62.1 69

Manning's n Values, num = 3
Sta. Value Sta. Value Sta. Value
0 .035 12 .015 24.1 .035

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
0 62.1 11 11 11 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 172
Description: PROPOSED COND.

Station Elevation Data, num = 9
Sta. Elev. Sta. Elev. Sta. Elev. Sta. Elev. Sta. Elev.
0 70 8 69 8.1 62.2 18 62.2 18.1 59
40 58.5 40.1 61 51 61 51.1 69

Manning's n Values, num = 4
Sta. Value Sta. Value Sta. Value Sta. Value
0 .035 8 .015 18.1 .035 40 .015

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
8 51 15 15 15 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 170
Description: BOX INLET

Station Elevation Data, num = 20
Sta. Elev. Sta. Elev. Sta. Elev. Sta. Elev. Sta. Elev.
0 68.75 .1 60.75 7.9 60.75 8 68.75 9 68.75
9.1 59.5 12.1 58 16.1 58 18.9 59.5 19 64
19.9 64 20 59.5 23 58 27 58 29.9 59.5
30 68.75 30.8 68.75 30.9 60.75 39 60.75 39.1 68.75

Manning's n Values, num = 9
Sta. Value Sta. Value Sta. Value Sta. Value Sta. Value
0 .015 9.1 .035 12.1 .015 16.1 .035 18.9 .015
20 .035 23 .015 27 .035 29.9 .015

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
0 39.1 78 78 78 .5 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 160
Description: BOX OUTLET

Station Elevation Data, num = 20
Sta. Elev. Sta. Elev. Sta. Elev. Sta. Elev. Sta. Elev.
0 67.75 .1 59.75 7.9 59.75 8 67.75 9 67.75
9.1 58.5 12.1 57 16.1 57 18.9 58.5 19 63
19.9 63 20 58.5 23 57 27 57 29.9 58.5
30 67.75 30.8 67.75 30.9 59.75 39 59.75 39 67.75

Manning's n Values, num = 9
Sta. Value Sta. Value Sta. Value Sta. Value Sta. Value
0 .015 9.1 .035 12.1 .015 16.1 .035 18.9 .015

20 .035 23 .015 27 .035 29.9 .015

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
0 39 21 21 21 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 155
Description: PROPOSED COND.

Station Elevation Data, num = 10

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	69	5	69	5.1	59.8	13	59.8	13.1	54
42	54	42.1	59.8	56	59.8	56.1	69.3	77	70

Manning's n Values, num = 5

Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value
0	.035	5	.015	13.1	.035	42	.015	56.1	.035

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
13 42.1 30 35 35 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 152
Description: PROPOSED COND.

Station Elevation Data, num = 18

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	73	.5	72	7	70	14	69	14.1	61
23	61	24	58	35	56	41	54	62	54
69	54	69	56	92	58	92.1	60	103	60.2
103.1	66	115	68	124	70				

Manning's n Values, num = 6

Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value
0	.015	.5	.035	14	.015	24	.035	92	.015
103.1	.035								

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
23 92.1 10 11 10 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 145
Description: PROPOSED COND.

Station Elevation Data, num = 13

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	68	.5	61.25	9.5	61.2	9.6	60	19	58
30	56	63	56	86	58	96	60	100	60
109	60.2	114	61	114.5	64				

Manning's n Values, num = 5

Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value
0	.015	9.6	.035	100	.015	109	.035	114	.015

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
9.6 100 18 16 18 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 142
Description: PROPOSED COND.

Station Elevation Data, num = 6

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	60	8	58	12	56	55	56	66	58
71	60								

Manning's n Values, num = 2

Sta.	Value	Sta.	Value
0	.085	8	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
8	66	15	20	20	.1	.3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 132
Description: PROPOSED COND.

Station Elevation Data, num = 8

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	60	5	58	10	56	13	55	59	55.6
62	56	70	58	80	60				

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.085	10	.075	62	.085

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
10	62	20	30	45	.1	.3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 122
Description: PROPOSED COND.

Station Elevation Data, num = 8

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	60	4	58	9	56	14	54	19	53.5
55	54	74	56	83	58				

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.085	14	.075	55	.085

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
14	55	35	27	26	.1	.3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 115
Description: PROPOSED COND.

Station Elevation Data, num = 8

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	58	5	56	10	54	15	52	51	52
56	54	65	56	72	58				

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.085	10	.075	56	.085

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

```
        10     56          28     31     35         .1     .3

CROSS SECTION INPUT    Reach: PINE CREEK     River Station: 110
Description: PROPOSED COND.

Station Elevation Data,  num = 10
   Sta.  Elev.   Sta.  Elev.   Sta.  Elev.   Sta.  Elev.   Sta.  Elev.
     0     58      4     56      9     54     13     52     47     50
    50     50     54     52     58     54     61     56     66     58

Manning's n Values,  num = 3
   Sta.  Value   Sta.  Value   Sta.  Value
     0   .085     13   .075     54   .085

Bank Sta: Left   Right    Lengths: Left Channel   Right    Coeff Contr.   Expan.
        13     54           30     30     30         .1     .3

CROSS SECTION INPUT    Reach: PINE CREEK     River Station: 105
Description: PROPOSED COND.

Station Elevation Data,  num = 9
   Sta.  Elev.   Sta.  Elev.   Sta.  Elev.   Sta.  Elev.   Sta.  Elev.
     0     56      5     54     10     52     17     50     41   49.6
    47     50     52     52     55     54     59     56

Manning's n Values,  num = 3
   Sta.  Value   Sta.  Value   Sta.  Value
     0   .085     10   .075     52   .085

Bank Sta: Left   Right    Lengths: Left Channel   Right    Coeff Contr.   Expan.
        10     52            0      0      0         .1     .3

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

SUMMARY OF MANNING'S N VALUES

*************************************************************************************************************
*   Reach   * River Sta. *  n1   *   n2   *   n3   *   n4   *   n5   *   n6   *   n7   *   n8   *   n9   *
*************************************************************************************************************
*PINE CREEK *   240    *  .085*  .075*  .085*     *     *     *     *     *     *
*PINE CREEK *   230    *  .085*  .075*  .085*     *     *     *     *     *     *
*PINE CREEK *   210    *  .085*  .075*  .085*     *     *     *     *     *     *
*PINE CREEK *   185    *  .085*  .075*  .015*  .035*     *     *     *     *     *
*PINE CREEK *   180    *  .015*  .035*  .015*     *     *     *     *     *     *
*PINE CREEK *   175    *  .035*  .015*  .035*     *     *     *     *     *     *
*PINE CREEK *   172    *  .035*  .015*  .035*  .015*     *     *     *     *     *
*PINE CREEK *   170    *  .015*  .035*  .015*  .035*  .015*  .035*  .015*  .035*  .015*
*PINE CREEK *   160    *  .015*  .035*  .015*  .035*  .015*  .035*  .015*  .035*  .015*
*PINE CREEK *   155    *  .035*  .015*  .035*  .015*  .035*     *     *     *     *
*PINE CREEK *   152    *  .015*  .035*  .015*  .035*  .015*  .035*     *     *     *
*PINE CREEK *   145    *  .015*  .035*  .015*  .035*  .015*     *     *     *     *
*PINE CREEK *   142    *  .085*  .035*     *     *     *     *     *     *     *
*PINE CREEK *   132    *  .085*  .075*  .085*     *     *     *     *     *     *
*PINE CREEK *   122    *  .085*  .075*  .085*     *     *     *     *     *     *
*PINE CREEK *   115    *  .085*  .075*  .085*     *     *     *     *     *     *
*PINE CREEK *   110    *  .085*  .075*  .085*     *     *     *     *     *     *
```

*PINE CREEK * 105 * .085* .075* .085* * * * * * *

****

SUMMARY OF REACH LENGTHS

****

Reach	River Sta.	Left	Channel	Right
PINE CREEK	240	69	69	68
PINE CREEK	230	111	115	120
PINE CREEK	210	50	46	55
PINE CREEK	185	25	25	28
PINE CREEK	180	20	25	18
PINE CREEK	175	11	11	11
PINE CREEK	172	15	15	15
PINE CREEK	170	78	78	78
PINE CREEK	160	21	21	21
PINE CREEK	155	30	35	35
PINE CREEK	152	10	11	10
PINE CREEK	145	18	16	18
PINE CREEK	142	15	20	20
PINE CREEK	132	20	30	45
PINE CREEK	122	35	27	26
PINE CREEK	115	28	31	35
PINE CREEK	110	30	30	30
PINE CREEK	105	0	0	0

****

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

****

Reach	River Sta.	Contr.	Expan.
PINE CREEK	240	.1	.3
PINE CREEK	230	.1	.3
PINE CREEK	210	.1	.3
PINE CREEK	185	.1	.3
PINE CREEK	180	.1	.3
PINE CREEK	175	.1	.3
PINE CREEK	172	.1	.3
PINE CREEK	170	.5	.3
PINE CREEK	160	.1	.3
PINE CREEK	155	.1	.3
PINE CREEK	152	.1	.3
PINE CREEK	145	.1	.3
PINE CREEK	142	.1	.3
PINE CREEK	132	.1	.3
PINE CREEK	122	.1	.3
PINE CREEK	115	.1	.3
PINE CREEK	110	.1	.3
PINE CREEK	105	.1	.3

****

5 Year Storm

HEC-RAS Version 1.2 April 1996
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```
X   X XXXXXX  XXXX     XXXX    XX    XXXX
X   X X     X  X    X  X   X X  X
X   X X     X       X  X   X  X  X
XXXXXXX XXXX   X    XXX XXXX   XXXXXX  XXXX
X   X X     X       X  X   X  X     X
X   X X     X  X    X  X  X  X     X
X   X XXXXXX  XXXX     X  X  X  X  XXXXX
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****

PROJECT DATA
Project Title: CHAPEL HILLS BOX 5 YEAR STORM
Project File : chb98.prj
Run Date and Time: 2/18/98 11:34:48 AM

Project in English units

****

PLAN DATA

Plan Title: Plan 17
Plan File : x:\870000.all\871614\hydro\hecras\pcch98\chb98.p17

Geometry Title: Plan 17
Geometry File : x:\870000.all\871614\hydro\hecras\pcch98\chb98.p17

Flow Title : Plan 17
Flow File : x:\870000.all\871614\hydro\hecras\pcch98\chb98.p17

Plan Summary Information:
Number of: Cross Sections = 18 Mulitple Openings = 0
Culverts = 0 Inline Weirs = 0
Bridges = 0

Computational Information
Water surface calculation tolerance = .01
Critical depth calculaton tolerance = .01
Maximum number of interations = 20
Maximum difference tolerance = .3
Flow tolerance factor = .001

Computational Flow Regime: Mixed Flow

Encroachment Data: None

Flow Distribution Locations: None

****

FLOW DATA

Flow Title: 100 YEAR FEMA
Flow File : x:\870000.all\871614\hydro\hecras\pcch98\chb98.f02

Flow Data (cfs)

Reach	Riv Sta	PF#1
PINE CREEK	240	815
PINE CREEK	160	815
PINE CREEK	152	950

Boundary Conditions

Reach	Profile	Upstream	Downstream
PINE CREEK	1	Normal S = .025	Normal S = .047

****

GEOMETRY DATA

Geometry Title: chb98 prpsd
Geometry File : x:\870000.all\871614\hydro\hecras\pcch98\chb98.g02

CROSS SECTION INPUT Reach: PINE CREEK River Station: 240
Description: PROPOSED COND.

Station Elevation Data, num = 10

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	74	8	72	13	70	18	68	21	66
26	66	46	68	61	70	67	72	74	74

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.085	13	.075	61	.085

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
13	61	69	69	68	.1	.3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 230
Description: PROPOSED COND.

Station Elevation Data, num = 8

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-25	72	0	70	5	68	10	66	24	66
51	68	60	70	67	72				

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value

-25 .085 5 .075 51 .085

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
5 51 111 115 120 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 210
Description: PROPOSED COND.

Station Elevation Data, num = 8

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	70	7	68	23	66	42	64	58	64
75	66	80	68	86	70				

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.085	23	.075	75	.085

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
23 75 50 46 55 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 185
Description: PROPOSED COND.

Station Elevation Data, num = 9

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	72	13	68	47	66	53	64	83	64
110	66	118	66	118.1	70	126	72		

Manning's n Values, num = 4

Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value
0	.085	47	.075	110	.015	118.1	.035

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
0 110 25 25 28 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 180
Description: PROPOSED COND.

Station Elevation Data, num = 10

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-18	68	4	66	10	65.8	32	64	40	62
63	62	72	63	72.1	64	81	64	81.1	70

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
-18	.015	10	.035	72	.015

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
-18 81.1 20 25 18 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 175
Description: PROPOSED COND.

Station Elevation Data, num = 12

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	70	12	65.8	24	65.6	24.1	62	26	60

```
   29   59.5    45   59.5    48    60    52   60.5   52.1    62
   62    62   62.1    69

Manning's n Values,  num = 3
  Sta.  Value   Sta.  Value   Sta.  Value
    0   .035    12   .015   24.1   .035

Bank Sta: Left   Right   Lengths: Left Channel   Right   Coeff Contr.   Expan.
        0   62.1            11     11     11          .1      .3

CROSS SECTION INPUT    Reach: PINE CREEK     River Station: 172
Description: PROPOSED COND.

Station Elevation Data,  num = 9
  Sta.  Elev.   Sta.  Elev.   Sta.  Elev.   Sta.  Elev.   Sta.  Elev.
    0    70     8     69    8.1   62.2    18   62.2   18.1    59
   40   58.5   40.1    61     51    61    51.1    69

Manning's n Values,  num = 4
  Sta.  Value   Sta.  Value   Sta.  Value   Sta.  Value
    0   .035     8   .015   18.1   .035    40   .015

Bank Sta: Left   Right   Lengths: Left Channel   Right   Coeff Contr.   Expan.
        8     51            15     15     15          .1      .3

CROSS SECTION INPUT    Reach: PINE CREEK     River Station: 170
Description: BOX INLET

Station Elevation Data,  num = 20
  Sta.  Elev.   Sta.  Elev.   Sta.  Elev.   Sta.  Elev.   Sta.  Elev.
    0  68.75     .1  60.75    7.9  60.75     8  68.75     9  68.75
  9.1   59.5   12.1     58   16.1     58   18.9   59.5    19     64
 19.9     64    20   59.5     23     58    27     58   29.9   59.5
   30  68.75   30.8  68.75   30.9  60.75    39  60.75   39.1  68.75

Manning's n Values,  num = 9
  Sta.  Value   Sta.  Value   Sta.  Value   Sta.  Value   Sta.  Value
    0   .015    9.1   .035   12.1   .015   16.1   .035   18.9   .015
   20   .035     23   .015     27   .035   29.9   .015

Bank Sta: Left   Right   Lengths: Left Channel   Right   Coeff Contr.   Expan.
        0   39.1            78     78     78          .5      .3

CROSS SECTION INPUT    Reach: PINE CREEK     River Station: 160
Description: BOX OUTLET

Station Elevation Data,  num = 20
  Sta.  Elev.   Sta.  Elev.   Sta.  Elev.   Sta.  Elev.   Sta.  Elev.
    0  67.75     .1  59.75    7.9  59.75     8  67.75     9  67.75
  9.1   58.5   12.1     57   16.1     57   18.9   58.5    19     63
 19.9     63    20   58.5     23     57    27     57   29.9   58.5
   30  67.75   30.8  67.75   30.9  59.75    39  59.75    39  67.75

Manning's n Values,  num = 9
  Sta.  Value   Sta.  Value   Sta.  Value   Sta.  Value   Sta.  Value
    0   .015    9.1   .035   12.1   .015   16.1   .035   18.9   .015
```

```
   20   .035    23   .015    27   .035   29.9   .015

Bank Sta: Left   Right   Lengths: Left Channel   Right   Coeff Contr.   Expan.
        0     39            21     21     21          .1      .3

CROSS SECTION INPUT   Reach: PINE CREEK    River Station: 155
Description: PROPOSED COND.

Station Elevation Data,  num = 10
  Sta.   Elev.   Sta.   Elev.   Sta.   Elev.   Sta.   Elev.   Sta.   Elev.
    0     69      5     69     5.1    59.8     13    59.8    13.1     54
   42     54    42.1   59.8     56    59.8    56.1   69.3     77      70

Manning's n Values,  num = 5
  Sta.   Value   Sta.   Value   Sta.   Value   Sta.   Value   Sta.   Value
    0    .035      5    .015   13.1    .035     42    .015   56.1    .035

Bank Sta: Left   Right   Lengths: Left Channel   Right   Coeff Contr.   Expan.
       13    42.1            30     35     35          .1      .3

CROSS SECTION INPUT   Reach: PINE CREEK    River Station: 152
Description: PROPOSED COND.

Station Elevation Data,  num = 18
  Sta.   Elev.   Sta.   Elev.   Sta.   Elev.   Sta.   Elev.   Sta.   Elev.
    0     73      .5    72      7     70      14     69     14.1     61
   23     61      24    58      35    56      41     54     62       54
   69     54      69    56      92    58     92.1    60     103     60.2
103.1     66     115    68     124    70

Manning's n Values,  num = 6
  Sta.   Value   Sta.   Value   Sta.   Value   Sta.   Value   Sta.   Value
    0    .015      .5    .035     14    .015     24    .035     92    .015
103.1    .035

Bank Sta: Left   Right   Lengths: Left Channel   Right   Coeff Contr.   Expan.
       23    92.1            10     11     10          .1      .3

CROSS SECTION INPUT   Reach: PINE CREEK    River Station: 145
Description: PROPOSED COND.

Station Elevation Data,  num = 13
  Sta.   Elev.   Sta.   Elev.   Sta.   Elev.   Sta.   Elev.   Sta.   Elev.
    0     68      .5   61.25    9.5    61.2     9.6     60      19      58
   30     56      63     56     86      58      96      60     100      60
  109    60.2     114    61    114.5    64

Manning's n Values,  num = 5
  Sta.   Value   Sta.   Value   Sta.   Value   Sta.   Value   Sta.   Value
    0    .015     9.6    .035    100    .015    109    .035    114    .015

Bank Sta: Left   Right   Lengths: Left Channel   Right   Coeff Contr.   Expan.
      9.6    100            18     16     18          .1      .3

CROSS SECTION INPUT   Reach: PINE CREEK    River Station: 142
Description: PROPOSED COND.
```

Station Elevation Data, num = 6

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	60	8	58	12	56	55	56	66	58
71	60								

Manning's n Values, num = 2

Sta.	Value	Sta.	Value
0	.085	8	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
8	66	15	20	20	.1	.3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 132
Description: PROPOSED COND.

Station Elevation Data, num = 8

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	60	5	58	10	56	13	55	59	55.6
62	56	70	58	80	60				

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.085	10	.075	62	.085

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
10	62	20	30	45	.1	.3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 122
Description: PROPOSED COND.

Station Elevation Data, num = 8

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	60	4	58	9	56	14	54	19	53.5
55	54	74	56	83	58				

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.085	14	.075	55	.085

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
14	55	35	27	26	.1	.3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 115
Description: PROPOSED COND.

Station Elevation Data, num = 8

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	58	5	56	10	54	15	52	51	52
56	54	65	56	72	58				

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.085	10	.075	56	.085

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.

10 56 28 31 35 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 110
Description: PROPOSED COND.

Station Elevation Data, num = 10

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	58	4	56	9	54	13	52	47	50
50	50	54	52	58	54	61	56	66	58

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.085	13	.075	54	.085

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
13 54 30 30 30 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 105
Description: PROPOSED COND.

Station Elevation Data, num = 9

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	56	5	54	10	52	17	50	41	49.6
47	50	52	52	55	54	59	56		

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.085	10	.075	52	.085

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
10 52 0 0 0 .1 .3

****

SUMMARY OF MANNING'S N VALUES

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7	n8	n9	
PINE CREEK	240	.085	.075	.085							
PINE CREEK	230	.085	.075	.085							
PINE CREEK	210	.085	.075	.085							
PINE CREEK	185	.085	.075	.015	.035						
PINE CREEK	180	.015	.035	.015							
PINE CREEK	175	.035	.015	.035							
PINE CREEK	172	.035	.015	.035	.015						
PINE CREEK	170	.015	.035	.015	.035	.015	.035	.015	.035	.015	
PINE CREEK	160	.015	.035	.015	.035	.015	.035	.015	.035	.015	
PINE CREEK	155	.035	.015	.035	.015	.035					
PINE CREEK	152	.015	.035	.015	.035	.015	.035				
PINE CREEK	145	.015	.035	.015	.035	.015					
PINE CREEK	142	.085	.035								
PINE CREEK	132	.085	.075	.085							
PINE CREEK	122	.085	.075	.085							
PINE CREEK	115	.085	.075	.085							
PINE CREEK	110	.085	.075	.085							

*PINE CREEK * 105 * .085* .075* .085* * * * * * *

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SUMMARY OF REACH LENGTHS

****

Reach	River Sta.	Left	Channel	Right
*PINE CREEK	240	69*	69*	68*
*PINE CREEK	230	111*	115*	120*
*PINE CREEK	210	50*	46*	55*
*PINE CREEK	185	25*	25*	28*
*PINE CREEK	180	20*	25*	18*
*PINE CREEK	175	11*	11*	11*
*PINE CREEK	172	15*	15*	15*
*PINE CREEK	170	78*	78*	78*
*PINE CREEK	160	21*	21*	21*
*PINE CREEK	155	30*	35*	35*
*PINE CREEK	152	10*	11*	10*
*PINE CREEK	145	18*	16*	18*
*PINE CREEK	142	15*	20*	20*
*PINE CREEK	132	20*	30*	45*
*PINE CREEK	122	35*	27*	26*
*PINE CREEK	115	28*	31*	35*
*PINE CREEK	110	30*	30*	30*
*PINE CREEK	105	0*	0*	0*

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****

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

****

Reach	River Sta.	Contr.*	Expan. *
*PINE CREEK	240	.1*	.3*
*PINE CREEK	230	.1*	.3*
*PINE CREEK	210	.1*	.3*
*PINE CREEK	185	.1*	.3*
*PINE CREEK	180	.1*	.3*
*PINE CREEK	175	.1*	.3*
*PINE CREEK	172	.1*	.3*
*PINE CREEK	170	.5*	.3*
*PINE CREEK	160	.1*	.3*
*PINE CREEK	155	.1*	.3*
*PINE CREEK	152	.1*	.3*
*PINE CREEK	145	.1*	.3*
*PINE CREEK	142	.1*	.3*
*PINE CREEK	132	.1*	.3*
*PINE CREEK	122	.1*	.3*
*PINE CREEK	115	.1*	.3*
*PINE CREEK	110	.1*	.3*
*PINE CREEK	105	.1*	.3*

****

100 Year Storm

HEC-RAS Version 1.2 April 1996
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

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

****

PROJECT DATA
Project Title: CHAPEL HILLS BOX 100 YEAR STORM
Project File : chb98.prj
Run Date and Time: 2/18/98 11:45:00 AM

Project in English units

****

PLAN DATA

Plan Title: Plan 17
Plan File : x:\870000.all\871614\hydro\hecras\pcch98\chb98.p17

Geometry Title: Plan 17
Geometry File : x:\870000.all\871614\hydro\hecras\pcch98\chb98.p17

Flow Title : Plan 17
Flow File : x:\870000.all\871614\hydro\hecras\pcch98\chb98.p17

Plan Summary Information:
Number of: Cross Sections = 18 Mulitple Openings = 0
Culverts = 0 Inline Weirs = 0
Bridges = 0

Computational Information
Water surface calculation tolerance = .01
Critical depth calculaton tolerance = .01
Maximum number of interations = 20
Maximum difference tolerance = .3
Flow tolerance factor = .001

Computational Flow Regime: Mixed Flow

Encroachment Data: None

Flow Distribution Locations: None

****

FLOW DATA

Flow Title: 100 YEAR FEMA
Flow File : x:\870000.all\871614\hydro\hecras\pcch98\chb98.f02

Flow Data (cfs)

Reach	Riv Sta	PF#1
PINE CREEK	240	1330
PINE CREEK	160	1330
PINE CREEK	152	1800

Boundary Conditions

Reach	Profile	Upstream	Downstream
PINE CREEK	1	Normal S = .025	Normal S = .047

****

GEOMETRY DATA

Geometry Title: chb98 prpsd
Geometry File : x:\870000.all\871614\hydro\hecras\pcch98\chb98.g02

CROSS SECTION INPUT Reach: PINE CREEK River Station: 240
Description: PROPOSED COND.

Station Elevation Data, num = 10

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	74	8	72	13	70	18	68	21	66
26	66	46	68	61	70	67	72	74	74

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.085	13	.075	61	.085

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
13	61	69	69	68	.1	.3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 230
Description: PROPOSED COND.

Station Elevation Data, num = 8

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-25	72	0	70	5	68	10	66	24	66
51	68	60	70	67	72				

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value

-25 .085 5 .075 51 .085

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
5 51 111 115 120 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 210
Description: PROPOSED COND.

Station Elevation Data, num = 8

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	70	7	68	23	66	42	64	58	64
75	66	80	68	86	70				

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.085	23	.075	75	.085

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
23 75 50 46 55 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 185
Description: PROPOSED COND.

Station Elevation Data, num = 9

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	72	13	68	47	66	53	64	83	64
110	66	118	66	118.1	70	126	72		

Manning's n Values, num = 4

Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value
0	.085	47	.075	110	.015	118.1	.035

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
0 110 25 25 28 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 180
Description: PROPOSED COND.

Station Elevation Data, num = 10

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-18	68	4	66	10	65.8	32	64	40	62
63	62	72	63	72.1	64	81	64	81.1	70

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
-18	.015	10	.035	72	.015

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
-18 81.1 20 25 18 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 175
Description: PROPOSED COND.

Station Elevation Data, num = 12

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	70	12	65.8	24	65.6	24.1	62	26	60

29 59.5 45 59.5 48 60 52 60.5 52.1 62
62 62 62.1 69

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.035	12	.015	24.1	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
0	62.1	11	11	.1	.3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 172
Description: PROPOSED COND.

Station Elevation Data, num = 9

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	70	8	69	8.1	62.2	18	62.2	18.1	59
40	58.5	40.1	61	51	61	51.1	69		

Manning's n Values, num = 4

Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value
0	.035	8	.015	18.1	.035	40	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
8	51	15	15	.1	.3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 170
Description: BOX INLET

Station Elevation Data, num = 20

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	68.75	.1	60.75	7.9	60.75	8	68.75	9	68.75
9.1	59.5	12.1	58	16.1	58	18.9	59.5	19	64
19.9	64	20	59.5	23	58	27	58	29.9	59.5
30	68.75	30.8	68.75	30.9	60.75	39	60.75	39.1	68.75

Manning's n Values, num = 9

Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value
0	.015	9.1	.035	12.1	.015	16.1	.035	18.9	.015
20	.035	23	.015	27	.035	29.9	.015		

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
0	39.1	78	78	.5	.3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 160
Description: BOX OUTLET

Station Elevation Data, num = 20

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	67.75	.1	59.75	7.9	59.75	8	67.75	9	67.75
9.1	58.5	12.1	57	16.1	57	18.9	58.5	19	63
19.9	63	20	58.5	23	57	27	57	29.9	58.5
30	67.75	30.8	67.75	30.9	59.75	39	59.75	39	67.75

Manning's n Values, num = 9

Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value
0	.015	9.1	.035	12.1	.015	16.1	.035	18.9	.015

20 .035 23 .015 27 .035 29.9 .015

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
0 39 21 21 21 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 155
Description: PROPOSED COND.

Station Elevation Data, num = 10

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	69	5	69	5.1	59.8	13	59.8	13.1	54
42	54	42.1	59.8	56	59.8	56.1	69.3	77	70

Manning's n Values, num = 5

Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value
0	.035	5	.015	13.1	.035	42	.015	56.1	.035

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
13 42.1 30 35 35 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 152
Description: PROPOSED COND.

Station Elevation Data, num = 18

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	73	.5	72	7	70	14	69	14.1	61
23	61	24	58	35	56	41	54	62	54
69	54	69	56	92	58	92.1	60	103	60.2
103.1	66	115	68	124	70				

Manning's n Values, num = 6

Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value
0	.015	.5	.035	14	.015	24	.035	92	.015
103.1	.035								

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
23 92.1 10 11 10 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 145
Description: PROPOSED COND.

Station Elevation Data, num = 13

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	68	.5	61.25	9.5	61.2	9.6	60	19	58
30	56	63	56	86	58	96	60	100	60
109	60.2	114	61	114.5	64				

Manning's n Values, num = 5

Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value	Sta.	Value
0	.015	9.6	.035	100	.015	109	.035	114	.015

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
9.6 100 18 16 18 .1 .3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 142
Description: PROPOSED COND.

Station Elevation Data, num = 6

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	60	8	58	12	56	55	56	66	58
71	60								

Manning's n Values, num = 2

Sta.	Value	Sta.	Value
0	.085	8	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
8	66	15	20	20	.1	.3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 132
Description: PROPOSED COND.

Station Elevation Data, num = 8

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	60	5	58	10	56	13	55	59	55.6
62	56	70	58	80	60				

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.085	10	.075	62	.085

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
10	62	20	30	45	.1	.3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 122
Description: PROPOSED COND.

Station Elevation Data, num = 8

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	60	4	58	9	56	14	54	19	53.5
55	54	74	56	83	58				

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.085	14	.075	55	.085

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
14	55	35	27	26	.1	.3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 115
Description: PROPOSED COND.

Station Elevation Data, num = 8

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	58	5	56	10	54	15	52	51	52
56	54	65	56	72	58				

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.085	10	.075	56	.085

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.

10	56		28	31	35	.1	.3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 110
Description: PROPOSED COND.

Station Elevation Data, num = 10

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	58	4	56	9	54	13	52	47	50
50	50	54	52	58	54	61	56	66	58

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.085	13	.075	54	.085

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
13	54	30	30	.1	.3

CROSS SECTION INPUT Reach: PINE CREEK River Station: 105
Description: PROPOSED COND.

Station Elevation Data, num = 9

Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0	56	5	54	10	52	17	50	41	49.6
47	50	52	52	55	54	59	56		

Manning's n Values, num = 3

Sta.	Value	Sta.	Value	Sta.	Value
0	.085	10	.075	52	.085

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
10	52	0	0	.1	.3

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SUMMARY OF MANNING'S N VALUES

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7	n8	n9
PINE CREEK	240	.085	.075	.085						
PINE CREEK	230	.085	.075	.085						
PINE CREEK	210	.085	.075	.085						
PINE CREEK	185	.085	.075	.015	.035					
PINE CREEK	180	.015	.035	.015						
PINE CREEK	175	.035	.015	.035						
PINE CREEK	172	.035	.015	.035	.015					
PINE CREEK	170	.015	.035	.015	.035	.015	.035	.015	.035	.015
PINE CREEK	160	.015	.035	.015	.035	.015	.035	.015	.035	.015
PINE CREEK	155	.035	.015	.035	.015	.035				
PINE CREEK	152	.015	.035	.015	.035	.015	.035			
PINE CREEK	145	.015	.035	.015	.035	.015				
PINE CREEK	142	.085	.035							
PINE CREEK	132	.085	.075	.085						
PINE CREEK	122	.085	.075	.085						
PINE CREEK	115	.085	.075	.085						
PINE CREEK	110	.085	.075	.085						

*PINE CREEK * 105 * .085* .075* .085* * * * * * *

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SUMMARY OF REACH LENGTHS

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* Reach	* River Sta. *	Left	* Channel*	Right *
*PINE CREEK *	240 *	69*	69*	68*
*PINE CREEK *	230 *	111*	115*	120*
*PINE CREEK *	210 *	50*	46*	55*
*PINE CREEK *	185 *	25*	25*	28*
*PINE CREEK *	180 *	20*	25*	18*
*PINE CREEK *	175 *	11*	11*	11*
*PINE CREEK *	172 *	15*	15*	15*
*PINE CREEK *	170 *	78*	78*	78*
*PINE CREEK *	160 *	21*	21*	21*
*PINE CREEK *	155 *	30*	35*	35*
*PINE CREEK *	152 *	10*	11*	10*
*PINE CREEK *	145 *	18*	16*	18*
*PINE CREEK *	142 *	15*	20*	20*
*PINE CREEK *	132 *	20*	30*	45*
*PINE CREEK *	122 *	35*	27*	26*
*PINE CREEK *	115 *	28*	31*	35*
*PINE CREEK *	110 *	30*	30*	30*
*PINE CREEK *	105 *	0*	0*	0*

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SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

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* Reach	* River Sta. *	Contr.*	Expan. *
*PINE CREEK *	240 *	.1*	.3*
*PINE CREEK *	230 *	.1*	.3*
*PINE CREEK *	210 *	.1*	.3*
*PINE CREEK *	185 *	.1*	.3*
*PINE CREEK *	180 *	.1*	.3*
*PINE CREEK *	175 *	.1*	.3*
*PINE CREEK *	172 *	.1*	.3*
*PINE CREEK *	170 *	.5*	.3*
*PINE CREEK *	160 *	.1*	.3*
*PINE CREEK *	155 *	.1*	.3*
*PINE CREEK *	152 *	.1*	.3*
*PINE CREEK *	145 *	.1*	.3*
*PINE CREEK *	142 *	.1*	.3*
*PINE CREEK *	132 *	.1*	.3*
*PINE CREEK *	122 *	.1*	.3*
*PINE CREEK *	115 *	.1*	.3*
*PINE CREEK *	110 *	.1*	.3*
*PINE CREEK *	105 *	.1*	.3*

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DRAINAGE MAP