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Final Drainage Report for

Salt River Evaluation: McClintock Road to SR-101L

FCDMC Contract Number 1999C067

August 2000

Prepared for:

Flood Control District of Maricopa County
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Phoenix, AZ
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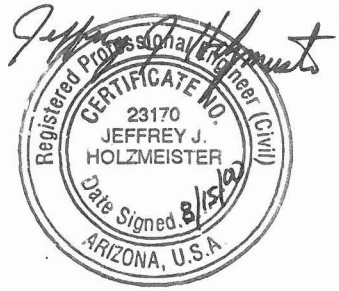

Appendix

Appendix A	Excerpts from Simons, Li and Associates Drainage Report
Appendix B	HEC-RAS Summary and Output
Appendix C	Pier Scour Calculations
Appendix D	Survey Notes

Computer CD (Back Pocket)	HEC-RAS Computer Runs
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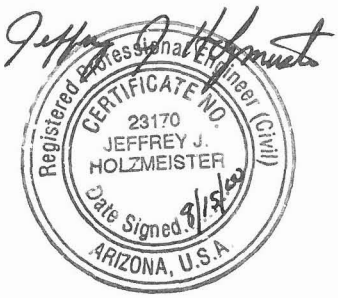
	Survey ASCII File



1 INTRODUCTION

1.1 Overview

The Flood Control District of Maricopa County (FCDMC) has retained Premier Engineering Corporation (Premier) as On-Call consultants under contract number 1999C067, Salt River Evaluation. As part of this contract, the FCDMC has requested that Premier determine the height of the existing Salt River bank protection levees from McClintock Drive to SR 101L and to perform a hydraulic analysis to determine levee freeboard for various scenarios.

The FCDMC is concerned that portions of the Salt River Levee within the study limits may lack adequate freeboard. Premier performed a survey to verify levee elevations and to use as the basis for the hydraulic analysis. The hydraulic analysis was performed to determine the existing hydraulic conditions and to model future decreases in conveyance due to new vegetative growth. Additionally, Premier determined the local pier scour depths for the Salt River Reach form McClintock Bridge to SR101L.

1.2 Scope and Objective

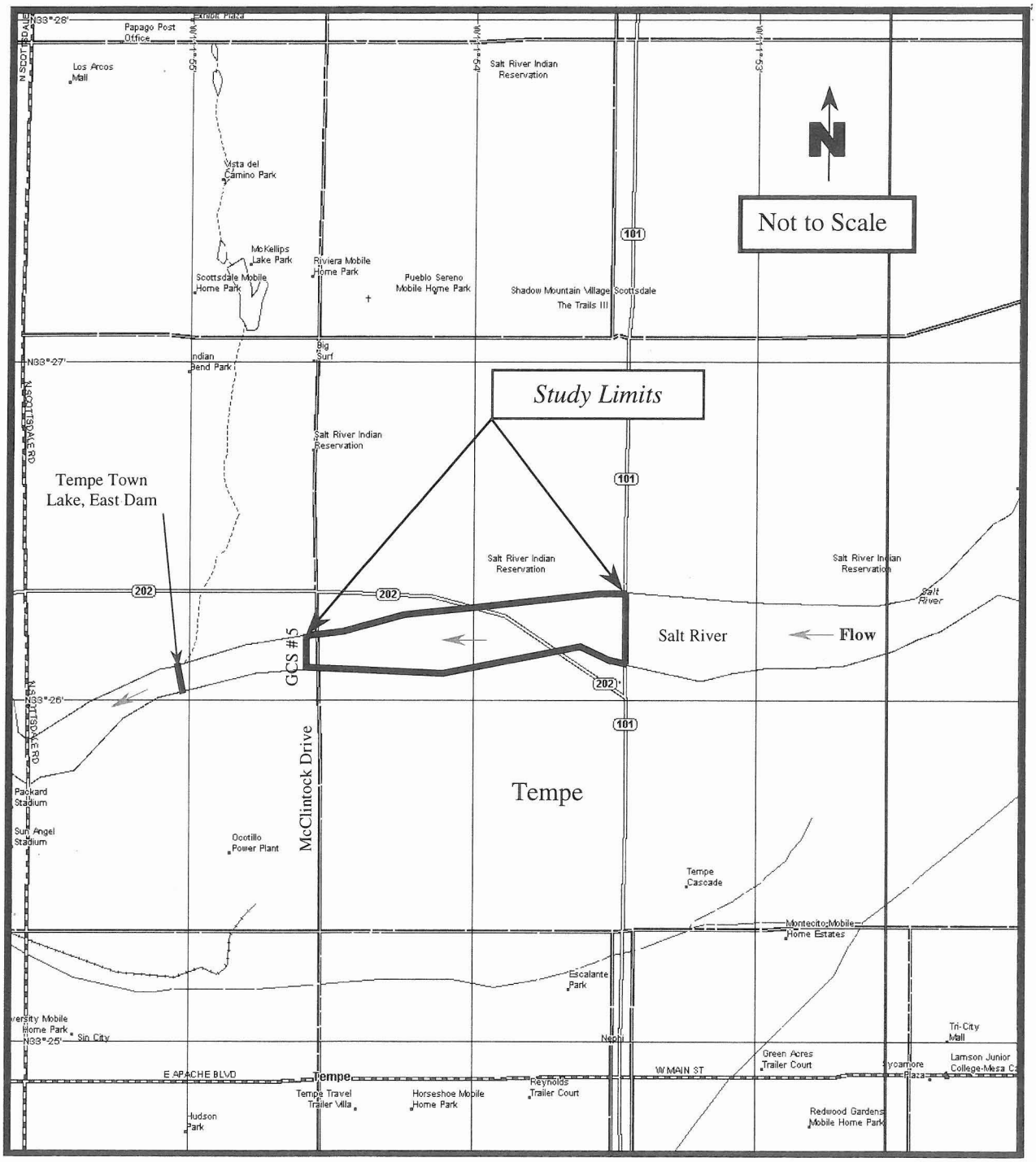
The specific objectives of this report are to:

- Verify levee elevations.
- Determine the existing condition hydraulics of the Salt River within the previously stated limits. The 100-year pre-Roosevelt Dam flow of 215,000 cfs and post dam flow discharge of 172,000 cfs were used in this evaluation. Manning n values were based upon field observed vegetative growth.
- Determine the highest n value for the channel reach using the 172,000 cfs and the 215,000 cfs 100-year discharges and a minimum freeboard requirement of 3 feet.
- Determine a preliminary management plan for the existing vegetative growth based on hydraulic considerations.
- Determine the pier scour depths for the 100-year storm event.

1.3 Location

The study site is bounded by the Salt River Pima-Maricopa Indian Community to the north, and the City of Tempe to the south, west, and east. The portion of the Salt River being studied begins at a grade control structure (GCS # 5) just downstream (west) of McClintock Drive Bridge and ends under the SR101/202 Loop interchange. Tempe Town Lake is 1,800 feet downstream of GCS 5. Additionally, one mile of the SR 202 Bridge crosses the length of the study reach. The length of the study reach is approximately 1.1 miles. See figure 1 for the project location.

Figure 1: Location Map



1.4 Previous Drainage Studies

The following sources of information were utilized in this study.

- *Final Hydraulic & Scour Analysis Report, Salt River East Papago Freeway McClintock Drive to SR 101L*, Maricopa County, Arizona, prepared by Simons, Li and Associates (SLA), July1997.
- *Salt-Gila River Floodplain Delineation Restudy*, prepared by Michael Baker Jr, Inc. (Baker), May 1999
- *Maricopa County Flood Insurance Study*, Volume 1 of 12, September 1995
- *Landiscor Aerial Photo 2000 Atlas* by Landiscor Aerial Information, January 2000.

2 SITE CONDITION

The study reach has been channelized for its entire length. Cement Stabilized Alluvium (CSA) protection is provided for both the north and the south banks. The channel bottom as built, was devoid of vegetation. The bed material is comprised principally of small to medium size cobbles.

Since the completion of the levee system in 1996, vegetation of the channel bottom has taken place. There are new Salt Cedars, weeds, and Cottonwood saplings concentrated near the levee banks and in small isolated pockets in the main channel. Figure 2 shows the existing vegetation growing in the study reach.

Prior to the construction of the McClintock drop structure and the Town Lake, sub surface water was conveyed west under the Salt River channel bed over an impervious clay pan. This flow path has been blocked with the construction of the drop structure, Tempe Town Lake and its attendant dam structures (and toe down). This standing body of water concentrates in a depressed portion of the reach. The deepest potion is centered in the middle of the reach. The maximum depth of the standing water is about 12 feet. The limits of the ponded water are about 420 feet east of the McClintock Bridge to under the SR 101/202 interchange. Figure 2 also shows a portion of the depressed section with the standing water.

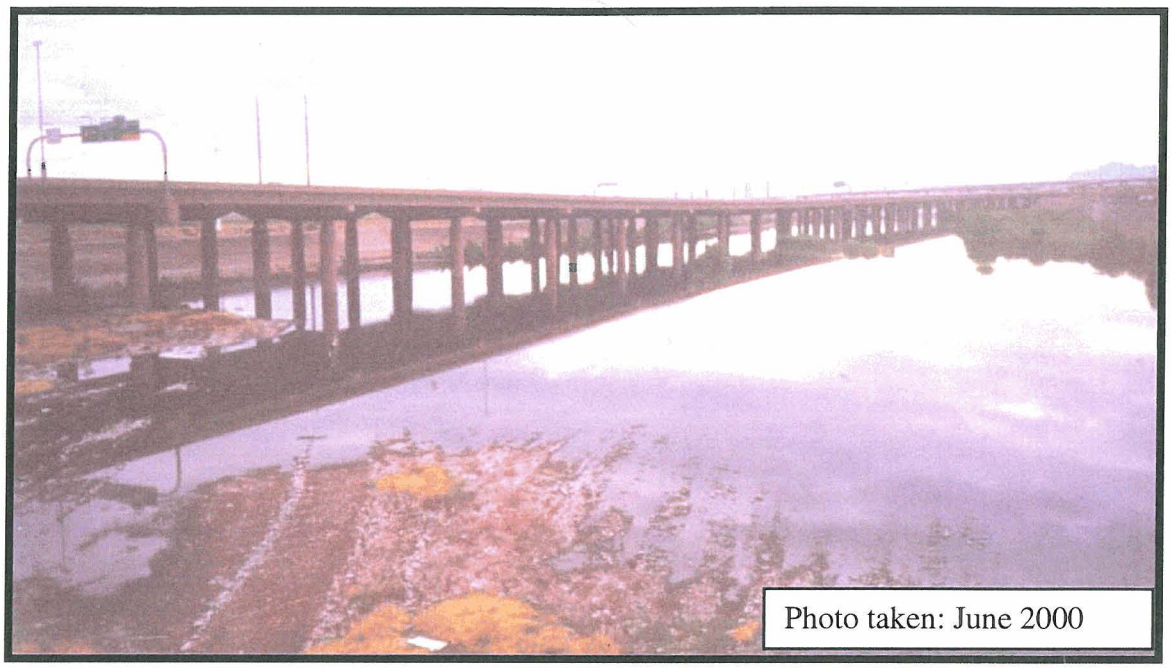


Figure 2: Looking from McClintock Bridge East at Body of Standing Water

3 LEVEE ELEVATION VERIFICATION

As part of this study, a verification of the top of levee elevations was conducted. The surveyed levee elevations were compared to the elevations reported in the Simons, Li and Associates drainage report. See Section 7 for the list of references. The results of the analysis are presented in Table 1. The surveyed elevations were found to match reasonably well with the Simons, Li As-Built Elevations.

Table 1: ***Levee Elevation Summary***

	North Levee Elevations			South Levee Elevations				
Cross Section	Premier Surveyed Elevation (ft)	SL Design Elevation (ft)	SL As-Built Elevation (ft)	Premier Surveyed Elevation (ft)	SL Design Elevation (ft)	SL As-Built Elevation (ft)	North Levee * Delta El.	South Levee * Delta El.
240	1182.96	1182.40	1183.00	1184.55	1184.10	1184.60	-0.04	-0.05
239	1180.67	1181.70	1180.60	1184.02	1183.50	1183.90	0.07	0.12
238	1181.17	1181.30	1181.50	1182.96	1183.00	1183.20	-0.33	-0.24
237	1180.99	1180.60	1181.00	1181.89	1182.50	1182.50	-0.01	-0.61
236	1179.16	1179.00	1179.00	1181.93	1182.10	1182.10	0.16	-0.17
235	1177.93	1177.80	1177.90	1178.74	1178.40	1178.70	0.03	0.04
234	1176.92	1176.30	1177.00	1176.39	1176.10	1176.40	-0.08	-0.01
233	1174.38	1174.40	1174.00	1174.80	1174.50	1175.10	0.38	-0.30
232	1173.92	1173.60	1173.80	1173.84	1173.60	1173.40	0.12	0.44
231	1172.77	1172.80	1172.60	1172.53	1172.80	1172.60	0.17	-0.07
230	1172.91	1172.50	1172.80	1172.16	1172.20	1172.30	0.11	-0.14
229	1174.61	1173.40	1173.00	1172.12	1172.20	1172.20	1.61	-0.08
228	1172.89	1172.60	1172.40	1172.27	1172.00	1172.30	0.49	-0.03
123.8	1170.06	1172.10	1170.20	1171.46	1171.80	1172.10	-0.14	-0.64
123.7	1170.06	1172.10	1170.20	1171.46	1171.80	1172.10	-0.14	-0.64
120.5	1172.40	1171.40	1171.80	1173.02	NA	NA	0.60	NA

Note: Delta El = Premier surveyed Elevation-As-Built El.

The maximum differences between the surveyed elevations (in the north levee) were located at stations 229 and 238. The north levee heights at station 229 and 238 surveyed by Premier were 1.61 feet higher and 0.33 feet lower respectively than the SLA as-built survey. The south levee heights at station 232 and 123.7 (and 123.8) surveyed by Premier were 0.44 feet higher and 0.64 feet lower receptively than the SLA as-built survey. Note that the McClintock Bridge is located at 123.75. The majority of levee elevations matched well. It appears that the design levee elevations are valid. Therefore, lack of adequate freeboard cannot be attributed to the use of incorrect levee elevations.

4 HYDROLOGY

Two 100-year peak discharges were used in the hydraulic evaluation of the Salt River reach. The first 100-year year peak discharge of 215,000 cfs was based upon the pre-Roosevelt dam condition. This flow was used to design the existing levee system. This 100-year discharge is also cited in the 1983-84 Army Corps of Engineers Flood study done for the FCDMC.

The second 100-year peak discharge of 172,000 cfs represents a design the existing hydrologic conditions are based upon a Post-Roosevelt Dam condition. This flow was first developed in floodplain restudy conducted by Baker in 1999. The 100-year Post-Roosevelt Dam flow from this report is 172,000 cfs.

5 HYDRAULICS

Several hydraulic scenarios were performed within the river. The different scenarios examined were:

1. Q_{100} = 215, 000 cfs and 172,000 cfs, surveyed geometry, Manning's n value = 0.035 (ideal design condition)
2. Q_{100} = 215, 000 cfs and 172,000 cfs, surveyed geometry, Manning's n value = 0.055 (maximum vegetative growth)
3. Q_{100} = 215, 000 cfs and 172,000 cfs, surveyed geometry, Manning's n value varied to match observed vegetative condition (strip condition)
4. Q_{100} = 215, 000 cfs and 172,000 cfs, surveyed geometry, Maximum Manning's n value that will allow the levee system to function with 3 foot of freeboard.
5. Q_{100} = 215, 000 cfs surveyed geometry, Maximum Manning's n value that will allow the levee system to function without overtopping.
6. Q_{100} = 215, 000 cfs and 172,000 cfs, Reach has "filled in" attaining its equilibrium slope (equilibrium slope determined by. Manning's n value = 0.035 (ideal design value)
7. Q_{100} = 215, 000 cfs and 172,000 cfs, Reach has "filled in" attaining its equilibrium slope. Manning's n value = 0.055 (maximum vegetative growth)
8. Q_{100} = 215, 000 cfs and 172,000 cfs, Reach has "filled in" attaining its equilibrium slope. Manning's n value varied to match observed vegetative condition (strip condition)

9. Q_{100} = 215, 000 cfs and 172,000 cfs, Reach has "filled in" attaining its equilibrium slope. Maximum Manning's n value that will allow the levee system to function with 3 foot of freeboard.
10. Q_{100} = 215,000 cfs, Reach has "filled in" attaining its equilibrium slope. Maximum Manning's n value that will allow the levee system to function (without overtopping).

5.1 Methodology and Procedures

The US Army Corps of Engineer's (COE) hydraulic water surface profile program HEC-RAS was used to determine water surface elevations (WSEL) for this study.

The SLA drainage report was used to determine the downstream starting point for the present study's hydraulic analysis. Starting water surface elevations and the equilibrium slope were taken from this report. Refer to Appendix A for excerpts from this report. The levee elevations and HEC-2 water surface profiles found in the SLA report were used for comparison purposes.

The Army Corps of Engineers criteria was applied for the determination of minimum levee freeboard. These criteria state that the minimum allowable freeboard of the levee is the 100-year water surface elevation plus 3 feet. The original design criteria were the same.

The evaluation discharges were 215,000 and 172,000 cfs respectively. The HEC-RAS model was run in the subcritical flow regime. The starting water surface elevations for the 215,000 cfs and 172,000 flows were 1166.59 and 1163.07 respectively. The beginning water surface for the 215,000 cfs discharge was derived from the previous the study by SLA. The beginning water surface elevation for the 172,000 cfs discharge was derived from the Baker study of the Salt River. The beginning cross section (number 120.5 in the SLA report and 223.08 in the Baker study) was located just downstream (west) of the McClintock Drive Bridge at GCS # 5.

5.1.1 Cross Section Location

Cross section locations were kept the same as in the Simons, Li and Associates drainage report. This was done to allow expedient comparisons between the channel conditions at the time of construction and the existing condition.

The cross sections were surveyed by Survnet and the results of the survey were delivered to Premier Engineering. Using the Microstation and Inroads programs, a basic HEC-2 file was created. This formed the basis of the HEC-RAS hydraulic model. Standing water (at a depth of up to 12 feet) created problems for the survey crew. Crew members swam the river with a survey rod to obtain cross section data. They attempted to identify all grade breaks in the channel invert. However, the depth of flow may have prevented identification of all grade breaks. Figure 3 shows the cross section locations.

5.1.2 Energy Loss Coefficients

The energy loss coefficients for contraction and expansion (at most cross sections) were 0.1 and 0.3 respectively. The loss coefficients were increased at locations where flow was being contracted by a bridge opening or was expanding downstream of a bridge. These coefficients were to 0.3 and 0.5 respectively. These energy loss coefficients were derived from the HEC-RAS user manuals.

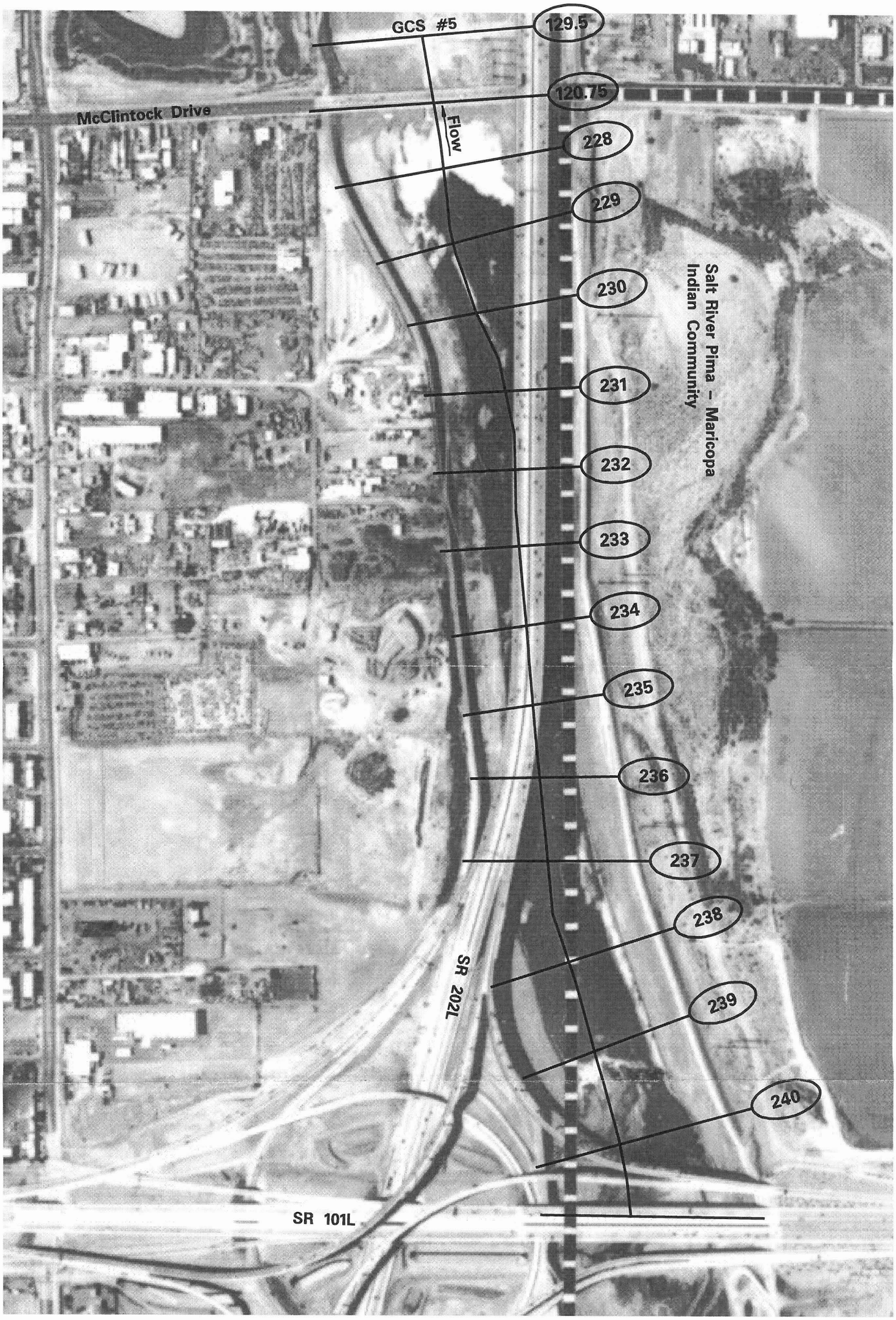
5.1.3 Ineffective Conveyance Areas

As mentioned previously, the study reach contains a depressed area within the channel reach. During large storm events the depression fills in and no conveyance takes place. For modeling purposes, the cross section points corresponding to the depressed area were "raised" (not deleted). See the diskette at the back of the report for the electronic copies of the HEC-RAS runs. The HEC-RAS plan titled "Imported" contains the original surveyed cross section data from the survey. This may be viewed for comparison purposes.

There was no ineffective (conveyance) area modeled around McClintock bridge. This was done because the abutments correspond to the levee locations. Therefore there were no zones of near zero flow velocity in the vicinity of the bridge.

5.1.4 Manning's "n" Roughness Values

Manning n values were varied for the different run scenarios. They were varied to reflect different channel conditions and "what if" objectives. This data will be utilized in the development of a river management plan by the FCDMC. The "n" values ranged from 0.035 to 0.055.



Pre–Roosevelt Dam Q100 = 215,000 cfs
Post–Roosevelt Dam Q100 = 172,000 cfs

N

1" = 500'

Photo source: "2000 Phx. Photo Atlas" Landiscor Aerial Information, January 2000.

Plotted By: JMC 08/15/00 09:34:59 [redacted]9952\Salt River\Cadd\fig3_xsecs.dgn

SALT RIVER
McCLINTOCK DR TO SR101L
CROSS SECTION LOCATION

FIGURE 3

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5.2 Hydraulic Model Scenarios

Various scenarios were run to evaluate existing hydraulic conditions, possible future conditions, and to evaluate "what if" scenarios. The following provides a description of each type of evaluation, the assumptions and purpose. See Appendix B for HEC-RAS model output.

5.2.1 Surveyed Topo Condition (n = 0.035)

This run was made to evaluate the effects of updated (surveyed) topography on the existing hydraulic models. A hydraulic model was created that incorporated the surveyed cross section geometry and previous hydraulic model assumptions. Both 100-year flows were run as separate flow profiles. This run became the "base" condition model.

Some alterations were made to the surveyed cross sections when imported into the hydraulic model. The depression in the middle of the reach was treated as if it was "filled in". This was achieved by "raising" the elevations within each affected cross section. This accounted for the non-conveyance areas represented by the depression. Refer to Appendix B for HEC-RAS profiles of the existing ground line along the channel reach. The results of the analysis are presented in Table 2. The available freeboards for each scenario are presented in Tables 3 and 4.

Note that for the levee system (at any particular cross section) to function within design parameters, there needs to be at least 3 feet of freeboard with respect to the 100-year water surface elevation and the top of levee elevation.

Note: The South bank levee is generally higher than the North bank levee.

5.2.2 Surveyed Topo and "strip" n values

In a real world situation, different roughness elements (i.e. vegetation, different bed material) are distributed horizontally (in a "strip" pattern) over the width of any given cross section. A hydraulic run was made incorporating "strip" n values. Therefore, Manning's n values for each cross section were applied to the existing condition cross section geometry. The Manning's n value distribution for each cross section was based upon observations made during a site visit and aerial photos from the Landiscor Photo Atlas. This run best simulates the existing conditions at the site. Refer to Figures 3 and 4 for photos showing vegetation that corresponds to a particular n value used for this run.

5.2.3 Surveyed Topo and Maximum Vegetative Growth (n = 0.055)

This model was based upon the surveyed cross sectional geometry but assumes that there is greatly increased vegetative growth resulting from the newly available supply of standing water. The greatest expected growth would create a roughness of about 0.055 across all of the cross sections. The purpose of this run was to determine how high vegetative growth might affect freeboards given the existing topography.

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HEC-RAS Results and Freeboard
Salt River: McClintock-SR101L

Project: FCDMC On-Call
Subject: ***WSEL Comparisons and Freeboards***

By: KD
Date: Jul-00
Checked:
Premier Project No.: 9952

Table 2: Summary of Water Surface Elevations

River Sta	Simons, Li HEC-2		HEC-RAS SCENARIOS																	
	Design	As-Built	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
240	1179.3	1179.6	1178.63	1184.16	1178.88	1176.9	1175.12	1180.18	1175.38	1177.97	1181.17	1179.73	1185.24	1179.95	1178.00	1176.26	1181.32	1176.51	1178.09	1181.15
239	1178.5	1178.8	1178.12	1183.6	1178.39	1176.4	1174.67	1179.69	1174.95	1177.49	1180.63	1179.17	1184.64	1179.42	1177.46	1175.77	1180.78	1176.04	1177.59	1180.58
238	1178.3	1178.6	1177.88	1183.27	1178.15	1176.2	1174.44	1179.37	1174.72	1177.21	1180.35	1178.87	1184.27	1179.13	1177.20	1175.48	1180.42	1175.76	1177.27	1180.26
237	1177.6	1177.9	1177.52	1182.75	1177.8	1175.91	1174.11	1178.9	1174.41	1176.79	1179.9	1178.46	1183.7	1178.73	1176.86	1175.11	1179.89	1175.4	1176.83	1179.80
236	1175.8	1176.1	1176.09	1181.47	1176.44	1174.38	1172.88	1177.79	1173.24	1175.65	1178.56	1176.97	1182.36	1177.32	1175.27	1173.82	1178.73	1174.19	1175.61	1178.36
235	1174.5	1174.6	1175.14	1180.33	1175.5	1173.5	1172.04	1176.77	1172.41	1174.71	1177.52	1175.96	1181.17	1176.35	1174.33	1172.93	1177.66	1173.33	1174.65	1177.30
234	1172.8	1173.1	1173.53	1178.64	1173.92	1171.85	1170.6	1175.3	1170.98	1173.26	1175.91	1174.39	1179.52	1174.81	1172.74	1171.53	1176.21	1171.93	1173.24	1175.74
233	1171.3	1171.4	1171.82	1176.73	1172.2	1170.16	1169.03	1173.57	1169.4	1171.62	1174.12	1172.28	1177.41	1172.73	1170.44	1169.59	1174.31	1170.03	1171.36	1173.67
232	1170.5	1170.4	1171.07	1175.31	1171.25	1169.72	1168.29	1172.26	1168.48	1170.52	1173.03	1171.39	1175.86	1171.61	1169.88	1168.69	1172.86	1168.94	1170.23	1172.57
231	1169.7	1169.7	1170.23	1173.82	1170.25	1169.14	1167.44	1170.89	1167.48	1169.36	1171.86	1170.37	1174.2	1170.4	1169.14	1167.66	1171.33	1167.72	1168.99	1171.37
230	1169.1	1169.1	1169.54	1172.36	1169.53	1168.74	1166.73	1169.56	1166.73	1168.26	1170.8	1169.56	1172.57	1169.55	1168.66	1166.81	1169.81	1166.81	1167.87	1170.32
229	1169.2	1169.2	1169.62	1171.77	1169.54	1169.04	1166.7	1168.94	1166.65	1167.89	1170.56	1169.56	1171.83	1169.49	1168.93	1166.68	1169.03	1166.63	1167.48	1170.11
228	1169	1168.9	1169.2	1170.89	1169.12	1168.75	1166.25	1168.09	1166.2	1167.2	1169.93	1169.16	1170.89	1169.09	1168.70	1166.24	1168.11	1166.18	1166.85	1169.57
123.8	1168.5	1168.5	1168.01	1169.34	1167.99	1167.67	1164.93	1166.52	1164.92	1165.73	1168.57	1168.03	1169.36	1168.02	1167.70	1164.97	1166.55	1164.95	1165.46	1168.34
123.7	1168.5	1168.5	1167.19	1168.27	1167.19	1166.94	1163.93	1165.4	1163.92	1164.63	1167.64	1167.18	1168.25	1167.18	1166.92	1163.92	1165.38	1163.91	1164.36	1167.43
120.5	1166.6	1166.6	1166.59	1166.59	1166.59	1166.59	1163.07	1163.07	1163.07	1163.07	1166.59	1166.59	1166.59	1166.59	1166.59	1163.07	1163.07	1163.07	1163.07	1166.59

Scenario		Scenario		Scenario		Scenario	
A	Q_{100} = 215,000, Surveyed Topo n= 0.035	E	Q_{100} = 172,000, Surveyed, n= 0.035	J	Q_{100} = 215,000, Eq. Slope n= 0.035	N	Q_{100} = 172,000, Eq. Slope n= 0.035
B	Q_{100} = 215,000 Surveyed, n= 0.055	F	Q_{100} = 172,000 Surveyed, n= 0.055	K	Q_{100} = 215,000 Eq. Slope n= 0.055	O	Q_{100} = 172,000 Eq. Slope n= 0.055
C	Q_{100} = 215,000 Surveyed, Strip n value	G	Q_{100} = 172,000 Surveyed, Strip n value	L	Q_{100} = 215,000 Eq. Slope Strip n value	P	Q_{100} = 172,000 Eq. Slope Strip n value
D	Q_{100} = 215,000 Surveyed, Max n (0.029)	H	Q_{100} = 172,000 Surveyed, Max n (0.046)	M	Q_{100} = 215,000 Eq. Slope Max n (0.029)	Q	Q_{100} = 172,000 Eq. Slope Max n (0.042)
		I	Q_{100} = 215,000 Surveyed, Overtop. n (0.044)			R	Q_{100} = 215,000 Eq. Slope Overtop. n ( )

PREMIER
ENGINEERING CORPORATION

HEC-RAS Results and Freeboard
Salt River: McClintock-SR101L

Project: FCDMC On-Call
Subject: ***WSEL Comparisons and Freeboards***

By: KD
Date: Jul-00
Checked:
Premier Project No.: 9952

Table 3: Summary of North Levee Freeboard

River Sta	Levee Elevation			HEC-RAS SCENARIOS																		
	Design	As-Built	Surveyed	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
240	1182.4	1183	1182.96	4.33	-1.2	4.08	6.06	7.84	2.78	7.58	4.99	1.79	3.23	-2.28	3.01	4.96	6.7	1.64	6.45	4.87	1.81
239	1181.7	1180.6	1180.67	2.55	-2.93	2.28	4.27	6	0.98	5.72	3.18	0.04	1.5	-3.97	1.25	3.21	4.9	-0.11	4.63	3.08	0.09
238	1181.3	1181.5	1181.17	3.29	-2.1	3.02	4.97	6.73	1.8	6.45	3.96	0.82	2.3	-3.1	2.04	3.97	5.69	0.75	5.41	3.9	0.91
237	1180.6	1181	1180.99	3.47	-1.76	3.19	5.08	6.88	2.09	6.58	4.2	1.09	2.53	-2.71	2.26	4.13	5.88	1.1	5.59	4.16	1.19
236	1179	1179	1179.16	3.07	-2.31	2.72	4.78	6.28	1.37	5.92	3.51	0.6	2.19	-3.2	1.84	3.89	5.34	0.43	4.97	3.55	0.80
235	1177.8	1177.9	1177.93	2.79	-2.4	2.43	4.43	5.89	1.16	5.52	3.22	0.41	1.97	-3.24	1.58	3.60	5	0.27	4.6	3.28	0.63
234	1176.3	1177	1176.92	3.39	-1.72	3	5.07	6.32	1.62	5.94	3.66	1.01	2.53	-2.6	2.11	4.18	5.39	0.71	4.99	3.68	1.18
233	1174.4	1174	1174.38	2.56	-2.35	2.18	4.22	5.35	0.81	4.98	2.76	0.26	2.1	-3.03	1.65	3.94	4.79	0.07	4.35	3.02	0.71
232	1173.6	1173.8	1173.92	2.85	-1.39	2.67	4.2	5.63	1.66	5.44	3.4	0.89	2.53	-1.94	2.31	4.04	5.23	1.06	4.98	3.69	1.35
231	1172.8	1172.6	1172.77	2.54	-1.05	2.52	3.63	5.33	1.88	5.29	3.41	0.91	2.4	-1.43	2.37	3.63	5.11	1.44	5.05	3.78	1.40
230	1172.5	1172.8	1172.91	3.37	0.55	3.38	4.17	6.18	3.35	6.18	4.65	2.11	3.35	0.34	3.36	4.25	6.1	3.1	6.1	5.04	2.59
229	1173.4	1173	1174.61	4.99	2.84	5.07	5.57	7.91	5.67	7.96	6.72	4.05	5.05	2.78	5.12	5.68	7.93	5.58	7.98	7.13	4.50
228	1172.6	1172.4	1172.89	3.69	2	3.77	4.14	6.64	4.8	6.69	5.69	2.96	3.73	2	3.8	4.19	6.65	4.78	6.71	6.04	3.32
123.8	1172.1	1170.2	1170.06	2.05	0.72	2.07	2.39	5.13	3.54	5.14	4.33	1.49	2.03	0.7	2.04	2.36	5.09	3.51	5.11	4.6	1.72
123.7	1172.1	1170.2	1170.06	2.87	1.79	2.87	3.12	6.13	4.66	6.14	5.43	2.42	2.88	1.81	2.88	3.14	6.14	4.68	6.15	5.7	2.63
120.5	1171.4	1171.8	1172.4	5.81	5.81	5.81	5.81	9.33	9.33	9.33	9.33	5.81	5.81	5.81	5.81	5.81	9.33	9.33	9.33	9.33	5.81

Scenario		Scenario		Scenario		Scenario	
A	Q_{100} = 215,000, Surveyed Topo n= 0.035	E	Q_{100} = 172,000, Surveyed, n= 0.035	J	Q_{100} = 215,000, Eq. Slope n= 0.035	N	Q_{100} = 172,000, Eq. Slope n= 0.035
B	Q_{100} = 215,000 Surveyed, n= 0.055	F	Q_{100} = 172,000 Surveyed, n= 0.055	K	Q_{100} = 215,000 Eq. Slope n= 0.055	O	Q_{100} = 172,000 Eq. Slope n= 0.055
C	Q_{100} = 215,000 Surveyed, Strip n value	G	Q_{100} = 172,000 Surveyed, Strip n value	L	Q_{100} = 215,000 Eq. Slope Strip n value	P	Q_{100} = 172,000 Eq. Slope Strip n value
D	Q_{100} = 215,000 Surveyed, Max n (0.029)	H	Q_{100} = 172,000 Surveyed, Max n (0.046)	M	Q_{100} = 215,000 Eq. Slope Max n (0.029)	Q	Q_{100} = 172,000 Eq. Slope Max n (0.042)
		I	Q_{100} = 215,000 Surveyed, Overtop. n (0.044)			R	Q_{100} = 215,000 Eq. Slope Overtop. n ( )

Note: Scenario M, Cross Section 231 the freeboard is less than 3 feet. An n value of 0.029 allows the reach to maintain a criteria freeboard of 3 feet at all sections except 231. This section is just upstream of the bridge. Therefore backwater effect is controlling the freeboard at this location. Decreasing n throughout the reach does not increase freeboard at 231. Therefore, the min n value to affect a freeboard of atleast 3 feet for all sections except at 231 is shown here.

PREMIER
ENGINEERING CORPORATION

HEC-RAS Results and Freeboard
Salt River: McClintock-SR101L

Project: FCDMC On-Call
Subject: ***WSEL Comparisons and Freeboards***

By: KD
Date: Jul-00
Checked:
Premier Project No.: 9952

Table 4: Summary of South Levee Freeboard

River Sta	Levee Elevation			HEC-RAS SCENARIOS																	
	Design	As-Built	Surveyed	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
240	1184.1	1184.6	1184.55	5.92	0.39	5.67	7.65	9.43	4.37	9.17	6.58	3.38	4.82	-0.69	4.6	6.55	8.29	3.23	8.04	6.46	3.40
239	1183.5	1183.9	1184.02	5.9	0.42	5.63	7.62	9.35	4.33	9.07	6.53	3.39	4.85	-0.62	4.6	6.56	8.25	3.24	7.98	6.43	3.44
238	1183	1183.2	1182.96	5.08	-0.31	4.81	6.76	8.52	3.59	8.24	5.75	2.61	4.09	-1.31	3.83	5.76	7.48	2.54	7.2	5.69	2.70
237	1182.5	1182.5	1181.89	4.37	-0.86	4.09	5.98	7.78	2.99	7.48	5.1	1.99	3.43	-1.81	3.16	5.03	6.78	2	6.49	5.06	2.09
236	1182.1	1182.1	1181.93	5.84	0.46	5.49	7.55	9.05	4.14	8.69	6.28	3.37	4.96	-0.43	4.61	6.66	8.11	3.2	7.74	6.32	3.57
235	1178.4	1178.7	1178.74	3.6	-1.59	3.24	5.24	6.7	1.97	6.33	4.03	1.22	2.78	-2.43	2.39	4.41	5.81	1.08	5.41	4.09	1.44
234	1176.1	1176.4	1176.39	2.86	-2.25	2.47	4.54	5.79	1.09	5.41	3.13	0.48	2	-3.13	1.58	3.65	4.86	0.18	4.46	3.15	0.65
233	1174.5	1175.1	1174.8	2.98	-1.93	2.6	4.64	5.77	1.23	5.4	3.18	0.68	2.52	-2.61	2.07	4.36	5.21	0.49	4.77	3.44	1.13
232	1173.6	1173.4	1173.84	2.77	-1.47	2.59	4.12	5.55	1.58	5.36	3.32	0.81	2.45	-2.02	2.23	3.96	5.15	0.98	4.9	3.61	1.27
231	1172.8	1172.6	1172.53	2.3	-1.29	2.28	3.39	5.09	1.64	5.05	3.17	0.67	2.16	-1.67	2.13	3.39	4.87	1.2	4.81	3.54	1.16
230	1172.2	1172.3	1172.16	2.62	-0.2	2.63	3.42	5.43	2.6	5.43	3.9	1.36	2.6	-0.41	2.61	3.50	5.35	2.35	5.35	4.29	1.84
229	1172.2	1172.2	1172.12	2.5	0.35	2.58	3.08	5.42	3.18	5.47	4.23	1.56	2.56	0.29	2.63	3.19	5.44	3.09	5.49	4.64	2.01
228	1172	1172.3	1172.27	3.07	1.38	3.15	3.52	6.02	4.18	6.07	5.07	2.34	3.11	1.38	3.18	3.57	6.03	4.16	6.09	5.42	2.70
123.8	1171.8	1172.1	1171.46	3.45	2.12	3.47	3.79	6.53	4.94	6.54	5.73	2.89	3.43	2.1	3.44	3.76	6.49	4.91	6.51	6	3.12
123.7	1171.8	1172.1	1171.46	4.27	3.19	4.27	4.52	7.53	6.06	7.54	6.83	3.82	4.28	3.21	4.28	4.54	7.54	6.08	7.55	7.1	4.03
120.5*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Scenario		Scenario		Scenario		Scenario	
A	Q_{100} = 215,000, Surveyed Topo n= 0.035	E	Q_{100} = 172,000, Surveyed, n= 0.035	J	Q_{100} = 215,000, Eq. Slope n= 0.035	N	Q_{100} = 172,000, Eq. Slope n= 0.035
B	Q_{100} = 215,000 Surveyed, n= 0.055	F	Q_{100} = 172,000 Surveyed, n= 0.055	K	Q_{100} = 215,000 Eq. Slope n= 0.055	O	Q_{100} = 172,000 Eq. Slope n= 0.055
C	Q_{100} = 215,000 Surveyed, Strip n value	G	Q_{100} = 172,000 Surveyed, Strip n value	L	Q_{100} = 215,000 Eq. Slope Strip n value	P	Q_{100} = 172,000 Eq. Slope Strip n value
D	Q_{100} = 215,000 Surveyed, Max n (0.029)	H	Q_{100} = 172,000 Surveyed, Max n (0.046)	M	Q_{100} = 215,000 Eq. Slope Max n (0.029)	Q	Q_{100} = 172,000 Eq. Slope Max n (0.042)
		I	Q_{100} = 215,000 Surveyed, Overtop. n (0.044)			R	Q_{100} = 215,000 Eq. Slope Overtop. n (0.040)

* Elevation not provided in Simons, Li and Associates Drainage Report

Figure 4: Group of Salt Cedar, weeds, and 6-10 foot Cottonwood Saplings.

The N value would be 0.04-0.45 depending on height and thickness.

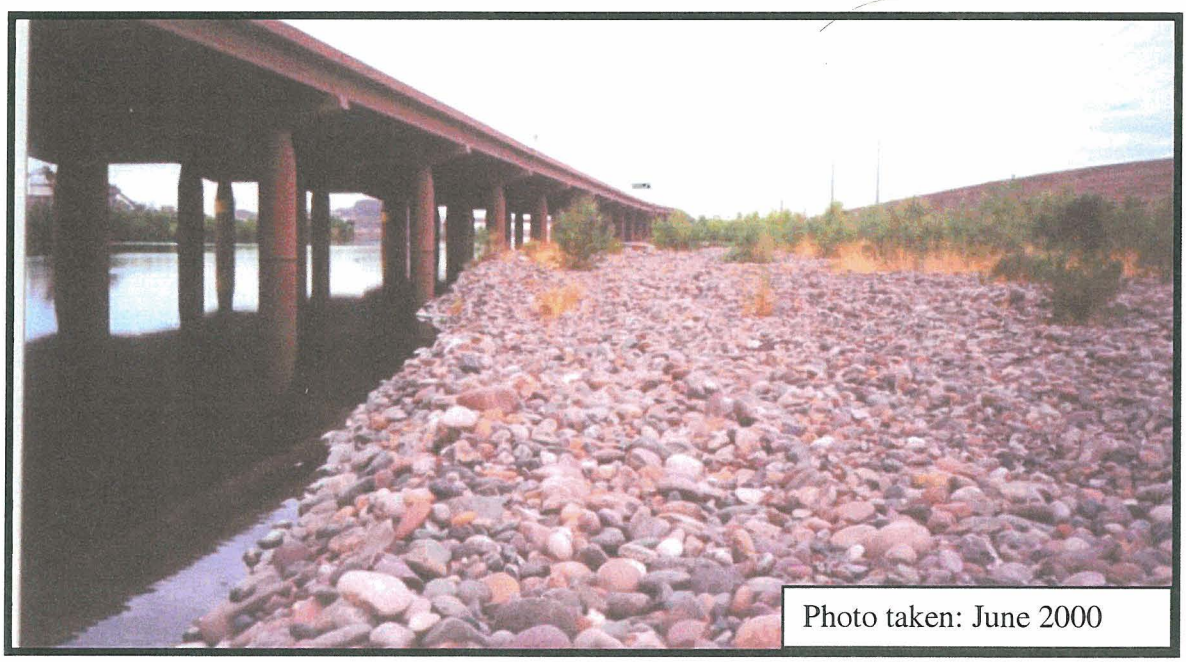


Figure 5: Typical Bed Material, n = 0.035

5.2.4 Survyed Topo and Max N value

It was desired to determine the maximum n value that could be applied to the channel before the levee system would cease to function with 3 foot of minimum freeboard. In the existing condition, a flow of 215,000 cfs generates water surfaces at most of the cross sections, which do not meet the 3-foot minimum requirement. It was found that the minimum n value that will allow the system to function was 0.029 and 0.046 for the 215,000 cfs and the 172,000 cfs flow respectively.

5.2.5 Surveyed Topo and Overtopping n Value (n = 0.044)

The levee system does not function with adequate freeboard for the Pre-Roosevelt flow (215,000 cfs). The next logical question was how vegetated could the channel reach become before the levee system was overtopped by the 215,000 cfs flood? A hydraulic model was set up to explore this scenario. It was found that the maximum n value of 0.044 applied uniformly to the reach cross sections would cause just the levee to be overtopped.

5.2.6 Equilibrium Slope (n = 0.035)

The SLA drainage report identified an average equilibrium of 0.037%. Over the long term, the Salt River channel bed will attempt to reach this slope. Therefore a model was formulated for this eventuality. In this hydraulic model, the minimum channel elevations were adjusted (raised) to meet the projected equilibrium slope. This slope was applied from the low point at GCS #5 (cross section 120.5) and extended upstream. A new minimum channel elevation was determined for each cross section. The same scenarios were run for the equilibrium slope condition as those performed for the base condition scenario. Figure 6 shows the surveyed channel profile, equilibrium slope profile, and the SLA, channel profile. Table 3 summarizes the water surface elevations for the equilibrium slope condition. Note that the Equilibrium condition produced higher water surface elevations than the Base condition. This was because the thalweg elevation was higher for the equilibrium condition than for the Base condition. Hydraulic runs were again performed for various roughness scenarios in the same manner as that done for the existing topography condition.

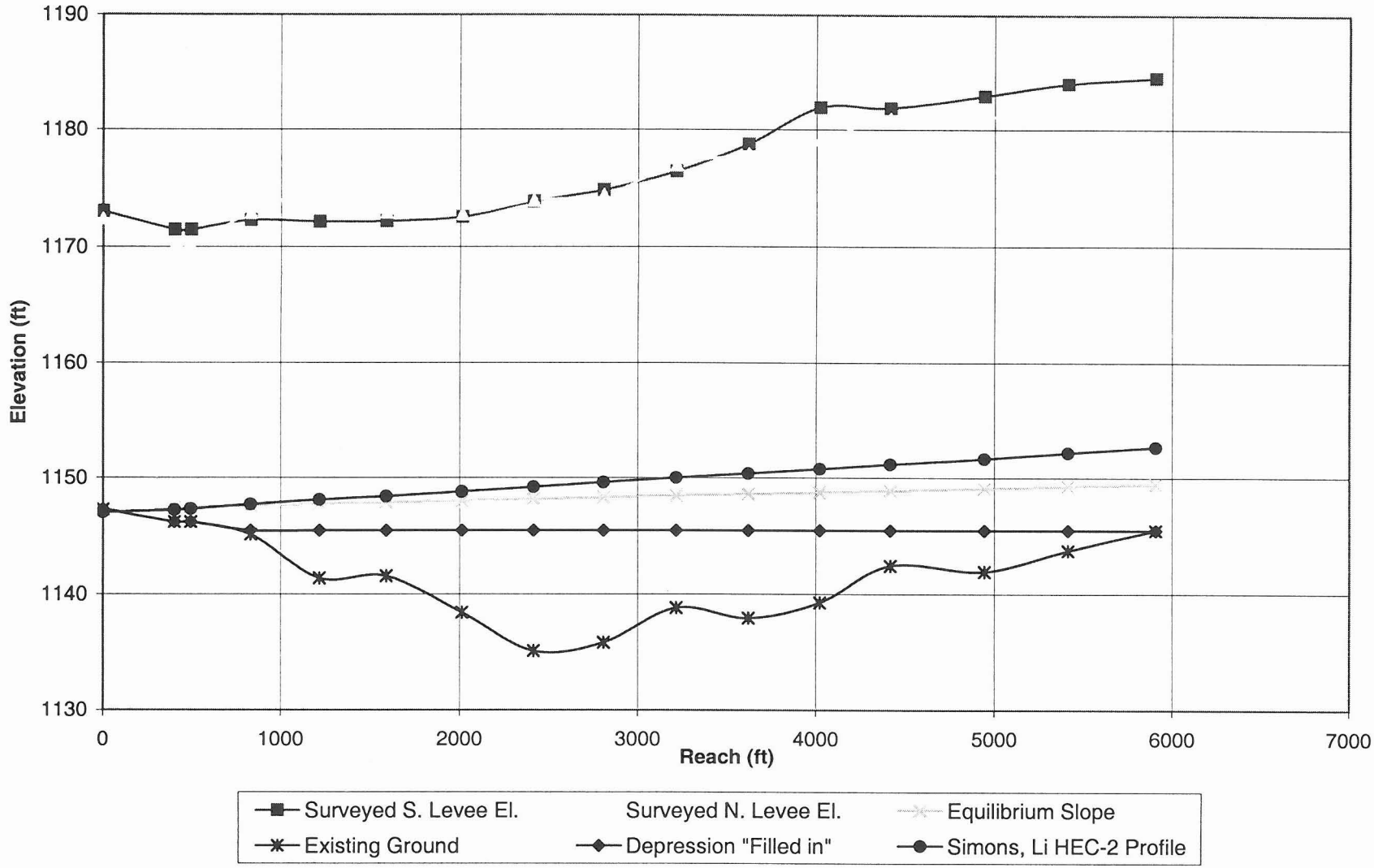
5.2.7 Equilibrium Slope "strip" n value

For this scenario, the n values were varied horizontally and the equilibrium slope condition was maintained.

5.2.8 Equilibrium Slope (n = 0.055)

It is also likely that the growth of new vegetation will coincide with the channel attaining its equilibrium slope. Therefore this scenario was explored by creating new HEC-2 and HEC-RAS models.

Figure 6:
Salt River Channel Profiles



5.2.9 Equilibrium Slope and Max n value

The maximum n value for the channel sections was determined assuming the equilibrium slope condition. The maximum n value for the channel reach was 0.029 and 0.042 for the 215,000 cfs and 172,000 cfs flows, respectively.

5.2.10 Equilibrium Slope and Overtopping n Value (n = 0.040)

The n value that would allow the levee to just function (without overtopping) was sought for planning purposes. The 215,000 100-year profile was used in this analysis. It was found that the maximum n value of 0.040 applied uniformly to the reach cross sections would cause this condition.

5.3 Local Pier Scour

A local pier scour analysis was performed to see how the different hydraulic scenarios would impact the scour at the existing piers.

The FCDMC Drainage Design manual was used as the source for scour criteria and methodology. The manual recommends using the Federal Highway s Administration (FHWA) publication *HEC-18 Evaluating Scour at Bridges* Third Edition. The equation used to estimate pier scour was the CSU equation. Hydraulic design conditions (flow velocity, flow depth, and Froude number) were determined using HEC-RAS.

As per FCDMC direction, debris was accounted for in the calculations by doubling the pier width. Table 5 summarizes the pier scour calculations. See Appendix C for the scour calculations.

Table 5: *Local Pier Scour*

Scenario	River Sta of Max	Flow Velocity	Flow Depth	Diameter (ft)	Ys (ft)
Q_{100} = 215,000, Surveyed Topo, n= 0.035	233	16.41	26.86	9	**37**
Q_{100} = 215,000 Surveyed Topo, n= 0.055	233	12.85	31.3	9	**33**
Q_{100} = 215,000 Surveyed Topo, Strip n value	233	15.99	27.27	9	**36**
Q_{100} = 215,000 Surveyed Topo, Max n (0.029) value	233	14.89	29.29	9	**35**
Q_{100} = 215,000 Surveyed Topo, Overtopping n (0.044) value	233	14.91	29.25	9	**35**
Q_{100} = 172,000, Surveyed Topo, n= 0.035	233	14.96	24.08	9	**35**
Q_{100} = 172,000 Surveyed Topo, n= 0.055	233	12.11	28.81	9	**32**
Q_{100} = 172,000 Surveyed Topo, Strip n value	233	14.56	24.49	9	**34**
Q_{100} = 172,000 Surveyed Topo, Max n (0.046) value	233	13.47	26.32	9	**34**
Q_{100} = 215,000, Eq. Slope n= 0.035	233	17.17	24.46	9	**36**
Q_{100} = 215,000 Eq. Slope n= 0.055	233	13.74	29.83	9	**34**
Q_{100} = 215,000 Eq. Slope Strip n value	233	16.58	24.97	9	**36**
Q_{100} = 215,000 Eq. Slope Max n (0.029) value	233	18.87	22.5	9	**38**
Q_{100} = 215,000 Eq. Slope Overtopping n (0.04) value	233	16.08	25.92	9	**36**
Q_{100} = 172,000, Eq. Slope n= 0.035	233	15.66	21.77	9	**34**
Q_{100} = 172,000 Eq. Slope n= 0.055	233	12.51	26.67	9	**32**
Q_{100} = 172,000 Eq. Slope Strip n value	233	15.11	22.28	9	**34**
Q_{100} = 172,000 Eq. Slope Max n (0.043) value	233	14.12	23.87	9	**33**

Note: The pier diameter used in the scour calculations was 2 times the diameter shown in Table 6.

6 CONCLUSIONS AND RECOMMENDATIONS

The following sections briefly summarize and provide conclusions and recommendations for the main topics already addressed in previous sections of this report.

6.1 Verification of Levee elevations.

The Premier survey validated the As-Built levee elevations as presented on the As-built plans and the Simons, Li and Associates drainage report. The vast majority of the levee survey data was within 0.5 feet of the SLA as-built data. There were only four locations where the surveyed and As-Built elevations differed significantly (greater than 0.5 feet). These differences were not considered to present enough deviation to call into question the previous survey results. Refer to the above Section 3 for more detail.

6.2 Hydraulic Models

Various models were set up to determine the hydraulic conditions resulting from scenarios presented in the previous sections of the report. The main conclusions drawn from the analysis were:

- In the existing condition, the levee system functions, but lacks adequate freeboard (3 feet) for the 215,000 cfs 100-year discharge. The levee system operates with the allowable freeboard for a 100-year discharge of 172,000 cfs.
- The worst freeboard conditions resulted from the 215,000 cfs 100-year discharge passing through the river reach with a Manning's n value of 0.055 (maximum vegetative growth).
- The maximum n value for the channel reach that would allow the levee to function with 3 feet of freeboard was 0.029 and 0.042 for the 215,000 cfs and 172,000 cfs flows, respectively. Note that for the levee system to pass 215,000 cfs with 3 feet of freeboard in the existing condition (with the depression and very flat slope) the channel bed would almost need to be completely devoid of any sort of vegetation or other roughness elements (besides river cobbles). See Figure 7 for a photo showing the approximate condition for n = 0.029.
- The maximum n value that would allow the levee to contain the 100-year discharge of 215,000 cfs (no freeboard) was 0.044 and 0.040 for the surveyed topo condition and the equilibrium condition respectively. The 172,000 cfs profile was not evaluated because it was already found that even if the channel vegetation were to increase past its present density, the channel could still maintain the 3 foot freeboard in the face of the lower 100-year flow.

Figure 7: Clean Bed Condition, n = 0.025-0.029

The SLA drainage report found that the levee system would function based upon a roughness coefficient of 0.035. The difference in results between the Premier study and the SLA report is attributed to the different channel slopes used in the hydraulic models. The SLA hydraulic model assumed a significantly steeper slope than what was surveyed by Premier. The SLA slope was 0.096%. The Premier survey showed that in the existing condition, there was a depression within the reach. The Premier HEC-RAS model assumed that the depression was filled in, however, the resulting channel bed slope was still much flatter than the slope used in the SLA report. The milder slope caused an increase in water surface elevations that caused the levee freeboard criteria to be violated. See Figure 6 for a graphic representation of the channel profiles.

6.3 Local Pier Scour

Local pier scour was calculated and is being presented primarily for planning purposes. The maximum scour was found to be at river station 233. The maximum scour resulted from a 100-year discharge equal to 215,000 cfs, was about 38 feet. The pier scour depths calculated in this study are in line with values utilized by ADOT in the design of SR 202L. See Table 5 for results and Appendix C for the scour calculations.

6.4 Preliminary Management Plan

It was desired that this study formulate a management plan of the subject Salt River Reach that will ensure that the levee systems maintains its functionality. The following sections discuss the proposed solutions. District personal and Premier representatives can meet to discuss the proposals and refine the plans if need be.

6.4.1 Proposed Near Term Management Plan

New Cottonwood and Salt Cedar saplings have begun growing in the Salt River study reach. FCDMC personnel have stated that removing the trees is undesirable from a public relations standpoint. If at all possible, the preliminary management plan should include provisions for

the preservation of the existing trees. The existing tree pattern is limited to the edges of the standing water. Standing water may serve as a breeding ground for numerous insects. The FCDMC should monitor the need for pest control in this reach of the Salt River.

The HEC-RAS modeling showed that in the present condition (modeled as Surveyed Topo with "strip n value"), the levee system does not maintain adequate freeboard (3 feet) for the 215,000 cfs 100-year flow. However, for the 215,000 flow the levee system was not overtopped. For the smaller Post-Roosevelt flow conditions the levee system functions with at least the design freeboard. The smallest available freeboard was about 2 feet. The conclusion was drawn that although the required 3 foot of freeboard was not maintained, the levee system still provides adequate functionality. As long as the current vegetative conditions are maintained there is not an immediate or pressing need to eliminate trees within the study reach. See Appendix B for the HEC-RAS runs mentioned above.

6.4.2 Proposed Long Term Management Plan

An evaluation was conducted to determine the maximum permissible n values that would allow the channel levee system to function within the allowable 3 foot freeboard limit. . It was found that given the existing geometry (newly surveyed topography), the levee system did not maintain 3 foot of freeboard at all cross section locations (for the Pre-Roosevelt flow – 215,000 cfs). Consequently, the maximum permissible n value for the existing condition was calculated to be 0.029. When the Post-Roosevelt flow was substituted into the analysis, the maximum n value was 0.046. When the equilibrium slope condition was evaluated, the results were approximately the same. The exception being that the max n value for the 172,000 cfs flow was found to be 0.042.

Team members feel that the local depression (caused by mining) may be filled with sediment during large flow events. In addition, water currently filling the depression may be eliminated or reduced. The City of Mesa Waste Water Treatment Plant, the Price Road Tunnel, and irrigation tailwater appear to be the primary sources of water. These sources may be eliminated/reduced in the future. This could significantly reduce the volume of standing water. The reduction in the surface area of standing water may promote growth of vegetation (i.e., increase in Mannings "n" value).

Based on these findings it is proposed that when possible the degree of vegetation be kept at a minimum. It is anticipated that for large storm events, much of the existing vegetation (including Salt Ceders) will be "swept" away. The FCDMC should try and maintain the newly "clean" river bottom and not allow the re-growth of new sapling.

The channel bottom should not be allowed to vegetate past a condition that would increase the channel roughness greater than the permissible Mannings n value. This roughness value varies depending upon the assumed channel conditions (e.g. the channel bed achieves its equilibrium slope). Table 6 summarizes the permissible n values for different channel condition scenarios.

Table 6: *Permissible n Values*

Condition	n Value
Q_{100} = 172,000 cfs, Surveyed w/ non-effective depression filled , Max n	0.046
Q_{100} = 215,000 cfs, Surveyed w/ non-effective depression filled , Overtop. n	0.044
Q_{100} = 172,000 cfs, Eq. Slope Condition , Max n	0.042
Q_{100} = 215,000 cfs, Eq. Slope Condtion, Overtop. n	0.04

Note: The "Max n" value is the n value that allows the levee system to maintain 3 foot of freeboard.

As can be seen from Table 6, the permissible n values for the critical scenarios are close in value to each other. The controlling n value is about 0.040. Therefore, vegetative re-growth in the channel should not be allowed to increase past the approximate condition represented by an n value of about 0.040. The following photos show the approximate vegetative state corresponding to this value.

It is recommended that the FCDMC implement an annual program to document the vegetation and capacity of this reach of the Salt River.

Figure 8: Vegetative conditions corresponding to approximately n =0.040

These photos may be used as a guide in determining the approximate roughness for the Salt River, given different vegetative situations.

Figure 9: Typical Vegetation height for n = 0.040, 6 ft

The following figure shows the approximate vegetation density and distribution for a channel n value of about 0.40.

Figure 10: Overview of Reach with about 0.040 n value.

Other management schemes may be considered such as carefully maintaining/managing areas of vegetation within the channel reach. An HEC-RAS hydraulic analysis should be performed which models the lay out of any proposed managed area (s) and to determine the impact to freeboard. The main conclusion to be drawn from this report is that the available margin for additional vegetative growth is small. The channel bottom vegetation should not be allowed to increase much past its existing condition.

7 REFERENCES

1. Flood Control District of Maricopa County, Prepared by Simons, Li and Associates, *Final Hydraulic & Scour Analysis Report Salt River East Papago Freeway McClintock Drive to SR 101L Maricopa County, Arizona.* July 1997.
2. Flood Control District of Maricopa County, Prepared by Michael Baker, Jr Inc. *Salt-Gila River Flood Delineation Restudy Volume 1 of 5.* May 1999.
3. Maricopa County, Arizona. *Drainage Design Manual, Volume I, Hydrology*, January, 1992.
4. Maricopa County, Arizona. *Drainage Design Manual, Volume II, Hydraulics*, January 28, 1996.
5. Landiscor Aerial Information, *Phoenix Ownership 2000 Aerial Atlas.* January 2000.
6. US. *Army Corps of Engineers. HEC-RAS River Analysis System. Hydrologic Engineering Center, Davis California. Users Manual.* September 1998, Version 2.2.
7. US. *Army Corps of Engineers. HEC2 Water Surface Profiles, Hydrologic Engineering Center, Davis California. Users Manual.* September 1990.

Appendix A: Excerpts from Simons, Li and Associates Report

FINAL HYDRAULIC & SCOUR ANALYSIS REPORT

SALT RIVER
EAST PAPAGO FREEWAY
McCLINTOCK DRIVE TO SR 101L
MARICOPA COUNTY, ARIZONA

Submitted to:

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CERTIFICATE NO. 28660
BART S. BERGENDAHL
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ARIZONA, U.S.A.

July, 1997

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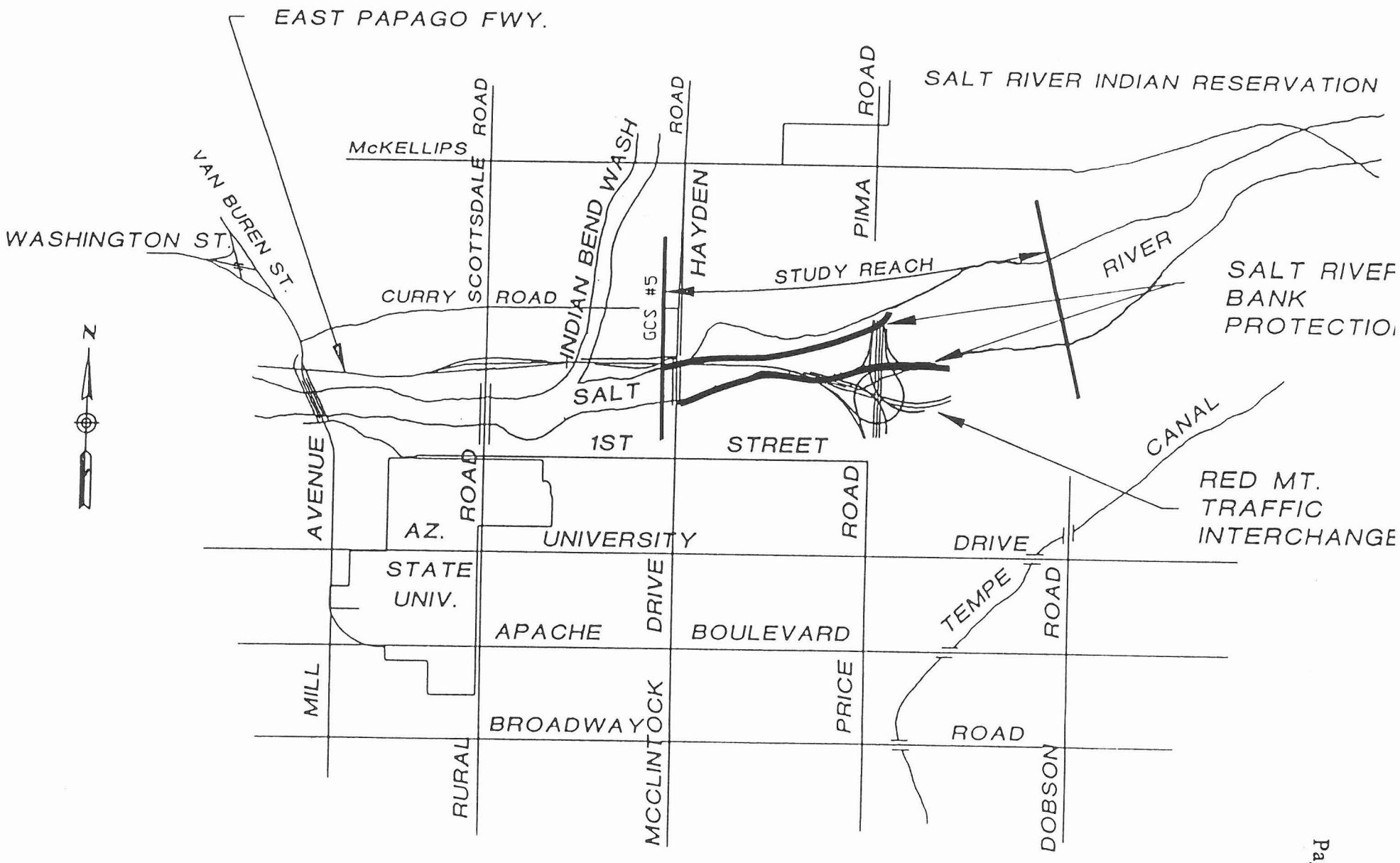


FIGURE 1.1 SITE MAP

II. HYDROLOGY

The following section describes the sources and development of hydrologic information used in the analyses of the Salt River within the study reach.

2.1 Background Summary

The Salt River has a contributing drainage area of approximately 1,000 square miles above the project reach. In 1982, the Los Angeles District Corps of Engineers (Corps) finalized a hydrologic study for the Gila River and tributaries, which includes the Salt River, as part of the Central Arizona Water Control Study (CAWCS) (3). One purpose of the CAWCS study was to develop discharge-frequency relationships at various points along the Gila River and tributaries for existing conditions. To develop existing conditions discharge-frequency relationships, recorded stream flow for the Salt and Gila Rivers had to be converted to a sequence of "standardized" existing conditions discharges. Standardization, converting all stream flow data to the same base existing conditions, was required because the recorded data was published for a non-homogeneous period of record. To standardize flow in the Salt River, Salt River Project (SRP) reservoirs were modeled using the HEC-5 computer program to simulate SRP operation under existing conditions. The HEC-5 model was calibrated using the December 1965 through January 1966 and March 1978 floods. Utilizing complex analysis procedures, resulting annual maximum values for the peak and various flow duration discharges were ordered and plotted on log-probability frequency paper.

A second study was performed by the Corps (4) which quantified the impact of the modified Roosevelt Dam on the discharge-frequency relationships at selected sites within the Gila River Basin. The Corps studies cited provide the best current estimate of existing and future hydrologic conditions (i.e., pre- and post-Roosevelt modifications) in the study reach.

The Mill Avenue bridge is approximately 2 miles downstream of the study area. Table 2.1 presents the results of the Corps hydrologic analyses for the Salt River at the Mill Avenue Bridge. These discharges were used to define the peak discharges for various frequency flood events within the project reach. The peak discharge-frequency data presented in Table 2.1 were developed from the Corps HEC-5 analyses.

A 100-year flood hydrograph for this study was developed from the Corps balanced flood hydrograph for the regulated 100-year flow routed through the existing SRP reservoir system. The design hydrograph is based on the most recent Corps hydrologic analyses (4). Different magnitude flood events utilized identical scaled versions of the Corps hydrograph. The design hydrograph, which was utilized for the estimation of sediment transport volumes and time dependent changes to the Salt River, is illustrated in Figure 2.1.

2.2 Flood Insurance Study

In 1983-84, the Corps performed a Flood Insurance Study (FIS) (5) encompassing 28 miles of the Salt River from the confluence with the Gila River to Country Club Drive. The study was performed for the Flood Control District of Maricopa County. The Corps Salt River FIS was adopted by the

Table 2.1 Salt River Discharge at Mill Avenue Bridge.

Return Period (years)	Discharge (cfs)
5	40,000
10	93,000
20	135,000
50	160,000
100	215,000
200	275,000
500	330,000

Q100

Federal Emergency Management Agency (FEMA) and the mapping was published as the regulatory floodplain and floodway. The Salt River FIS used the peak flood discharges developed by CAWCS (3) and are presented as existing conditions in Table 2.1. The FIS estimated a 100-year frequency peak discharge of 215,000 cfs through the project reach and 220,000 cfs upstream of the Pima Freeway Crossing.

2.3 Sand and Gravel Mining

The study limits are located within a reach of the Salt River which has historically been used as a source of sand and gravel for construction materials. A study by SLA for ADOT (5) has documented that extensive in-stream and floodplain mining operations can significantly impact the stability of a river system. The findings from this study were used to develop criteria for bank protection toe-down design in areas adjacent to sand and gravel mining pits.

III. DESIGN HYDRAULIC ANALYSIS

The final project design conditions include 100-year bank protection on both the north and south banks. The design channel invert was based on historical mapping which indicated a natural bed slope of approximately 0.1% extending upstream from GCS #5. The U.S. Army Corps of Engineers computer program "HEC-2 Water Surface Profiles" (6) was used to calculate the proposed hydraulic conditions for the Salt River through the project reach. Structures modeled within the study reach include the existing bridge at McClintock Drive, the East Papago Freeway structure, and the Red Mountain Traffic Interchange (RMTI) structures. The RMTI consists of three structures: the S-W/S-E ramp, Pima Freeway mainline bridge, and the E-N/W-N ramp. All bridges were modeled using the HEC-2 special bridge routine.

3.1 Topographic Data Sets

Three topographic data sets were combined to form the mapping for the study reach. The project reach was mapped in 1994 by Kenney Aerial Mapping, Inc. The June 1990 Cooper Aerial of Phoenix mapping and the March 1986 Kenney Aerial Mapping topography were used upstream of the project reach.

SLA developed the HEC-2 cross sections from the combined mapping data. Cross-sections were oriented perpendicular to the direction of flow and were spaced at approximately 400 foot intervals. Figure 3.1 presents the HEC-2 cross-section location maps for the study reach. Table 3.1 provides the approximate north and south bank stations for each cross-section location.

3.2 Downstream Boundary Conditions

WSEl100

Starting water-surface elevations of 1157.45 and 1166.59 feet were assumed for the 10 and 100-year rigid boundary analyses respectively. These elevations were based on the 10 and 100-year water-surface elevations of the CRSS Civil Engineers, Inc. HEC-2 output at GCS #5 (7).

3.3 Energy-Loss Coefficients

The roughness coefficients used in the HEC-2 analysis generally coincide with the 1983-84 FIS (8) values ranging from 0.033 to 0.040 for the main channel, and 0.040 to 0.050 for the overbanks. A main channel "n" value of 0.035 was used to provide water-surface elevations outside the project reach.

Expansion and contraction coefficients were set at 0.3 and 0.1, respectively. The expansion and contraction coefficients were modified to 0.5 and 0.3 through the various bridge crossings in the study reach. These values are consistent with recommendations provided in the HEC-2 Users Manual (6).

3.4 Ineffective Flow Areas

Encroachment stations were included upstream of the RMTI structures where the north floodplain is being actively mined. While the existing overbank pits will pond during a flood, the conveyance

Table 3.1 Cross-Section Location by Bank Station

HEC-2 Cross-Section	North Bank Station	South Bank Station
120.5	224+84	0+60
122	226+36	2+10
122.65	227+24	2+80
123.55	228+14	4+00
228	230+58	8+30
229	234+65	12+60
230	13+85	16+10
231	18+40	19+70
232	22+50	23+60
233	26+35	27+60
234	30+15	31+90
235	34+20	35+95
236	38+45	39+46
237	42+80	43+51
238	48+96	46+70
239	51+20	22+01
240	56+70	27+74
241	62+18	32+92

capacity was conservatively considered to be negligible. Therefore, the north overbank, upstream of the RMTI, was eliminated from the total effective flow area.

All cross-sections were reviewed and encroachment stations inserted to comply with HEC-2's limitations and maintain reasonable section-to-section conveyance continuity. The ineffective flow encroachments were determined for the 100-year flood event and may not be applicable for different frequency flood events.

3.5 Hydraulic Analysis Results

Hydraulic parameters were developed for the 10- and 100-year frequency flood events for the entire study reach. Within the project reach, the average channel velocities range from 7.8 to 16.7 fps, depths vary between 19.5 and 27.0 feet, and top widths range from 607 feet to 1068 feet for the 100-year event with 100-year bank protection. Tables 3.2 and 3.3 present a summary of the HEC-2 design hydraulics for the 100-year flood with 100-year bank protection and with 10-year bank protection, respectively. The 1992 hydraulic analysis for 10-year bank protection generated the worst-case scour at some cross-sections and, therefore, was used for the final design at those locations. Appendix A contains the HEC-2 hydraulic input and output data for the 100-year bank protection constructed.

Table 3.2 100-Year Design Hydraulics w/100-Year Bank Protection

HEC-2 CROSS-SECTION	WATER SURFACE ELEVATION (feet)	VELOCITY (fps)	DEPTH (feet)	TOP WIDTH (feet)
120.5	1166.6	11.1	19.6	1037
122	1166.7	11.5	19.5	1009
122.65	1166.8	11.5	19.6	1007
123.55	1168.5	10.5	21.2	1061
228	1169.0	10.3	21.3	1003
229	1169.2	11.3	21.1	923
230	1169.1	13.9	20.7	768
231	1169.7	15.0	20.9	701
232	1170.5	15.8	21.3	654
233	1171.3	16.7	21.7	609
234	1172.8	16.2	22.8	607
235	1174.5	14.7	24.1	630
236	1175.8	13.6	25.0	657
237	1177.6	10.5	26.4	802
238	1178.3	9.7	26.6	863
239	1178.5	10.3	26.3	840
240	1179.3	8.8	26.6	969
241	1180.2	7.8	27.0	1068

Table 3.3 100-Year Design Hydraulics w/10-Year Bank Protection

HEC-2 CROSS-SECTION	WATER SURFACE ELEVATION (feet)	VELOCITY (fps)	DEPTH (feet)	TOP WIDTH (feet)
120.5	1166.5	11.9	19.5	1073
122	1166.7	12.1	19.5	1051
122.65	1166.8	12.2	19.6	1051
123.55	1168.4	11.0	21.1	1060
228	1169.0	10.7	21.3	952
229	1169.4	11.3	21.3	893
230	1169.4	14.4	21.0	740
231	1167.6	22.9	18.8	594
232	1172.6	18.7	23.4	811
233	1176.5	13.3	26.9	1811
234	1177.4	12.1	27.4	1712
235	1178.1	11.6	27.7	1675
236	1178.5	11.3	27.7	1491
237	1179.4	9.7	28.2	1319
238	1180.0	8.5	28.3	1496
239	1180.2	8.6	28.0	1453
240	1180.4	9.8	27.6	845
241	1182.0	7.3	28.8	1081

IV. DESIGN SCOUR ANALYSIS

This section of the report presents the procedures, methodology, assumptions, and results of the scour analysis for the proposed bank protection. Several scour components were considered in determining the total scour potential. These are described below. With the exception of long-term degradation, the scour depths used to establish the design toe-down elevations were estimated for the 100-year design flood.

4.1 Long-Term Degradation

The procedures described by the Bureau of Reclamation (9) were utilized to quantify the long-term degradation component of total potential scour. Long-term degradation was computed using the concepts of equilibrium slope and stream bed armoring.

The dominant discharge was used for the long-term degradation analysis. The dominant discharge is defined as the discharge which, if allowed to flow constantly, would have the same overall channel shaping effect as the natural fluctuating discharges. The dominant discharge is typically between a 5-year and 10-year event for ephemeral channels (10). The design hydraulic conditions for the 10-year event were used in determining the long-term degradation response for the project reach of the Salt River.

Eq. Slope

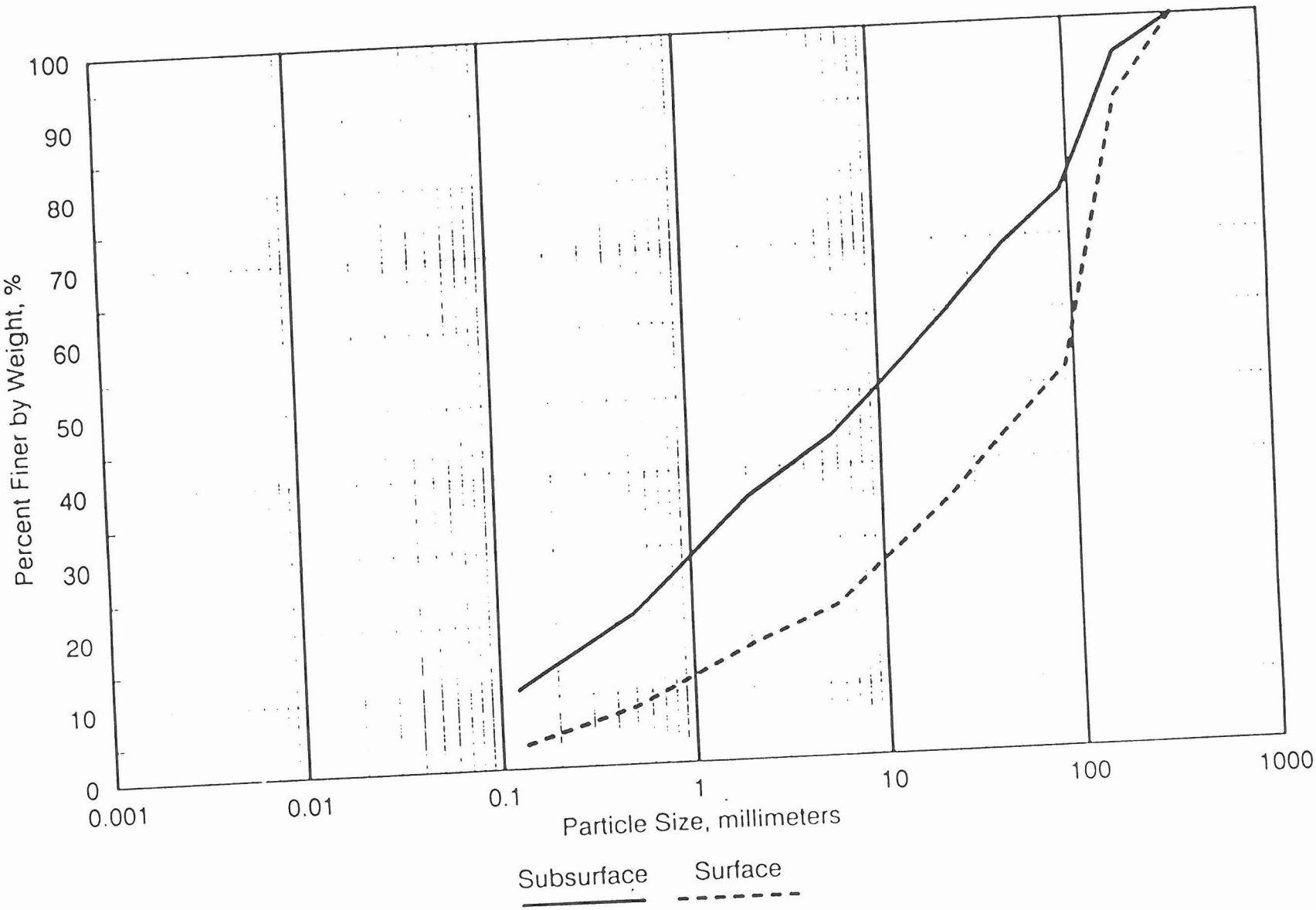
The analysis resulted in an estimated armor depth of 4.8 feet, and an equilibrium slope of 0.037%. The potential long-term degradation component at each cross-section location was computed as the smaller of: 1) the estimated armoring depth, or 2) depth to the equilibrium slope. GCS #5 was used as the pivot point for the equilibrium slope analysis.

4.2 Low-Flow Incisement

The large width-depth ratios for the design project reach of the Salt River require that consideration be given to the development of a low-flow channel. There are no rigorous methodologies for the prediction of low-flow channel incisement. A review of existing field conditions and experience from previous projects along the Salt River indicate a low-flow incisement depth of 2 feet is reasonable for the project reach.

4.3 General Scour

General scour refers to the vertical lowering of the channel bed over relatively short time periods, typically during the passage of a single flood event. General scour occurs because of an increase in slope or decrease in channel width, which causes the average velocity and bed shear stress to increase. This produces an increase in stream power (τV). Therefore, more bed material is transported through the contracted section than is transported into it. As the bed level is lowered, velocity decreases, and shear stress decreases and equilibrium is restored when the transport rate through the contracted section is equal to the incoming rate. Contraction scour can be defined as a special case of general scour that occurs at a specific location such as a bridge crossing or a relatively short, natural contraction of the channel cross-section.



Salt River Composite Gradations

Figure 4.1 Salt River Characteristic Grain Size Distribution

channel invert. According to the 1992 recommendations, one quarter (1/4) of the pit depth is used for the lateral migration scour component if the pit is located within 150 feet of the bank invert.

Figure 4.1 Salt River Characteristic Grain Size Distribution

Particle Size (mm)	Surface Material (Percent Finer)	Subsurface Material (Percent Finer)
362.0	100	100
181.0	89	95
90.5	52	76
45.2	44	69
22.6	35	60
11.31	28	52
5.66	21	44
2.00	16	36
0.500	8	21
0.125	3	11

4.7 Recommended Toe-Down Depth

The total calculated toe-down is the sum of the long-term degradation, general scour, low-flow incisement, bed form components, and the factor of safety, plus the mining toe-down when applicable. However, based on engineering judgement and previous experience on the Salt River, a minimum total toe-down depth of 10 feet was recommended. In addition to the previously mentioned scour components, bend scour and local scour were also investigated and the recommended toe-down depth was adjusted accordingly. Since the Salt River does not contain any significant bends in the project reach, this component did not contribute to the toe-down depth. Local scour is due to flow obstructions such as bridge piers and abutments in the flow path, drop structures, or storm drain outfalls. Adjustments due to local scour are listed in Tables 4.2 and 4.3.

4.8 Scour Analysis Results

A summary of the scour analysis results for the north and south bank are presented in Tables 4.2 and 4.3, respectively. Examples of detailed calculations can be found in the historical correspondence of Appendix C.

Table 5.3 Top of North Bank Summary

HEC-2 Cross-Section	Design Water Surface (feet)	Design Bank Elevation (feet)	Design Freeboard (feet)	As-Built Water Surface (feet)	*As-Built Bank Elevation (feet)	As-Built Freeboard (feet)
120.5	1166.6	1171.4	4.8	1166.6	1171.8	5.2
122	1166.7	1171.8	5.1	1166.7	1170.3	3.6
122.65	1166.8	1171.9	5.1	1166.8	1169.4	2.6
123.55	1168.5	1172.1	3.6	1168.5	1170.2	1.7
228	1169.0	1172.6	3.6	1168.9	1172.4	3.5
229	1169.2	1173.4	4.2	1169.2	1173	3.8
230	1169.1	1172.5	3.4	1169.1	1172.8	3.7
231	1169.7	1172.8	3.1	1169.7	1172.6	2.9
232	1170.5	1173.6	3.1	1170.4	1173.8	3.4
233	1171.3	1174.4	3.1	1171.4	1174	2.6
234	1172.8	1176.3	3.5	1173.1	1177	3.9
235	1174.5	1177.8	3.3	1174.6	1177.9	3.3
236	1175.8	1179.0	3.2	1176.1	1179	2.9
237	1177.6	1180.6	3.0	1177.9	1181	3.1
238	1178.3	1181.3	3.0	1178.6	1181.5	2.9
239	1178.5	1181.7	3.2	1178.8	1180.6	1.8
240	1179.3	1182.4	3.1	1179.6	1183	3.4
241	1180.2	1184.0	3.8	1180.4	1182.6	2.2

* Information provided by DMJM

Table 5.4 Top of South Bank Summary

HEC-2 Cross-Section	Design Water Surface (feet)	Design Bank Elevation (feet)	Design Freeboard (feet)	As-Built Water Surface (feet)	*As-Built Bank Elevation (feet)	As-Built Freeboard (feet)
123.55	1168.5	1171.8	3.3	1168.5	1172.1	3.6
228	1169	1172	3.0	1168.9	1172.3	3.4
229	1169.2	1172.2	3.0	1169.2	1172.2	3.0
230	1169.1	1172.2	3.1	1169.1	1172.3	3.2
231	1169.7	1172.8	3.1	1169.7	1172.6	2.9
232	1170.5	1173.6	3.1	1170.4	1173.4	3.0
233	1171.3	1174.5	3.2	1171.4	1175.1	3.7
234	1172.8	1176.1	3.3	1173.1	1176.4	3.3
235	1174.5	1178.4	3.9	1174.6	1178.7	4.1
236	1175.8	1182.1	6.3	1176.1	1182.1	6.0
237	1177.6	1182.5	4.9	1177.9	1182.5	4.6
238	1178.3	1183.0	4.7	1178.6	1183.2	4.6
239	1178.5	1183.5	5.0	1178.8	1183.9	5.1
240	1179.3	1184.1	4.8	1179.6	1184.6	5.0
241	1180.2	1184.6	4.4	1180.4	1184.5	4.1

* Information provided by DMJM

VI. AS-BUILT CONDITIONS

6.1 Description

After the completion of construction in 1996, a ground survey was conducted by Urban Engineering to map the as-built geometry of the both the north and south bank protection. A digital terrain model (DTM) was generated from the survey and used as the basis to verify the as-built conditions and hydraulics. Figure 3.1 reflects the as-built contour DTM.

6.2 Comparison with Design

The location of the design cross-sections was digitized onto the DTM and BOSS HEC-2 was used to determine the as-built channel geometry and generate the as-built hydraulics. Figure 6.1 compares a typical as-built cross-section with a design cross-section for the same location. Table 6.1 provides a comparison between as-built velocity, depth, and top width and the respective design parameters. The parameters compare very well at all cross-sections. The maximum differences are as follows: velocity -- 0.7 fps, depth -- 0.3 feet, and top width -- 27 feet.

Tables 5.1 and 5.2 provide the as-built toe-down elevations for the north and south banks, respectively. As shown in the tables, the as-built elevations match the design elevations section by section. ADOT has certified that the bank protection toe-down was built in accordance with the design plans at all locations along the north and south banks (re: letter in Appendix C).

Tables 5.3 and 5.4 provide the as-built top-of-bank elevations and freeboard for the north and south banks, respectively. The top-of-bank elevations were developed from the ground survey of as-built conditions and provided by DMJM. As shown in the tables, the as-built freeboard varies from the design freeboard at most locations. At some locations the variance is significant with the freeboard less than the minimum three-foot required. This is especially true along the north bank where the freeboard is reduced to 1.7 feet upstream of the McClintock Drive Bridge and 1.8 feet just downstream of the Red Mountain Traffic Interchange.

Table 6.1 Design Versus As-Built Hydraulics

HEC-2 Cross-Section	As-Built Velocity (fps)	Design Velocity (fps)	As-Built Depth (feet)	Design Depth (feet)	As-Built Top Width (feet)	Design Top Width (feet)
120.5	11.0	11.1	19.6	19.6	1063	1037
122	11.5	11.5	19.5	19.5	1036	1010
122.65	11.5	11.5	19.6	19.6	1038	1007
123.55	10.5	10.5	21.2	21.2	1059	1061
228	10.4	10.3	21.2	21.3	999	1003
229	11.4	11.3	21.1	21.1	922	923
230	13.9	13.9	20.7	20.7	770	768
231	15.3	15.0	20.9	20.9	698	701
232	16.5	15.8	21.2	21.3	648	654
233	17.0	16.7	21.8	21.7	605	609
234	16.1	16.2	23.2	22.8	608	607
235	15.1	14.7	24.2	24.1	624	630
236	13.5	13.6	25.4	25.0	656	657
237	10.4	10.5	26.7	26.4	805	802
238	9.6	9.7	26.9	26.6	865	863
239	10.2	10.3	26.6	26.3	840	840
240	8.7	8.8	26.9	26.6	973	969
241	7.9	7.8	27.2	27.0	1054	1068

APPENDIX A

HEC-2 Design Data Files

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*  Version   4.6.2;  May 1991            *
*                                        *
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*  U.S. ARMY CORPS OF ENGINEERS
*  HYDROLOGIC ENGINEERING CENTER
*  609 SECOND STREET, SUITE D
*  DAVIS, CALIFORNIA 95616-4687
*          (916) 756-1104
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 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
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T2      RED MOUNTAIN FREEWAY SALT RIVER BANK PROTECTION
T3

        FILE NAME : DESIGN.DAT
        Hydraulic Analysis for the 100-year design

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X3   10
GR   1168      0        1164     17.95    1162     24.38    1162     36.95    1164     71.76
```

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

SUMMARY PRINTOUT

	SECNO	CWSEL	DEPTH	VCH	Q	TOPWID	10*KS	ELMIN	AREA
	120.500	1166.59	19.59	11.07	215000.00	1037.18	13.87	1147.00	19429.93
	122.000	1166.70	19.50	11.49	215000.00	1009.57	15.12	1147.20	18707.49
	122.650	1166.81	19.61	11.46	215000.00	1006.63	14.93	1147.20	18755.49
*	123.550	1168.48	21.18	10.45	215000.00	1060.68	11.74	1147.30	20580.07
	228.000	1168.95	21.25	10.27	215000.00	1002.76	11.04	1147.70	20926.65
	229.000	1169.17	21.07	11.32	215000.00	922.79	13.69	1148.10	18995.57
	230.000	1169.13	20.73	13.87	215000.00	768.48	21.42	1148.40	15502.77
	231.000	1169.70	20.90	15.02	215000.00	700.77	25.13	1148.80	14317.18
	232.000	1170.48	21.28	15.84	215000.00	653.90	27.66	1149.20	13572.10
	233.000	1171.29	21.69	16.74	215000.00	608.53	30.53	1149.60	12846.37
	234.000	1172.77	22.77	16.17	215000.00	606.75	27.03	1150.00	13299.43
	235.000	1174.48	24.08	14.74	215000.00	630.01	20.92	1150.40	14588.24
	236.000	1175.78	24.98	13.61	215000.00	657.32	16.97	1150.80	15795.73
	237.000	1177.56	26.36	10.51	215000.00	802.49	9.19	1151.20	20460.53
	238.000	1178.25	26.55	9.68	215000.00	862.57	7.08	1151.70	22200.39
	239.000	1178.49	26.29	10.28	220000.00	840.03	8.10	1152.20	21391.37
	240.000	1179.32	26.62	8.77	220000.00	968.79	5.74	1152.70	25078.99

SECNO	CWSEL	DEPTH	VCH	Q	TOPWID	10*KS	ELMIN	AREA
240.100	1179.35	26.55	8.79	220000.00	969.51	5.78	1152.80	25038.34
240.200	1179.61	26.81	8.64	220000.00	977.02	5.51	1152.80	25472.70
240.300	1179.74	26.84	8.42	220000.00	1000.28	5.23	1152.90	26126.24
240.400	1179.86	26.86	8.22	220000.00	1023.52	4.96	1153.00	26771.28

240.500	1180.05	26.95	8.04	220000.00	1042.31	4.72	1153.10	27367.97
240.600	1180.12	27.02	7.92	220000.00	1054.95	4.57	1153.10	27774.93
241.100	1180.17	26.97	7.84	220000.00	1067.83	4.48	1153.20	28073.44
241.200	1180.34	27.14	7.75	220000.00	1073.68	4.34	1153.20	28400.89

1

SUMMARY OF ERRORS AND SPECIAL NOTES

CAUTION SECNO= 123.550 PROFILE= 1 HYDRAULIC JUMP D.S.

APPENDIX B

HEC-2 As-Built Files

```
1*****************************************
*  HEC-2 WATER SURFACE PROFILES           *
*                                         *
*  Version   4.6.2;  May 1991             *
*                                         *
*  RUN DATE    19JUN97    TIME   14:58:52 *
*****************************************
```

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

```
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
```

1

19JUN97 14:58:52 PAGE 1

THIS RUN EXECUTED 19JUN97 14:58:52

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

 Version   4.6.2;  May 1991
*************************************
```

```
T1   SIMONS, LI & ASOCIATES, INC. (PAZ-DMJM-07)
T2   RED MOUNTAIN FREEWAY SALT RIVER BANK PROTECTION
T3

      FILE NAME: ASB_D.DAT
      Hydraulic Analysis for the As-Built conditions with design invert
```

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
		2						215000	1166.59	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	-1		-1					-6		

J3 VARIABLE CODES FOR SUMMARY PRINTOUT

38	1	8	26	43	4	5	42

EC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

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

SUMMARY PRINTOUT

	SECNO	CWSEL	DEPTH	VCH	Q	TOPWID	10*KS	ELMIN
	120.500	1166.59	19.59	10.97	215000.00	1063.25	13.90	1147.00
	122.000	1166.69	19.49	11.46	215000.00	1035.83	15.49	1147.20
	122.650	1166.79	19.59	11.48	215000.00	1037.98	15.60	1147.20
*	123.550	1168.47	21.17	10.47	215000.00	1058.98	11.86	1147.30
	228.000	1168.90	21.20	10.44	215000.00	999.01	11.52	1147.70
	229.000	1169.15	21.05	11.43	215000.00	922.04	14.10	1148.10
	230.000	1169.14	20.74	13.90	215000.00	769.85	21.62	1148.40
	231.000	1169.65	20.85	15.30	215000.00	698.05	26.33	1148.80
	232.000	1170.38	21.18	16.48	215000.00	647.99	31.00	1149.20
	233.000	1171.41	21.81	17.00	215000.00	605.25	31.59	1149.60
	234.000	1173.12	23.12	16.05	215000.00	607.50	26.38	1150.00
	235.000	1174.60	24.20	15.09	215000.00	623.50	22.32	1150.40
	236.000	1176.14	25.34	13.51	215000.00	656.28	16.53	1150.80
	237.000	1177.89	26.69	10.43	215000.00	804.08	8.98	1151.20
	238.000	1178.59	26.89	9.55	215000.00	864.65	6.78	1151.70
	239.000	1178.80	26.60	10.19	220000.00	840.13	7.84	1152.20
	240.000	1179.61	26.91	8.71	220000.00	973.45	5.61	1152.70

1

SECNO	CWSEL	DEPTH	VCH	Q	TOPWID	10*KS	ELMIN
240.100	1179.70	26.90	8.55	220000.00	994.94	5.42	1152.80
240.200	1179.93	27.13	8.37	220000.00	996.32	5.09	1152.80

240.300	1180.07	27.17	8.09	220000.00	1046.70	4.82	1152.90
240.410	1180.28	27.28	7.60	220000.00	1097.11	4.20	1153.00
240.500	1180.43	27.33	7.55	220000.00	1101.08	4.12	1153.10
240.600	1180.42	27.32	7.79	220000.00	1079.56	4.45	1153.10
241.100	1180.44	27.24	7.85	220000.00	1053.72	4.47	1153.20
241.200	1180.60	27.40	7.78	220000.00	1059.55	4.38	1153.20

1

SUMMARY OF ERRORS AND SPECIAL NOTES

CAUTION SECNO= 123.550 PROFILE= 1 HYDRAULIC JUMP D.S.

LONG-TERM DEGRADATION/AGGRADATION

ARMORING AND EQUILIBRIUM SLOPE CALCULATIONS

HEC-2 CROSS SECTION	MEYER-PETER, MULLER (mm)	BOTTOM VELOCITY METHOD (mm)	SHIELD'S DIAGRAM (mm)	YANG INCIPIENT MOTION (mm)	AVERAGE ARMOR SIZE (mm)	SCHOK-LITSCH METHOD	MEYER-PETER, MULLER METHOD	SHIELD'S DIAGRAM METHOD	AVERAGE SLOPE (ft/ft)
120.50	88	216	115	231	162	0.00044	0.00061	0.00046	0.00050
122.00	82	206	107	220	154	0.00043	0.00059	0.00045	0.00049
122.65	82	203	107	217	152	0.00043	0.00057	0.00044	0.00048
123.55	52	139	68	149	102	0.00045	0.00050	0.00038	0.00045
124.00	52	140	68	150	102	0.00045	0.00050	0.00038	0.00045
228.00	53	164	69	175	115	0.00037	0.00050	0.00038	0.00041
229.00	49	153	64	163	107	0.00037	0.00048	0.00037	0.00041
230.00	82	249	107	266	176	0.00031	0.00048	0.00037	0.00039
231.00	129	384	169	410	273	0.00026	0.00048	0.00036	0.00037
232.00	110	335	145	357	237	0.00026	0.00043	0.00033	0.00034
233.00	74	232	97	248	163	0.00027	0.00039	0.00030	0.00032
234.00	50	162	66	173	113	0.00030	0.00037	0.00028	0.00032
235.00	45	146	59	156	101	0.00031	0.00037	0.00028	0.00032
236.00	41	133	54	142	93	0.00032	0.00036	0.00028	0.00032
237.00	28	93	37	100	64	0.00036	0.00036	0.00027	0.00033
238.00	20	70	26	75	47	0.00040	0.00036	0.00027	0.00034
239.00	20	72	27	77	49	0.00040	0.00036	0.00028	0.00035
240.10	25	89	33	95	60	0.00038	0.00037	0.00028	0.00034
240.20	24	83	31	89	57	0.00038	0.00037	0.00028	0.00034
240.30	20	72	27	77	49	0.00040	0.00036	0.00028	0.00035
240.40	18	63	23	67	43	0.00042	0.00036	0.00028	0.00035
240.50	16	58	21	62	39	0.00043	0.00036	0.00028	0.00036
240.60	15	54	20	58	37	0.00044	0.00036	0.00028	0.00036
241.10	14	51	19	55	35	0.00045	0.00036	0.00028	0.00036
241.20	14	49	18	53	33	0.00046	0.00036	0.00028	0.00037
242.00	17	45	22	48	33	0.00055	0.00036	0.00027	0.00040
243.00	12	27	15	29	21	0.00063	0.00036	0.00027	0.00042
244.00	28	47	36	50	40	0.00065	0.00040	0.00028	0.00044
245.00	46	68	61	73	62	0.00060	0.00038	0.00029	0.00042
246.00	105	102	137	109	113	0.00041	0.00061	0.00027	0.00043
247.00	72	104	94	111	95	0.00032	0.00059	0.00026	0.00039
248.00	493	424	646	453	504	0.00026	0.00061	0.00027	0.00038
249.00	212	214	278	228	233	0.00028	0.00049	0.00022	0.00033
250.00	304	264	398	282	312	0.00026	0.00045	0.00020	0.00031
251.00	747	601	979	642	742	0.00018	0.00039	0.00018	0.00025
252.00	61	91	80	97	82	0.00029	0.00035	0.00017	0.00027
253.00	13	26	18	27	21	0.00046	0.00043	0.00021	0.00037
AVERAGE	89	152	117	163	130	0.00039	0.00043	0.00030	0.00037

DLR 8-7-92

ASSUMED VALUES:

STREAMBED "n" =	0.040	
SHIELDS PARAMETER =	0.06	
D50 =	15	mm
D90 =	165	mm
SPECIFIC WEIGHT OF SEDIMENT =	165	pcf
SPECIFIC WEIGHT OF WATER =	62.4	pcf
KINEMATIC VISCOSITY =	0.00001	sq ft/s

Appendix B: HEC-RAS Summary and Output

PREMIER
ENGINEERING CORPORATION

Levee Elevation Comparison
Salt River: McClintock-SR101L

Project: FCDMC On-Call
Subject: Levee Elevations

By: KD
Date: Jun-00
Checked:
Premier Project No.: 9952

As-Built - Surveyed

River Sta	Dist U/S	South Lt Sta	South Lt El.	South Design	South As-Built	North Rt Sta	North Rt El.	North Design	North As-Built	Delta South	Delta North
240	5909.93	27.32	1184.55	1184.1	1184.6	1017.89	1182.96	1182.4	1183	**0.05**	**0.04**
239	5415.44	14.34	1184.02	1183.5	1183.9	893.33	1180.67	1181.7	1180.6	**-0.12**	**-0.07**
238	4943.04	17.15	1182.96	1183	1183.2	888.42	1181.17	1181.3	1181.5	**0.24**	**0.33**
237	4417.44	0	1181.89	1182.5	1182.5	871.13	1180.99	1180.6	1181	**0.61**	**0.01**
236	4021.13	2.89	1181.93	1182.1	1182.1	747.26	1179.16	1179	1179	**0.17**	**-0.16**
235	3619.22	14.19	1178.74	1178.4	1178.7	707.85	1177.93	1177.8	1177.9	**-0.04**	**-0.03**
234	3214.56	28.87	1176.39	1176.1	1176.4	699.23	1176.92	1176.3	1177	**0.01**	**0.08**
233	2809.43	30.89	1174.8	1174.5	1175.1	699.58	1174.38	1174.4	1174	**0.3**	**-0.38**
232	2417.81	11.52	1173.84	1173.6	1173.4	735.64	1173.92	1173.6	1173.8	**-0.44**	**-0.12**
231	2013.73	21.08	1172.53	1172.8	1172.6	780.88	1172.77	1172.8	1172.6	**0.07**	**-0.17**
230	1590.24	31.47	1172.16	1172.2	1172.3	866.19	1172.91	1172.5	1172.8	**0.14**	**-0.11**
229	1216.04	15.77	1172.12	1172.2	1172.2	1033.93	1174.61	1173.4	1173	**0.08**	**-1.61**
228	830.28	32.48	1172.27	1172	1172.3	1114.72	1172.89	1172.6	1172.4	**0.03**	**-0.49**
123.8	493.53	68.75	1171.46	1171.8	1172.1	1179.7	1170.06	1172.1	1170.2	**0.64**	**0.14**
123.7	402.53	68.75	1171.46	1171.8	1172.1	1179.7	1170.06	1172.1	1170.2	**0.64**	**0.14**
120.5	0	10.52	1173.02	No Elev. Given		1113.18	1172.4	1171.4	1171.8		

PREMIER
ENGINEERING CORPORATION

HEC-RAS Results and Freeboard
Salt River: McClintock-SR101L

Project: FCDMC On-Call
Subject: WSEL and Freeboard

By: KD
Date: Jun-00
Checked:
Premier Project No.: 9952

Surveyed Topo and N = 0.035

Q = 215,000 cfs

HEC-RAS Information								Freeboard									
River Sta	Reach L	Dist U/S	Q Total (cfs)	Min. Channel El.	WSEl	Y ft	V fps	Lt Sta	Lt El.	As-Built El.	Rt Sta	Rt El.	As-Built El.	Lt	Rt	Required ft	Comment
240	494.49	5909.93	215,000	1145.43	1178.63	33.2	8.11	27.32	1184.55	1184.6	1017.89	1182.96	1183	**5.92**	**4.33**	***3.00***	Adequate
239	472.4	5415.44	215,000	1143.7	1178.12	34.42	9.01	14.34	1184.02	1183.9	893.33	1180.67	1180.6	**5.9**	**2.55**	***3.00***	More FB Required
238	525.6	4943.04	215,000	1141.9	1177.88	35.98	9.01	17.15	1182.96	1183.2	888.42	1181.17	1181.5	**5.08**	**3.29**	***3.00***	Adequate
237	396.31	4417.44	215,000	1142.4	1177.52	35.12	9.12	0	1181.89	1182.5	871.13	1180.99	1181	**4.37**	**3.47**	***3.00***	Adequate
236	401.91	4021.13	215,000	1139.27	1176.09	36.82	12.02	2.89	1181.93	1182.1	747.26	1179.16	1179	**5.84**	**3.07**	***3.00***	Adequate
235	404.66	3619.22	215,000	1137.95	1175.14	37.19	11.45	20.16	1178.74	1178.7	741.28	1177.93	1177.9	**3.6**	**2.79**	***3.00***	More FB Required
234	405.13	3214.56	215,000	1138.83	1173.53	34.7	14.48	28.87	1176.39	1176.4	699.23	1176.92	1177	**2.86**	**3.39**	***3.00***	More FB Required
233	391.62	2809.43	215,000	1135.87	1171.82	35.95	15.63	30.89	1174.8	1175.1	699.58	1174.38	1174	**2.98**	**2.56**	***3.00***	More FB Required
232	404.08	2417.81	215,000	1135.15	1171.07	35.92	14.56	11.52	1173.84	1173.4	735.64	1173.92	1173.8	**2.77**	**2.85**	***3.00***	More FB Required
231	423.49	2013.73	215,000	1138.41	1170.23	31.82	14.01	21.08	1172.53	1172.6	780.88	1172.77	1172.6	**2.3**	**2.54**	***3.00***	More FB Required
230	374.2	1590.24	215,000	1141.52	1169.54	28.02	13.21	31.47	1172.16	1172.3	866.19	1172.91	1172.8	**2.62**	**3.37**	***3.00***	More FB Required
229	385.76	1216.04	215,000	1141.35	1169.62	28.27	10.51	15.77	1172.12	1172.2	1033.93	1174.61	1173	**2.5**	**4.99**	***3.00***	More FB Required
228	336.75	830.28	215,000	1145.07	1169.20	24.13	10.28	32.48	1172.27	1172.3	1114.72	1172.89	1172.4	**3.07**	**3.69**	***3.00***	Adequate
123.8	91	493.53	215,000	1146.17	1168.01	21.84	12.28	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**3.45**	**2.05**	***3.00***	More FB Required
123.7	402.53	402.53	215,000	1146.17	1167.19	21.02	12.86	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**4.27**	**2.87**	***3.00***	More FB Required
120.5	0	0	215,000	1147.26	1166.59	19.33	12.12	10.52	1173.02		1113.18	1172.4	1171.8	**6.43**	**5.81**	***3.00***	Adequate

Q = 172,000 cfs

HEC-RAS Information								Freeboard									
River Sta	Reach L	Dist U/S	Q Total (cfs)	Min. Channel El.	WSEl	Y ft	V fps	Lt Sta	Lt El.	As-Built El.	Rt Sta	Rt El.	As-Built El.	Lt	Rt	Required ft	Comment
240	494.49	5909.93	172,000	1145.43	1175.12	29.69	7.39	27.32	1184.55	1184.6	1017.89	1182.96	1183	**9.43**	**7.84**	***3.00***	Adequate
239	472.4	5415.44	172,000	1143.7	1174.67	30.97	8.18	14.34	1184.02	1183.9	893.33	1180.67	1180.6	**9.35**	**6**	***3.00***	Adequate
238	525.6	4943.04	172,000	1141.9	1174.44	32.54	8.19	17.15	1182.96	1183.2	888.42	1181.17	1181.5	**8.52**	**6.73**	***3.00***	Adequate
237	396.31	4417.44	172,000	1142.4	1174.11	31.71	8.23	0	1181.89	1182.5	871.13	1180.99	1181	**7.78**	**6.88**	***3.00***	Adequate
236	401.91	4021.13	172,000	1139.27	1172.88	33.61	10.9	2.89	1181.93	1182.1	747.26	1179.16	1179	**9.05**	**6.28**	***3.00***	Adequate
235	404.66	3619.22	172,000	1137.95	1172.04	34.09	10.65	20.16	1181.79	1178.7	741.28	1179.23	1177.9	**9.75**	**7.19**	***3.00***	Adequate
234	405.13	3214.56	172,000	1138.83	1170.60	31.77	13.16	28.87	1176.39	1176.4	699.23	1176.92	1177	**5.79**	**6.32**	***3.00***	Adequate
233	391.62	2809.43	172,000	1135.87	1169.03	33.16	14.27	30.89	1174.8	1175.1	699.58	1174.67	1174	**5.77**	**5.64**	***3.00***	Adequate
232	404.08	2417.81	172,000	1135.15	1168.29	33.14	13.25	11.52	1173.84	1173.4	735.64	1173.92	1173.8	**5.55**	**5.63**	***3.00***	Adequate
231	423.49	2013.73	172,000	1138.41	1167.44	29.03	12.84	21.08	1172.53	1172.6	780.88	1172.77	1172.6	**5.09**	**5.33**	***3.00***	Adequate
230	374.2	1590.24	172,000	1141.52	1166.73	25.21	12.13	31.47	1172.16	1172.3	866.19	1172.91	1172.8	**5.43**	**6.18**	***3.00***	Adequate
229	385.76	1216.04	172,000	1141.35	1166.70	25.35	9.69	15.77	1172.12	1172.2	1033.93	1174.61	1173	**5.42**	**7.91**	***3.00***	Adequate
228	336.75	830.28	172,000	1145.07	1166.25	21.18	9.57	32.48	1172.27	1172.3	1114.72	1172.89	1172.4	**6.02**	**6.64**	***3.00***	Adequate
123.8	91	493.53	172,000	1146.17	1164.93	18.76	11.87	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**6.53**	**5.13**	***3.00***	Adequate
123.7	402.53	402.53	172,000	1146.17	1163.93	17.76	12.72	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**7.53**	**6.13**	***3.00***	Adequate
120.5	0	0	172,000	1147.26	1163.07	15.81	12.13	10.52	1173.02		1113.18	1172.4	1171.8	**9.95**	**9.33**	***3.00***	Adequate

Note: Bridge at 123.75

PREMIER
ENGINEERING CORPORATION

HEC-RAS Results and Freeboard
Salt River: McClintock-SR101L

Project: FCDMC On-Call
Subject: WSEL and Freeboard

By: KD
Date: Jun-00
Checked:
Premier Project No.: 9952

Surveyed Topow/ Vegetative Growth (n = 0.055)

Q = 215,000 cfs

HEC-RAS Information								Freeboard										
River Sta	Reach L	Dist U/S	Q Total (cfs)	Min. Channel El.	WSEl	Y ft	V fps	Lt Sta	Lt El.	As-Built El.	Rt Sta	Rt El.	As-Built El.	Lt	Rt	Required ft	Comment
240	494.49	5909.93	215,000	1145.43	1184.16	38.73	6.76	27.32	1184.55	1184.6	1017.89	1182.96	1183	**0.39**	**-1.2**	***3.00***	More FB Required
239	472.4	5415.44	215,000	1143.70	1183.60	39.90	7.58	14.34	1184.02	1183.9	893.33	1180.67	1180.6	**0.42**	**-2.93**	***3.00***	More FB Required
238	525.6	4943.04	215,000	1141.90	1183.27	41.37	7.58	17.15	1182.96	1183.2	888.42	1181.17	1181.5	**-0.31**	**-2.1**	***3.00***	More FB Required
237	396.31	4417.44	215,000	1142.40	1182.75	40.35	7.75	0	1181.89	1182.5	871.13	1180.99	1181	**-0.86**	**-1.76**	***3.00***	More FB Required
236	401.91	4021.13	215,000	1139.27	1181.47	42.20	10.02	2.89	1181.93	1182.1	747.26	1179.16	1179	**0.46**	**-2.31**	***3.00***	More FB Required
235	404.66	3619.22	215,000	1137.95	1180.33	42.38	9.29	20.16	1181.79	1178.7	741.28	1179.23	1177.9	**1.46**	**-1.1**	***3.00***	More FB Required
234	405.13	3214.56	215,000	1138.83	1178.64	39.81	11.98	28.87	1176.39	1176.4	699.23	1176.92	1177	**-2.25**	**-1.72**	***3.00***	More FB Required
233	391.62	2809.43	215,000	1135.87	1176.73	40.86	12.85	30.89	1174.8	1175.1	699.58	1174.67	1174	**-1.93**	**-2.06**	***3.00***	More FB Required
232	404.08	2417.81	215,000	1135.15	1175.31	40.16	12.27	11.52	1173.84	1173.4	735.64	1173.92	1173.8	**-1.47**	**-1.39**	***3.00***	More FB Required
231	423.49	2013.73	215,000	1138.41	1173.82	35.41	12.07	21.08	1172.53	1172.6	780.88	1172.77	1172.6	**-1.29**	**-1.05**	***3.00***	More FB Required
230	374.2	1590.24	215,000	1141.52	1172.36	30.84	11.75	31.47	1172.16	1172.3	866.19	1172.91	1172.8	**-0.2**	**0.55**	***3.00***	More FB Required
229	385.76	1216.04	215,000	1141.35	1171.77	30.42	9.56	15.77	1172.12	1172.2	1033.93	1174.61	1173	**0.35**	**2.84**	***3.00***	More FB Required
228	336.75	830.28	215,000	1145.07	1170.89	25.82	9.51	32.48	1172.27	1172.3	1114.72	1172.89	1172.4	**1.38**	**2**	***3.00***	More FB Required
123.8	91	493.53	215,000	1146.17	1169.34	23.17	11.42	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**2.12**	**0.72**	***3.00***	More FB Required
123.7	402.53	402.53	215,000	1146.17	1168.27	22.10	12.1	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**3.19**	**1.79**	***3.00***	More FB Required
120.5	0	0	215,000	1147.26	1166.59	19.33	12.12	10.52	1173.02		1113.18	1172.4	1171.8	**6.43**	**5.81**	***3.00***	Adequate

Note: Bridge at 123.75

Q = 172,000 cfs

HEC-RAS Information								Freeboard										
River Sta	Reach L	Dist U/S	Q Total (cfs)	Min. Channel El.	WSEl	Y ft	V fps	Lt Sta	Lt El.	As-Built El.	Rt Sta	Rt El.	As-Built El.	Lt	Rt	Required ft	Comment
240	494.49	5909.93	172,000	1145.43	1180.18	34.75	6.15	27.32	1184.55	1184.6	1017.89	1182.96	1183	**4.37**	**2.78**	***3.00***	More FB Required
239	472.4	5415.44	172,000	1143.70	1179.69	35.99	6.83	14.34	1184.02	1183.9	893.33	1180.67	1180.6	**4.33**	**0.98**	***3.00***	More FB Required
238	525.6	4943.04	172,000	1141.90	1179.37	37.47	6.85	17.15	1182.96	1183.2	888.42	1181.17	1181.5	**3.59**	**1.8**	***3.00***	More FB Required
237	396.31	4417.44	172,000	1142.40	1178.90	36.50	6.97	0	1181.89	1182.5	871.13	1180.99	1181	**2.99**	**2.09**	***3.00***	More FB Required
236	401.91	4021.13	172,000	1139.27	1177.79	38.52	9.06	2.89	1181.93	1182.1	747.26	1179.16	1179	**4.14**	**1.37**	***3.00***	More FB Required
235	404.66	3619.22	172,000	1137.95	1176.77	38.82	8.52	20.16	1181.79	1178.7	741.28	1179.23	1177.9	**5.02**	**2.46**	***3.00***	More FB Required
234	405.13	3214.56	172,000	1138.83	1175.30	36.47	10.8	28.87	1176.39	1176.4	699.23	1176.92	1177	**1.09**	**1.62**	***3.00***	More FB Required
233	391.62	2809.43	172,000	1135.87	1173.57	37.70	11.6	30.89	1174.8	1175.1	699.58	1174.67	1174	**1.23**	**1.1**	***3.00***	More FB Required
232	404.08	2417.81	172,000	1135.15	1172.26	37.11	11.07	11.52	1173.84	1173.4	735.64	1173.92	1173.8	**1.58**	**1.66**	***3.00***	More FB Required
231	423.49	2013.73	172,000	1138.41	1170.89	32.48	10.88	21.08	1172.53	1172.6	780.88	1172.77	1172.6	**1.64**	**1.88**	***3.00***	More FB Required
230	374.2	1590.24	172,000	1141.52	1169.56	28.04	10.56	31.47	1172.16	1172.3	866.19	1172.91	1172.8	**2.6**	**3.35**	***3.00***	More FB Required
229	385.76	1216.04	172,000	1141.35	1168.94	27.59	8.67	15.77	1172.12	1172.2	1033.93	1174.61	1173	**3.18**	**5.67**	***3.00***	Adequate
228	336.75	830.28	172,000	1145.07	1168.09	23.02	8.69	32.48	1172.27	1172.3	1114.72	1172.89	1172.4	**4.18**	**4.8**	***3.00***	Adequate
123.8	91	493.53	172,000	1146.17	1166.52	20.35	10.72	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**4.94**	**3.54**	***3.00***	Adequate
123.7	402.53	402.53	172,000	1146.17	1165.40	19.23	11.51	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**6.06**	**4.66**	***3.00***	Adequate
120.5	0	0	172,000	1147.26	1163.07	15.81	12.13	10.52	1173.02		1113.18	1172.4	1171.8	**9.95**	**9.33**	***3.00***	Adequate

Note: Bridge at 123.75

PREMIER
ENGINEERING CORPORATION

HEC-RAS Results and Freeboard
Salt River: McClintock-SR101L

Project: FCDMC On-Call
Subject: WSEL and Freeboard

By: KD
Date: Jun-00
Checked:
Premier Project No.: 9952

Surveyed Topo "Strip" n values)

Q = 215,000 cfs

HEC-RAS Information								Freeboard									
River Sta	Reach L	Dist U/S	Q Total (cfs)	Min. Channel El.	WSEI	Y ft	V fps	Lt Sta	Lt El.	As-Built El.	Rt Sta	Rt El.	As-Built El.	Lt	Rt	Required ft	Comment
240	494.49	5909.93	215,000	1145.43	1178.88	33.45	7.99	27.32	1184.55	1184.6	1017.89	1182.96	1183	**5.67**	**4.08**	***3.00***	Adequate
239	472.4	5415.44	215,000	1143.7	1178.39	34.69	8.86	14.34	1184.02	1183.9	893.33	1180.67	1180.6	**5.63**	**2.28**	***3.00***	More FB Required
238	525.6	4943.04	215,000	1141.9	1178.15	36.25	8.88	17.15	1182.96	1183.2	888.42	1181.17	1181.5	**4.81**	**3.02**	***3.00***	Adequate
237	396.31	4417.44	215,000	1142.4	1177.80	35.4	8.99	0	1181.89	1182.5	871.13	1180.99	1181	**4.09**	**3.19**	***3.00***	Adequate
236	401.91	4021.13	215,000	1139.27	1176.44	37.17	11.76	2.89	1181.93	1182.1	747.26	1179.16	1179	**5.49**	**2.72**	***3.00***	More FB Required
235	404.66	3619.22	215,000	1137.95	1175.50	37.55	11.54	20.16	1181.79	1178.7	741.28	1179.23	1177.9	**6.29**	**3.73**	***3.00***	Adequate
234	405.13	3214.56	215,000	1138.83	1173.92	35.09	14.11	28.87	1176.39	1176.4	699.23	1176.92	1177	**2.47**	**3**	***3.00***	More FB Required
233	391.62	2809.43	215,000	1135.87	1172.20	36.33	15.24	30.89	1174.8	1175.1	699.58	1174.67	1174	**2.6**	**2.47**	***3.00***	More FB Required
232	404.08	2417.81	215,000	1135.15	1171.25	36.1	14.4	11.52	1173.84	1173.4	735.64	1173.92	1173.8	**2.59**	**2.67**	***3.00***	More FB Required
231	423.49	2013.73	215,000	1138.41	1170.25	31.84	13.9	21.08	1172.53	1172.6	780.88	1172.77	1172.6	**2.28**	**2.52**	***3.00***	More FB Required
230	374.2	1590.24	215,000	1141.52	1169.53	28.01	13.01	31.47	1172.16	1172.3	866.19	1172.91	1172.8	**2.63**	**3.38**	***3.00***	More FB Required
229	385.76	1216.04	215,000	1141.35	1169.54	28.19	10.54	15.77	1172.12	1172.2	1033.93	1174.61	1173	**2.58**	**5.07**	***3.00***	More FB Required
228	336.75	830.28	215,000	1145.07	1169.12	24.05	10.27	32.48	1172.27	1172.3	1114.72	1172.89	1172.4	**3.15**	**3.77**	***3.00***	Adequate
123.8	91	493.53	215,000	1146.17	1167.99	21.82	12.11	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**3.47**	**2.07**	***3.00***	More FB Required
123.7	402.53	402.53	215,000	1146.17	1167.19	21.02	12.69	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**4.27**	**2.87**	***3.00***	More FB Required
120.5	0	0	215,000	1147.26	1166.59	19.33	11.99	10.52	1173.02		1113.18	1172.4	1171.8	**6.43**	**5.81**	***3.00***	Adequate

Q = 172,000 cfs

HEC-RAS Information								Freeboard									
River Sta	Reach L	Dist U/S	Q Total (cfs)	Min. Channel El.	WSEI	Y ft	V fps	Lt Sta	Lt El.	As-Built El.	Rt Sta	Rt El.	As-Built El.	Lt	Rt	Required ft	Comment
240	494.49	5909.93	172,000	1145.43	1175.38	29.95	7.28	27.32	1184.55	1184.6	1017.89	1182.96	1183	**9.17**	**7.58**	***3.00***	Adequate
239	472.4	5415.44	172,000	1143.7	1174.95	31.25	8.04	14.34	1184.02	1183.9	893.33	1180.67	1180.6	**9.07**	**5.72**	***3.00***	Adequate
238	525.6	4943.04	172,000	1141.9	1174.72	32.82	8.07	17.15	1182.96	1183.2	888.42	1181.17	1181.5	**8.24**	**6.45**	***3.00***	Adequate
237	396.31	4417.44	172,000	1142.4	1174.41	32.01	8.11	0	1181.89	1182.5	871.13	1180.99	1181	**7.48**	**6.58**	***3.00***	Adequate
236	401.91	4021.13	172,000	1139.27	1173.24	33.97	10.66	2.89	1181.93	1182.1	747.26	1179.16	1179	**8.69**	**5.92**	***3.00***	Adequate
235	404.66	3619.22	172,000	1137.95	1172.41	34.46	10.74	20.16	1181.79	1178.7	741.28	1179.23	1177.9	**9.38**	**6.82**	***3.00***	Adequate
234	405.13	3214.56	172,000	1138.83	1170.98	32.15	12.82	28.87	1176.39	1176.4	699.23	1176.92	1177	**5.41**	**5.94**	***3.00***	Adequate
233	391.62	2809.43	172,000	1135.87	1169.4	33.53	13.9	30.89	1174.8	1175.1	699.58	1174.67	1174	**5.4**	**5.27**	***3.00***	Adequate
232	404.08	2417.81	172,000	1135.15	1168.48	33.33	13.11	11.52	1173.84	1173.4	735.64	1173.92	1173.8	**5.36**	**5.44**	***3.00***	Adequate
231	423.49	2013.73	172,000	1138.41	1167.48	29.07	12.74	21.08	1172.53	1172.6	780.88	1172.77	1172.6	**5.05**	**5.29**	***3.00***	Adequate
230	374.2	1590.24	172,000	1141.52	1166.73	25.21	11.97	31.47	1172.16	1172.3	866.19	1172.91	1172.8	**5.43**	**6.18**	***3.00***	Adequate
229	385.76	1216.04	172,000	1141.35	1166.65	25.3	9.72	15.77	1172.12	1172.2	1033.93	1174.61	1173	**5.47**	**7.96**	***3.00***	Adequate
228	336.75	830.28	172,000	1145.07	1166.2	21.13	9.57	32.48	1172.27	1172.3	1114.72	1172.89	1172.4	**6.07**	**6.69**	***3.00***	Adequate
123.8	91	493.53	172,000	1146.17	1164.92	18.75	11.76	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**6.54**	**5.14**	***3.00***	Adequate
123.7	402.53	402.53	172,000	1146.17	1163.92	17.75	12.62	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**7.54**	**6.14**	***3.00***	Adequate
120.5	0	0	172,000	1147.26	1163.07	15.81	12.03	10.52	1173.02		1113.18	1172.4	1171.8	**9.95**	**9.33**	***3.00***	Adequate

Note: Bridge at 123.75

PREMIER
ENGINEERING CORPORATION

HEC-RAS Results and Freeboard
Salt River: McClintock-SR101L

Project: FCDMC On-Call
Subject: WSEL and Freeboard

By: KD
Date: Jun-00
Checked:
Premier Project No.: 9952

Surveyed Topo w/ Max n value =0.029 & 0.046

Q = 215,000 cfs

HEC-RAS Information								Freeboard									
River Sta	Reach L	Dist U/S	Q Total (cfs)	Min. Channel El.	WSEl	Y ft	V fps	Lt Sta	Lt El.	As-Built El.	Rt Sta	Rt El.	As-Built El.	Lt	Rt	Required ft	Comment
240	494.49	5909.93	215,000	1145.43	1176.90	31.47	8.63	27.32	1184.55	1184.6	1017.89	1182.96	1183	**7.65**	**6.06**	***3.00***	Adequate
239	472.4	5415.44	215,000	1143.70	1176.40	32.70	9.57	14.34	1184.02	1183.9	893.33	1180.67	1180.6	**7.62**	**4.27**	***3.00***	Adequate
238	525.6	4943.04	215,000	1141.90	1176.20	34.30	9.57	17.15	1182.96	1183.2	888.42	1181.17	1181.5	**6.76**	**4.97**	***3.00***	Adequate
237	396.31	4417.44	215,000	1142.40	1175.91	33.51	9.64	0	1181.89	1182.5	871.13	1180.99	1181	**5.98**	**5.08**	***3.00***	Adequate
236	401.91	4021.13	215,000	1139.27	1174.38	35.11	12.83	2.89	1181.93	1182.1	747.26	1179.16	1179	**7.55**	**4.78**	***3.00***	Adequate
235	404.66	3619.22	215,000	1137.95	1173.50	35.55	12.38	20.16	1178.74	1178.7	741.28	1177.93	1177.9	**5.24**	**4.43**	***3.00***	Adequate
234	405.13	3214.56	215,000	1138.83	1171.85	33.02	15.55	28.87	1176.39	1176.4	699.23	1176.92	1177	**4.54**	**5.07**	***3.00***	Adequate
233	391.62	2809.43	215,000	1135.87	1170.16	34.29	16.87	30.89	1174.8	1175.1	699.58	1174.38	1174	**4.64**	**4.22**	***3.00***	Adequate
232	404.08	2417.81	215,000	1135.15	1169.72	34.57	15.48	11.52	1173.84	1173.4	735.64	1173.92	1173.8	**4.12**	**4.2**	***3.00***	Adequate
231	423.49	2013.73	215,000	1138.41	1169.14	30.73	14.74	21.08	1172.53	1172.6	780.88	1172.77	1172.6	**3.39**	**3.63**	***3.00***	Adequate
230	374.2	1590.24	215,000	1141.52	1168.74	27.22	13.72	31.47	1172.16	1172.3	866.19	1172.91	1172.8	**3.42**	**4.17**	***3.00***	Adequate
229	385.76	1216.04	215,000	1141.35	1169.04	27.69	10.79	15.77	1172.12	1172.2	1033.93	1174.61	1173	**3.08**	**5.57**	***3.00***	Adequate
228	336.75	830.28	215,000	1145.07	1168.75	23.68	10.51	32.48	1172.27	1172.3	1114.72	1172.89	1172.4	**3.52**	**4.14**	***3.00***	Adequate
123.8	91	493.53	215,000	1146.17	1167.67	21.50	12.51	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**3.79**	**2.39**	***3.00***	More FB Required
123.7	402.53	402.53	215,000	1146.17	1166.94	20.77	13.06	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**4.52**	**3.12**	***3.00***	Adequate
120.5	0	0	215,000	1147.26	1166.59	19.33	12.12	10.52	1173.02		1113.18	1172.4	1171.8	**6.43**	**5.81**	***3.00***	Adequate

Note: Bridge at 123.75

Q = 172,000 cfs

HEC-RAS Information								Freeboard									
River Sta	Reach L	Dist U/S	Q Total (cfs)	Min. Channel El.	WSEl	Y ft	V fps	Lt Sta	Lt El.	As-Built El.	Rt Sta	Rt El.	As-Built El.	Lt	Rt	Required ft	Comment
240	494.49	5909.93	172,000	1145.43	1177.97	32.54	6.64	27.32	1184.55	1184.6	1017.89	1182.96	1183	**6.58**	**4.99**	***3.00***	Adequate
239	472.4	5415.44	172,000	1143.70	1177.49	33.79	7.36	14.34	1184.02	1183.9	893.33	1180.67	1180.6	**6.53**	**3.18**	***3.00***	Adequate
238	525.6	4943.04	172,000	1141.90	1177.21	35.31	7.38	17.15	1182.96	1183.2	888.42	1181.17	1181.5	**5.75**	**3.96**	***3.00***	Adequate
237	396.31	4417.44	172,000	1142.40	1176.79	34.39	7.48	0	1181.89	1182.5	871.13	1180.99	1181	**5.1**	**4.2**	***3.00***	Adequate
236	401.91	4021.13	172,000	1139.27	1175.65	36.38	9.77	2.89	1181.93	1182.1	747.26	1179.16	1179	**6.28**	**3.51**	***3.00***	Adequate
235	404.66	3619.22	172,000	1137.95	1174.71	36.76	9.35	20.16	1181.79	1178.7	741.28	1179.23	1177.9	**7.08**	**4.52**	***3.00***	Adequate
234	405.13	3214.56	172,000	1138.83	1173.26	34.43	11.71	28.87	1176.39	1176.4	699.23	1176.92	1177	**3.13**	**3.66**	***3.00***	Adequate
233	391.62	2809.43	172,000	1135.87	1171.62	35.75	12.62	30.89	1174.8	1175.1	699.58	1174.67	1174	**3.18**	**3.05**	***3.00***	Adequate
232	404.08	2417.81	172,000	1135.15	1170.52	35.37	11.94	11.52	1173.84	1173.4	735.64	1173.92	1173.8	**3.32**	**3.4**	***3.00***	Adequate
231	423.49	2013.73	172,000	1138.41	1169.36	30.95	11.67	21.08	1172.53	1172.6	780.88	1172.77	1172.6	**3.17**	**3.41**	***3.00***	Adequate
230	374.2	1590.24	172,000	1141.52	1168.26	26.74	11.23	31.47	1172.16	1172.3	866.19	1172.91	1172.8	**3.9**	**4.65**	***3.00***	Adequate
229	385.76	1216.04	172,000	1141.35	1167.89	26.54	9.13	15.77	1172.12	1172.2	1033.93	1174.61	1173	**4.23**	**6.72**	***3.00***	Adequate
228	336.75	830.28	172,000	1145.07	1167.20	22.13	9.09	32.48	1172.27	1172.3	1114.72	1172.89	1172.4	**5.07**	**5.69**	***3.00***	Adequate
123.8	91	493.53	172,000	1146.17	1165.73	19.56	11.26	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**5.73**	**4.33**	***3.00***	Adequate
123.7	402.53	402.53	172,000	1146.17	1164.63	18.46	12.11	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**6.83**	**5.43**	***3.00***	Adequate
120.5	0	0	172,000	1147.26	1163.07	15.81	12.13	10.52	1173.02		1113.18	1172.4	1171.8	**9.95**	**9.33**	***3.00***	Adequate

Note: Bridge at 123.75

PREMIER
ENGINEERING CORPORATION

HEC-RAS Results and Freeboard
Salt River: McClintock-SR101L

Project: FCDMC On-Call
Subject: WSEL and Freeboard

By: KD
Date: Jun-00
Checked:
Premier Project No.: 9952

Surveyed Topo w/ Max n before overtopping (n = 0.044)

Q = 215,000 cfs

HEC-RAS Information								Freeboard										
River Sta	Reach L	Dist U/S	Q Total (cfs)	Min. Channel El.	WSEl	Y ft	V fps	Lt Sta	Lt El.	As-Built El.	Rt Sta	Rt El.	As-Built El.	Lt	Rt	Required ft	Comment
240	494.49	5909.93	215,000	1145.43	1181.17	35.74	7.43	27.32	1184.55	1184.6	1017.89	1182.96	1183	**3.38**	**1.79**	***3.00***	More FB Required
239	472.4	5415.44	215,000	1143.70	1180.63	36.93	8.29	14.34	1184.02	1183.9	893.33	1180.67	1180.6	**3.39**	**0.04**	***3.00***	More FB Required
238	525.6	4943.04	215,000	1141.90	1180.35	38.45	8.29	17.15	1182.96	1183.2	888.42	1181.17	1181.5	**2.61**	**0.82**	***3.00***	More FB Required
237	396.31	4417.44	215,000	1142.40	1179.90	37.50	8.44	0	1181.89	1182.5	871.13	1180.99	1181	**1.99**	**1.09**	***3.00***	More FB Required
236	401.91	4021.13	215,000	1139.27	1178.56	39.29	11.02	2.89	1181.93	1182.1	747.26	1179.16	1179	**3.37**	**0.6**	***3.00***	More FB Required
235	404.66	3619.22	215,000	1137.95	1177.52	39.57	10.31	20.16	1178.74	1178.7	741.28	1177.93	1177.9	**1.22**	**0.41**	***3.00***	More FB Required
234	405.13	3214.56	215,000	1138.83	1175.91	37.08	13.19	28.87	1176.39	1176.4	699.23	1176.92	1177	**0.48**	**1.01**	***3.00***	More FB Required
233	391.62	2809.43	215,000	1135.87	1174.12	38.25	14.18	30.89	1174.8	1175.1	699.58	1174.38	1174	**0.68**	**0.26**	***3.00***	More FB Required
232	404.08	2417.81	215,000	1135.15	1173.03	37.88	13.4	11.52	1173.84	1173.4	735.64	1173.92	1173.8	**0.81**	**0.89**	***3.00***	More FB Required
231	423.49	2013.73	215,000	1138.41	1171.86	33.45	13.04	21.08	1172.53	1172.6	780.88	1172.77	1172.6	**0.67**	**0.91**	***3.00***	More FB Required
230	374.2	1590.24	215,000	1141.52	1170.80	29.28	12.48	31.47	1172.16	1172.3	866.19	1172.91	1172.8	**1.36**	**2.11**	***3.00***	More FB Required
229	385.76	1216.04	215,000	1141.35	1170.56	29.21	10.07	15.77	1172.12	1172.2	1033.93	1174.61	1173	**1.56**	**4.05**	***3.00***	More FB Required
228	336.75	830.28	215,000	1145.07	1169.93	24.86	9.94	32.48	1172.27	1172.3	1114.72	1172.89	1172.4	**2.34**	**2.96**	***3.00***	More FB Required
123.8	91	493.53	215,000	1146.17	1168.57	22.40	11.9	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**2.89**	**1.49**	***3.00***	More FB Required
123.7	402.53	402.53	215,000	1146.17	1167.64	21.47	12.54	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**3.82**	**2.42**	***3.00***	More FB Required
120.5	0	0	215,000	1147.26	1166.59	19.33	12.12	10.52	1173.02		1113.18	1172.4	1171.8	**6.43**	**5.81**	***3.00***	Adequate

Note: Bridge at 123.75

PREMIER
ENGINEERING CORPORATION

HEC-RAS Results and Freeboard
Salt River: McClintock-SR101L

Project: FCDMC On-Call
Subject: WSEL and Freeboard

By: KD
Date: Jun-00
Checked:
Premier Project No.: 9952

Equilibrium Slope Condition (n= 0.035)

Q = 215,000 cfs

HEC-RAS Information								Freeboard									
River Sta	Reach L	Dist U/S	Q Total (cfs)	Min. Channel El.	WSEl	Y ft	V fps	Lt Sta	Lt El.	As-Built El.	Rt Sta	Rt El.	As-Built El.	Lt	Rt	Required ft	Comment
240	494.49	5909.93	215,000	1149.45	1179.73	30.28	8.27	27.32	1184.55	1184.6	1017.89	1182.96	1183	**4.82**	**3.23**	***3.00***	Adequate
239	472.4	5415.44	215,000	1149.26	1179.17	29.91	9.24	14.34	1184.02	1183.9	893.33	1180.67	1180.6	**4.85**	**1.5**	***3.00***	More FB Required
238	525.6	4943.04	215,000	1149.09	1178.87	29.78	9.32	17.15	1182.96	1183.2	888.42	1181.17	1181.5	**4.09**	**2.3**	***3.00***	More FB Required
237	396.31	4417.44	215,000	1148.89	1178.46	29.57	9.47	0	1181.89	1182.5	871.13	1180.99	1181	**3.43**	**2.53**	***3.00***	More FB Required
236	401.91	4021.13	215,000	1148.75	1176.97	28.22	12.31	2.89	1181.93	1182.1	747.26	1179.16	1179	**4.96**	**2.19**	***3.00***	More FB Required
235	404.66	3619.22	215,000	1148.60	1175.96	27.36	11.32	20.16	1181.79	1178.7	741.28	1179.23	1177.9	**5.83**	**3.27**	***3.00***	Adequate
234	405.13	3214.56	215,000	1148.45	1174.39	25.94	14.66	28.87	1176.39	1176.4	699.23	1176.92	1177	**2**	**2.53**	***3.00***	More FB Required
233	391.62	2809.43	215,000	1148.30	1172.28	23.98	16.41	30.89	1174.8	1175.1	699.58	1174.38	1174	**2.52**	**2.1**	***3.00***	More FB Required
232	404.08	2417.81	215,000	1148.15	1171.39	23.24	15.33	11.52	1173.84	1173.4	735.64	1173.92	1173.8	**2.45**	**2.53**	***3.00***	More FB Required
231	423.49	2013.73	215,000	1148.01	1170.37	22.36	14.82	21.08	1172.53	1172.6	780.88	1172.77	1172.6	**2.16**	**2.4**	***3.00***	More FB Required
230	374.2	1590.24	215,000	1147.85	1169.56	21.71	13.94	31.47	1172.16	1172.3	866.19	1172.91	1172.8	**2.6**	**3.35**	***3.00***	More FB Required
229	385.76	1216.04	215,000	1147.71	1169.56	21.85	11.21	15.77	1172.12	1172.2	1033.93	1174.61	1173	**2.56**	**5.05**	***3.00***	More FB Required
228	336.75	830.28	215,000	1147.57	1169.16	21.59	10.59	32.48	1172.27	1172.3	1114.72	1172.89	1172.4	**3.11**	**3.73**	***3.00***	Adequate
123.8	91	493.53	215,000	1147.44	1168.03	20.59	12.32	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**3.43**	**2.03**	***3.00***	More FB Required
123.7	402.53	402.53	215,000	1147.41	1167.18	19.77	12.94	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**4.28**	**2.88**	***3.00***	More FB Required
120.5	0	0	215,000	1147.26	1166.59	19.33	12.12	10.52	1173.02		1113.18	1172.4	1171.8	**6.43**	**5.81**	***3.00***	Adequate

Note: Bridge at 123.75

Q = 172,000 cfs

HEC-RAS Information								Freeboard									
River Sta	Reach L	Dist U/S	Q Total (cfs)	Min. Channel El.	WSEl	Y ft	V fps	Lt Sta	Lt El.	As-Built El.	Rt Sta	Rt El.	As-Built El.	Lt	Rt	Required ft	Comment
240	494.49	5909.93	172,000	1149.45	1176.26	26.81	7.56	27.32	1184.55	1184.6	1017.89	1182.96	1183	**8.29**	**6.7**	***3.00***	Adequate
239	472.4	5415.44	172,000	1149.26	1175.77	26.51	8.4	14.34	1184.02	1183.9	893.33	1180.67	1180.6	**8.25**	**4.9**	***3.00***	Adequate
238	525.6	4943.04	172,000	1149.09	1175.48	26.39	8.5	17.15	1182.96	1183.2	888.42	1181.17	1181.5	**7.48**	**5.69**	***3.00***	Adequate
237	396.31	4417.44	172,000	1148.89	1175.11	26.22	8.58	0	1181.89	1182.5	871.13	1180.99	1181	**6.78**	**5.88**	***3.00***	Adequate
236	401.91	4021.13	172,000	1148.75	1173.82	25.07	11.19	2.89	1181.93	1182.1	747.26	1179.16	1179	**8.11**	**5.34**	***3.00***	Adequate
235	404.66	3619.22	172,000	1148.60	1172.93	24.33	10.49	20.16	1181.79	1178.7	741.28	1179.23	1177.9	**8.86**	**6.3**	***3.00***	Adequate
234	405.13	3214.56	172,000	1148.45	1171.53	23.08	13.3	28.87	1176.39	1176.4	699.23	1176.92	1177	**4.86**	**5.39**	***3.00***	Adequate
233	391.62	2809.43	172,000	1148.30	1169.59	21.29	15	30.89	1174.8	1175.1	699.58	1174.38	1174	**5.21**	**4.79**	***3.00***	Adequate
232	404.08	2417.81	172,000	1148.15	1168.69	20.54	14.01	11.52	1173.84	1173.4	735.64	1173.92	1173.8	**5.15**	**5.23**	***3.00***	Adequate
231	423.49	2013.73	172,000	1148.01	1167.66	19.65	13.64	21.08	1172.53	1172.6	780.88	1172.77	1172.6	**4.87**	**5.11**	***3.00***	Adequate
230	374.2	1590.24	172,000	1147.85	1166.81	18.96	12.86	31.47	1172.16	1172.3	866.19	1172.91	1172.8	**5.35**	**6.1**	***3.00***	Adequate
229	385.76	1216.04	172,000	1147.71	1166.68	18.97	10.43	15.77	1172.12	1172.2	1033.93	1174.61	1173	**5.44**	**7.93**	***3.00***	Adequate
228	336.75	830.28	172,000	1147.57	1166.24	18.67	9.89	32.48	1172.27	1172.3	1114.72	1172.89	1172.4	**6.03**	**6.65**	***3.00***	Adequate
123.8	91	493.53	172,000	1147.44	1164.97	17.53	11.91	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**6.49**	**5.09**	***3.00***	Adequate
123.7	402.53	402.53	172,000	1147.41	1163.92	16.51	12.83	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**7.54**	**6.14**	***3.00***	Adequate
120.5	0	0	172,000	1147.26	1163.07	15.81	12.13	10.52	1173.02		1113.18	1172.4	1171.8	**9.95**	**9.33**	***3.00***	Adequate

Note: Bridge at 123.75

PREMIER
ENGINEERING CORPORATION

HEC-RAS Results and Freeboard
Salt River: McClintock-SR101L

Project: FCDMC On-Call
Subject: WSEL and Freeboard

By: KD
Date: Jun-00
Checked:
Premier Project No.: 9952

Equilibrium Slope Condition (n= 0.055)

Q = 215,000 cfs

HEC-RAS Information								Freeboard									
River Sta	Reach L	Dist U/S	Q Total (cfs)	Min. Channel El.	WSEl	Y ft	V fps	Lt Sta	Lt El.	As-Built El.	Rt Sta	Rt El.	As-Built El.	Lt	Rt	Required ft	Comment
240	494.49	5909.93	215,000	1149.45	1185.24	35.79	6.88	27.32	1184.55	1184.6	1017.89	1182.96	1183	-0.69	-2.28	*3.00*	More FB Required
239	472.4	5415.44	215,000	1149.26	1184.64	35.38	7.74	14.34	1184.02	1183.9	893.33	1180.67	1180.6	-0.62	-3.97	*3.00*	More FB Required
238	525.6	4943.04	215,000	1149.09	1184.27	35.18	7.78	17.15	1182.96	1183.2	888.42	1181.17	1181.5	-1.31	-3.1	*3.00*	More FB Required
237	396.31	4417.44	215,000	1148.89	1183.70	34.81	7.98	0	1181.89	1182.5	871.13	1180.99	1181	-1.81	-2.71	*3.00*	More FB Required
236	401.91	4021.13	215,000	1148.75	1182.36	33.61	10.21	2.89	1181.93	1182.1	747.26	1179.16	1179	-0.43	-3.2	*3.00*	More FB Required
235	404.66	3619.22	215,000	1148.60	1181.17	32.57	9.18	20.16	1181.79	1178.7	741.28	1179.23	1177.9	0.62	-1.94	*3.00*	More FB Required
234	405.13	3214.56	215,000	1148.45	1179.52	31.07	12.08	28.87	1176.39	1176.4	699.23	1176.92	1177	-3.13	-2.6	*3.00*	More FB Required
233	391.62	2809.43	215,000	1148.30	1177.41	29.11	13.23	30.89	1174.8	1175.1	699.58	1174.38	1174	-2.61	-3.03	*3.00*	More FB Required
232	404.08	2417.81	215,000	1148.15	1175.86	27.71	12.68	11.52	1173.84	1173.4	735.64	1173.92	1173.8	-2.02	-1.94	*3.00*	More FB Required
231	423.49	2013.73	215,000	1148.01	1174.20	26.19	12.53	21.08	1172.53	1172.6	780.88	1172.77	1172.6	-1.67	-1.43	*3.00*	More FB Required
230	374.2	1590.24	215,000	1147.85	1172.57	24.72	12.22	31.47	1172.16	1172.3	866.19	1172.91	1172.8	-0.41	0.34	*3.00*	More FB Required
229	385.76	1216.04	215,000	1147.71	1171.83	24.12	10.09	15.77	1172.12	1172.2	1033.93	1174.61	1173	0.29	2.78	*3.00*	More FB Required
228	336.75	830.28	215,000	1147.57	1170.89	23.32	9.75	32.48	1172.27	1172.3	1114.72	1172.89	1172.4	1.38	2	*3.00*	More FB Required
123.8	91	493.53	215,000	1147.44	1169.36	21.92	11.46	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	2.1	0.7	*3.00*	More FB Required
123.7	402.53	402.53	215,000	1147.41	1168.25	20.84	12.18	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	3.21	1.81	*3.00*	More FB Required
120.5	0	0	215,000	1147.26	1166.59	19.33	12.12	10.52	1173.02		1113.18	1172.4	1171.8	6.43	5.81	*3.00*	Adequate

Note: Bridge at 123.75

Q = 172,000 cfs

HEC-RAS Information								Freeboard									
River Sta	Reach L	Dist U/S	Q Total (cfs)	Min. Channel El.	WSEl	Y ft	V fps	Lt Sta	Lt El.	As-Built El.	Rt Sta	Rt El.	As-Built El.	Lt	Rt	Required ft	Comment
240	494.49	5909.93	172,000	1149.45	1181.32	31.87	6.25	27.32	1184.55	1184.6	1017.89	1182.96	1183	3.23	1.64	*3.00*	More FB Required
239	472.4	5415.44	172,000	1149.26	1180.78	31.52	7	14.34	1184.02	1183.9	893.33	1180.67	1180.6	3.24	-0.11	*3.00*	More FB Required
238	525.6	4943.04	172,000	1149.09	1180.42	31.33	7.06	17.15	1182.96	1183.2	888.42	1181.17	1181.5	2.54	0.75	*3.00*	More FB Required
237	396.31	4417.44	172,000	1148.89	1179.89	31.00	7.21	0	1181.89	1182.5	871.13	1180.99	1181	2	1.1	*3.00*	More FB Required
236	401.91	4021.13	172,000	1148.75	1178.73	29.98	9.24	2.89	1181.93	1182.1	747.26	1179.16	1179	3.2	0.43	*3.00*	More FB Required
235	404.66	3619.22	172,000	1148.60	1177.66	29.06	8.4	20.16	1181.79	1178.7	741.28	1179.23	1177.9	4.13	1.57	*3.00*	More FB Required
234	405.13	3214.56	172,000	1148.45	1176.21	27.76	10.9	28.87	1176.39	1176.4	699.23	1176.92	1177	0.18	0.71	*3.00*	More FB Required
233	391.62	2809.43	172,000	1148.30	1174.31	26.01	11.99	30.89	1174.8	1175.1	699.58	1174.38	1174	0.49	0.07	*3.00*	More FB Required
232	404.08	2417.81	172,000	1148.15	1172.86	24.71	11.47	11.52	1173.84	1173.4	735.64	1173.92	1173.8	0.98	1.06	*3.00*	More FB Required
231	423.49	2013.73	172,000	1148.01	1171.33	23.32	11.33	21.08	1172.53	1172.6	780.88	1172.77	1172.6	1.2	1.44	*3.00*	More FB Required
230	374.2	1590.24	172,000	1147.85	1169.81	21.96	11.01	31.47	1172.16	1172.3	866.19	1172.91	1172.8	2.35	3.1	*3.00*	More FB Required
229	385.76	1216.04	172,000	1147.71	1169.03	21.32	9.2	15.77	1172.12	1172.2	1033.93	1174.61	1173	3.09	5.58	*3.00*	Adequate
228	336.75	830.28	172,000	1147.57	1168.11	20.54	8.93	32.48	1172.27	1172.3	1114.72	1172.89	1172.4	4.16	4.78	*3.00*	Adequate
123.8	91	493.53	172,000	1147.44	1166.55	19.11	10.76	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	4.91	3.51	*3.00*	Adequate
123.7	402.53	402.53	172,000	1147.41	1165.38	17.97	11.59	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	6.08	4.68	*3.00*	Adequate
120.5	0	0	172,000	1147.26	1163.07	15.81	12.13	10.52	1173.02		1113.18	1172.4	1171.8	9.95	9.33	*3.00*	Adequate

Note: Bridge at 123.75

PREMIER
ENGINEERING CORPORATION

HEC-RAS Results and Freeboard
Salt River: McClintock-SR101L

Project: FCDMC On-Call
Subject: WSEL and Freeboard

By: KD
Date: Jun-00
Checked:
Premier Project No.: 9952

Equilibrium Slope Condition "strip n" value

Q = 215,000 cfs

HEC-RAS Information								Freeboard									
River Sta	Reach L	Dist U/S	Q Total (cfs)	Min. Channel El.	WSEl	Y ft	V fps	Lt Sta	Lt El.	As-Built El.	Rt Sta	Rt El.	As-Built El.	Lt	Rt	Required ft	Comment
240	494.49	5909.93	215,000	1149.45	1179.95	30.50	8.14	27.32	1184.55	1184.6	1017.89	1182.96	1183	**4.6**	**3.01**	***3.00***	Adequate
239	472.4	5415.44	215,000	1149.26	1179.42	30.16	9.08	14.34	1184.02	1183.9	893.33	1180.67	1180.6	**4.6**	**1.25**	***3.00***	More FB Required
238	525.6	4943.04	215,000	1149.09	1179.13	30.04	9.18	17.15	1182.96	1183.2	888.42	1181.17	1181.5	**3.83**	**2.04**	***3.00***	More FB Required
237	396.31	4417.44	215,000	1148.89	1178.73	29.84	9.33	0	1181.89	1182.5	871.13	1180.99	1181	**3.16**	**2.26**	***3.00***	More FB Required
236	401.91	4021.13	215,000	1148.75	1177.32	28.57	12.03	2.89	1181.93	1182.1	747.26	1179.16	1179	**4.61**	**1.84**	***3.00***	More FB Required
235	404.66	3619.22	215,000	1148.60	1176.35	27.75	11.49	20.16	1181.79	1178.7	741.28	1179.23	1177.9	**5.44**	**2.88**	***3.00***	More FB Required
234	405.13	3214.56	215,000	1148.45	1174.81	26.36	14.25	28.87	1176.39	1176.4	699.23	1176.92	1177	**1.58**	**2.11**	***3.00***	More FB Required
233	391.62	2809.43	215,000	1148.30	1172.73	24.43	15.9	30.89	1174.8	1175.1	699.58	1174.38	1174	**2.07**	**1.65**	***3.00***	More FB Required
232	404.08	2417.81	215,000	1148.15	1171.61	23.46	15.12	11.52	1173.84	1173.4	735.64	1173.92	1173.8	**2.23**	**2.31**	***3.00***	More FB Required
231	423.49	2013.73	215,000	1148.01	1170.40	22.39	14.68	21.08	1172.53	1172.6	780.88	1172.77	1172.6	**2.13**	**2.37**	***3.00***	More FB Required
230	374.2	1590.24	215,000	1147.85	1169.55	21.70	13.71	31.47	1172.16	1172.3	866.19	1172.91	1172.8	**2.61**	**3.36**	***3.00***	More FB Required
229	385.76	1216.04	215,000	1147.71	1169.49	21.78	11.25	15.77	1172.12	1172.2	1033.93	1174.61	1173	**2.63**	**5.12**	***3.00***	More FB Required
228	336.75	830.28	215,000	1147.57	1169.09	21.52	10.57	32.48	1172.27	1172.3	1114.72	1172.89	1172.4	**3.18**	**3.8**	***3.00***	Adequate
123.8	91	493.53	215,000	1147.44	1168.02	20.58	12.15	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**3.44**	**2.04**	***3.00***	More FB Required
123.7	402.53	402.53	215,000	1147.41	1167.18	19.77	12.77	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**4.28**	**2.88**	***3.00***	More FB Required
120.5	0	0	215,000	1147.26	1166.59	19.33	11.99	10.52	1173.02		1113.18	1172.4	1171.8	**6.43**	**5.81**	***3.00***	Adequate

Note: Bridge at 123.75

Q = 172,000 cfs

HEC-RAS Information								Freeboard									
River Sta	Reach L	Dist U/S	Q Total (cfs)	Min. Channel El.	WSEl	Y ft	V fps	Lt Sta	Lt El.	As-Built El.	Rt Sta	Rt El.	As-Built El.	Lt	Rt	Required ft	Comment
240	494.49	5909.93	172,000	1149.45	1176.51	27.06	7.44	27.32	1184.55	1184.6	1017.89	1182.96	1183	**8.04**	**6.45**	***3.00***	Adequate
239	472.4	5415.44	172,000	1149.26	1176.04	26.78	8.25	14.34	1184.02	1183.9	893.33	1180.67	1180.6	**7.98**	**4.63**	***3.00***	Adequate
238	525.6	4943.04	172,000	1149.09	1175.76	26.67	8.37	17.15	1182.96	1183.2	888.42	1181.17	1181.5	**7.2**	**5.41**	***3.00***	Adequate
237	396.31	4417.44	172,000	1148.89	1175.40	26.51	8.44	0	1181.89	1182.5	871.13	1180.99	1181	**6.49**	**5.59**	***3.00***	Adequate
236	401.91	4021.13	172,000	1148.75	1174.19	25.44	10.92	2.89	1181.93	1182.1	747.26	1179.16	1179	**7.74**	**4.97**	***3.00***	Adequate
235	404.66	3619.22	172,000	1148.60	1173.33	24.73	10.65	20.16	1181.79	1178.7	741.28	1179.23	1177.9	**8.46**	**5.9**	***3.00***	Adequate
234	405.13	3214.56	172,000	1148.45	1171.93	23.48	12.93	28.87	1176.39	1176.4	699.23	1176.92	1177	**4.46**	**4.99**	***3.00***	Adequate
233	391.62	2809.43	172,000	1148.30	1170.03	21.73	14.53	30.89	1174.8	1175.1	699.58	1174.38	1174	**4.77**	**4.35**	***3.00***	Adequate
232	404.08	2417.81	172,000	1148.15	1168.94	20.79	13.79	11.52	1173.84	1173.4	735.64	1173.92	1173.8	**4.9**	**4.98**	***3.00***	Adequate
231	423.49	2013.73	172,000	1148.01	1167.72	19.71	13.51	21.08	1172.53	1172.6	780.88	1172.77	1172.6	**4.81**	**5.05**	***3.00***	Adequate
230	374.2	1590.24	172,000	1147.85	1166.81	18.96	12.67	31.47	1172.16	1172.3	866.19	1172.91	1172.8	**5.35**	**6.1**	***3.00***	Adequate
229	385.76	1216.04	172,000	1147.71	1166.63	18.92	10.46	15.77	1172.12	1172.2	1033.93	1174.61	1173	**5.49**	**7.98**	***3.00***	Adequate
228	336.75	830.28	172,000	1147.57	1166.18	18.61	9.89	32.48	1172.27	1172.3	1114.72	1172.89	1172.4	**6.09**	**6.71**	***3.00***	Adequate
123.8	91	493.53	172,000	1147.44	1164.95	17.51	11.8	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**6.51**	**5.11**	***3.00***	Adequate
123.7	402.53	402.53	172,000	1147.41	1163.91	16.50	12.72	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**7.55**	**6.15**	***3.00***	Adequate
120.5	0	0	172,000	1147.26	1163.07	15.81	12.03	10.52	1173.02		1113.18	1172.4	1171.8	**9.95**	**9.33**	***3.00***	Adequate

Note: Bridge at 123.75

PREMIER
ENGINEERING CORPORATION

HEC-RAS Results and Freeboard
Salt River: McClintock-SR101L

Project: FCDMC On-Call
Subject: WSEL and Freeboard

By: KD
Date: Jun-00
Checked:
Premier Project No.: 9952

Equilibrium Slope Condition Max N (n = 0.029 & 0.042)

Q = 215,000 cfs

HEC-RAS Information								Freeboard									
River Sta	Reach L	Dist U/S	Q Total (cfs)	Min. Channel El.	WSEl	Y ft	V fps	Lt Sta	Lt El.	As-Built El.	Rt Sta	Rt El.	As-Built El.	Lt	Rt	Required ft	Comment
240	494.49	5909.93	215,000	1149.45	1178.00	28.55	8.82	27.32	1184.55	1184.6	1017.89	1182.96	1183	**6.55**	**4.96**	***3.00***	Adequate
239	472.4	5415.44	215,000	1149.26	1177.46	28.20	9.83	14.34	1184.02	1183.9	893.33	1180.67	1180.6	**6.56**	**3.21**	***3.00***	Adequate
238	525.6	4943.04	215,000	1149.09	1177.20	28.11	9.93	17.15	1182.96	1183.2	888.42	1181.17	1181.5	**5.76**	**3.97**	***3.00***	Adequate
237	396.31	4417.44	215,000	1148.89	1176.86	27.97	10.03	0	1181.89	1182.5	871.13	1180.99	1181	**5.03**	**4.13**	***3.00***	Adequate
236	401.91	4021.13	215,000	1148.75	1175.27	26.52	13.17	2.89	1181.93	1182.1	747.26	1179.16	1179	**6.66**	**3.89**	***3.00***	Adequate
235	404.66	3619.22	215,000	1148.60	1174.33	25.73	12.23	20.16	1181.79	1178.7	741.28	1179.23	1177.9	**7.46**	**4.9**	***3.00***	Adequate
234	405.13	3214.56	215,000	1148.45	1172.74	24.29	15.74	28.87	1176.39	1176.4	699.23	1176.92	1177	**3.65**	**4.18**	***3.00***	Adequate
233	391.62	2809.43	215,000	1148.30	1170.44	22.14	17.94	30.89	1174.8	1175.1	699.58	1174.38	1174	**4.36**	**3.94**	***3.00***	Adequate
232	404.08	2417.81	215,000	1148.15	1169.88	21.73	16.48	11.52	1173.84	1173.4	735.64	1173.92	1173.8	**3.96**	**4.04**	***3.00***	Adequate
231	423.49	2013.73	215,000	1148.01	1169.14	21.13	15.76	21.08	1172.53	1172.6	780.88	1172.77	1172.6	**3.39**	**3.63**	***3.00***	Adequate
230	374.2	1590.24	215,000	1147.85	1168.66	20.81	14.58	31.47	1172.16	1172.3	866.19	1172.91	1172.8	**3.5**	**4.25**	***3.00***	Adequate
229	385.76	1216.04	215,000	1147.71	1168.93	21.22	11.56	15.77	1172.12	1172.2	1033.93	1174.61	1173	**3.19**	**5.68**	***3.00***	Adequate
228	336.75	830.28	215,000	1147.57	1168.70	21.13	10.83	32.48	1172.27	1172.3	1114.72	1172.89	1172.4	**3.57**	**4.19**	***3.00***	Adequate
123.8	91	493.53	215,000	1147.44	1167.70	20.26	12.56	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**3.76**	**2.36**	***3.00***	More FB Required
123.7	402.53	402.53	215,000	1147.41	1166.92	19.51	13.15	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**4.54**	**3.14**	***3.00***	Adequate
120.5	0	0	215,000	1147.26	1166.59	19.33	12.12	10.52	1173.02		1113.18	1172.4	1171.8	**6.43**	**5.81**	***3.00***	Adequate

Note: Bridge at 123.75

Q = 172,000 cfs

HEC-RAS Information								Freeboard									
River Sta	Reach L	Dist U/S	Q Total (cfs)	Min. Channel El.	WSEl	Y ft	V fps	Lt Sta	Lt El.	As-Built El.	Rt Sta	Rt El.	As-Built El.	Lt	Rt	Required ft	Comment
240	494.49	5909.93	172,000	1149.45	1178.09	28.64	7.03	27.32	1184.55	1184.6	1017.89	1182.96	1183	**6.46**	**4.87**	***3.00***	Adequate
239	472.4	5415.44	172,000	1149.26	1177.59	28.33	7.83	14.34	1184.02	1183.9	893.33	1180.67	1180.6	**6.43**	**3.08**	***3.00***	Adequate
238	525.6	4943.04	172,000	1149.09	1177.27	28.18	7.92	17.15	1182.96	1183.2	888.42	1181.17	1181.5	**5.69**	**3.9**	***3.00***	Adequate
237	396.31	4417.44	172,000	1148.89	1176.83	27.94	8.03	0	1181.89	1182.5	871.13	1180.99	1181	**5.06**	**4.16**	***3.00***	Adequate
236	401.91	4021.13	172,000	1148.75	1175.61	26.86	10.39	2.89	1181.93	1182.1	747.26	1179.16	1179	**6.32**	**3.55**	***3.00***	Adequate
235	404.66	3619.22	172,000	1148.60	1174.65	26.05	9.63	20.16	1181.79	1178.7	741.28	1179.23	1177.9	**7.14**	**4.58**	***3.00***	Adequate
234	405.13	3214.56	172,000	1148.45	1173.24	24.79	12.31	28.87	1176.39	1176.4	699.23	1176.92	1177	**3.15**	**3.68**	***3.00***	Adequate
233	391.62	2809.43	172,000	1148.30	1171.36	23.06	13.71	30.89	1174.8	1175.1	699.58	1174.38	1174	**3.44**	**3.02**	***3.00***	Adequate
232	404.08	2417.81	172,000	1148.15	1170.23	22.08	12.96	11.52	1173.84	1173.4	735.64	1173.92	1173.8	**3.61**	**3.69**	***3.00***	Adequate
231	423.49	2013.73	172,000	1148.01	1168.99	20.98	12.7	21.08	1172.53	1172.6	780.88	1172.77	1172.6	**3.54**	**3.78**	***3.00***	Adequate
230	374.2	1590.24	172,000	1147.85	1167.87	20.02	12.15	31.47	1172.16	1172.3	866.19	1172.91	1172.8	**4.29**	**5.04**	***3.00***	Adequate
229	385.76	1216.04	172,000	1147.71	1167.48	19.77	9.98	15.77	1172.12	1172.2	1033.93	1174.61	1173	**4.64**	**7.13**	***3.00***	Adequate
228	336.75	830.28	172,000	1147.57	1166.85	19.28	9.56	32.48	1172.27	1172.3	1114.72	1172.89	1172.4	**5.42**	**6.04**	***3.00***	Adequate
123.8	91	493.53	172,000	1147.44	1165.46	18.02	11.52	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**6**	**4.6**	***3.00***	Adequate
123.7	402.53	402.53	172,000	1147.41	1164.36	16.95	12.43	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**7.1**	**5.7**	***3.00***	Adequate
120.5	0	0	172,000	1147.26	1163.07	15.81	12.13	10.52	1173.02		1113.18	1172.4	1171.8	**9.95**	**9.33**	***3.00***	Adequate

Note: Bridge at 123.75

PREMIER
ENGINEERING CORPORATION

HEC-RAS Results and Freeboard
Salt River: McClintock-SR101L

Project: FCDMC On-Call
Subject: WSEL and Freeboard

By: KD
Date: Jun-00
Checked:
Premier Project No.: 9952

Equilibrium Slope Condition Max N for Overtopping

Q = 215,000 cfs

HEC-RAS Information								Freeboard									
River Sta	Reach L	Dist U/S	Q Total (cfs)	Min. Channel El.	WSEl	Y ft	V fps	Lt Sta	Lt El.	As-Built El.	Rt Sta	Rt El.	As-Built El.	Lt	Rt	Required ft	Comment
240	494.49	5909.93	215,000	1149.45	1181.15	31.70	7.86	27.32	1184.55	1184.6	1017.89	1182.96	1183	**3.4**	**1.81**	***3.00***	More FB Required
239	472.4	5415.44	215,000	1149.26	1180.58	31.32	8.79	14.34	1184.02	1183.9	893.33	1180.67	1180.6	**3.44**	**0.09**	***3.00***	More FB Required
238	525.6	4943.04	215,000	1149.09	1180.26	31.17	8.87	17.15	1182.96	1183.2	888.42	1181.17	1181.5	**2.7**	**0.91**	***3.00***	More FB Required
237	396.31	4417.44	215,000	1148.89	1179.80	30.91	9.04	0	1181.89	1182.5	871.13	1180.99	1181	**2.09**	**1.19**	***3.00***	More FB Required
236	401.91	4021.13	215,000	1148.75	1178.36	29.61	11.71	2.89	1181.93	1182.1	747.26	1179.16	1179	**3.57**	**0.8**	***3.00***	More FB Required
235	404.66	3619.22	215,000	1148.60	1177.30	28.70	10.66	20.16	1181.79	1178.7	741.28	1179.23	1177.9	**4.49**	**1.93**	***3.00***	More FB Required
234	405.13	3214.56	215,000	1148.45	1175.74	27.29	13.88	28.87	1176.39	1176.4	699.23	1176.92	1177	**0.65**	**1.18**	***3.00***	More FB Required
233	391.62	2809.43	215,000	1148.30	1173.67	25.37	15.41	30.89	1174.8	1175.1	699.58	1174.38	1174	**1.13**	**0.71**	***3.00***	More FB Required
232	404.08	2417.81	215,000	1148.15	1172.57	24.42	14.53	11.52	1173.84	1173.4	735.64	1173.92	1173.8	**1.27**	**1.35**	***3.00***	More FB Required
231	423.49	2013.73	215,000	1148.01	1171.37	23.36	14.14	21.08	1172.53	1172.6	780.88	1172.77	1172.6	**1.16**	**1.4**	***3.00***	More FB Required
230	374.2	1590.24	215,000	1147.85	1170.32	22.47	13.44	31.47	1172.16	1172.3	866.19	1172.91	1172.8	**1.84**	**2.59**	***3.00***	More FB Required
229	385.76	1216.04	215,000	1147.71	1170.11	22.40	10.92	15.77	1172.12	1172.2	1033.93	1174.61	1173	**2.01**	**4.5**	***3.00***	More FB Required
228	336.75	830.28	215,000	1147.57	1169.57	22.00	10.38	32.48	1172.27	1172.3	1114.72	1172.89	1172.4	**2.7**	**3.32**	***3.00***	More FB Required
123.8	91	493.53	215,000	1147.44	1168.34	20.90	12.11	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**3.12**	**1.72**	***3.00***	More FB Required
123.7	402.53	402.53	215,000	1147.41	1167.43	20.02	12.76	68.75	1171.46	1172.1	1179.7	1170.06	1170.2	**4.03**	**2.63**	***3.00***	More FB Required
120.5	0	0	215,000	1147.26	1166.59	19.33	12.12	10.52	1173.02		1113.18	1172.4	1171.8	**6.43**	**5.81**	***3.00***	Adequate

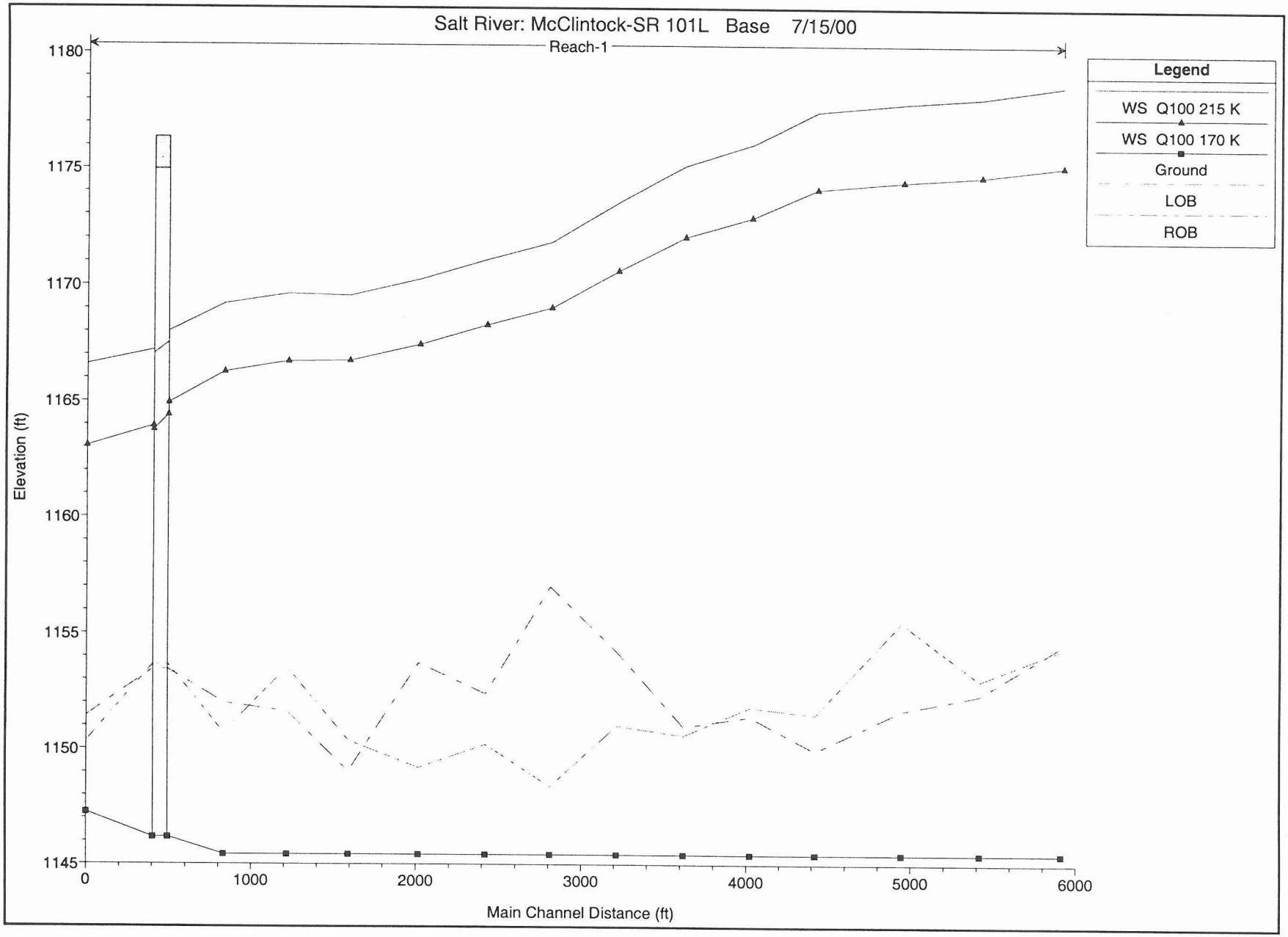
Note: Bridge at 123.75

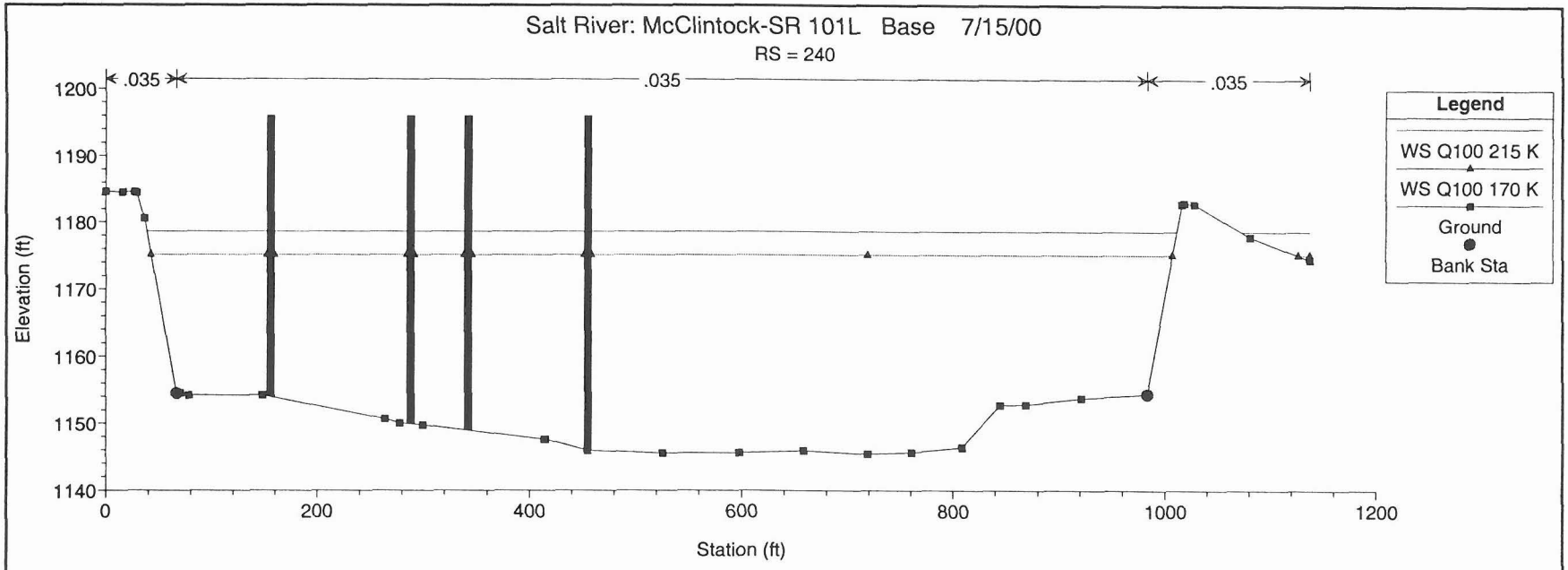
Q_{100} = 215,000 cfs and 172,000 cfs, Survyed Topo, n = 0.035

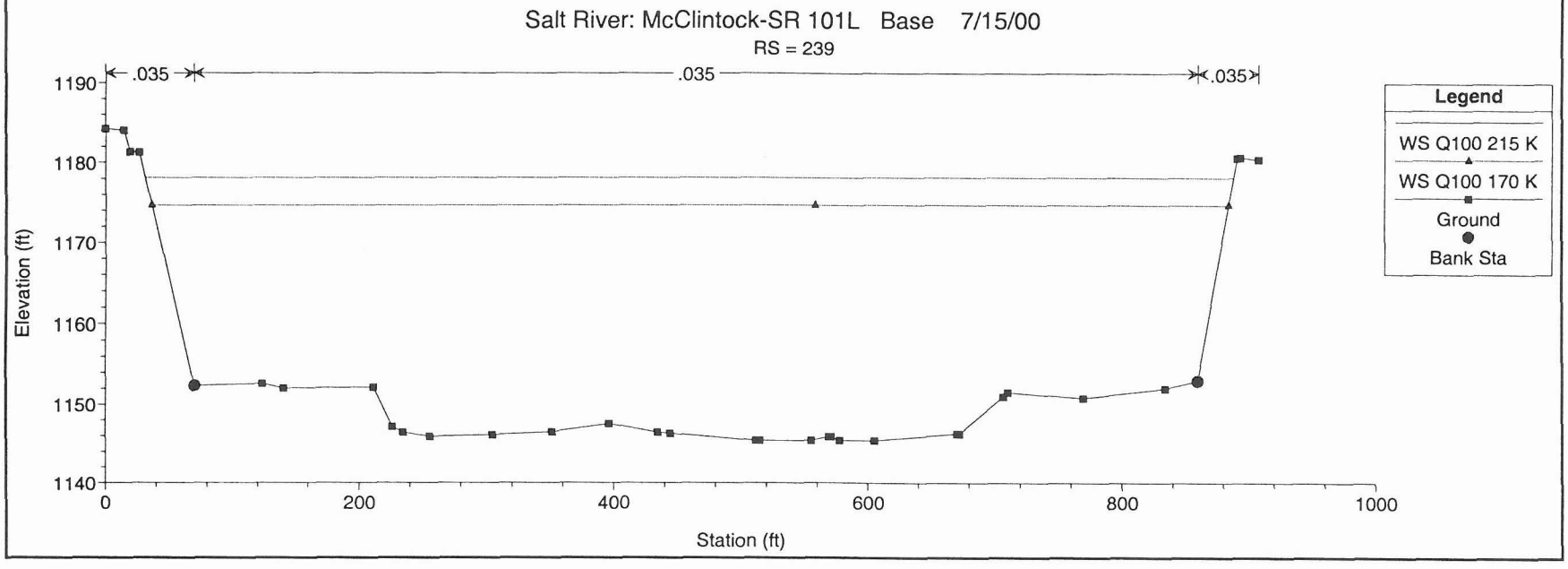
Plan Title: Base

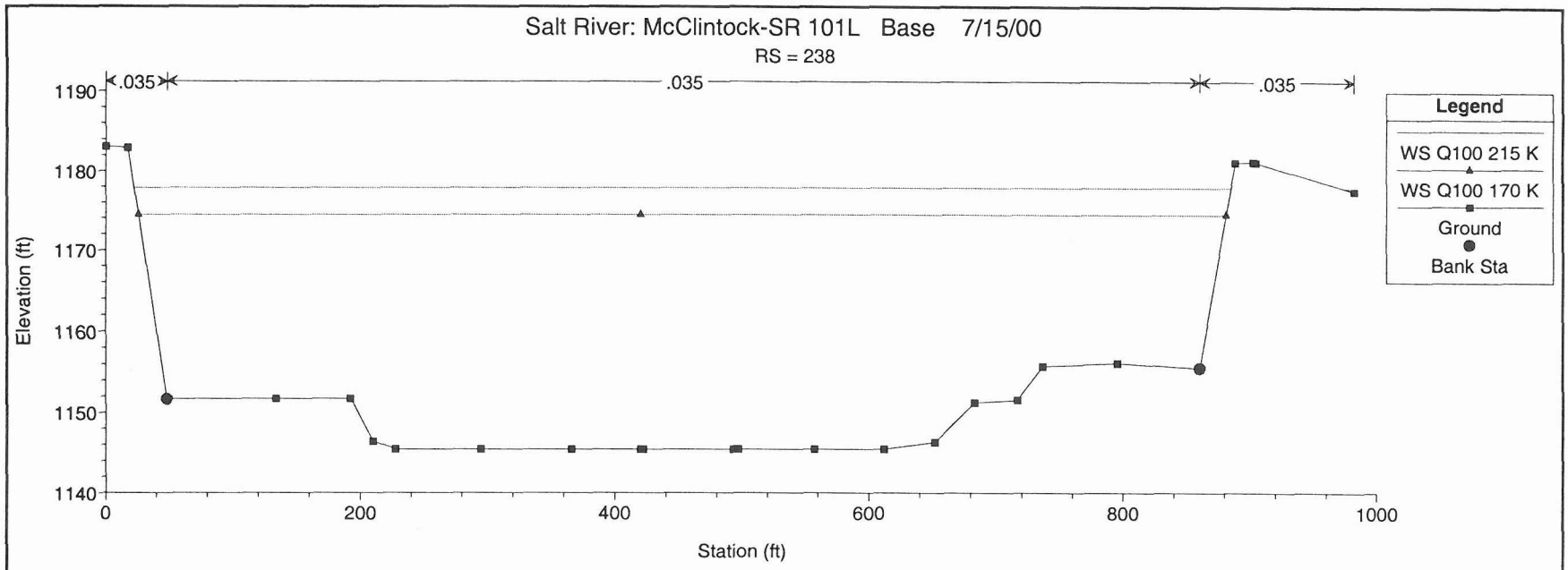
HEC-RAS Plan: Base River: RIVER-1 Reach: Reach-1

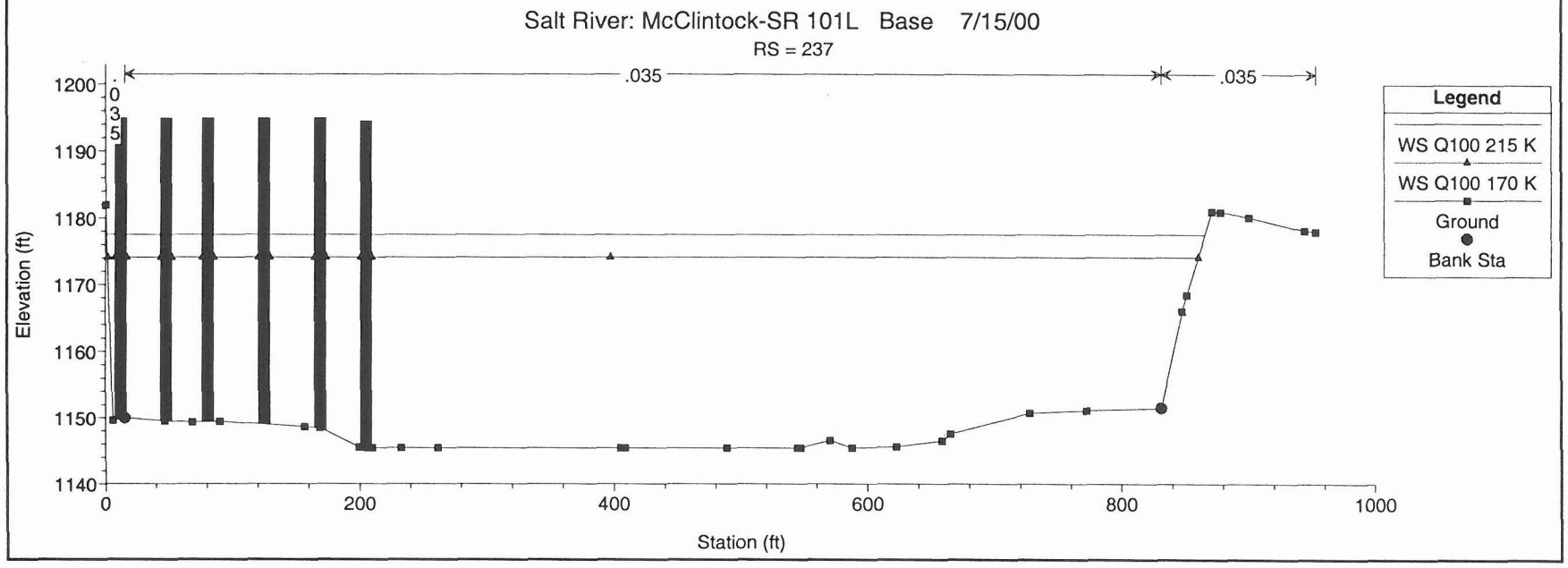
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	240	215000.00	1145.43	1178.63		1179.64	0.000547	8.11	26955.60	1008.93	0.26
Reach-1	240	172000.00	1145.43	1175.12		1175.96	0.000521	7.39	23516.27	946.89	0.26
Reach-1	239	215000.00	1145.43	1178.12		1179.36	0.000491	9.01	24309.79	857.10	0.29
Reach-1	239	172000.00	1145.43	1174.67		1175.70	0.000476	8.18	21371.22	848.01	0.28
Reach-1	238	215000.00	1145.43	1177.88		1179.13	0.000505	9.01	24210.41	870.41	0.29
Reach-1	238	172000.00	1145.43	1174.44		1175.47	0.000494	8.19	21251.06	855.34	0.29
Reach-1	237	215000.00	1145.43	1177.52		1178.80	0.000776	9.12	23846.78	810.86	0.29
Reach-1	237	172000.00	1145.43	1174.11		1175.16	0.000708	8.23	21096.63	804.88	0.28
Reach-1	236	215000.00	1145.43	1176.09		1178.30	0.001423	12.02	18168.64	682.80	0.40
Reach-1	236	172000.00	1145.43	1172.88		1174.71	0.001324	10.90	15991.76	675.80	0.39
Reach-1	235	215000.00	1145.43	1175.14		1177.64	0.001754	11.45	17144.60	673.07	0.37
Reach-1	235	172000.00	1145.43	1172.04		1174.09	0.001654	10.65	15071.47	666.02	0.37
Reach-1	234	215000.00	1145.43	1173.53		1176.74	0.002439	14.48	15072.33	626.54	0.51
Reach-1	234	172000.00	1145.43	1170.60		1173.25	0.002281	13.16	13247.33	619.17	0.49
Reach-1	233	215000.00	1145.43	1171.82		1175.57	0.003104	15.63	13932.02	626.26	0.57
Reach-1	233	172000.00	1145.43	1169.03		1172.16	0.002955	14.27	12191.39	619.80	0.56
Reach-1	232	215000.00	1145.43	1171.07		1174.32	0.002549	14.56	15010.69	676.67	0.53
Reach-1	232	172000.00	1145.43	1168.29		1170.99	0.002402	13.25	13144.70	655.31	0.51
Reach-1	231	215000.00	1145.43	1170.23		1173.25	0.002432	14.01	15529.24	718.11	0.52
Reach-1	231	172000.00	1145.43	1167.44		1169.98	0.002356	12.84	13535.20	711.53	0.51
Reach-1	230	215000.00	1145.43	1169.54		1172.19	0.002059	13.21	16625.98	780.28	0.49
Reach-1	230	172000.00	1145.43	1166.73		1168.97	0.001997	12.13	14451.62	766.93	0.48
Reach-1	229	215000.00	1145.43	1169.62		1171.32	0.001259	10.51	20680.88	957.61	0.39
Reach-1	229	172000.00	1145.43	1166.70		1168.15	0.001253	9.69	17906.93	948.22	0.39
Reach-1	228	215000.00	1145.43	1169.20	1159.40	1170.82	0.001185	10.28	21199.56	1032.78	0.39
Reach-1	228	172000.00	1145.43	1166.25	1157.81	1167.67	0.001220	9.57	18177.44	1021.34	0.39
Reach-1	123.8	215000.00	1146.17	1168.01	1161.40	1170.28	0.001684	12.28	18113.51	1067.98	0.50
Reach-1	123.8	172000.00	1146.17	1164.93	1159.75	1167.07	0.001999	11.87	14887.73	1033.45	0.53
Reach-1	123.75	Bridge									
Reach-1	123.7	215000.00	1146.17	1167.19	1161.40	1169.70	0.001960	12.86	17250.37	1053.81	0.54
Reach-1	123.7	172000.00	1146.17	1163.93	1159.75	1166.40	0.002511	12.72	13855.13	1023.22	0.59
Reach-1	120.5	215000.00	1147.26	1166.59	1160.10	1168.83	0.001720	12.12	18114.22	1066.26	0.50
Reach-1	120.5	172000.00	1147.26	1163.07	1158.53	1165.32	0.002302	12.13	14406.35	1040.47	0.56

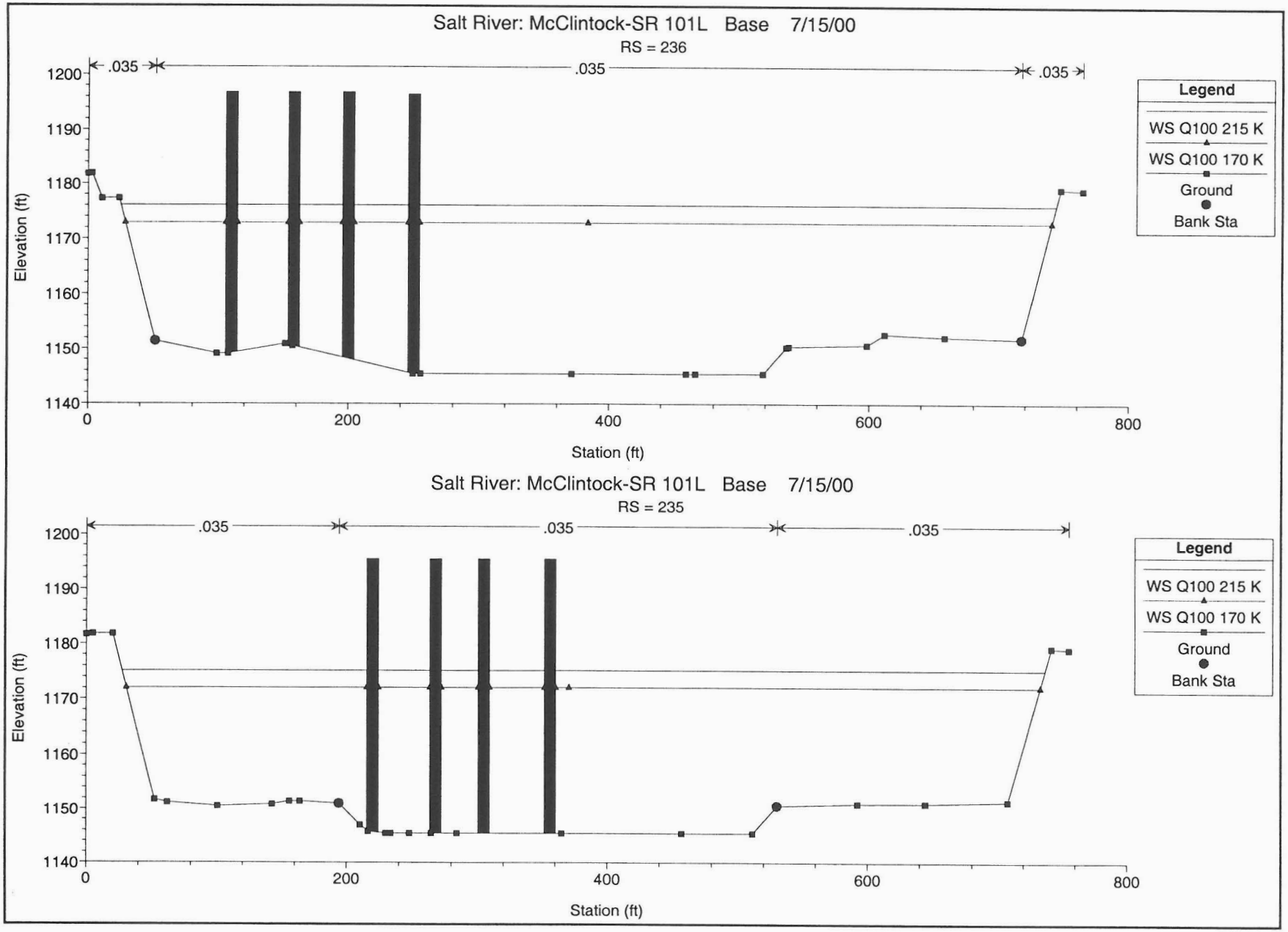

Salt River: McClintock-SR 101L Base 7/15/00
Reach-1
Legend
WS Q100 215 K
WS Q100 170 K
Ground
LOB
ROB
Elevation (ft)
1180
1175
1170
1165
1160
1155
1150
1145
0
1000
2000
3000
4000
5000
6000
Main Channel Distance (ft)

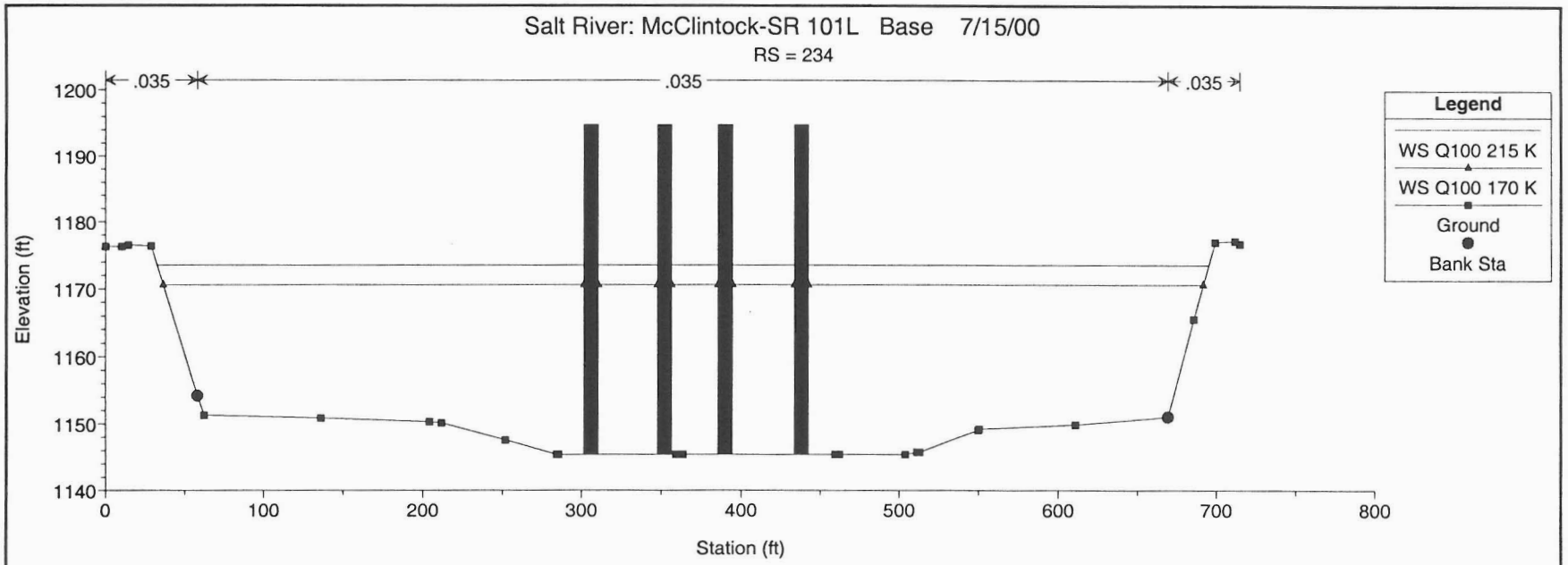

Salt River: McClintock-SR 101L Base 7/15/00
RS = 240
.035
.035
.035
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

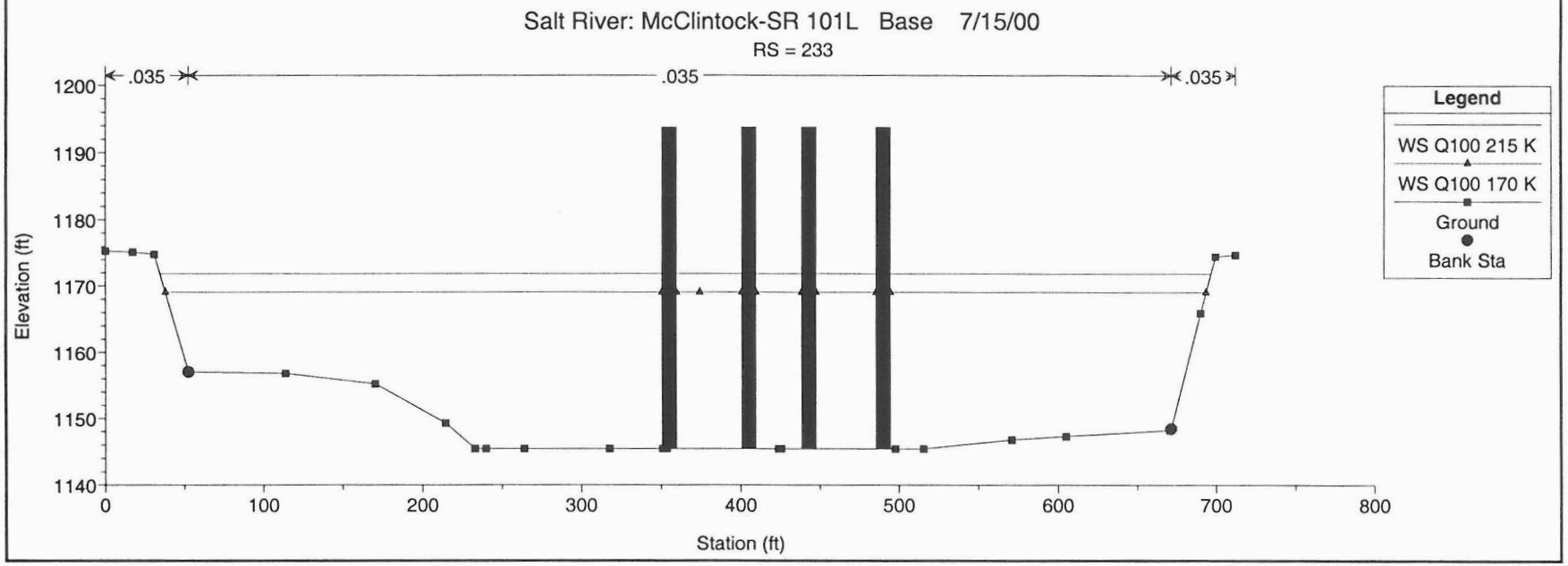

Salt River: McClintock-SR 101L Base 7/15/00
RS = 239
.035
.035
.035
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

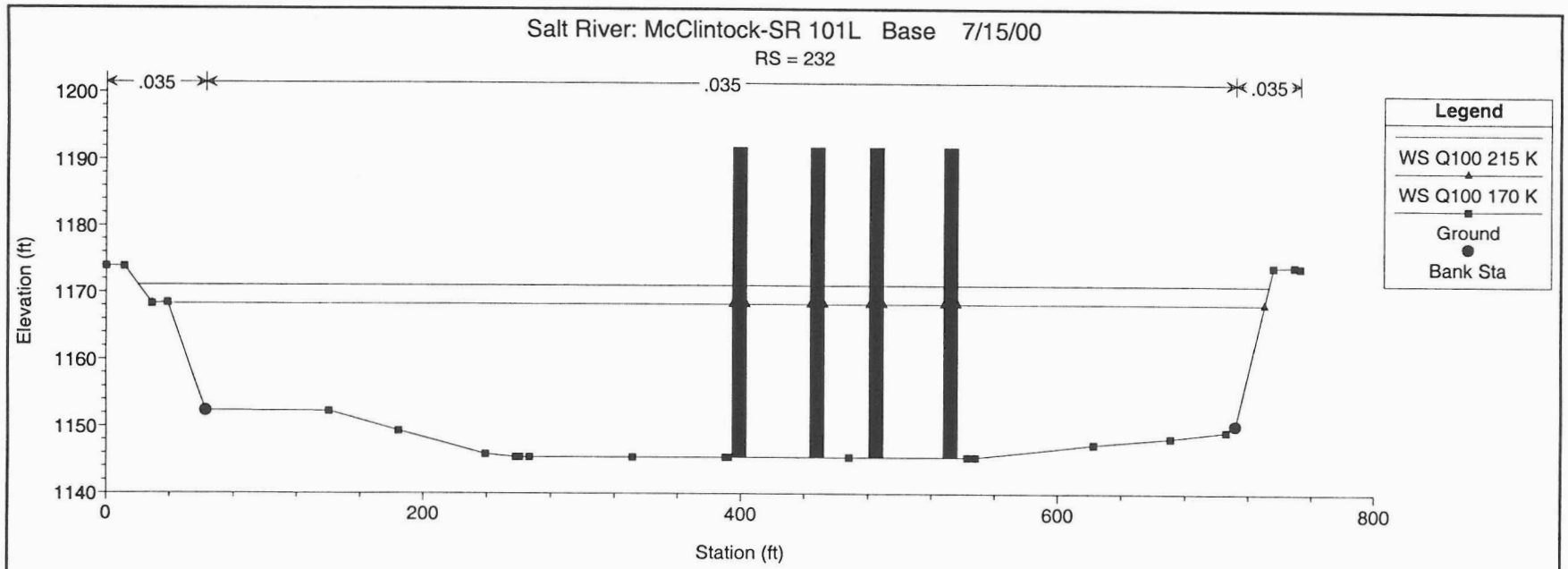

Salt River: McClintock-SR 101L Base 7/15/00
RS = 238
.035
.035
.035
Elevation (ft)
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

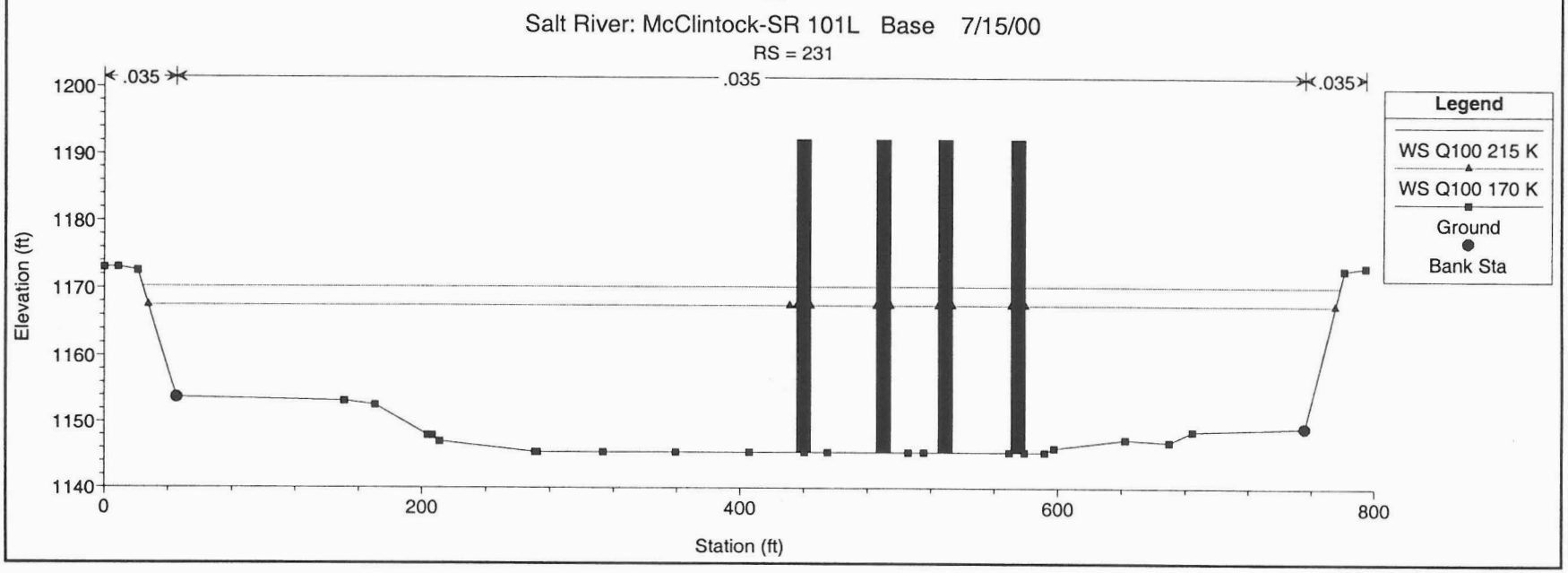

Salt River: McClintock-SR 101L Base 7/15/00
RS = 237
.035
.035
.035
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

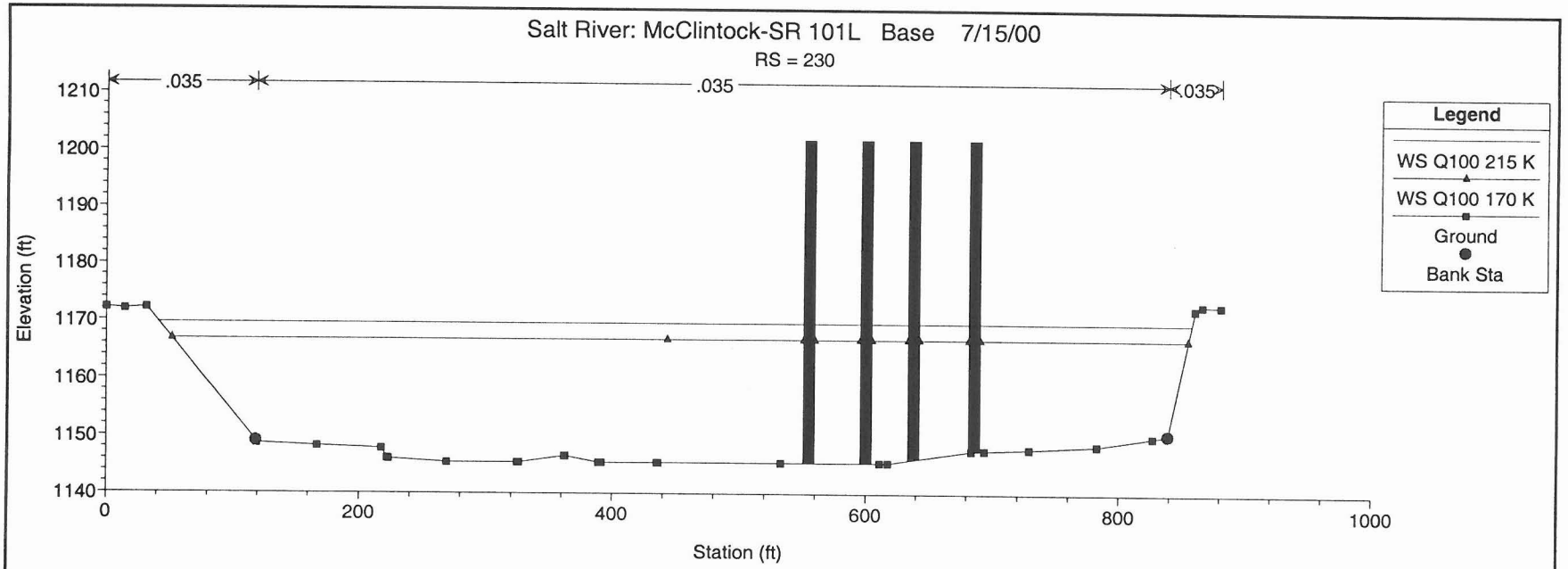

Salt River: McClintock-SR 101L Base 7/15/00
RS = 236
.035
.035
.035
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta
Salt River: McClintock-SR 101L Base 7/15/00
RS = 235
.035
.035
.035
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

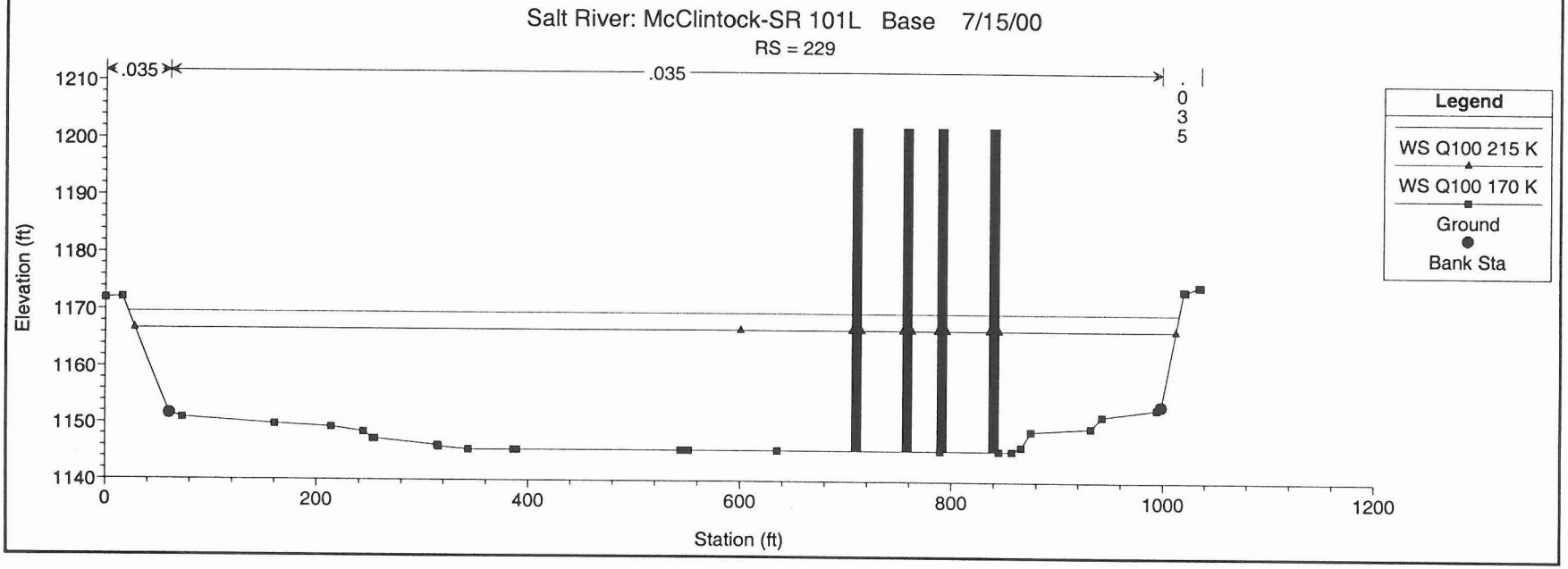

Salt River: McClintock-SR 101L Base 7/15/00
RS = 234
.035
.035
.035
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

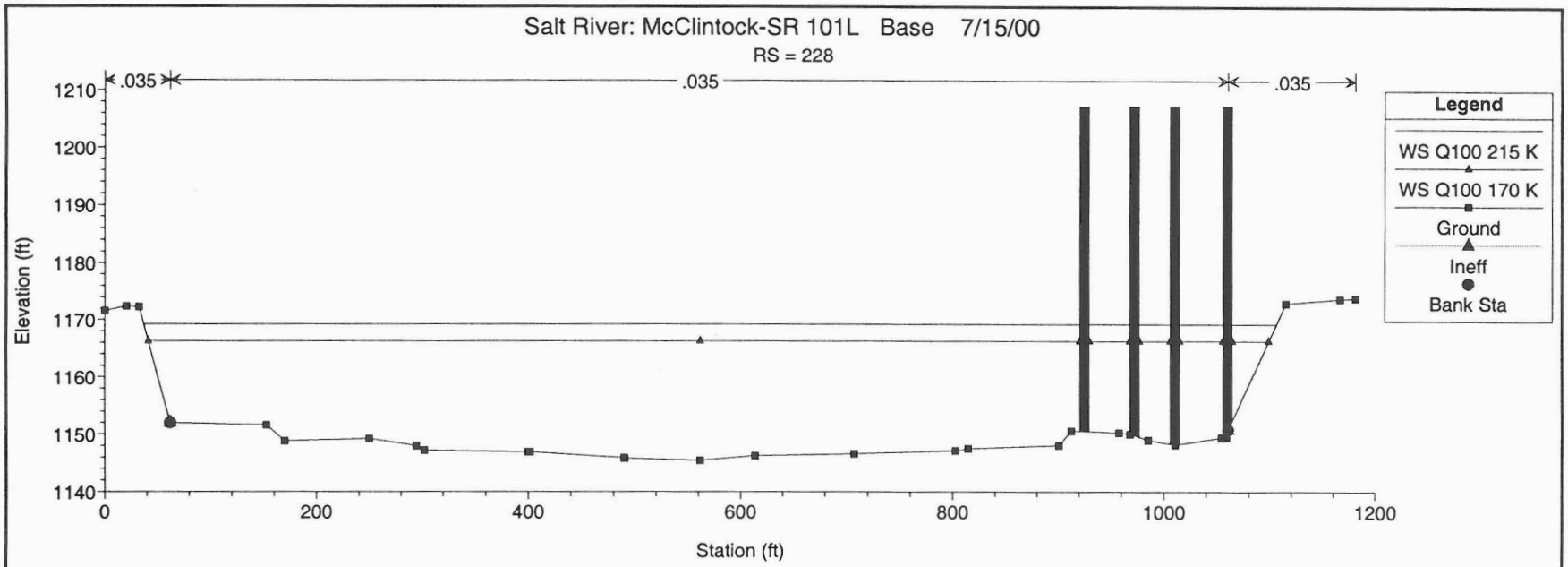

Salt River: McClintock-SR 101L Base 7/15/00
RS = 233
.035
.035
.035
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

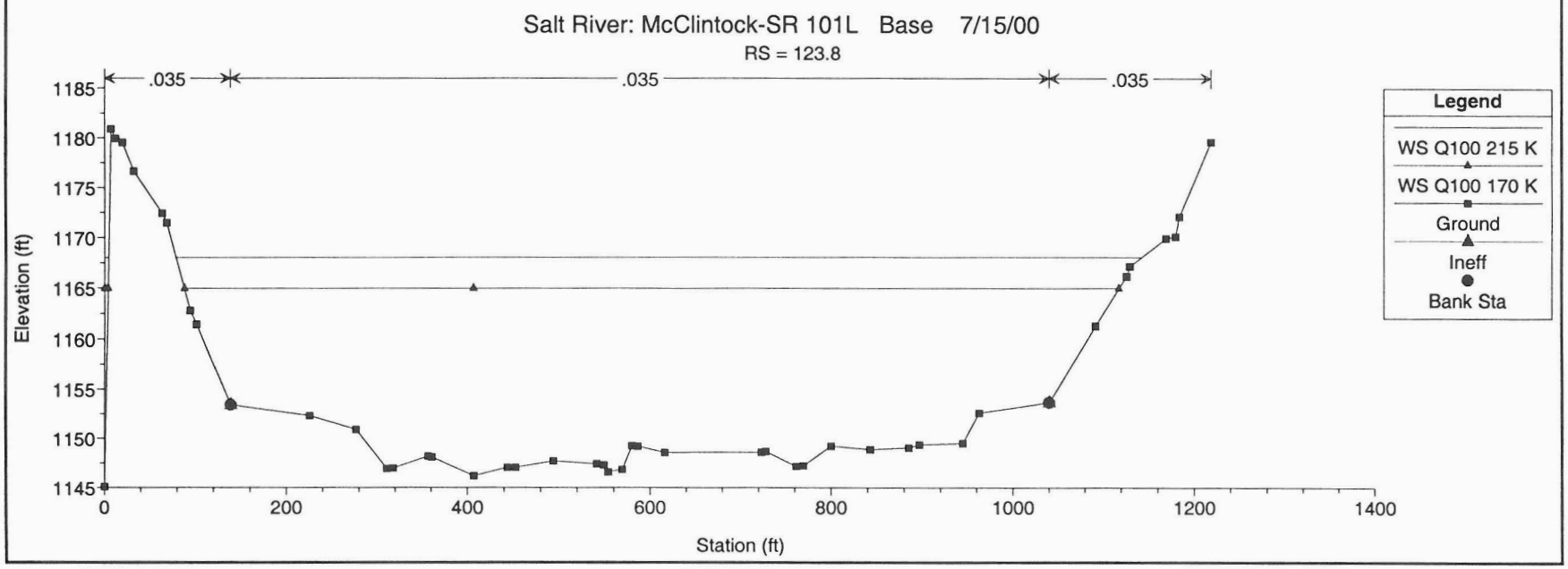

Salt River: McClintock-SR 101L Base 7/15/00
RS = 232
.035
.035
.035
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

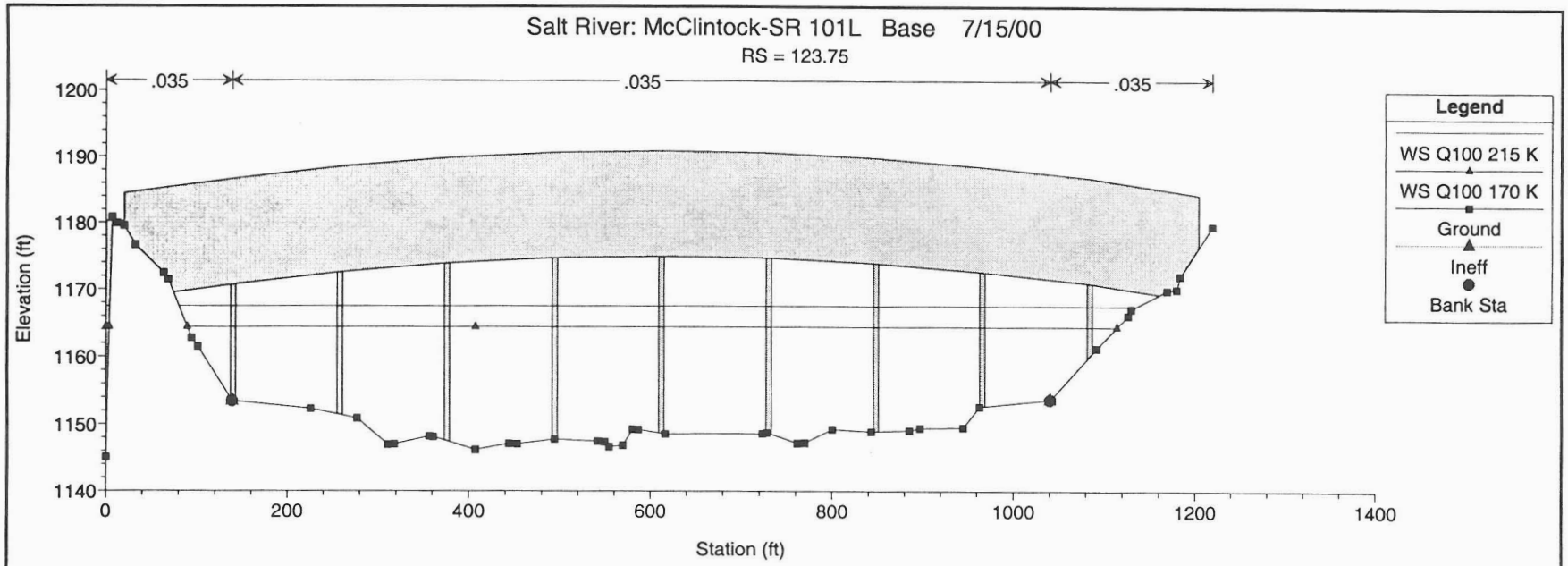

Salt River: McClintock-SR 101L Base 7/15/00
RS = 231
.035
.035
.035
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

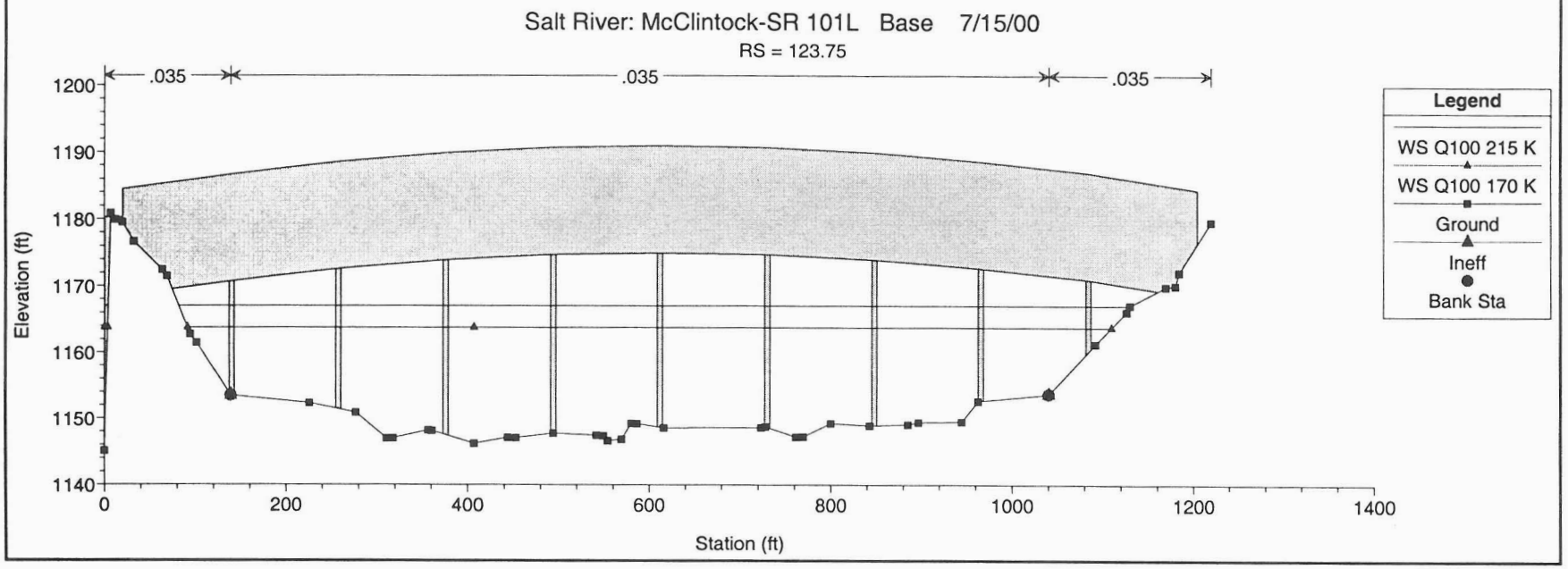

Salt River: McClintock-SR 101L Base 7/15/00
RS = 230
.035
.035
.035
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)

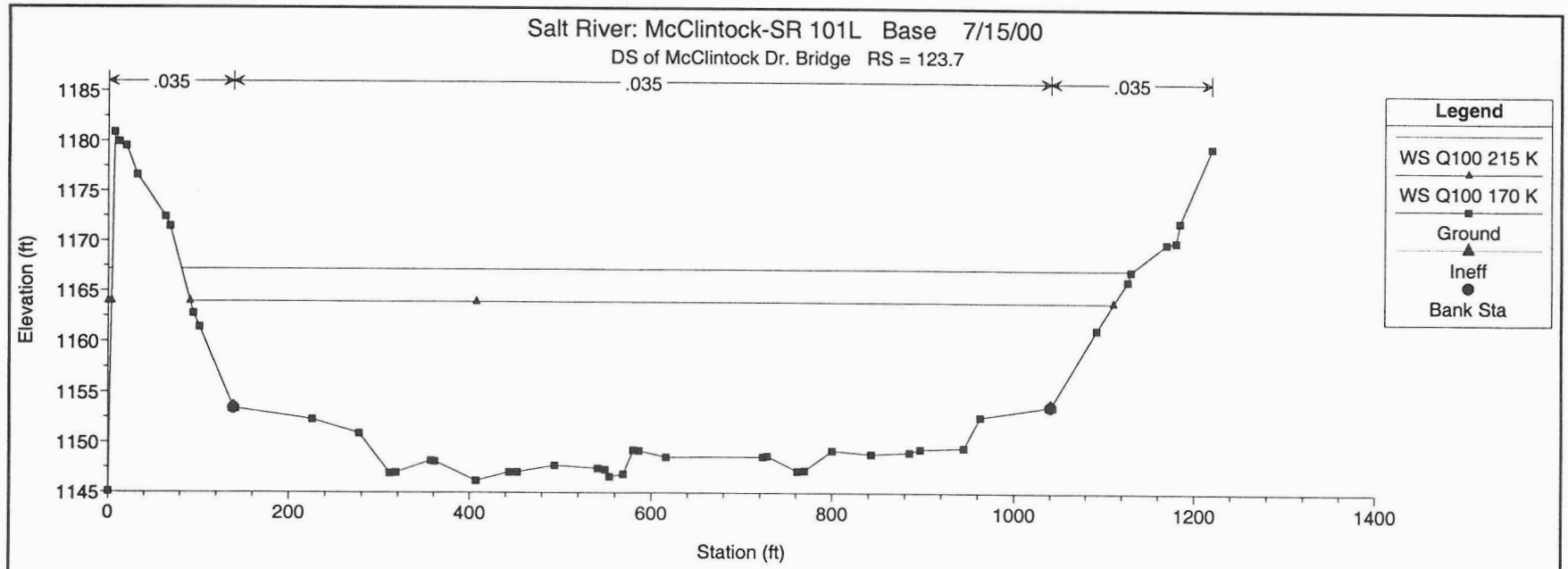

Salt River: McClintock-SR 101L Base 7/15/00
RS = 229
.035
.035
.035
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)

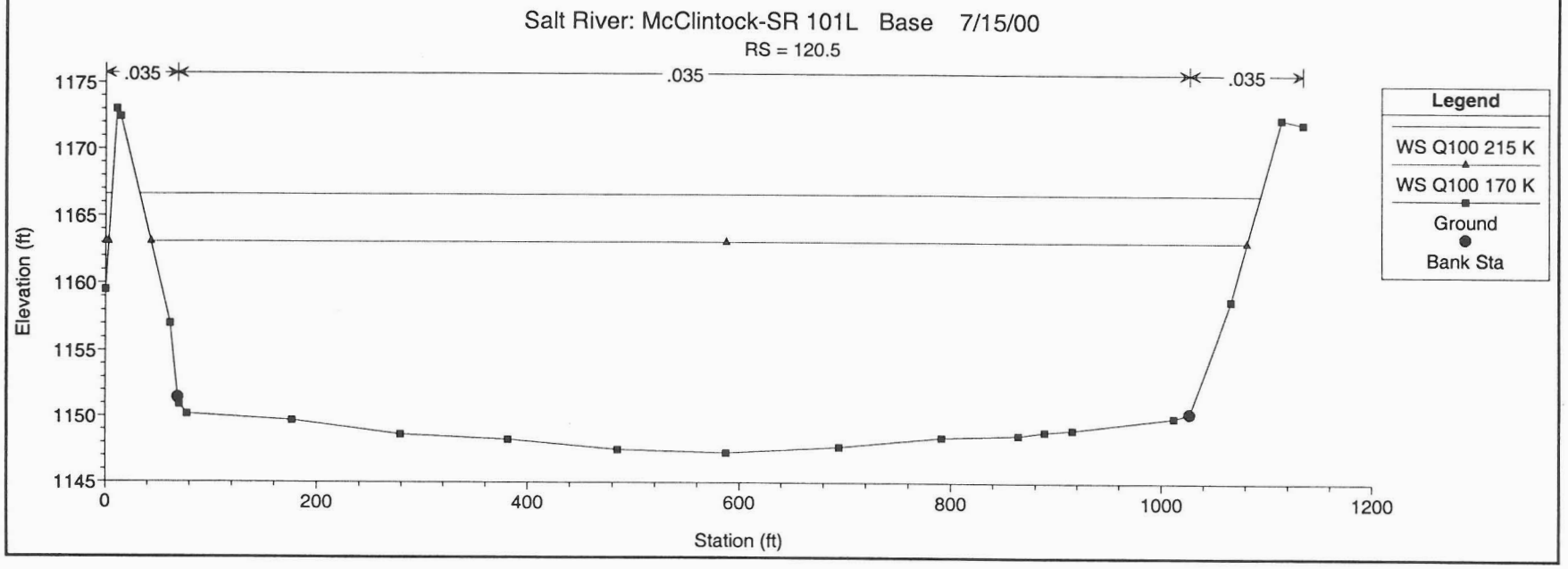

Salt River: McClintock-SR 101L Base 7/15/00
RS = 228
.035
.035
.035
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base 7/15/00
RS = 123.8
.035
.035
.035
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base 7/15/00
RS = 123.75
.035
.035
.035
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base 7/15/00
RS = 123.75
.035
.035
.035
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base 7/15/00
DS of McClintock Dr. Bridge RS = 123.7
.035
.035
.035
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta

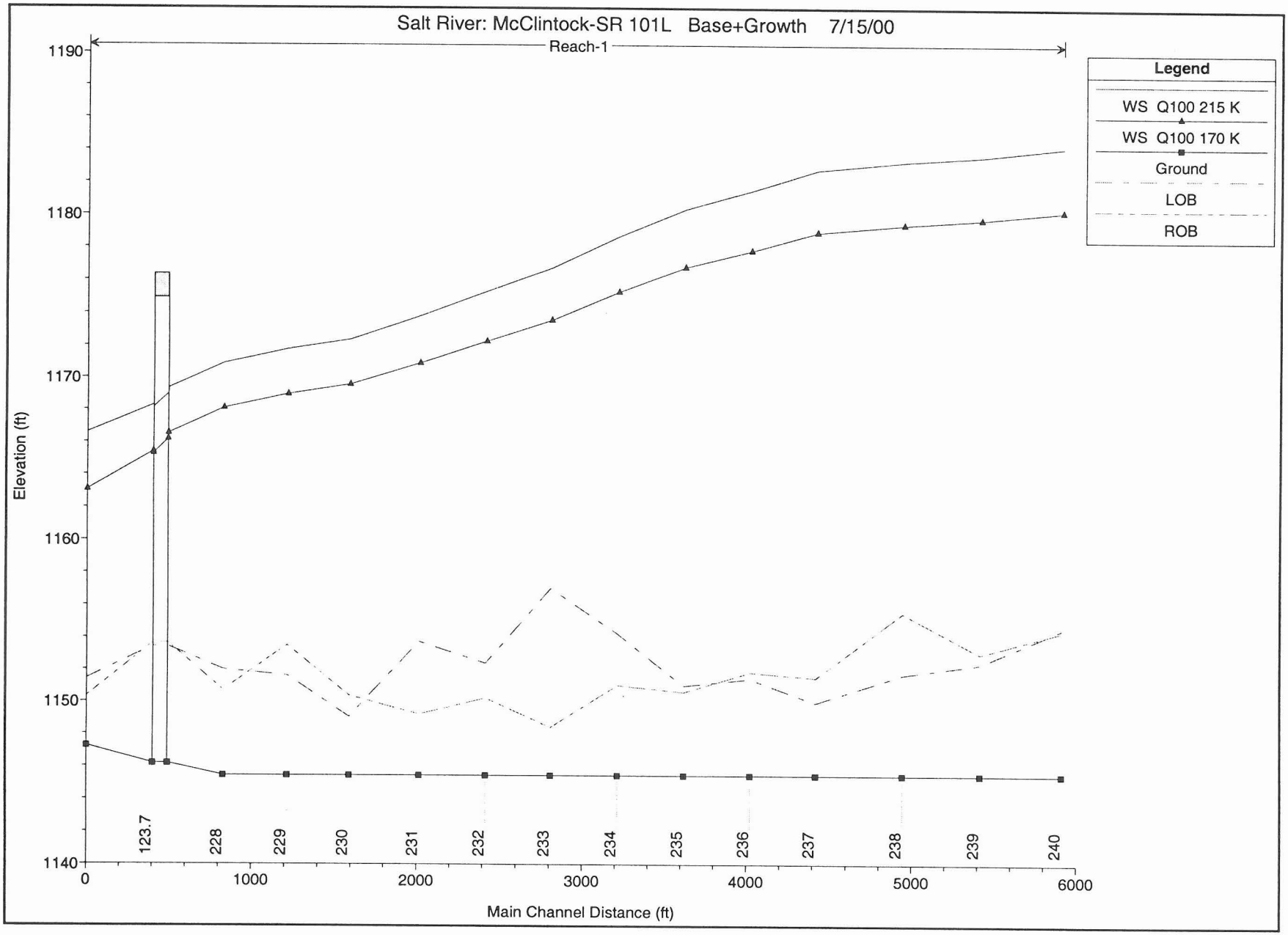

Salt River: McClintock-SR 101L Base 7/15/00
RS = 120.5
.035
.035
.035
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

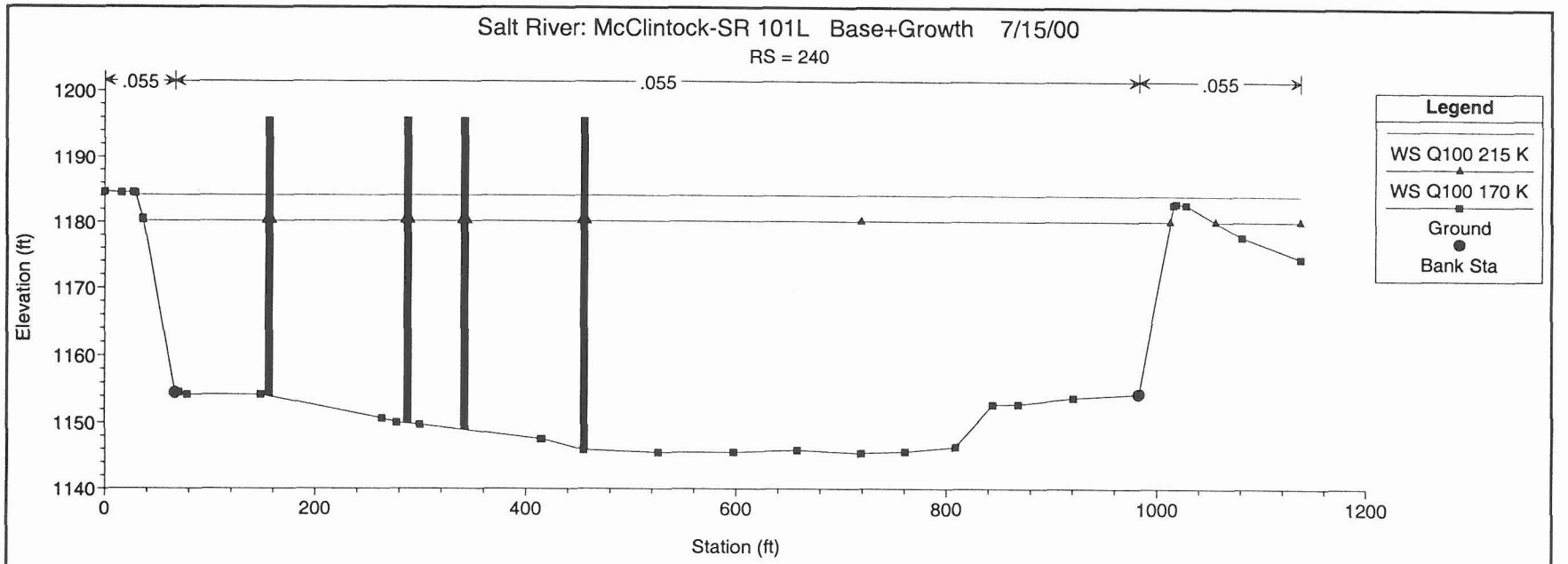
Q_{100} = 215,000 cfs and 172,000 cfs, Survyed Topo, n = 0.055
(Max Growth Condition)

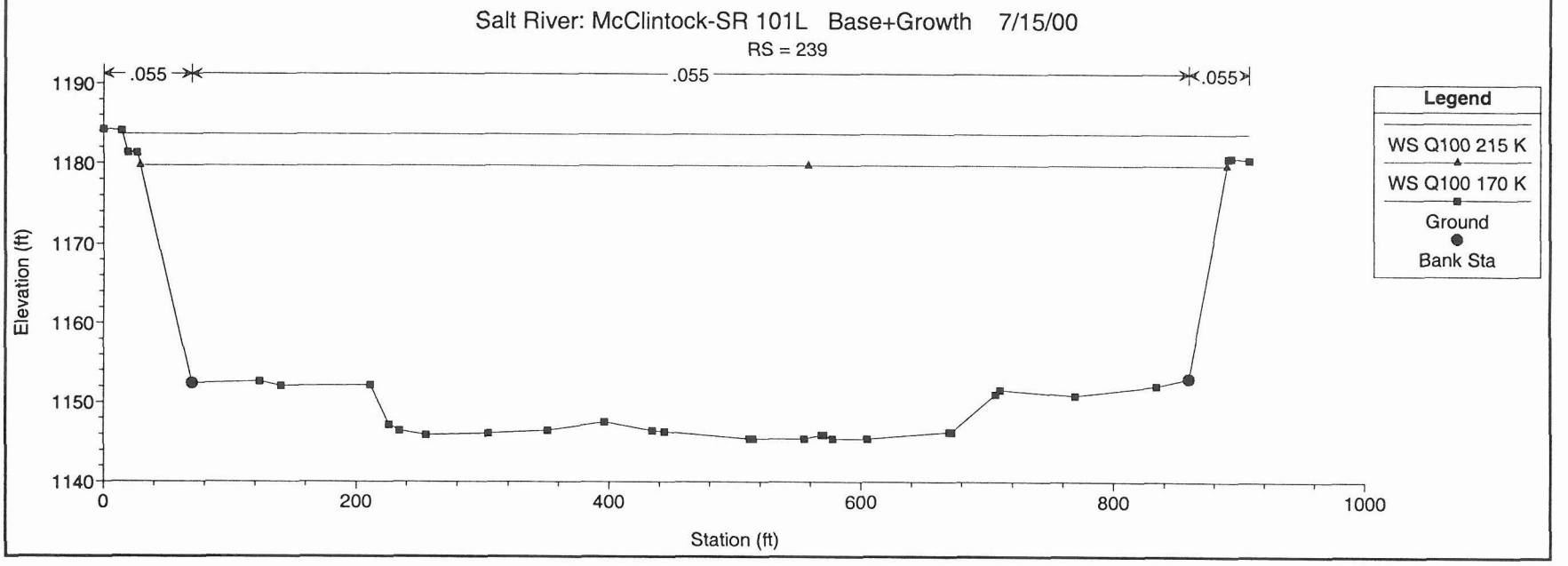
Plan Title: Base+Growth

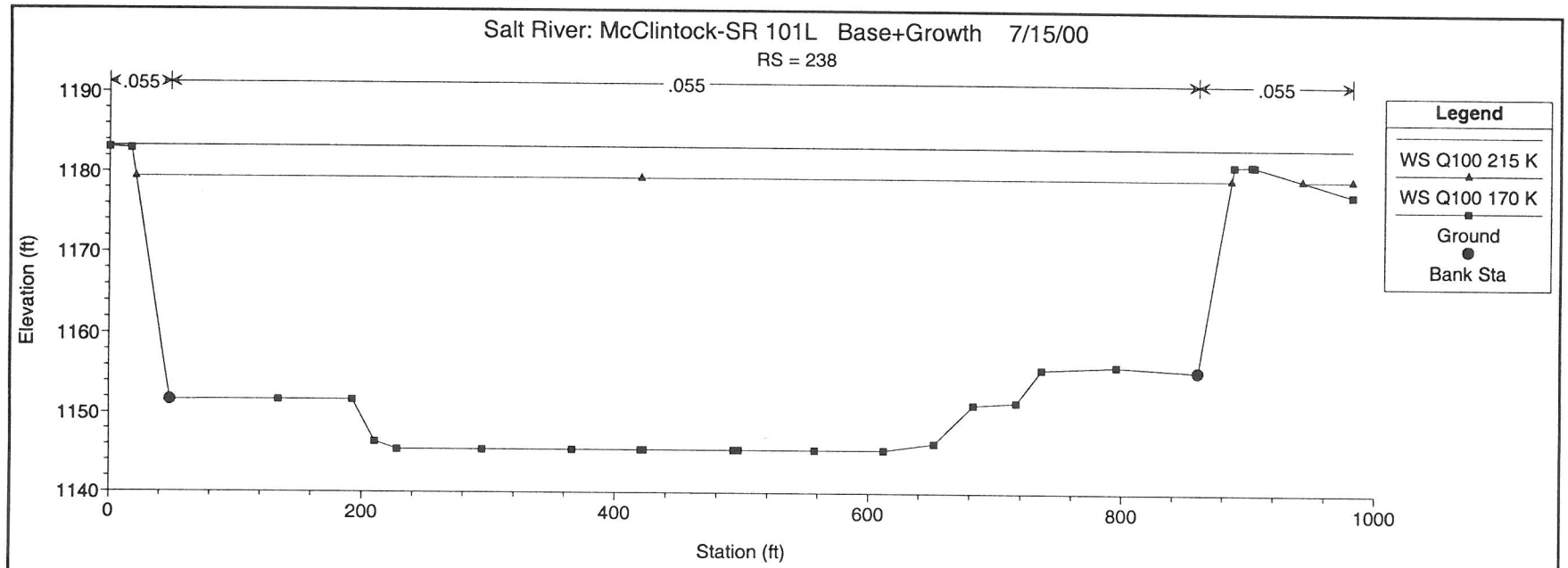
HEC-RAS Plan: Base River: RIVER-1 Reach: Reach-1

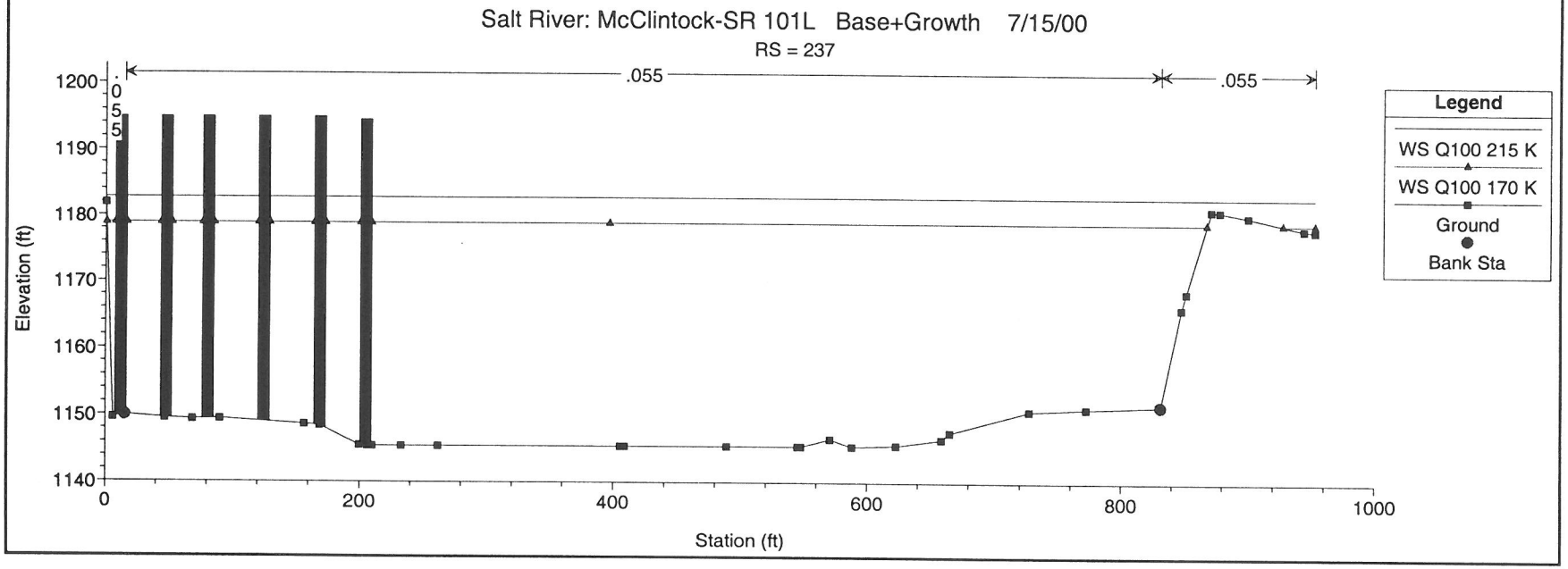
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	240	215000.00	1145.43	1184.16		1184.85	0.000787	6.76	32737.21	1079.37	0.20
Reach-1	240	172000.00	1145.43	1180.18		1180.76	0.000736	6.15	28531.01	1029.24	0.19
Reach-1	239	215000.00	1145.43	1183.60		1184.47	0.000684	7.58	29106.94	892.56	0.23
Reach-1	239	172000.00	1145.43	1179.69		1180.40	0.000651	6.83	25656.55	861.24	0.22
Reach-1	238	215000.00	1145.43	1183.27		1184.15	0.000703	7.58	29225.00	981.75	0.23
Reach-1	238	172000.00	1145.43	1179.37		1180.09	0.000674	6.85	25532.46	905.18	0.22
Reach-1	237	215000.00	1145.43	1182.75		1183.67	0.001200	7.75	28369.83	899.07	0.23
Reach-1	237	172000.00	1145.43	1178.90		1179.64	0.001075	6.97	24980.37	838.78	0.22
Reach-1	236	215000.00	1145.43	1181.47		1182.99	0.002059	10.02	21971.41	724.81	0.31
Reach-1	236	172000.00	1145.43	1177.79		1179.04	0.001884	9.06	19337.66	699.97	0.29
Reach-1	235	215000.00	1145.43	1180.33		1182.06	0.002533	9.29	20683.84	697.14	0.28
Reach-1	235	172000.00	1145.43	1176.77		1178.19	0.002301	8.52	18248.37	676.79	0.27
Reach-1	234	215000.00	1145.43	1178.64		1180.83	0.003449	11.98	18396.61	678.80	0.38
Reach-1	234	172000.00	1145.43	1175.30		1177.08	0.003133	10.80	16184.56	630.98	0.37
Reach-1	233	215000.00	1145.43	1176.73		1179.25	0.004275	12.85	17101.39	676.21	0.43
Reach-1	233	172000.00	1145.43	1173.57		1175.64	0.003924	11.60	15030.15	630.31	0.41
Reach-1	232	215000.00	1145.43	1175.31		1177.60	0.003789	12.27	17947.55	716.88	0.41
Reach-1	232	172000.00	1145.43	1172.26		1174.14	0.003458	11.07	15817.71	681.56	0.39
Reach-1	231	215000.00	1145.43	1173.82		1176.05	0.003816	12.07	18148.15	758.50	0.42
Reach-1	231	172000.00	1145.43	1170.89		1172.71	0.003511	10.88	16006.10	719.68	0.40
Reach-1	230	215000.00	1145.43	1172.36		1174.45	0.003569	11.75	18850.00	825.71	0.41
Reach-1	230	172000.00	1145.43	1169.56		1171.25	0.003249	10.56	16634.07	780.33	0.39
Reach-1	229	215000.00	1145.43	1171.77		1173.18	0.002326	9.56	22752.05	964.57	0.34
Reach-1	229	172000.00	1145.43	1168.94		1170.10	0.002192	8.67	20035.18	955.43	0.33
Reach-1	228	215000.00	1145.43	1170.89	1159.40	1172.28	0.002292	9.51	22956.67	1039.37	0.35
Reach-1	228	172000.00	1145.43	1168.09	1157.81	1169.25	0.002222	8.69	20055.46	1028.46	0.34
Reach-1	123.8	215000.00	1146.17	1169.34	1161.40	1171.31	0.003280	11.42	19556.86	1091.25	0.45
Reach-1	123.8	172000.00	1146.17	1166.52	1159.75	1168.26	0.003538	10.72	16540.78	1048.23	0.45
Reach-1	123.75	Bridge									
Reach-1	123.7	215000.00	1146.17	1168.27	1161.40	1170.48	0.003962	12.10	18397.68	1072.60	0.49
Reach-1	123.7	172000.00	1146.17	1165.40	1159.71	1167.41	0.004463	11.51	15370.36	1038.19	0.51
Reach-1	120.5	215000.00	1147.26	1166.59	1160.10	1168.83	0.004249	12.12	18114.22	1066.26	0.50
Reach-1	120.5	172000.00	1147.26	1163.07	1158.53	1165.32	0.005684	12.13	14406.35	1040.47	0.56

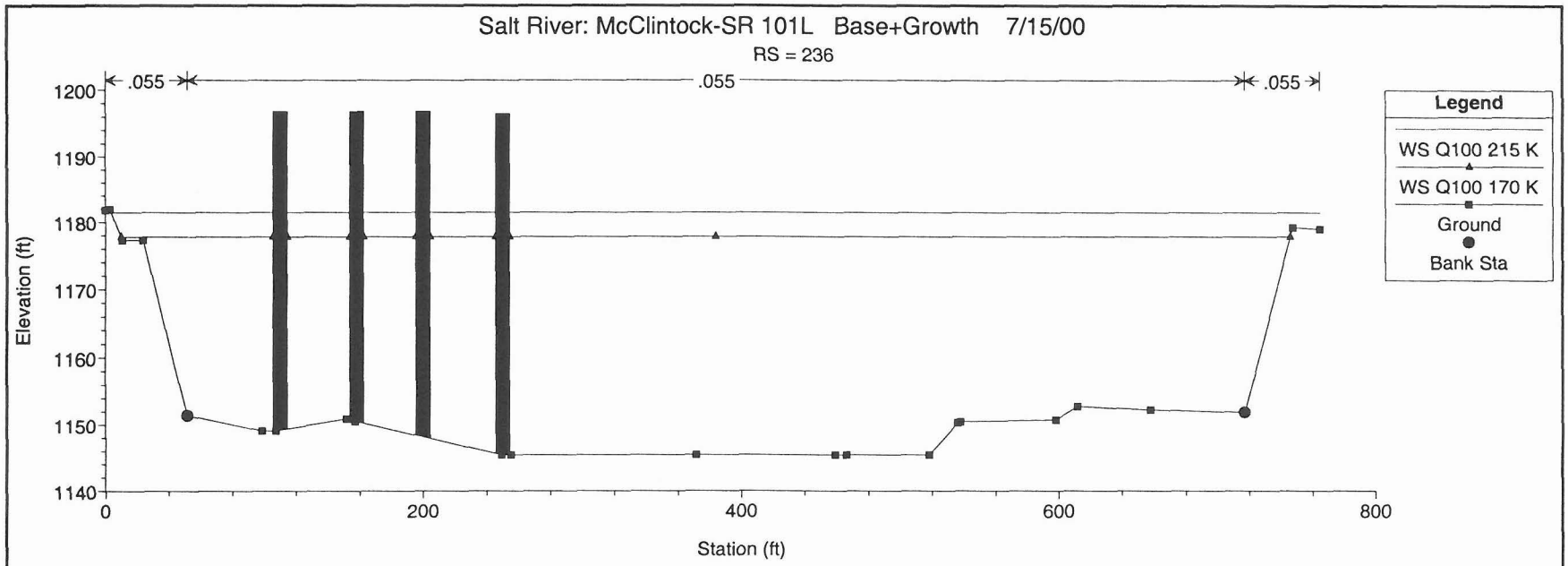

Salt River: McClintock-SR 101L Base+Growth 7/15/00
Reach-1
Legend
WS Q100 215 K
WS Q100 170 K
Ground
LOB
ROB
Elevation (ft)
1190
1180
1170
1160
1150
1140
0
1000
2000
3000
4000
5000
6000
Main Channel Distance (ft)
123.7
228
229
230
231
232
233
234
235
236
237
238
239
240

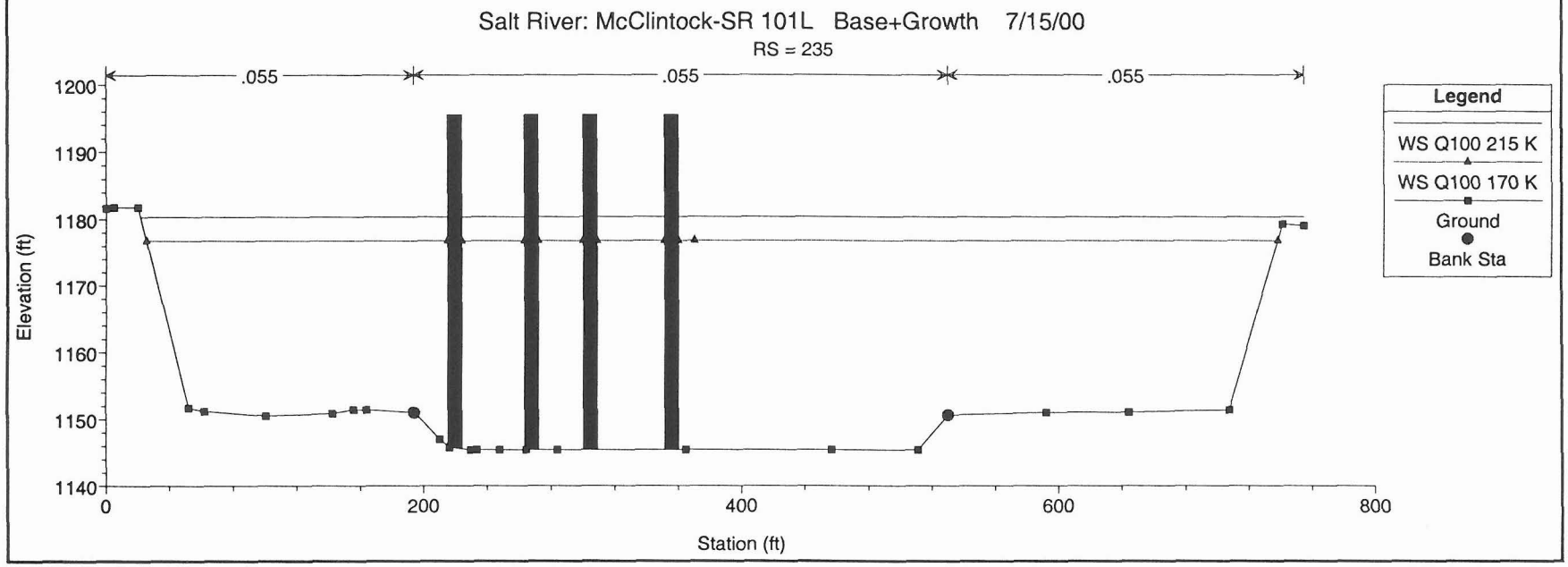

Salt River: McClintock-SR 101L Base+Growth 7/15/00
RS = 240
.055
.055
.055
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

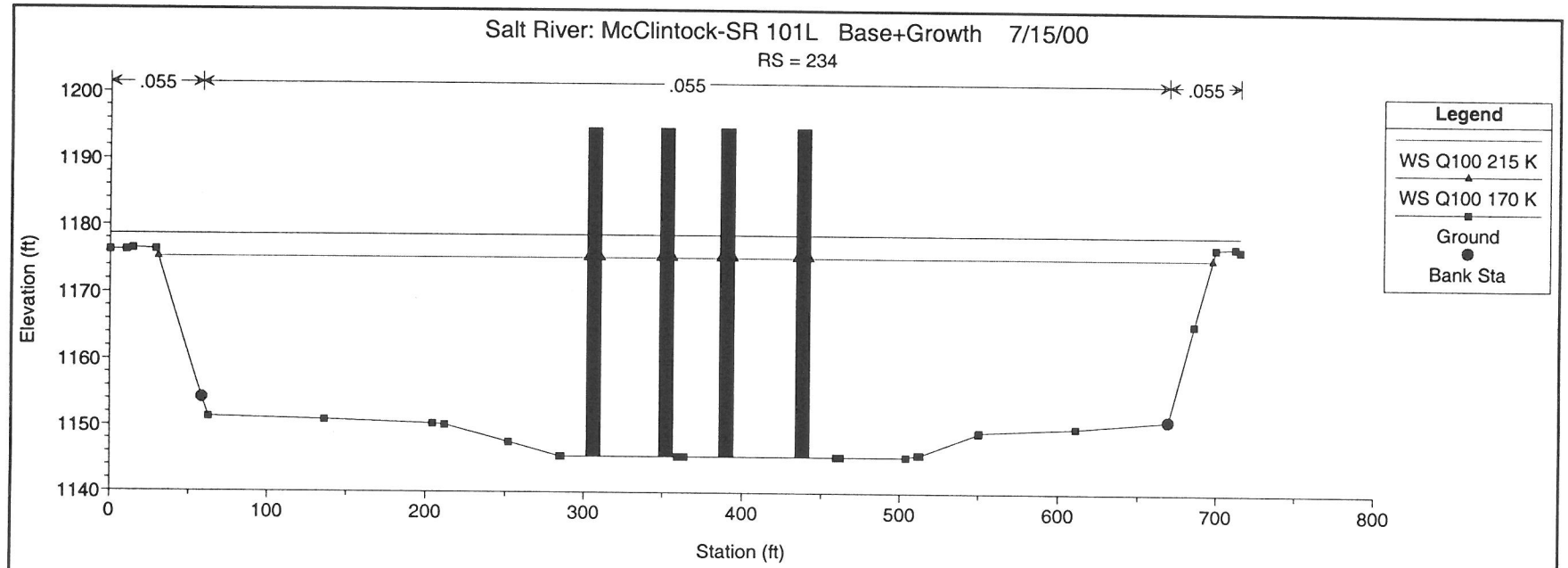

Salt River: McClintock-SR 101L Base+Growth 7/15/00
RS = 239
.055
.055
.055
Elevation (ft)
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

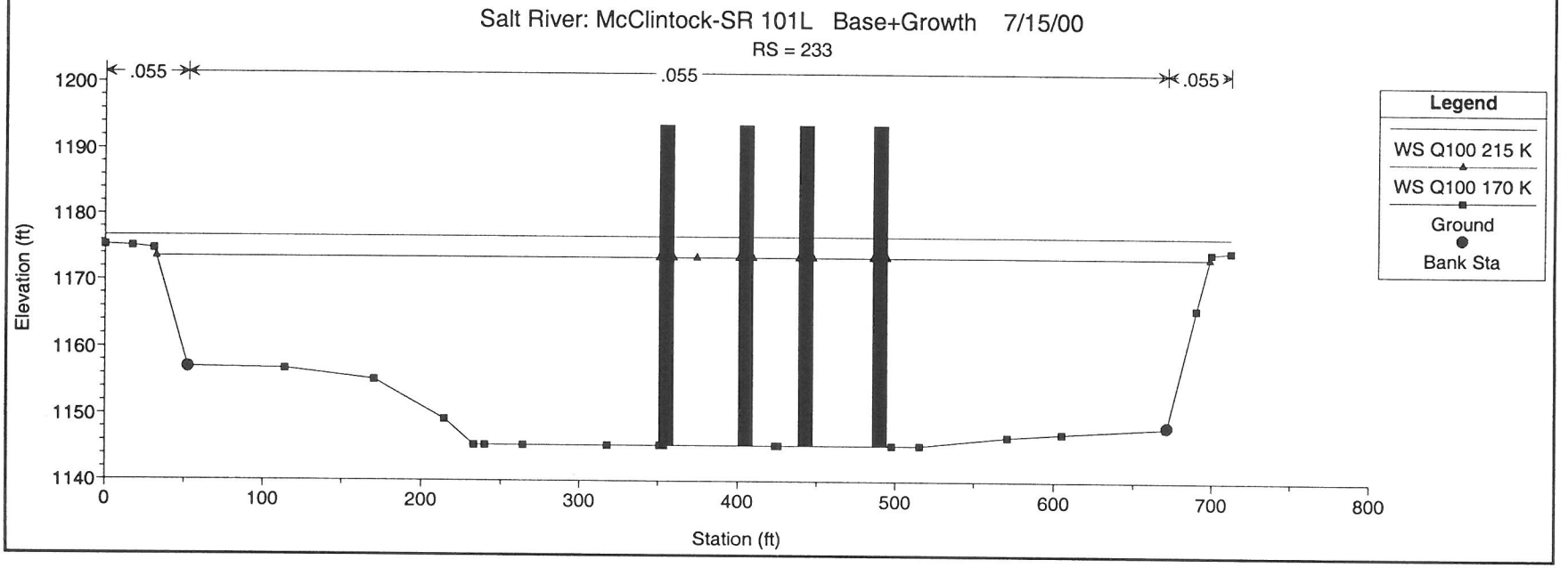

Salt River: McClintock-SR 101L Base+Growth 7/15/00
RS = 238
.055
.055
.055
Elevation (ft)
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

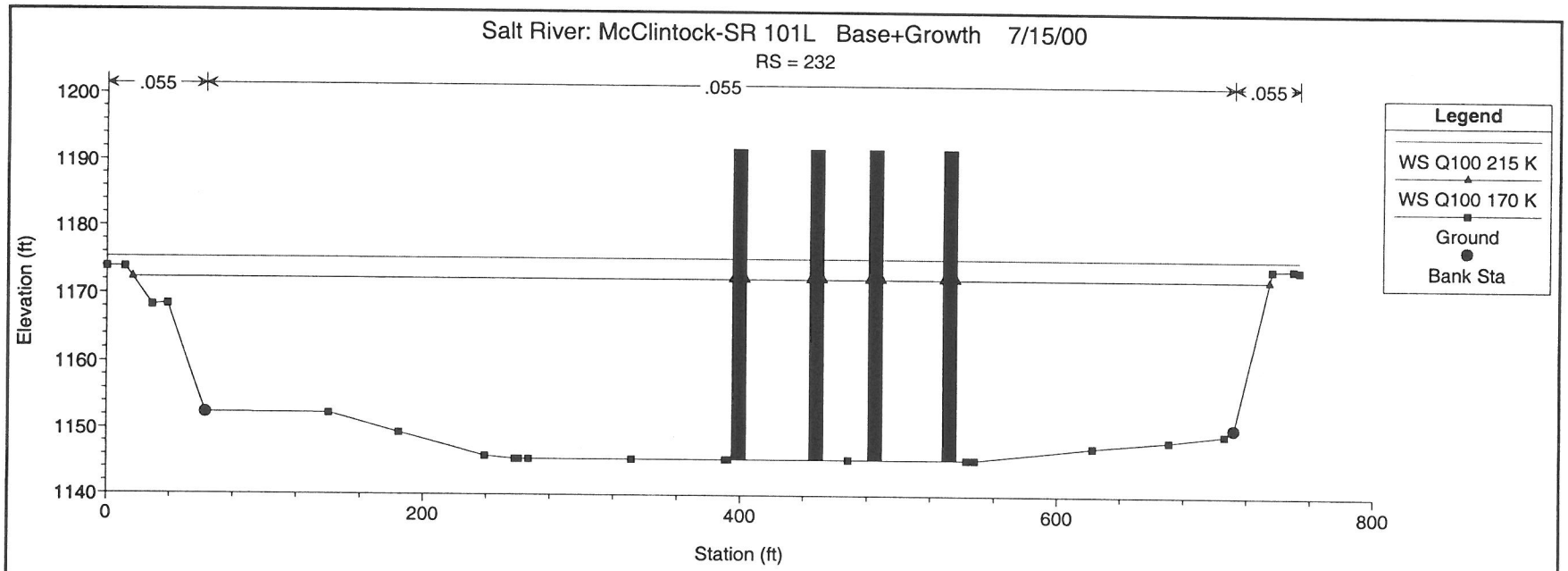

Salt River: McClintock-SR 101L Base+Growth 7/15/00
RS = 237
.055
.055
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

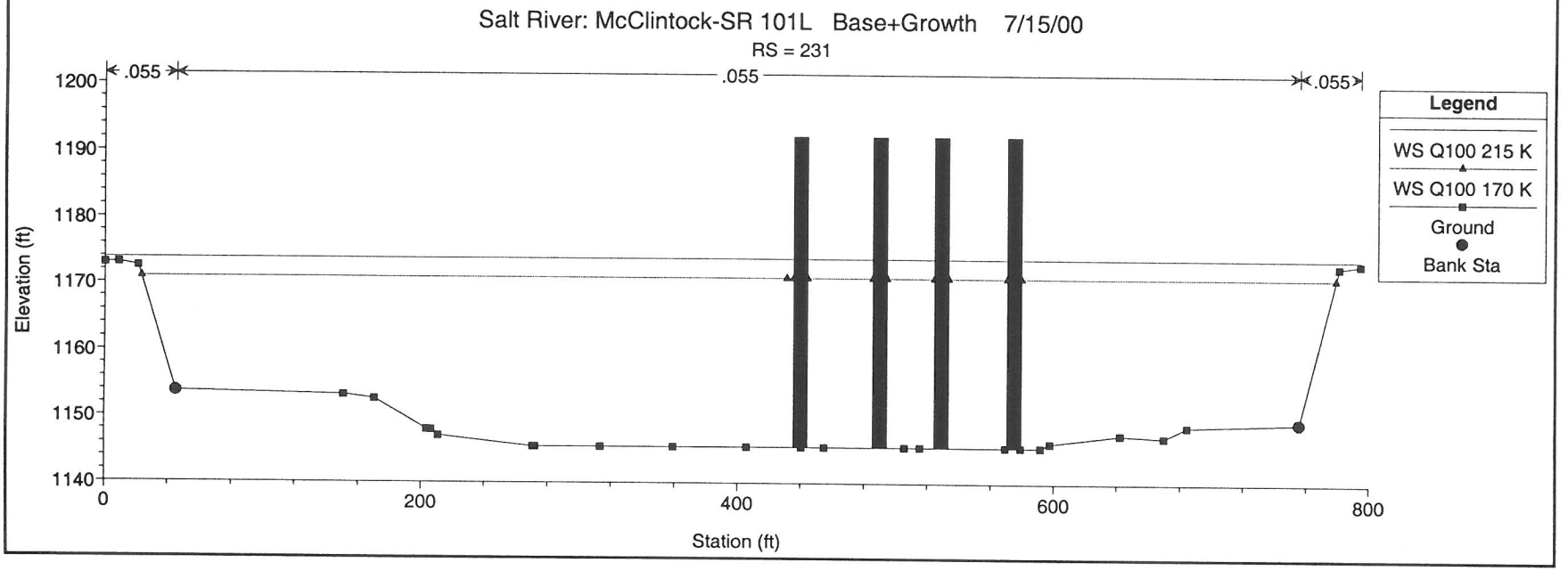

Salt River: McClintock-SR 101L Base+Growth 7/15/00
RS = 236
.055
.055
.055
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

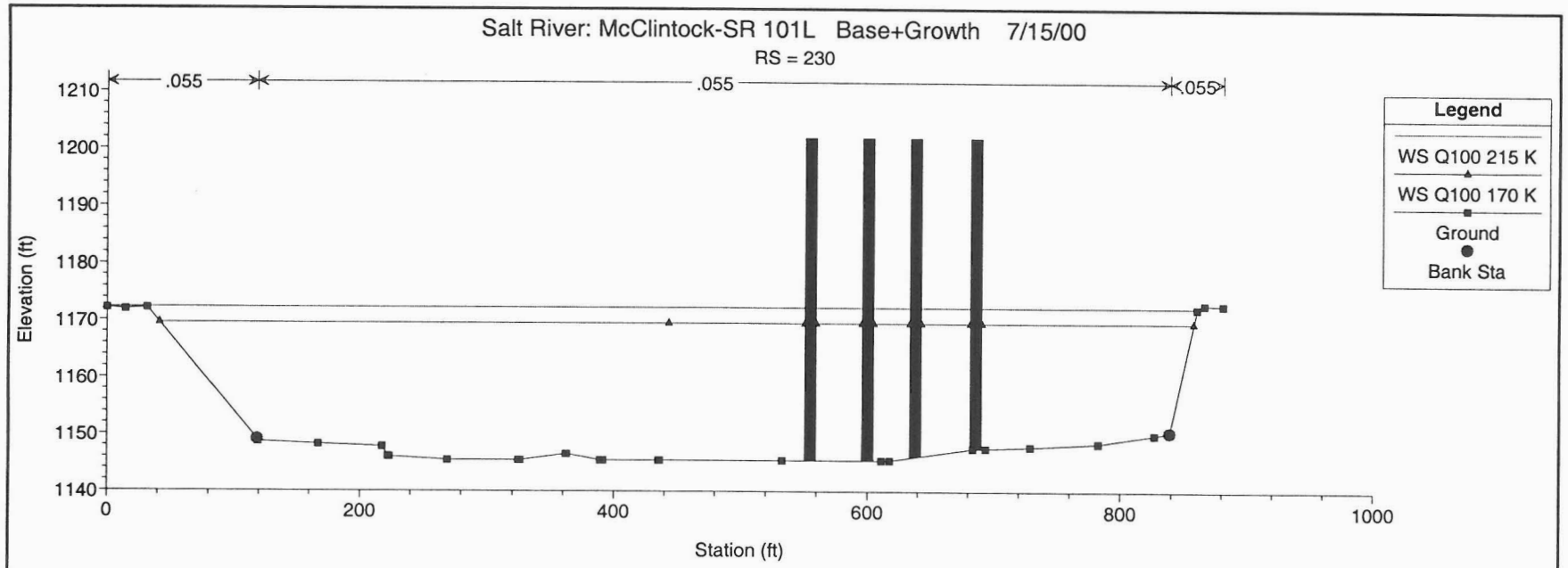

Salt River: McClintock-SR 101L Base+Growth 7/15/00
RS = 235
.055
.055
.055
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

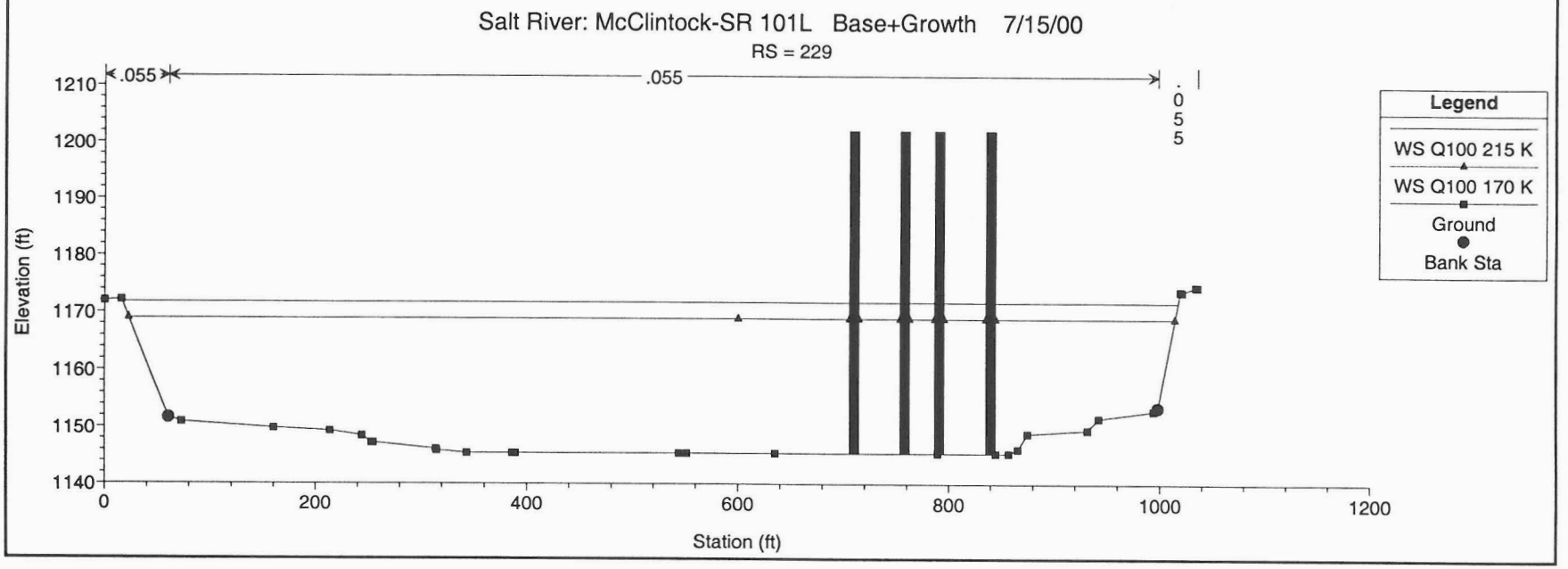

Salt River: McClintock-SR 101L Base+Growth 7/15/00
RS = 234
.055
.055
.055
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
100
200
300
400
500
600
700
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

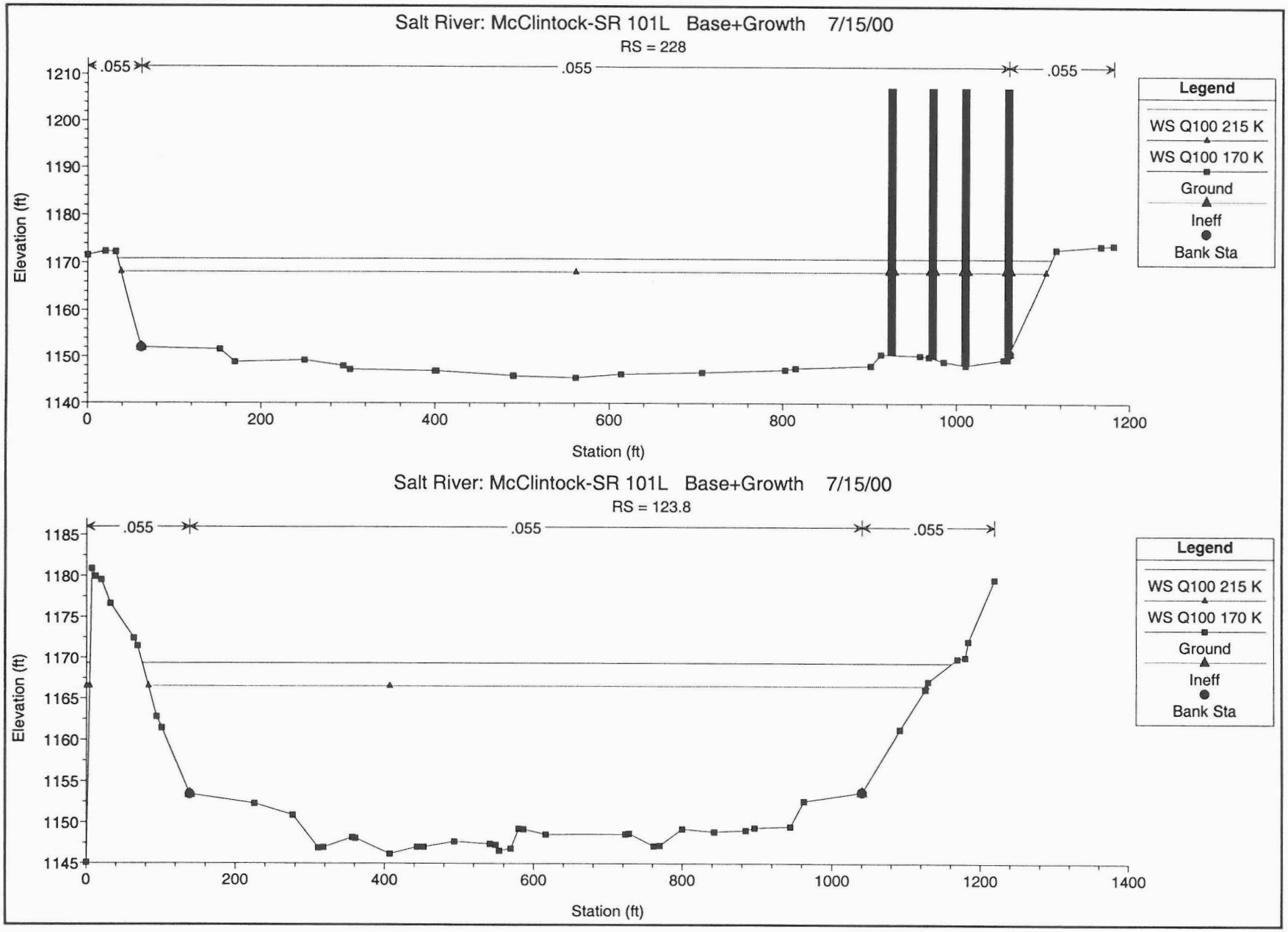

Salt River: McClintock-SR 101L Base+Growth 7/15/00
RS = 233
.055
.055
.055
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
100
200
300
400
500
600
700
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

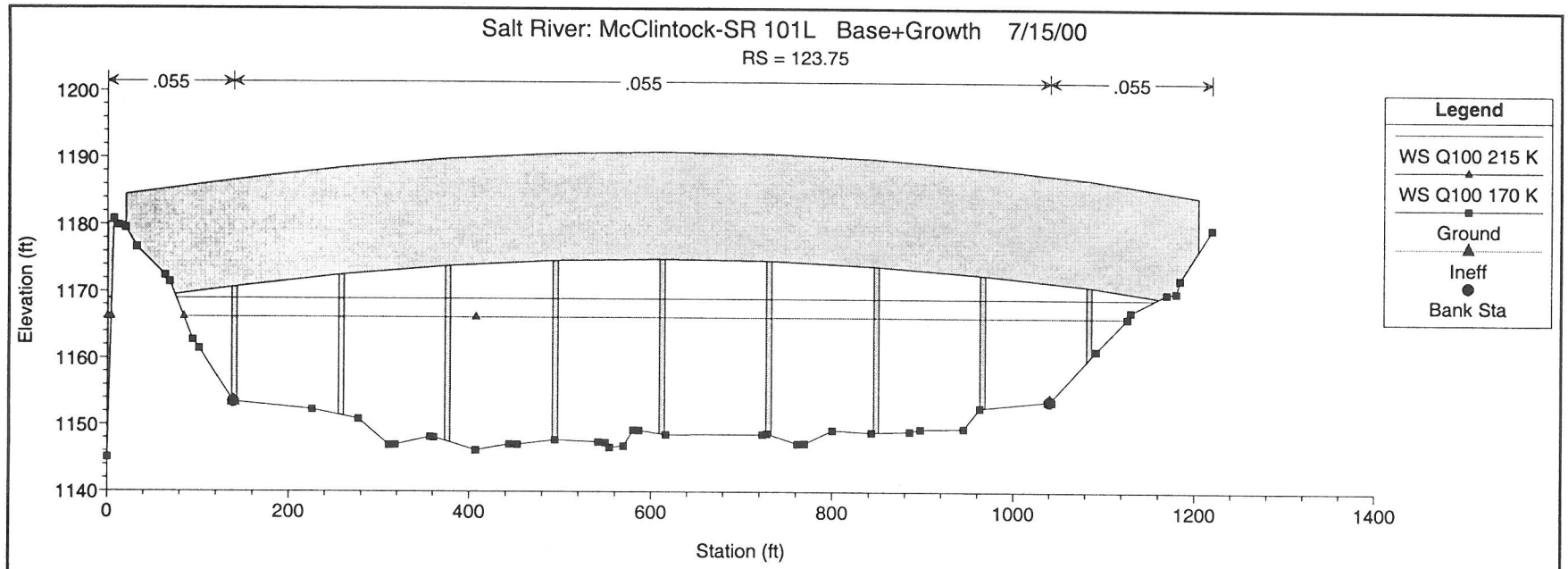

Salt River: McClintock-SR 101L Base+Growth 7/15/00
RS = 232
.055
.055
.055
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)

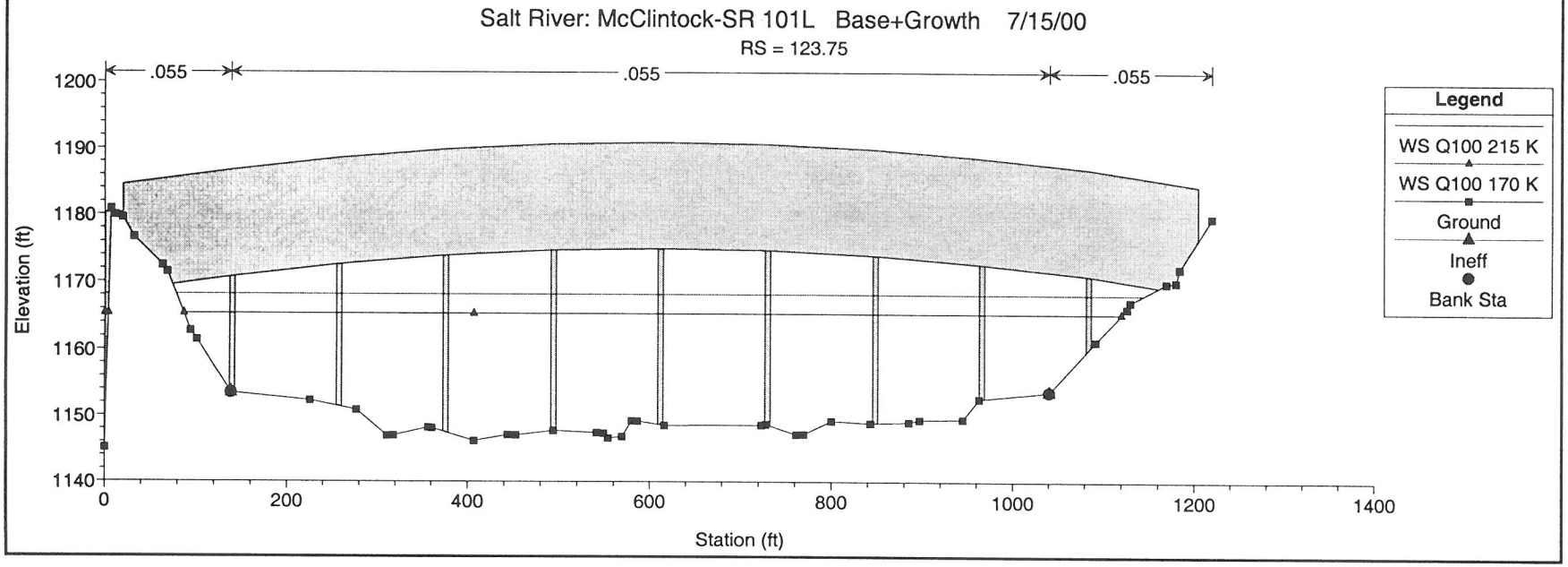

Salt River: McClintock-SR 101L Base+Growth 7/15/00
RS = 231
.055
.055
.055
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)

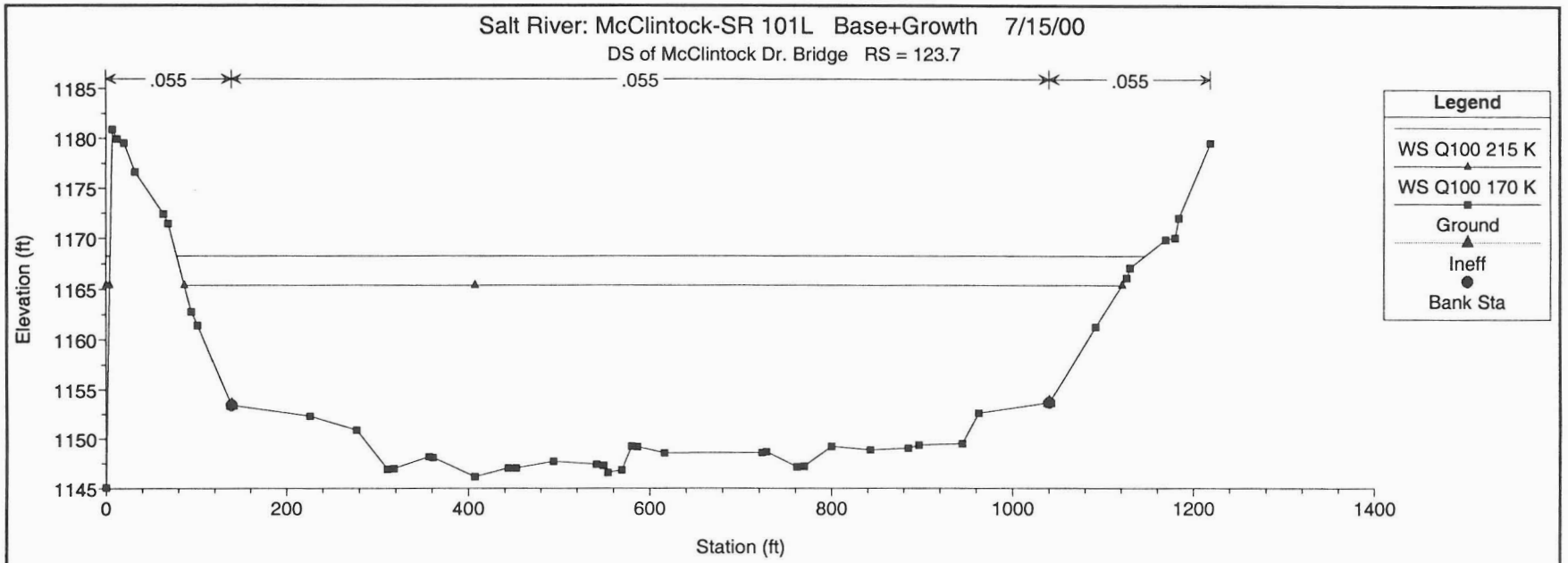

Salt River: McClintock-SR 101L Base+Growth 7/15/00
RS = 230
.055
.055
.055
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)

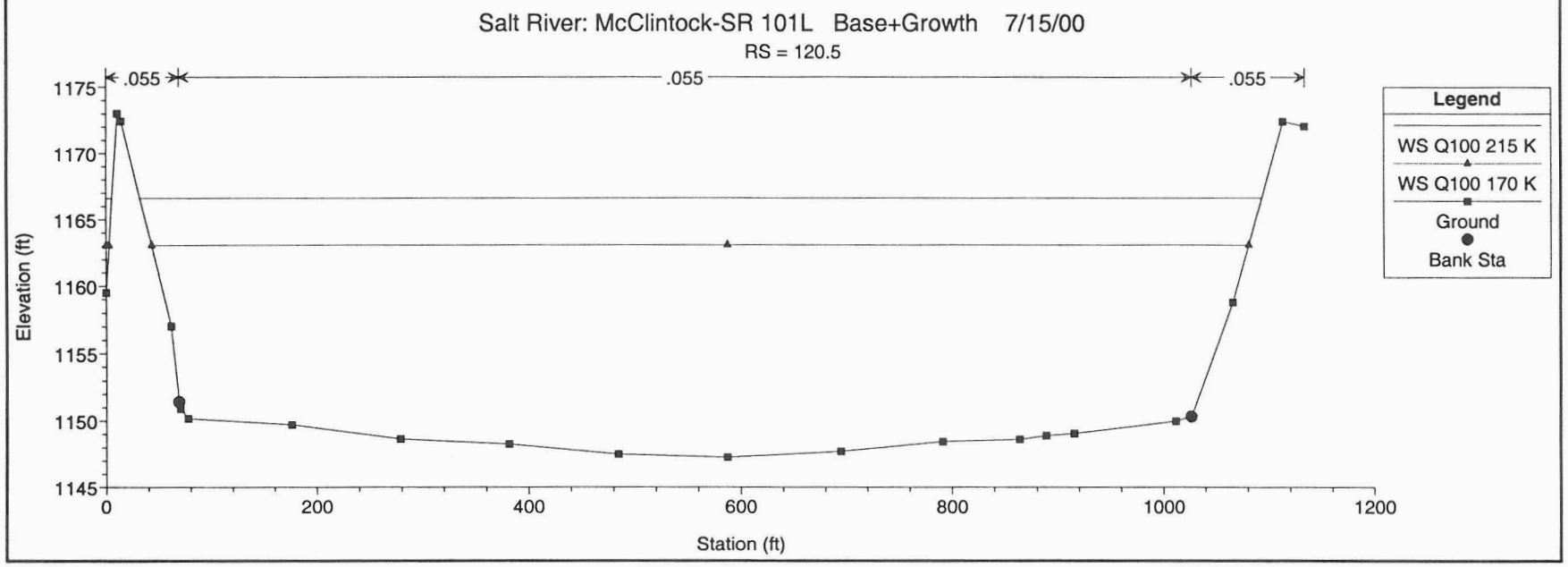

Salt River: McClintock-SR 101L Base+Growth 7/15/00
RS = 229
.055
.055
.055
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)


Salt River: McClintock-SR 101L Base+Growth 7/15/00
RS = 228
.055
.055
.055
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta
Salt River: McClintock-SR 101L Base+Growth 7/15/00
RS = 123.8
.055
.055
.055
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base+Growth 7/15/00
RS = 123.75
.055
.055
.055
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base+Growth 7/15/00
RS = 123.75
.055
.055
.055
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base+Growth 7/15/00
DS of McClintock Dr. Bridge RS = 123.7
.055
.055
.055
Elevation (ft)
1185
1180
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta

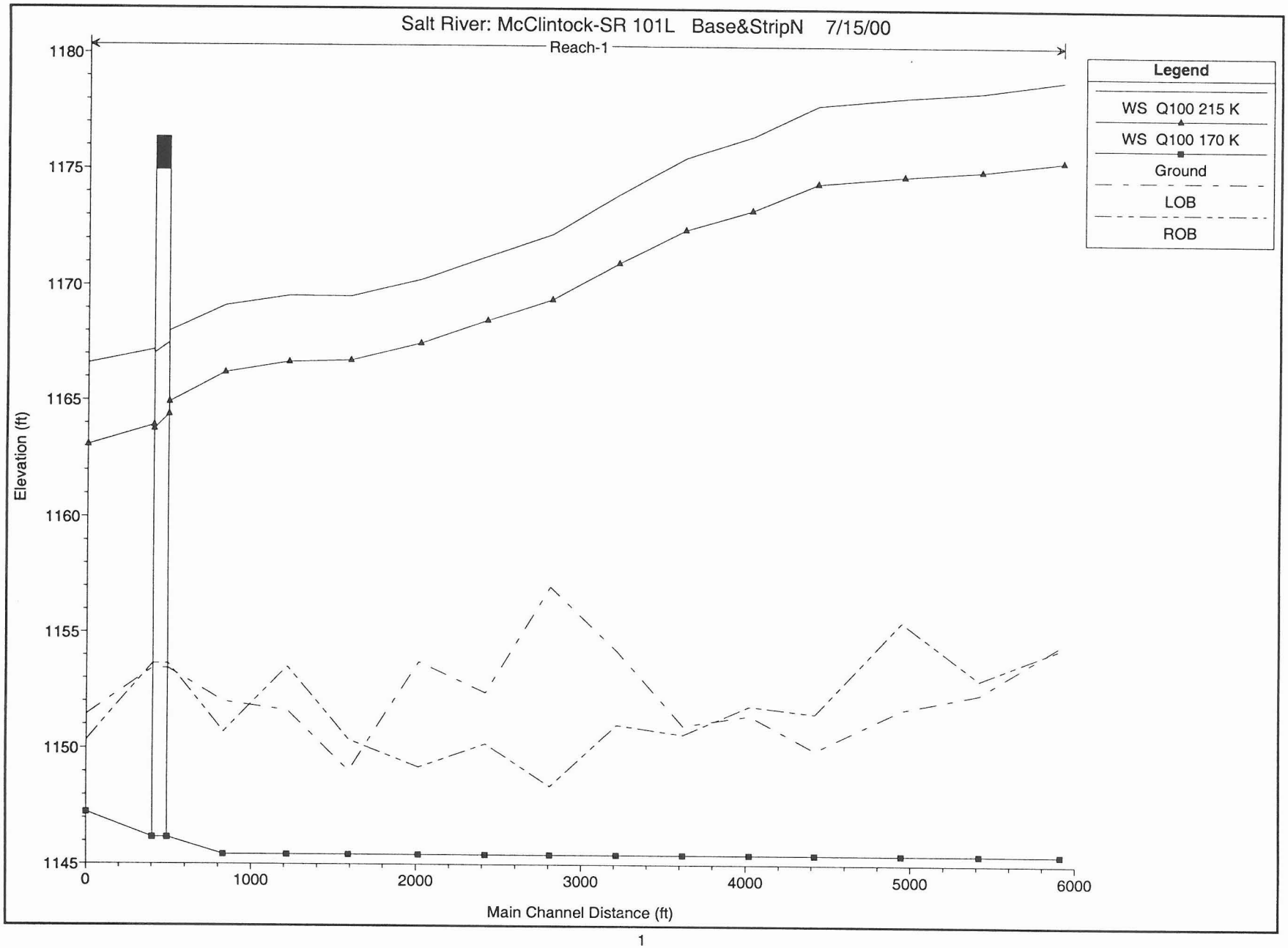

Salt River: McClintock-SR 101L Base+Growth 7/15/00
RS = 120.5
.055
.055
.055
Elevation (ft)
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

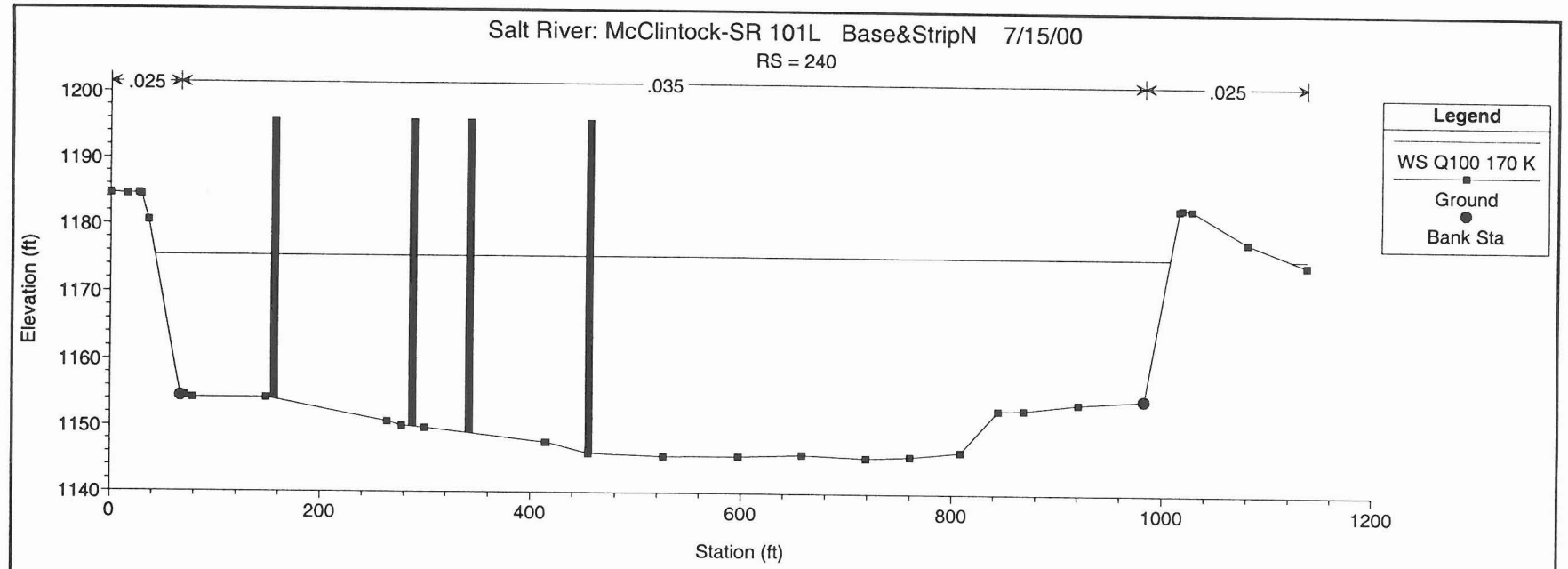
Q_{100} = 215,000 cfs and 172,000 cfs, Survyed Topo & Strip n Value

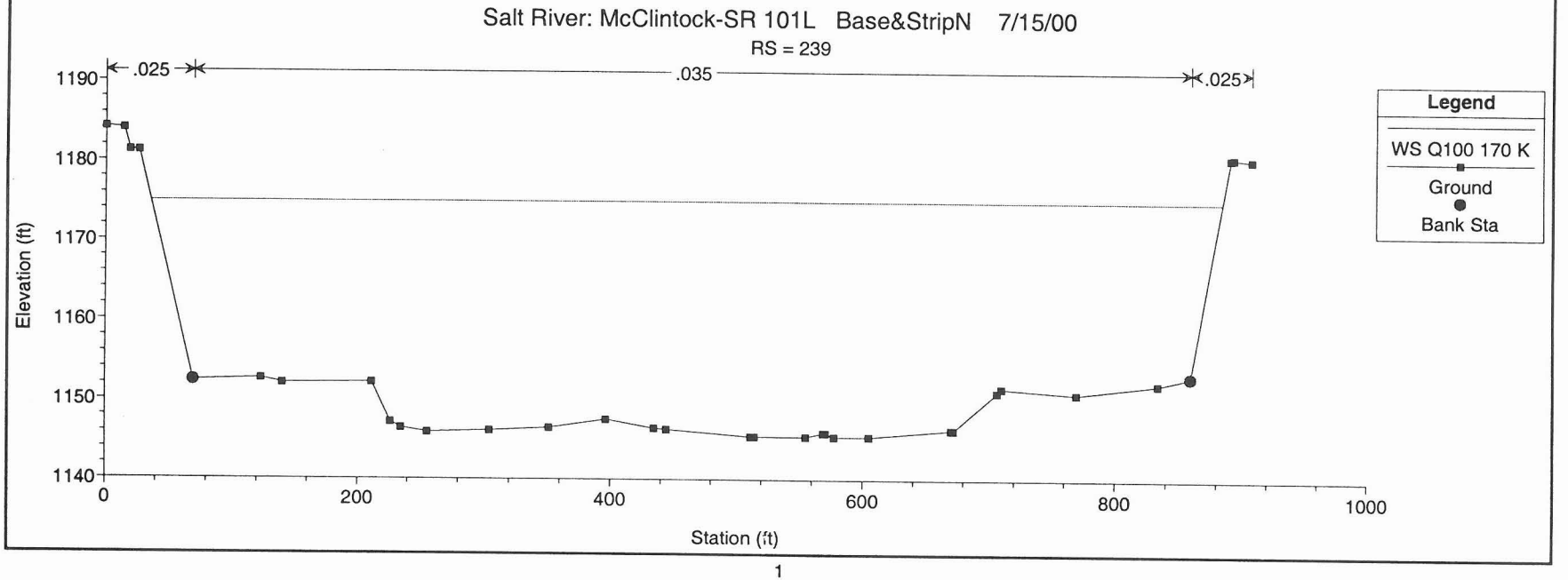
Plan Title: Base_StripN

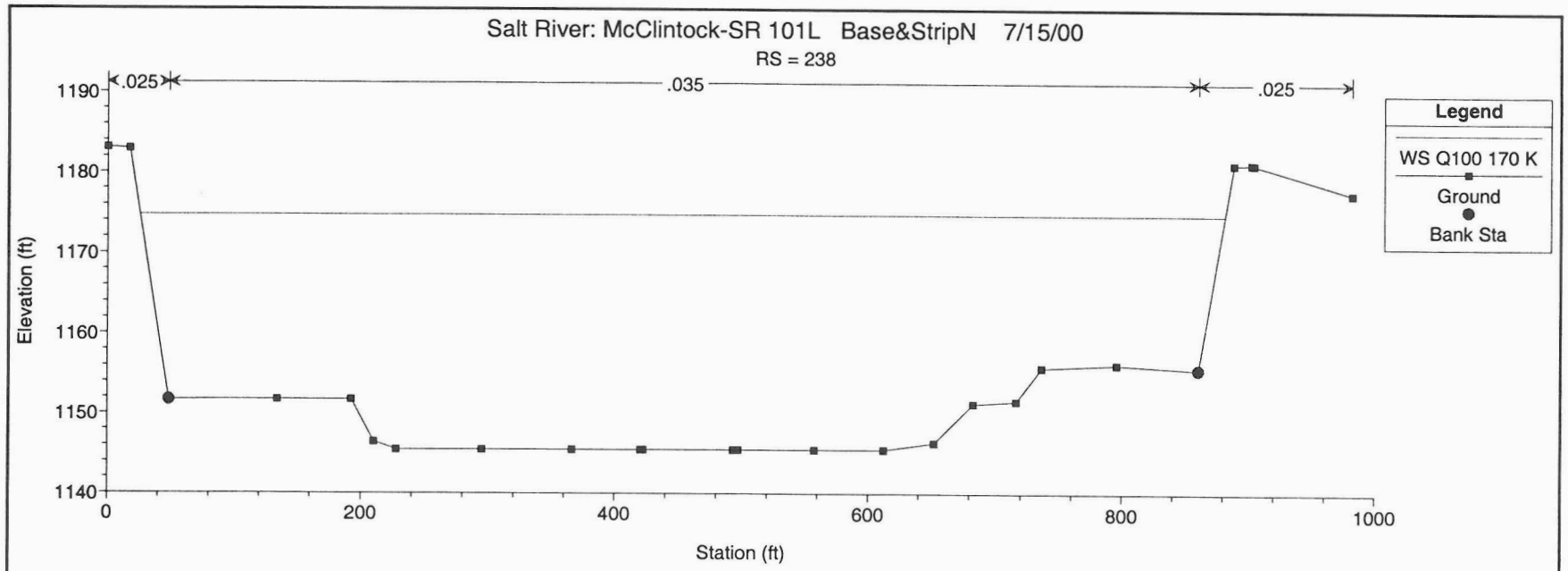
HEC-RAS Plan: Base&StripN River: RIVER-1 Reach: Reach-1

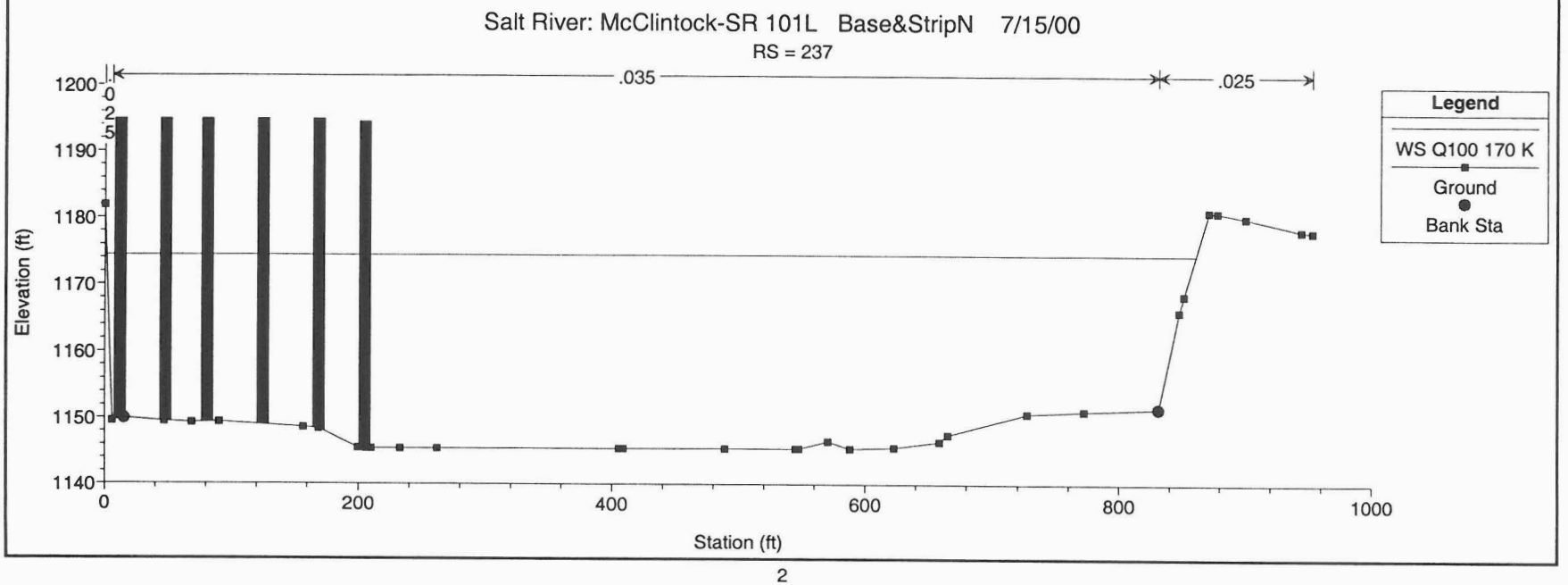
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	240	215000.00	1145.43	1178.88		1179.86	0.000526	7.99	27204.17	1012.16	0.26
Reach-1	240	172000.00	1145.43	1175.38		1176.19	0.000500	7.28	23757.89	951.71	0.25
Reach-1	239	215000.00	1145.43	1178.39		1179.59	0.000469	8.86	24539.12	857.81	0.29
Reach-1	239	172000.00	1145.43	1174.95		1175.94	0.000454	8.04	21605.37	848.74	0.28
Reach-1	238	215000.00	1145.43	1178.15		1179.36	0.000485	8.88	24449.28	876.79	0.29
Reach-1	238	172000.00	1145.43	1174.72		1175.72	0.000473	8.07	21494.01	855.94	0.28
Reach-1	237	215000.00	1145.43	1177.80		1179.05	0.000748	8.99	24076.29	811.36	0.29
Reach-1	237	172000.00	1145.43	1174.41		1175.42	0.000681	8.11	21333.79	805.40	0.27
Reach-1	236	215000.00	1145.43	1176.44		1178.57	0.001365	11.76	18412.32	683.58	0.39
Reach-1	236	172000.00	1145.43	1173.24		1174.99	0.001266	10.66	16234.93	676.58	0.38
Reach-1	235	215000.00	1145.43	1175.50		1177.91	0.001832	11.54	17391.16	673.90	0.37
Reach-1	235	172000.00	1145.43	1172.41		1174.38	0.001727	10.74	15317.81	666.87	0.37
Reach-1	234	215000.00	1145.43	1173.92		1176.99	0.002503	14.11	15318.87	627.53	0.49
Reach-1	234	172000.00	1145.43	1170.98		1173.51	0.002364	12.82	13484.62	620.14	0.47
Reach-1	233	215000.00	1145.43	1172.20		1175.79	0.003231	15.24	14170.10	627.14	0.55
Reach-1	233	172000.00	1145.43	1169.40		1172.39	0.003035	13.90	12422.31	620.66	0.54
Reach-1	232	215000.00	1145.43	1171.25		1174.44	0.003035	14.40	15132.26	677.41	0.52
Reach-1	232	172000.00	1145.43	1168.48		1171.13	0.002884	13.11	13269.57	666.00	0.50
Reach-1	231	215000.00	1145.43	1170.25		1173.23	0.002681	13.90	15541.16	718.15	0.52
Reach-1	231	172000.00	1145.43	1167.48		1169.98	0.002579	12.74	13560.66	711.61	0.51
Reach-1	230	215000.00	1145.43	1169.53		1172.13	0.002035	13.01	16611.59	780.19	0.48
Reach-1	230	172000.00	1145.43	1166.73		1168.94	0.002002	11.97	14448.54	766.91	0.47
Reach-1	229	215000.00	1145.43	1169.54		1171.26	0.001332	10.54	20612.27	957.38	0.39
Reach-1	229	172000.00	1145.43	1166.65		1168.11	0.001322	9.72	17857.63	948.05	0.39
Reach-1	228	215000.00	1145.43	1169.12	1159.42	1170.74	0.001186	10.27	21123.93	1032.50	0.39
Reach-1	228	172000.00	1145.43	1166.20	1157.83	1167.61	0.001223	9.57	18118.35	1021.11	0.39
Reach-1	123.8	215000.00	1146.17	1167.99	1161.41	1170.22	0.001640	12.11	18100.73	1067.77	0.49
Reach-1	123.8	172000.00	1146.17	1164.92	1159.75	1167.02	0.001964	11.76	14872.97	1033.30	0.52
Reach-1	123.75	Bridge									
Reach-1	123.7	215000.00	1146.17	1167.19	1161.41	1169.63	0.001911	12.69	17243.29	1053.69	0.53
Reach-1	123.7	172000.00	1146.17	1163.92	1159.75	1166.35	0.002471	12.62	13845.89	1023.12	0.58
Reach-1	120.5	215000.00	1147.26	1166.59	1160.09	1168.79	0.001686	11.99	18114.22	1066.26	0.50
Reach-1	120.5	172000.00	1147.26	1163.07	1158.52	1165.30	0.002267	12.03	14406.35	1040.47	0.56

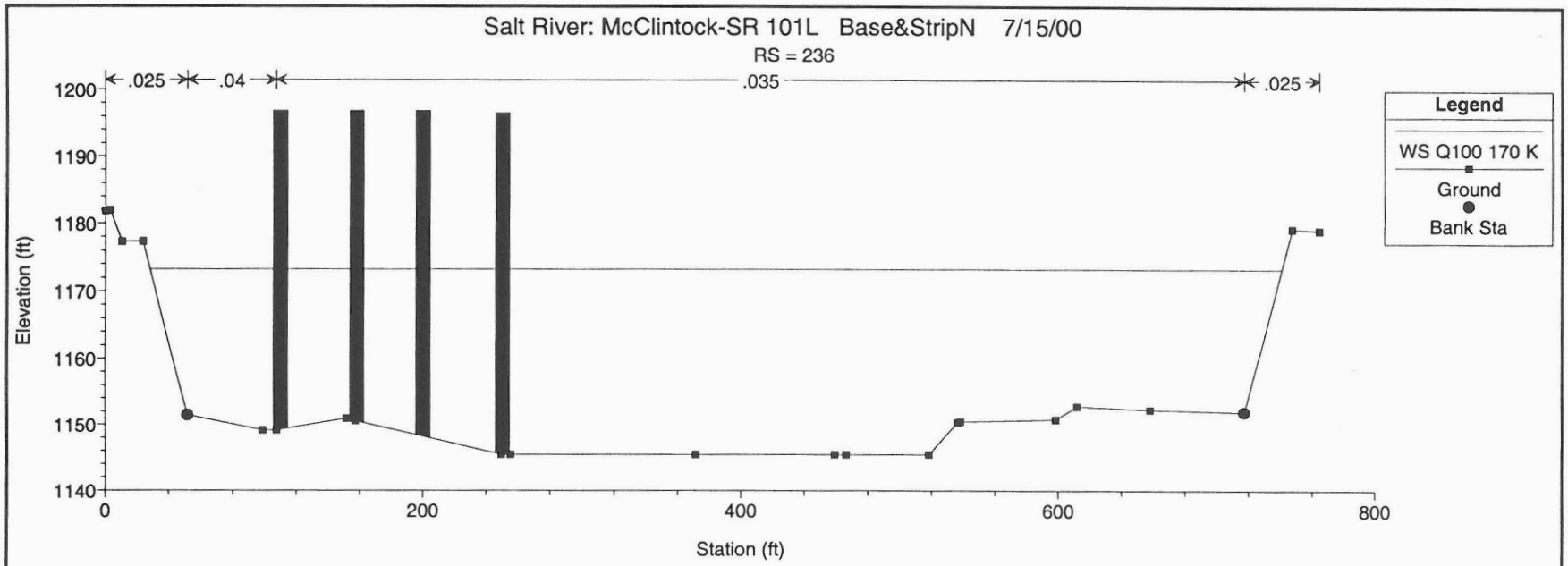

Salt River: McClintock-SR 101L Base&StripN 7/15/00
Reach-1
Legend
WS Q100 215 K
WS Q100 170 K
Ground
LOB
ROB
Elevation (ft)
1180
1175
1170
1165
1160
1155
1150
1145
0
1000
2000
3000
4000
5000
6000
Main Channel Distance (ft)

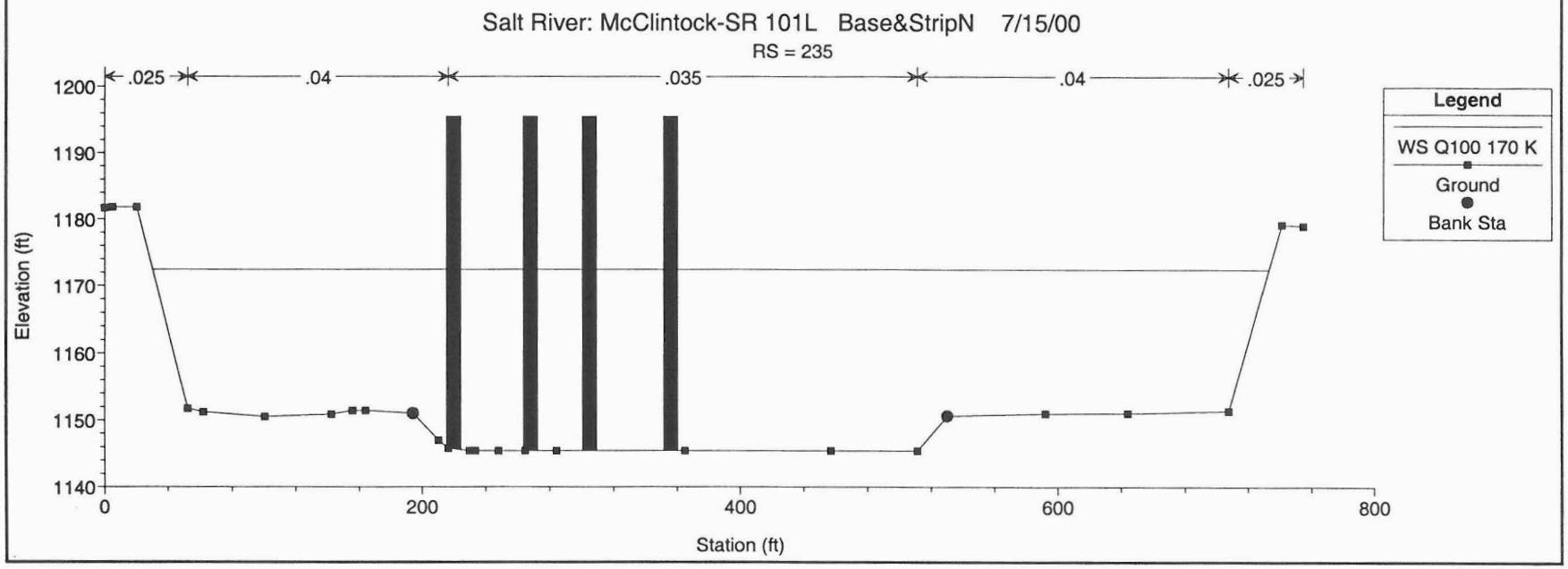

Salt River: McClintock-SR 101L Base&StripN 7/15/00
RS = 240
.025
.035
.025
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)


Salt River: McClintock-SR 101L Base&StripN 7/15/00
RS = 239
.025
.035
.025
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)


Salt River: McClintock-SR 101L Base&StripN 7/15/00
RS = 238
.025
.035
.025
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)


Salt River: McClintock-SR 101L Base&StripN 7/15/00
RS = 237
.035
.025
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)


Salt River: McClintock-SR 101L Base&StripN 7/15/00
RS = 236
.025
.04
.035
.025
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)


Salt River: McClintock-SR 101L Base&StripN 7/15/00
RS = 235
.025
.04
.035
.04
.025
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
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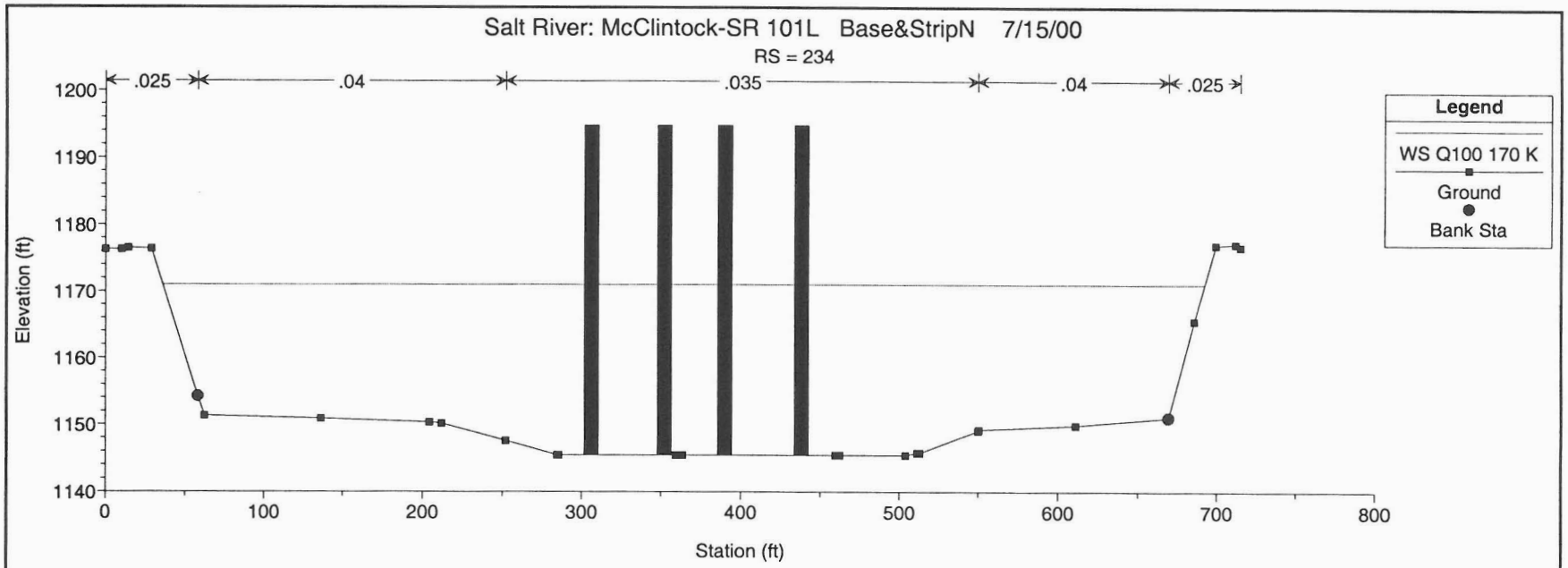
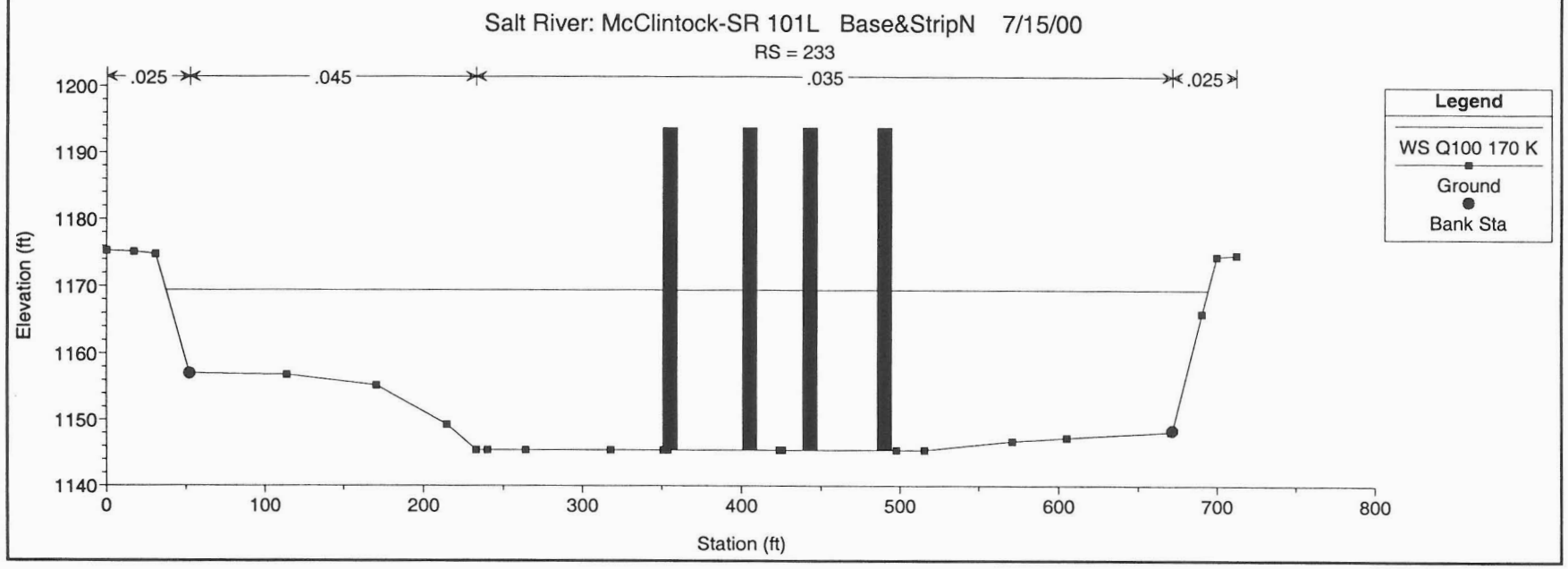
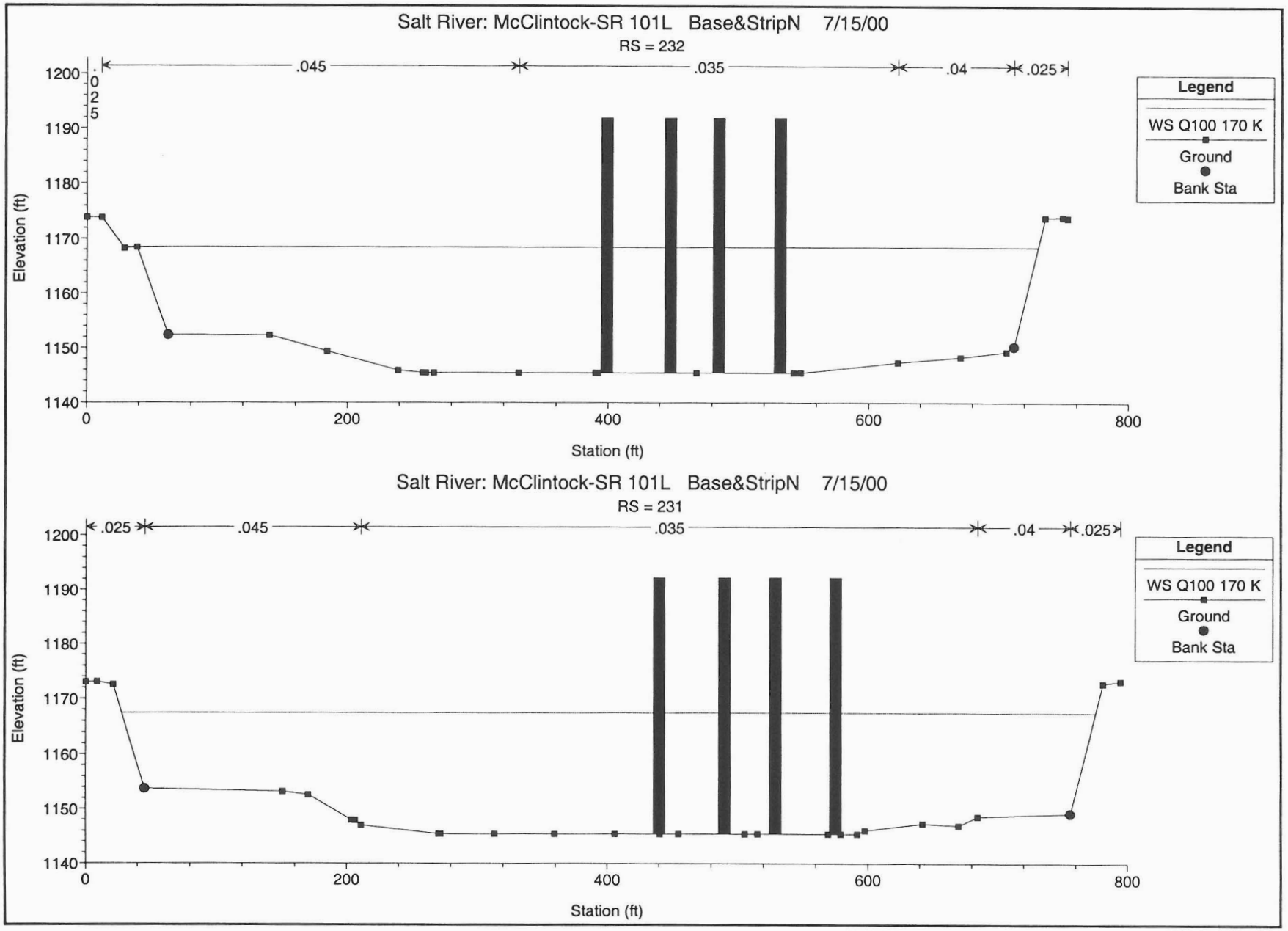
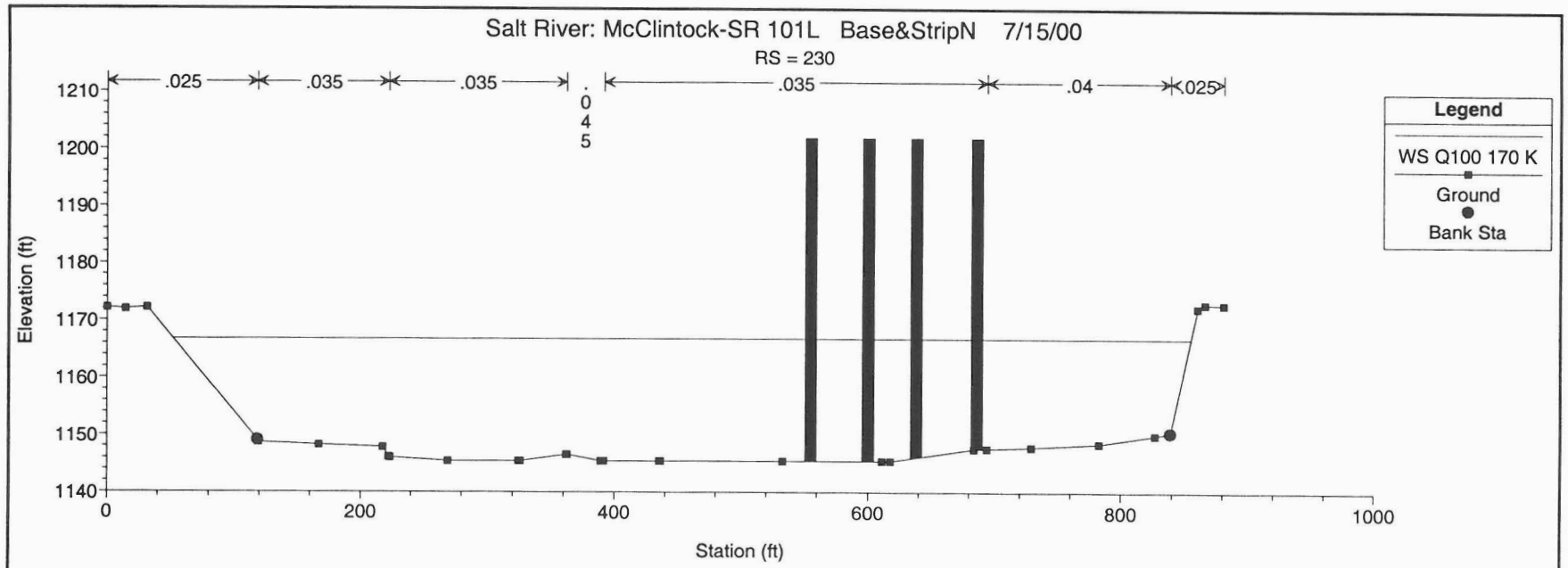
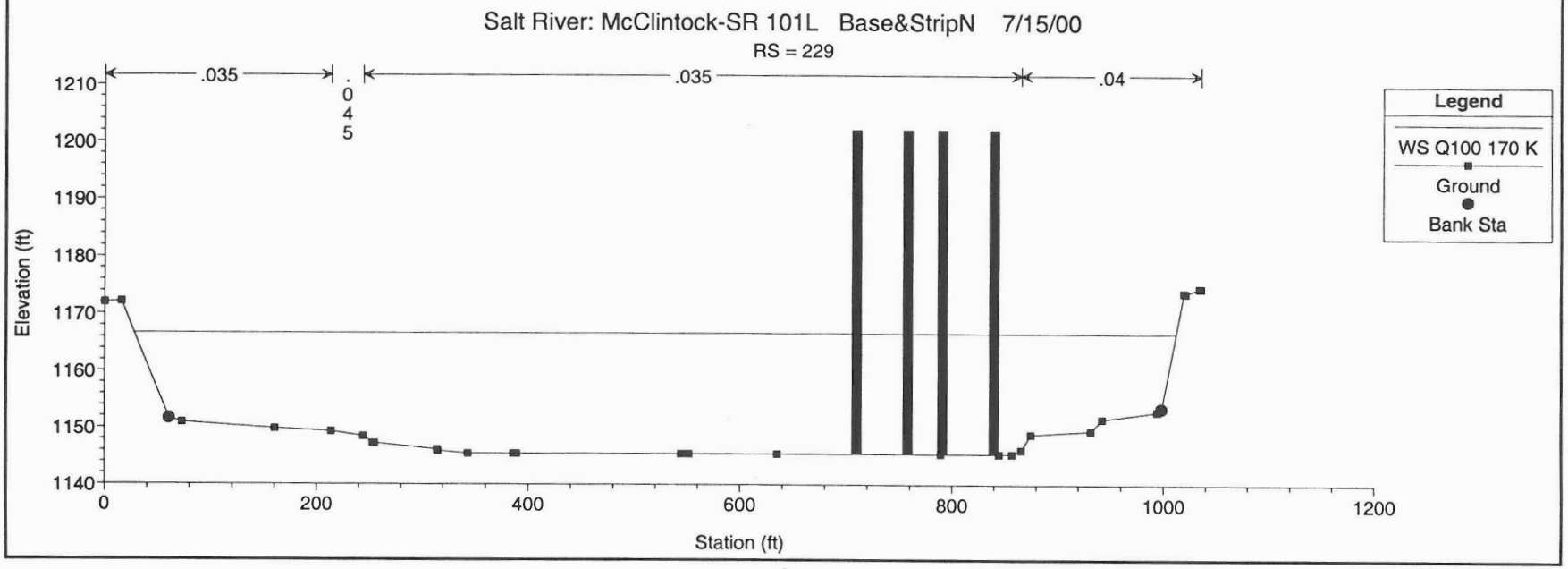
400
600
800
Station (ft)

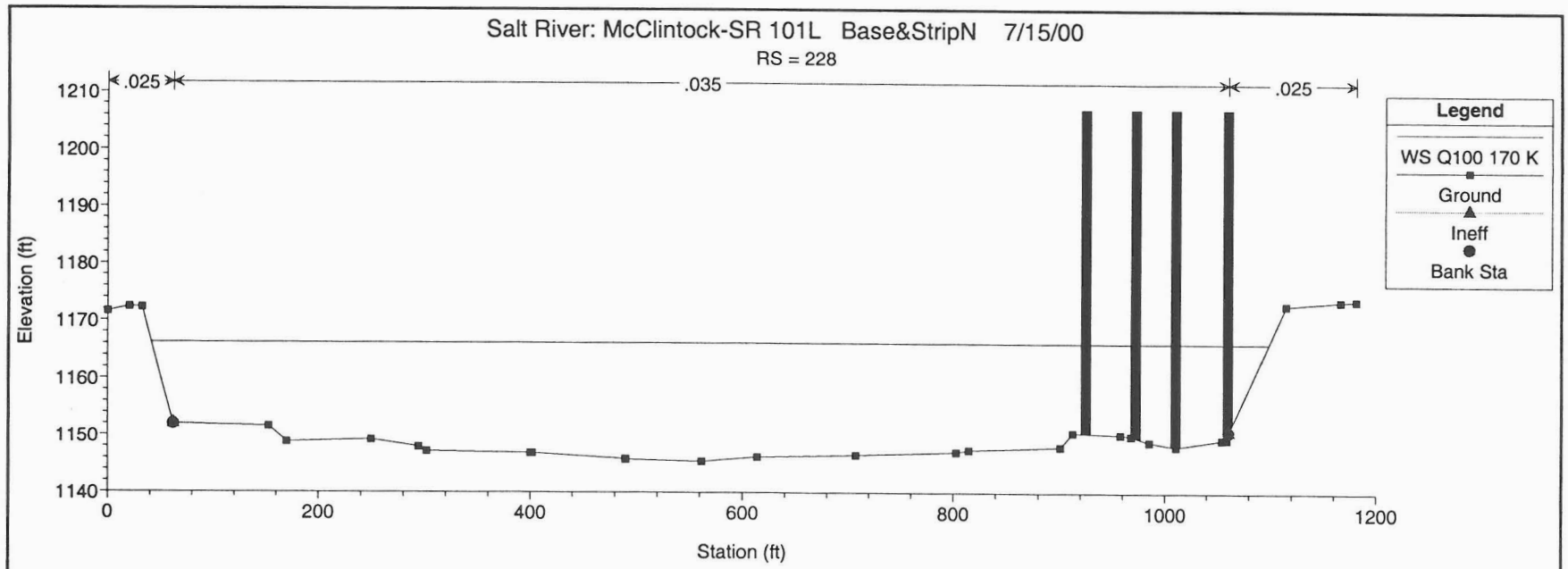

Salt River: McClintock-SR 101L Base&StripN 7/15/00
RS = 234
.025
.04
.035
.04
.025
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
100
200
300
400
500
600
700
800
Station (ft)

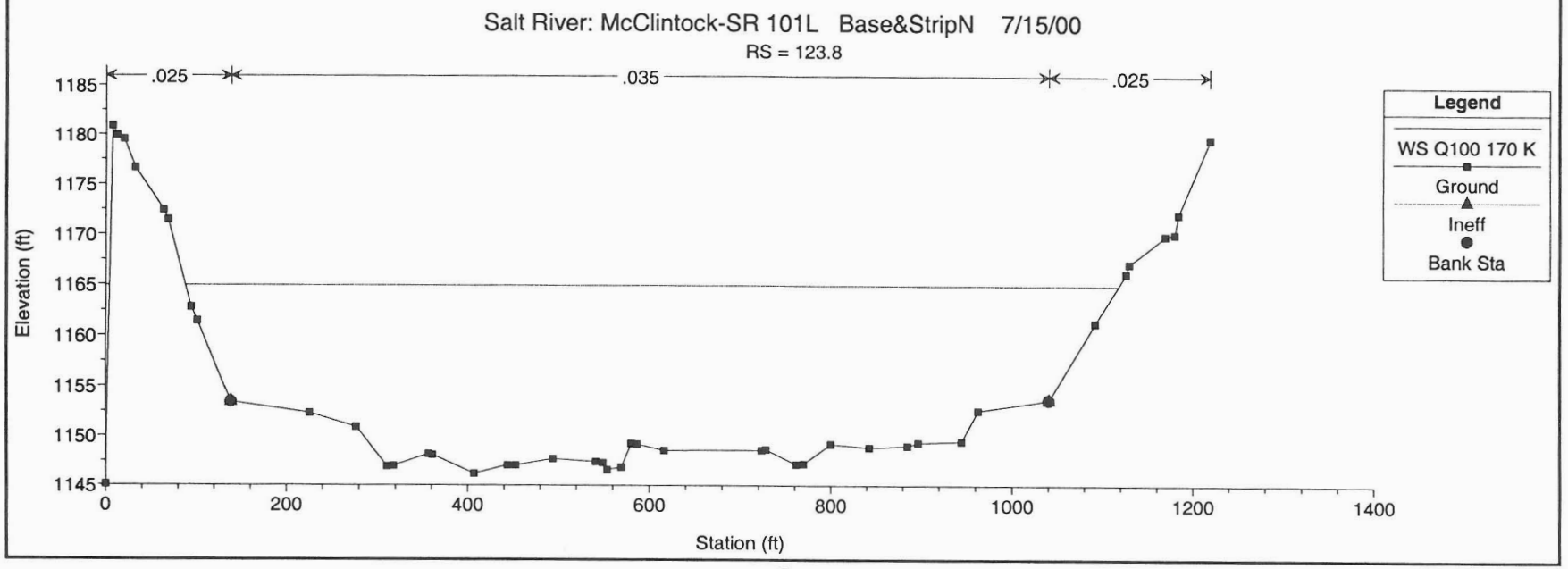

Salt River: McClintock-SR 101L Base&StripN 7/15/00
RS = 233
.025
.045
.035
.025
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
100
200
300
400
500
600
700
800
Station (ft)

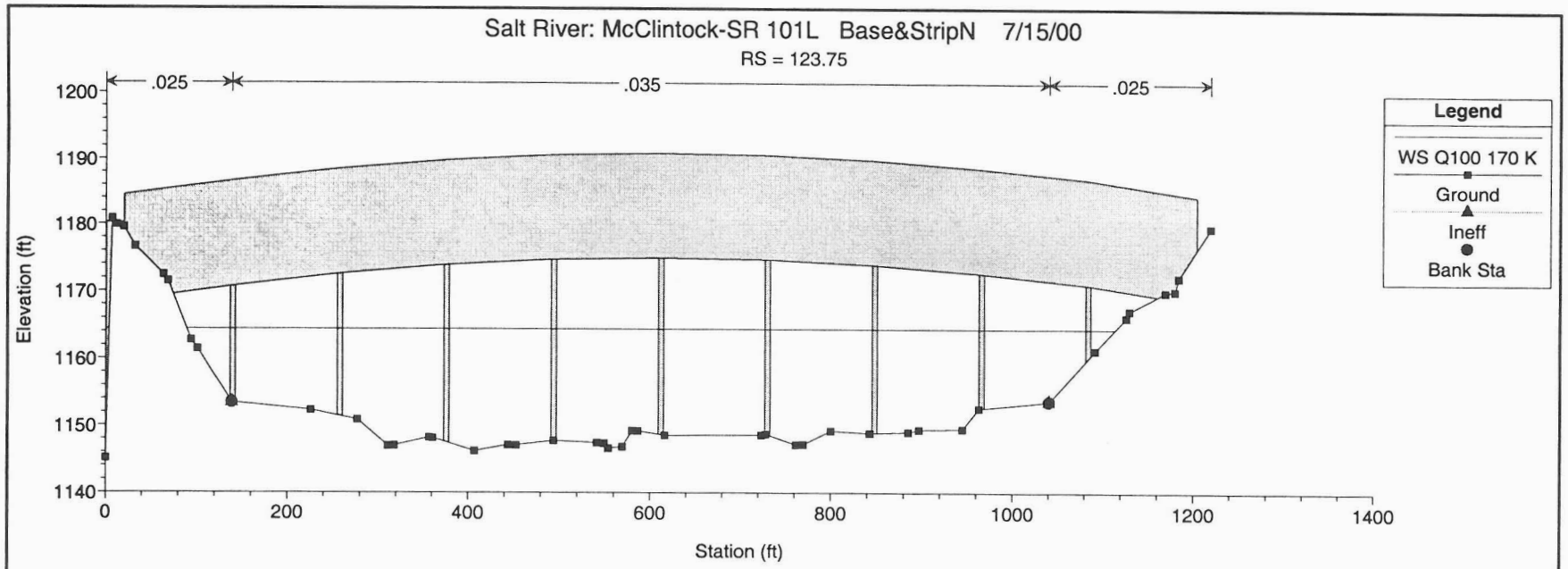

Salt River: McClintock-SR 101L Base&StripN 7/15/00
RS = 232
.045
.035
.04
.025
.025
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
Station (ft)
Salt River: McClintock-SR 101L Base&StripN 7/15/00
RS = 231
.025
.045
.035
.04
.025
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
Station (ft)

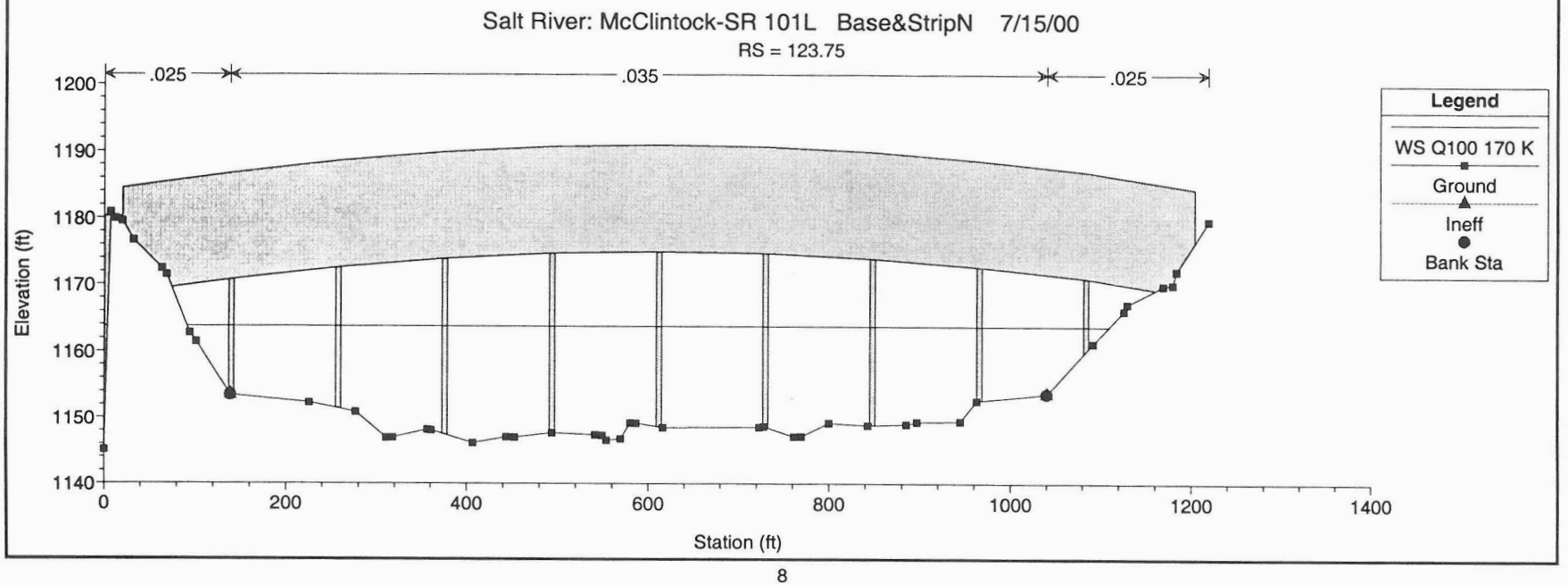

Salt River: McClintock-SR 101L Base&StripN 7/15/00
RS = 230
.025
.035
.035
.045
.035
.04
.025
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)

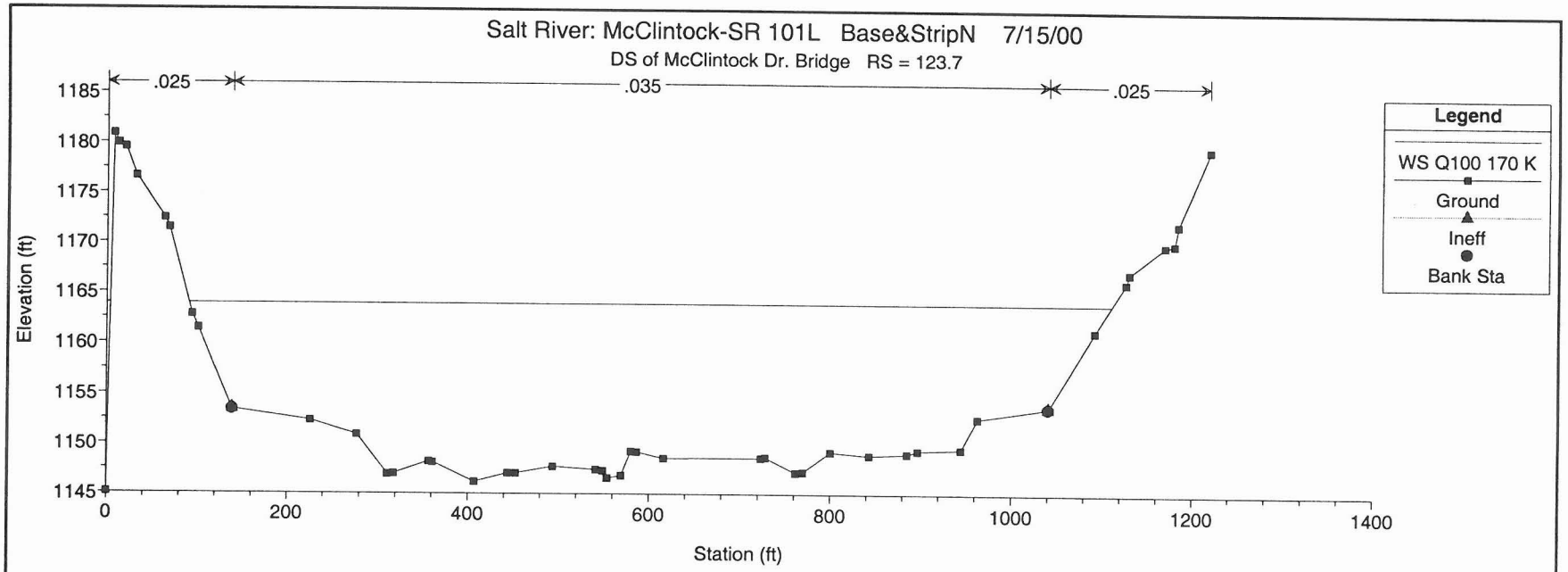

Salt River: McClintock-SR 101L Base&StripN 7/15/00
RS = 229
.035
.045
.035
.04
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)

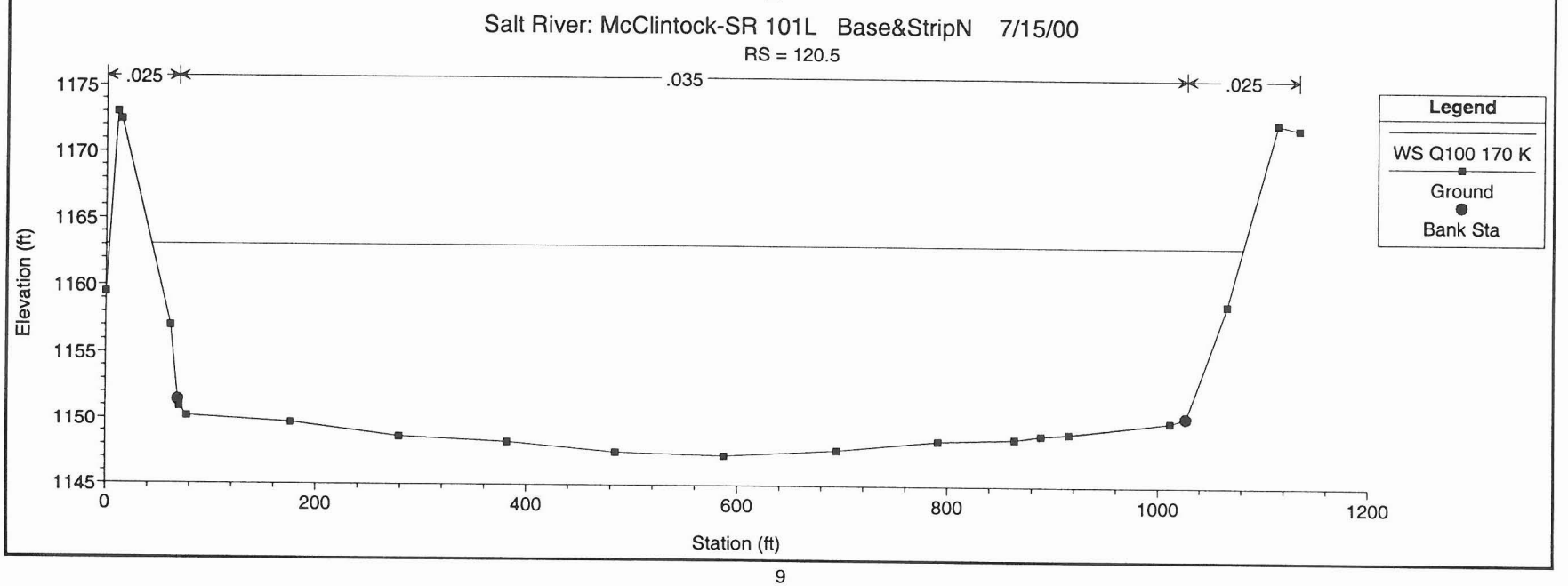

Salt River: McClintock-SR 101L Base&StripN 7/15/00
RS = 228
.025
.035
.025
Elevation (ft)
Station (ft)
Legend
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base&StripN 7/15/00
RS = 123.8
.025
.035
.025
Elevation (ft)
Station (ft)
Legend
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base&StripN 7/15/00
RS = 123.75
.025
.035
.025
Elevation (ft)
Station (ft)
Legend
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base&StripN 7/15/00
RS = 123.75
.025
.035
.025
Elevation (ft)
Station (ft)
Legend
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base&StripN 7/15/00
DS of McClintock Dr. Bridge RS = 123.7
.025
.035
.025
Elevation (ft)
Station (ft)
Legend
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base&StripN 7/15/00
RS = 120.5
.025
.035
.025
Elevation (ft)
Station (ft)
Legend
WS Q100 170 K
Ground
Bank Sta

Q_{100} = 215,000 cfs and 172,000 cfs, Survyed Topo & Max n Value

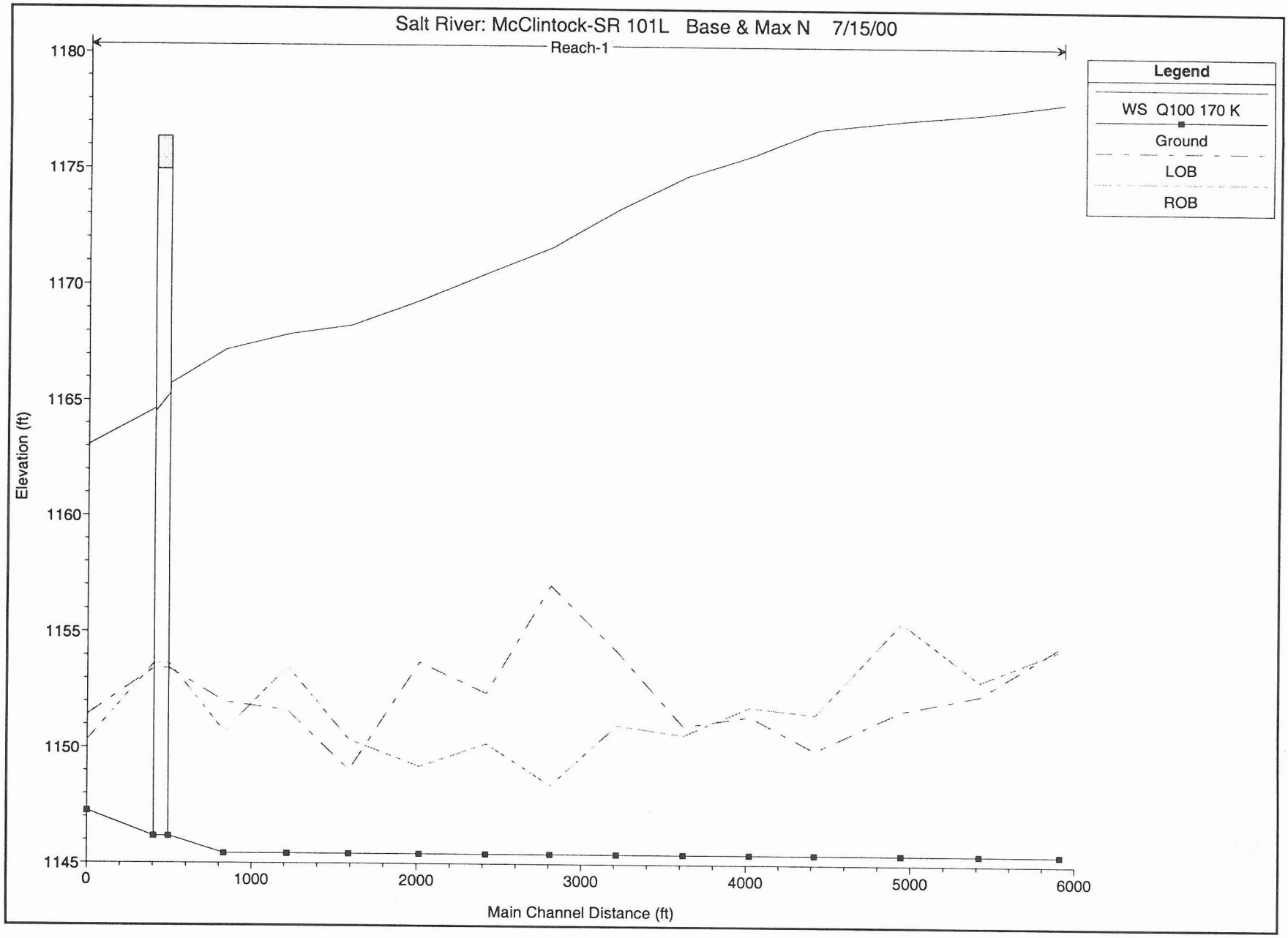
Plan Title: BaseMaxN

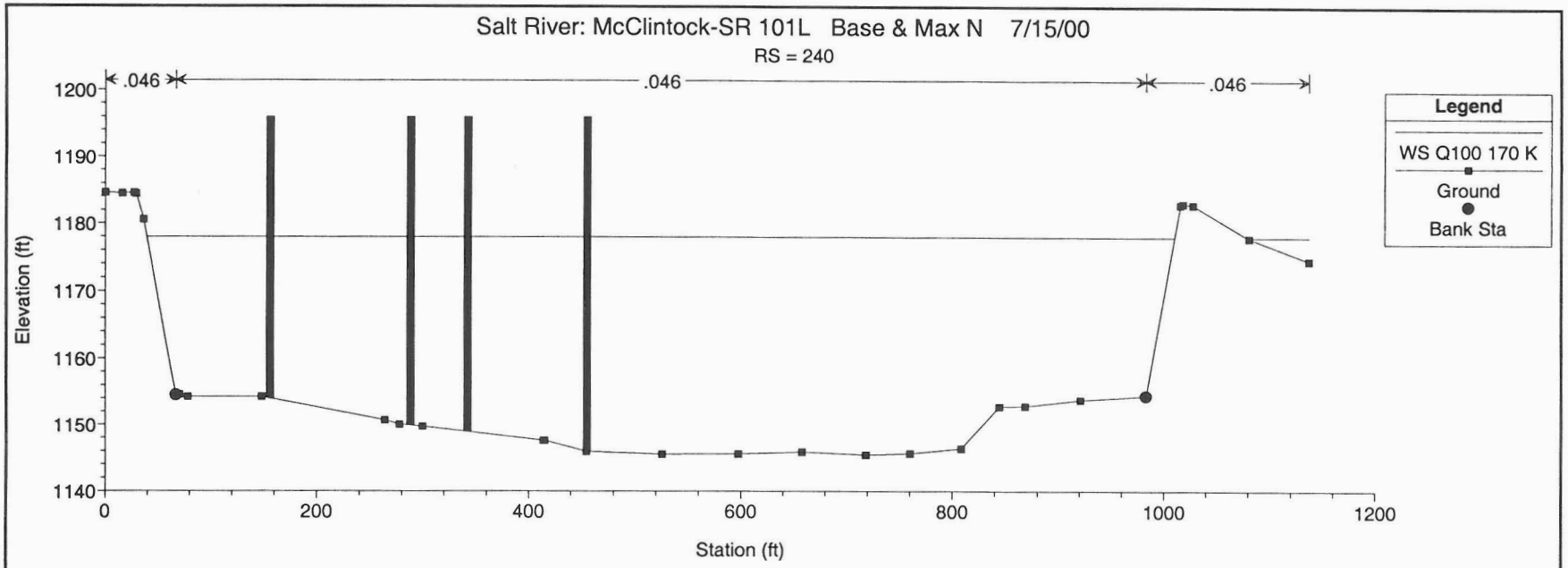
HEC-RAS Plan: BaseMaxN River: RIVER-1 Reach: Reach-1

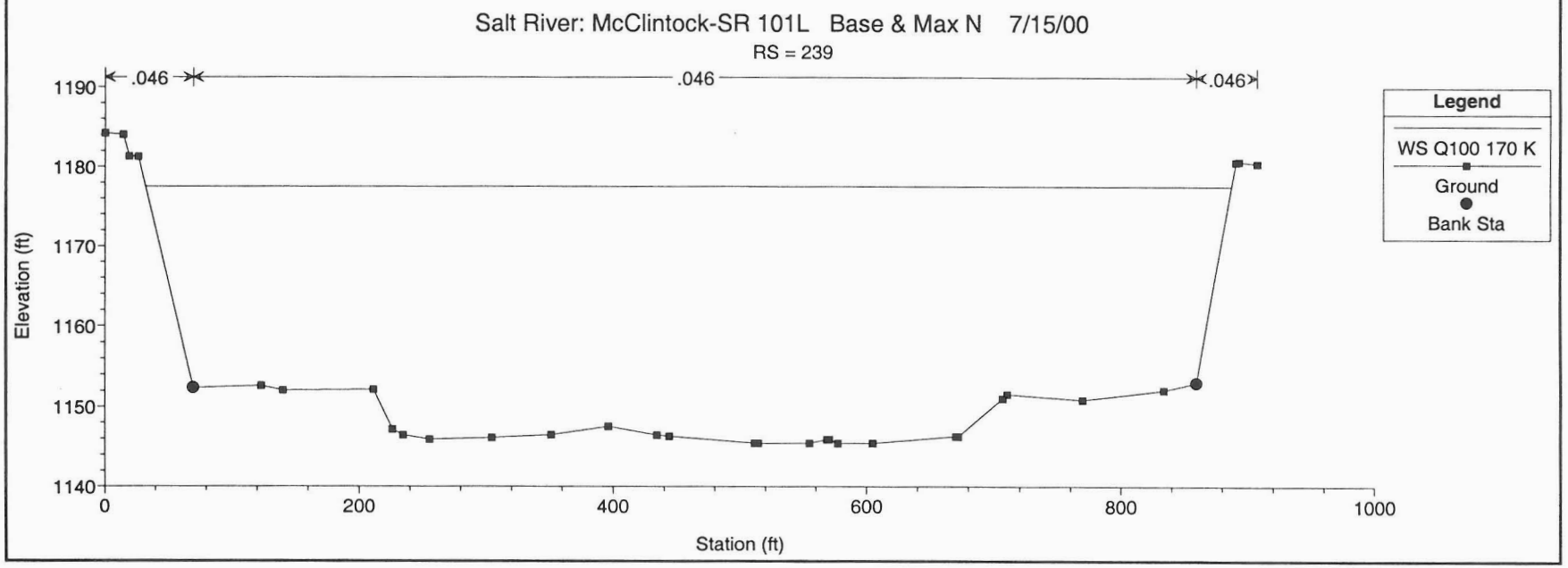
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	240	215000.00	1145.43	1176.90		1178.05	0.000454	8.63	25231.90	980.62	0.29
Reach-1	239	215000.00	1145.43	1176.40		1177.81	0.000412	9.57	22842.31	852.58	0.32
Reach-1	238	215000.00	1145.43	1176.20		1177.61	0.000424	9.57	22764.87	859.05	0.32
Reach-1	237	215000.00	1145.43	1175.91		1177.34	0.000627	9.64	22544.07	808.04	0.32
Reach-1	236	215000.00	1145.43	1174.38		1176.90	0.001186	12.83	17002.70	679.06	0.44
Reach-1	235	215000.00	1145.43	1173.50		1176.34	0.001470	12.38	16043.49	669.34	0.41
Reach-1	234	215000.00	1145.43	1171.85		1175.55	0.002069	15.55	14022.88	622.31	0.56
Reach-1	233	215000.00	1145.43	1170.16		1174.54	0.002681	16.87	12895.82	622.42	0.64
Reach-1	232	215000.00	1145.43	1169.72		1173.40	0.002101	15.48	14100.46	671.11	0.58
Reach-1	231	215000.00	1145.43	1169.14		1172.48	0.001950	14.74	14747.31	715.54	0.56
Reach-1	230	215000.00	1145.43	1168.74		1171.60	0.001584	13.72	15998.21	776.45	0.51
Reach-1	229	215000.00	1145.43	1169.04		1170.83	0.000939	10.79	20125.70	955.74	0.41
Reach-1	228	215000.00	1145.43	1168.75	1159.40	1170.45	0.000870	10.51	20743.69	1031.06	0.40
Reach-1	123.8	215000.00	1146.17	1167.67	1161.40	1170.04	0.001230	12.51	17756.63	1062.14	0.51
Reach-1	123.75	Bridge									
Reach-1	123.7	215000.00	1146.17	1166.94	1161.40	1169.52	0.001415	13.06	16978.99	1051.07	0.55
Reach-1	120.5	215000.00	1147.26	1166.59	1160.10	1168.83	0.001181	12.12	18114.22	1066.26	0.50

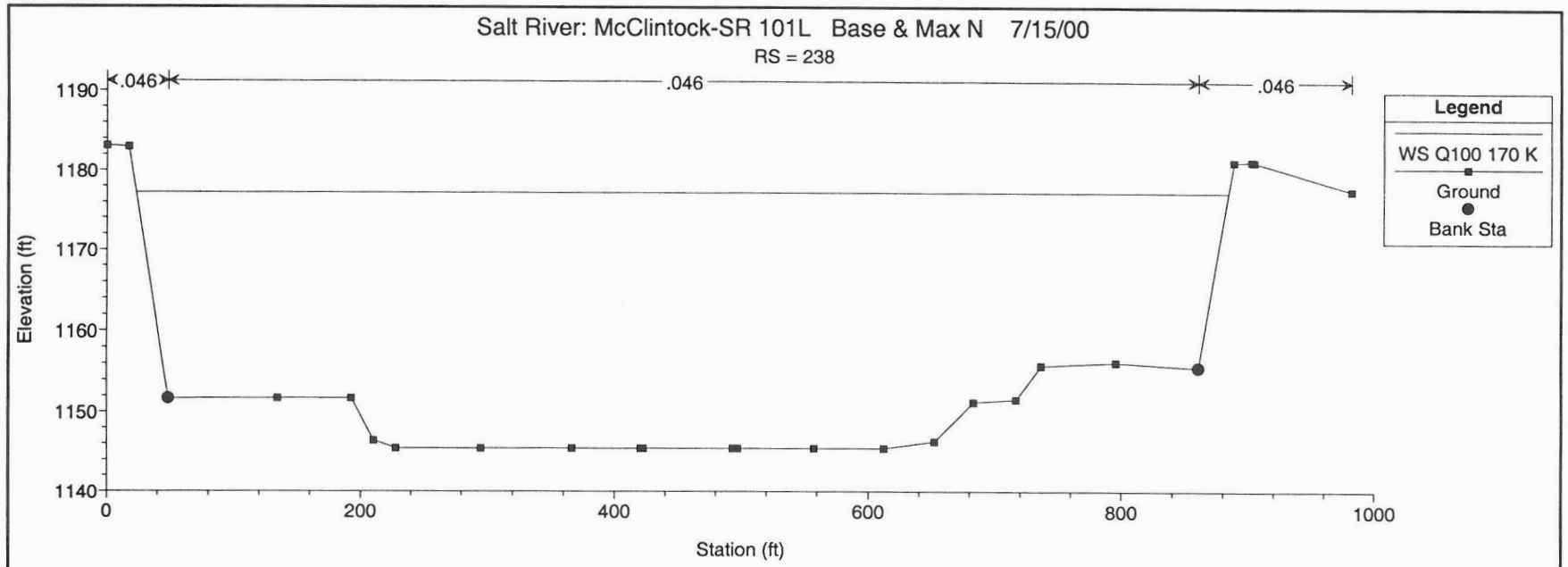
HEC-RAS Plan: BaseMaxN River: RIVER-1 Reach: Reach-1

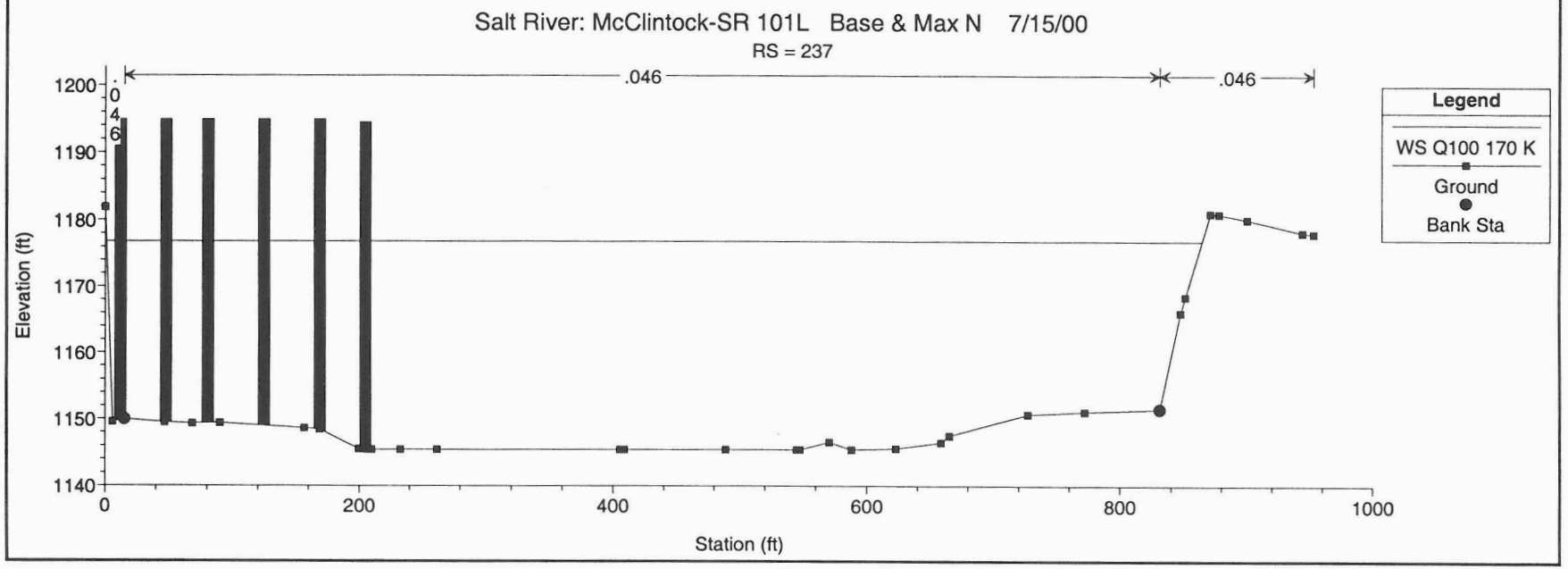
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	240	172000.00	1145.43	1177.97		1178.65	0.000649	6.64	26287.53	1000.19	0.22
Reach-1	239	172000.00	1145.43	1177.49		1178.33	0.000583	7.36	23774.93	855.46	0.24
Reach-1	238	172000.00	1145.43	1177.21		1178.05	0.000604	7.38	23630.21	861.16	0.24
Reach-1	237	172000.00	1145.43	1176.79		1177.66	0.000922	7.48	23260.38	809.59	0.24
Reach-1	236	172000.00	1145.43	1175.65		1177.12	0.001650	9.77	17873.28	681.85	0.33
Reach-1	235	172000.00	1145.43	1174.71		1176.36	0.002040	9.35	16858.14	672.10	0.31
Reach-1	234	172000.00	1145.43	1173.26		1175.36	0.002785	11.71	14906.83	625.87	0.41
Reach-1	233	172000.00	1145.43	1171.62		1174.06	0.003527	12.62	13804.40	625.79	0.46
Reach-1	232	172000.00	1145.43	1170.52		1172.71	0.003033	11.94	14636.97	674.39	0.44
Reach-1	231	172000.00	1145.43	1169.36		1171.45	0.003043	11.67	14902.49	716.05	0.44
Reach-1	230	172000.00	1145.43	1168.26		1170.18	0.002732	11.23	15630.99	774.20	0.43
Reach-1	229	172000.00	1145.43	1167.89		1169.17	0.001795	9.13	19031.85	952.04	0.35
Reach-1	228	172000.00	1145.43	1167.20	1157.81	1168.48	0.001793	9.09	19149.66	1025.03	0.36
Reach-1	123.8	172000.00	1146.17	1165.73	1159.75	1167.65	0.002911	11.26	15713.73	1041.56	0.49
Reach-1	123.75	Bridge									
Reach-1	123.7	172000.00	1146.17	1164.63	1159.71	1166.87	0.003688	12.11	14582.51	1030.43	0.54
Reach-1	120.5	172000.00	1147.26	1163.07	1158.53	1165.32	0.003976	12.13	14406.35	1040.47	0.56

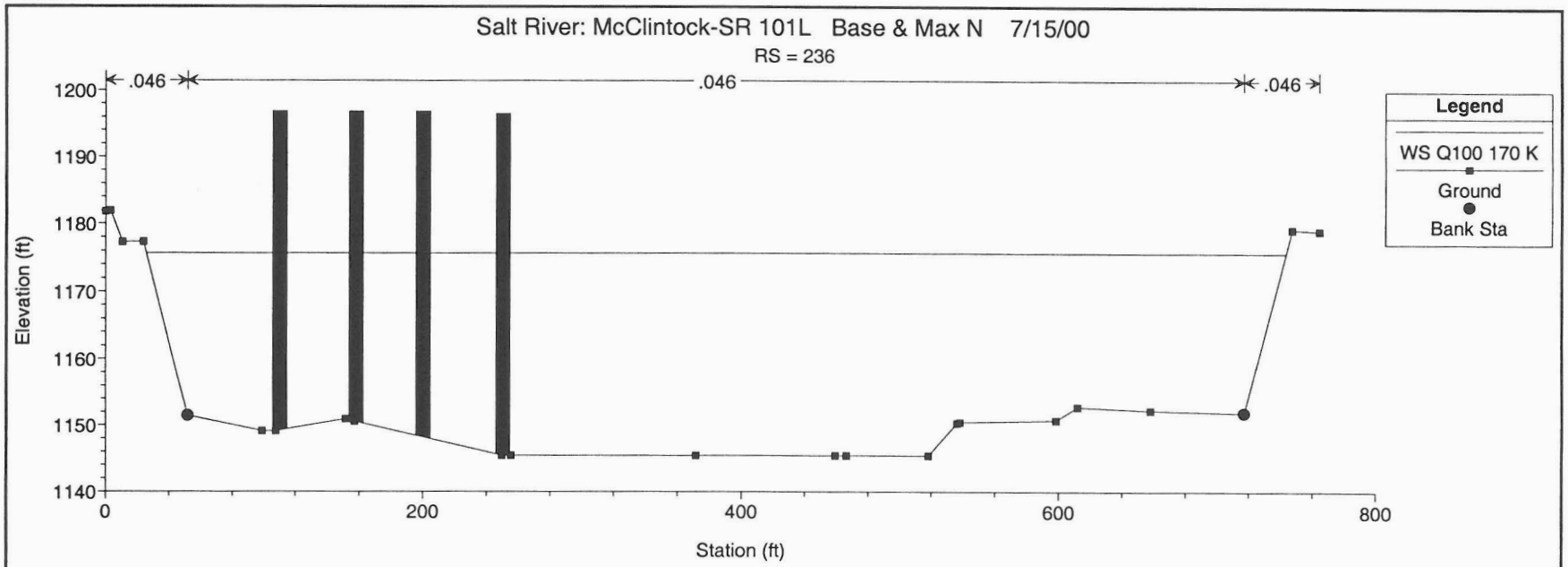

Salt River: McClintock-SR 101L Base & Max N 7/15/00
Reach-1
Legend
WS Q100 170 K
Ground
LOB
ROB
Elevation (ft)
1180
1175
1170
1165
1160
1155
1150
1145
0
1000
2000
3000
4000
5000
6000
Main Channel Distance (ft)


Salt River: McClintock-SR 101L Base & Max N 7/15/00
RS = 240
.046
.046
.046
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)


Salt River: McClintock-SR 101L Base & Max N 7/15/00
RS = 239
.046
.046
.046
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)


Salt River: McClintock-SR 101L Base & Max N 7/15/00
RS = 238
.046
.046
.046
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)


Salt River: McClintock-SR 101L Base & Max N 7/15/00
RS = 237
.046
.046
.046
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)


Salt River: McClintock-SR 101L Base & Max N 7/15/00
RS = 236
.046
.046
.046
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
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1170
1160
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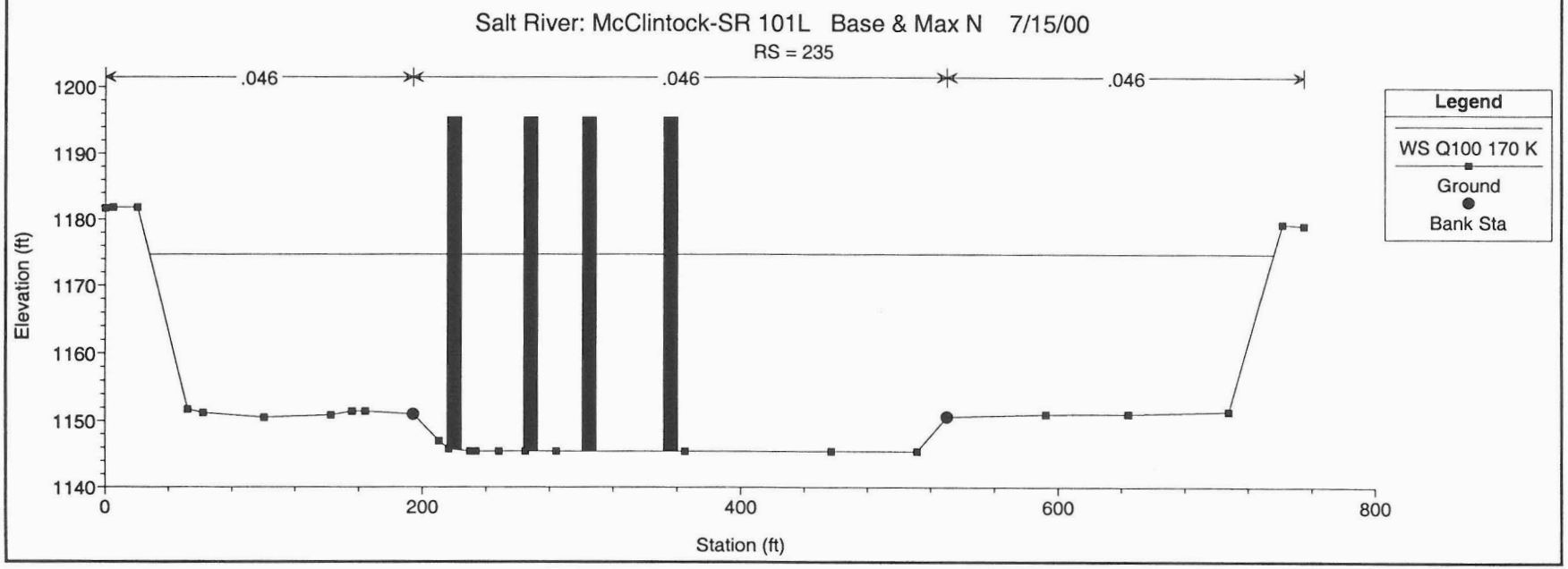
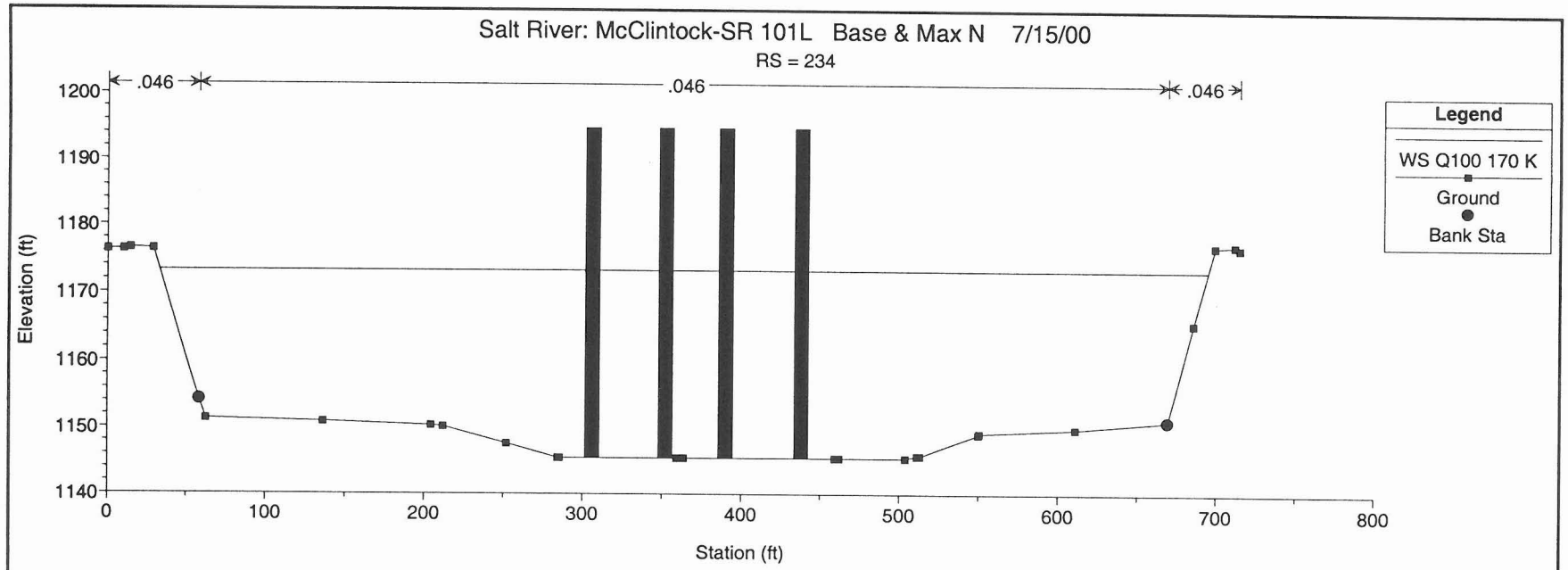
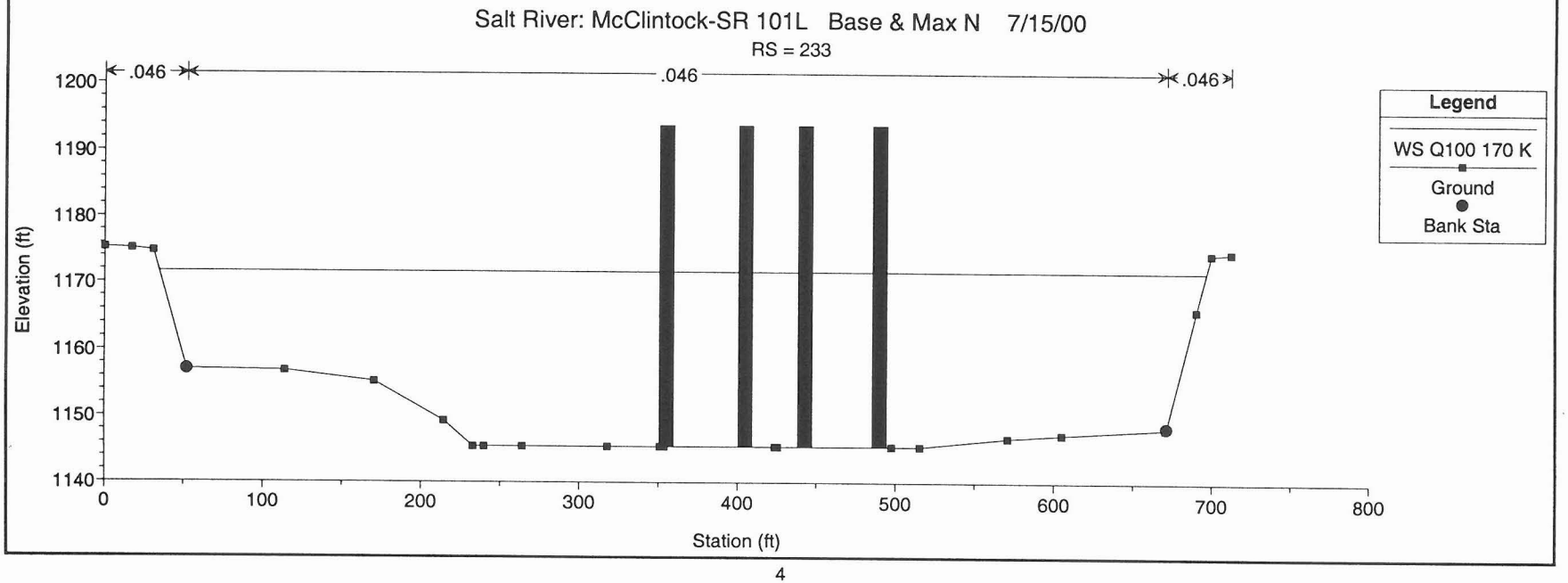
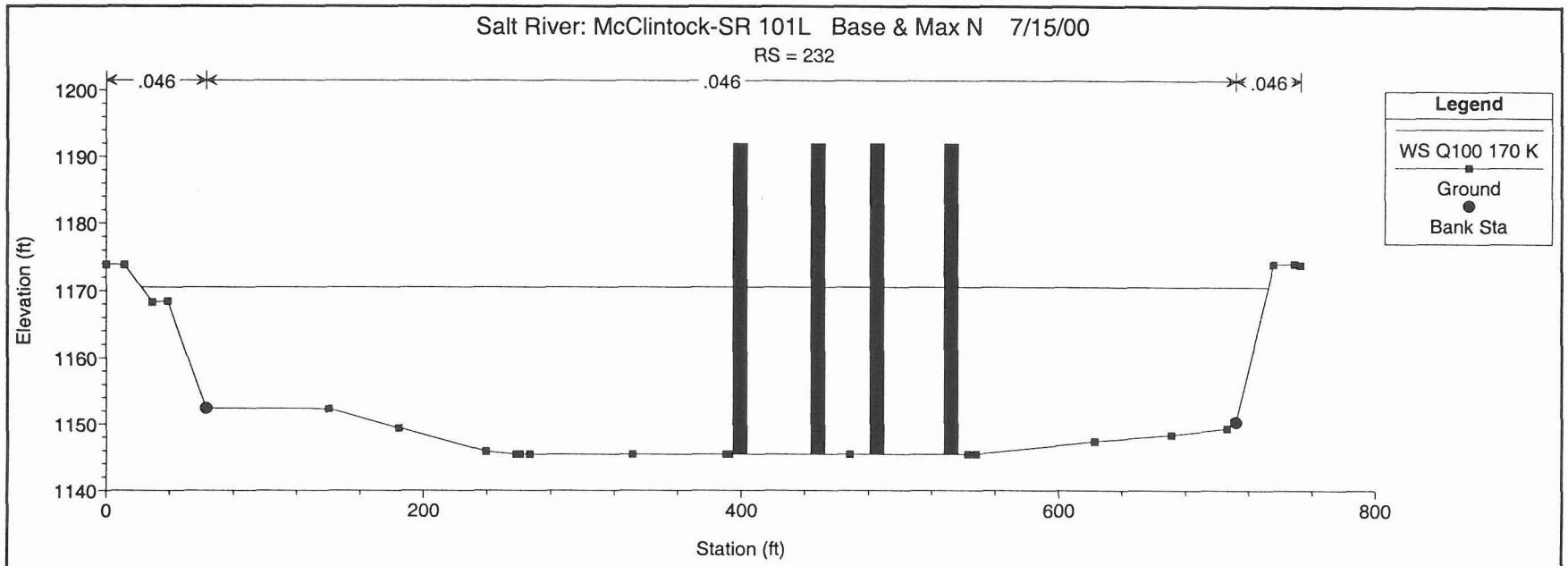
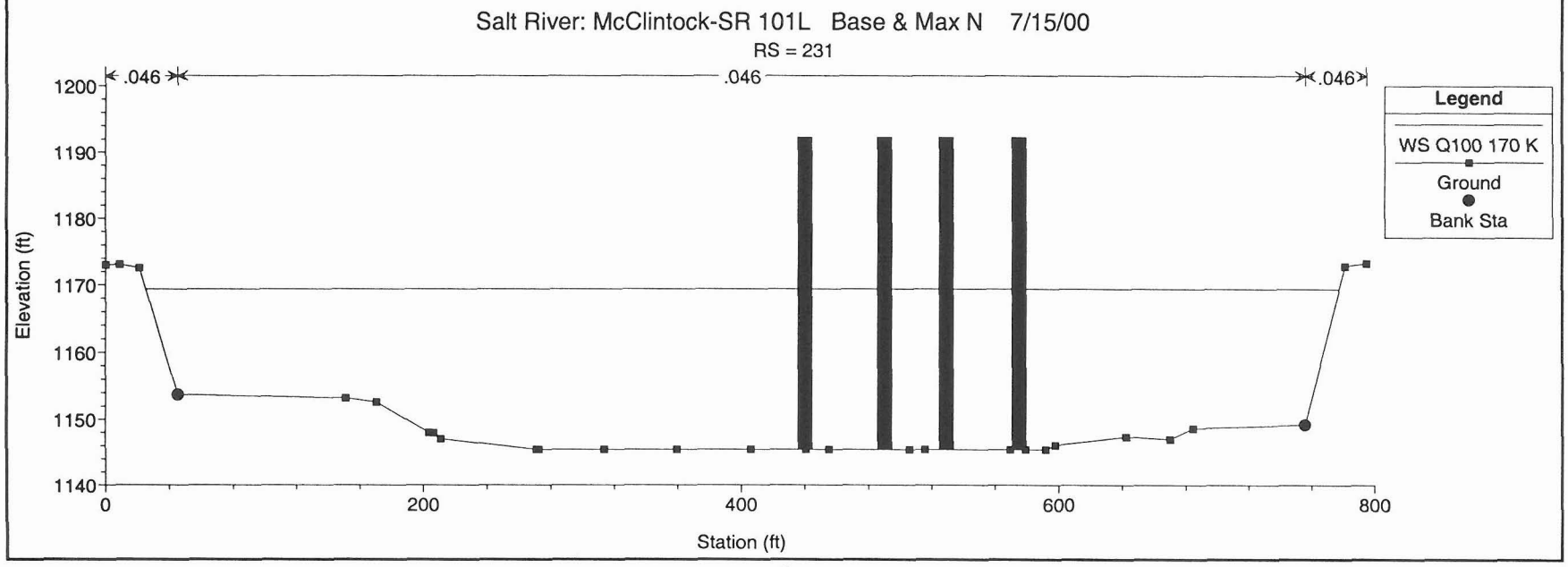
1140
0
200
400
600
800
Station (ft)

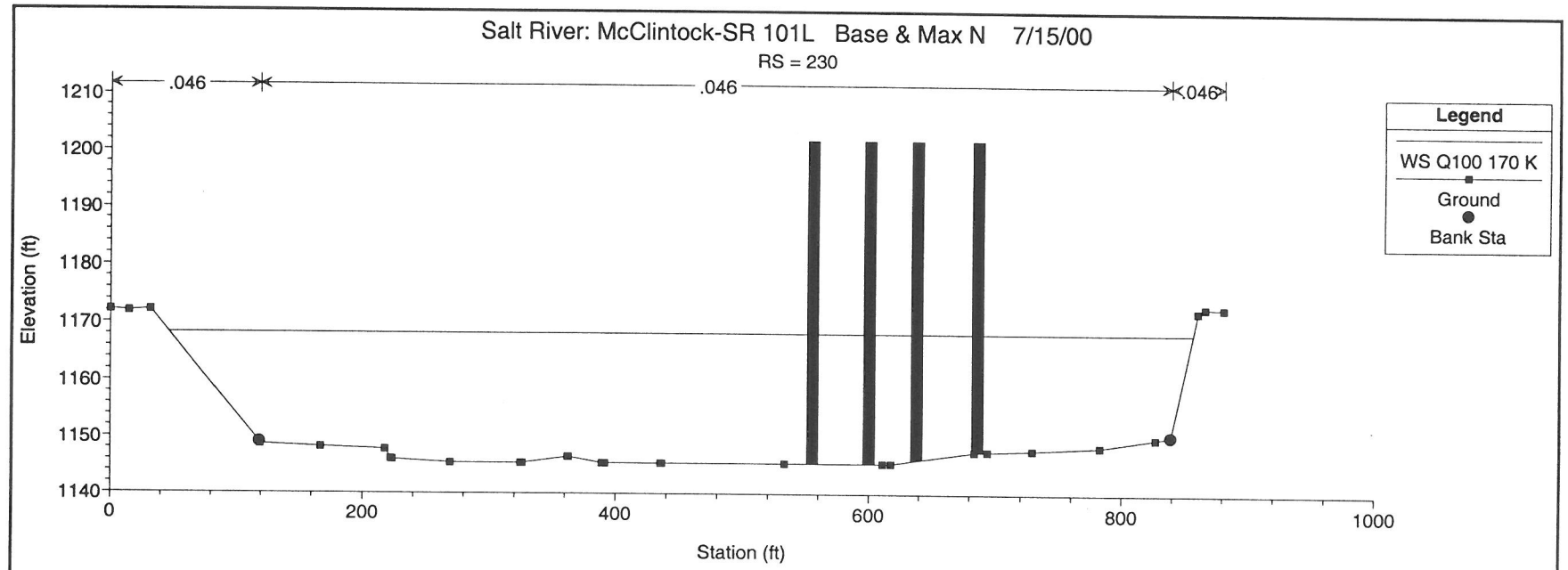

Salt River: McClintock-SR 101L Base & Max N 7/15/00
RS = 235
.046
.046
.046
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)

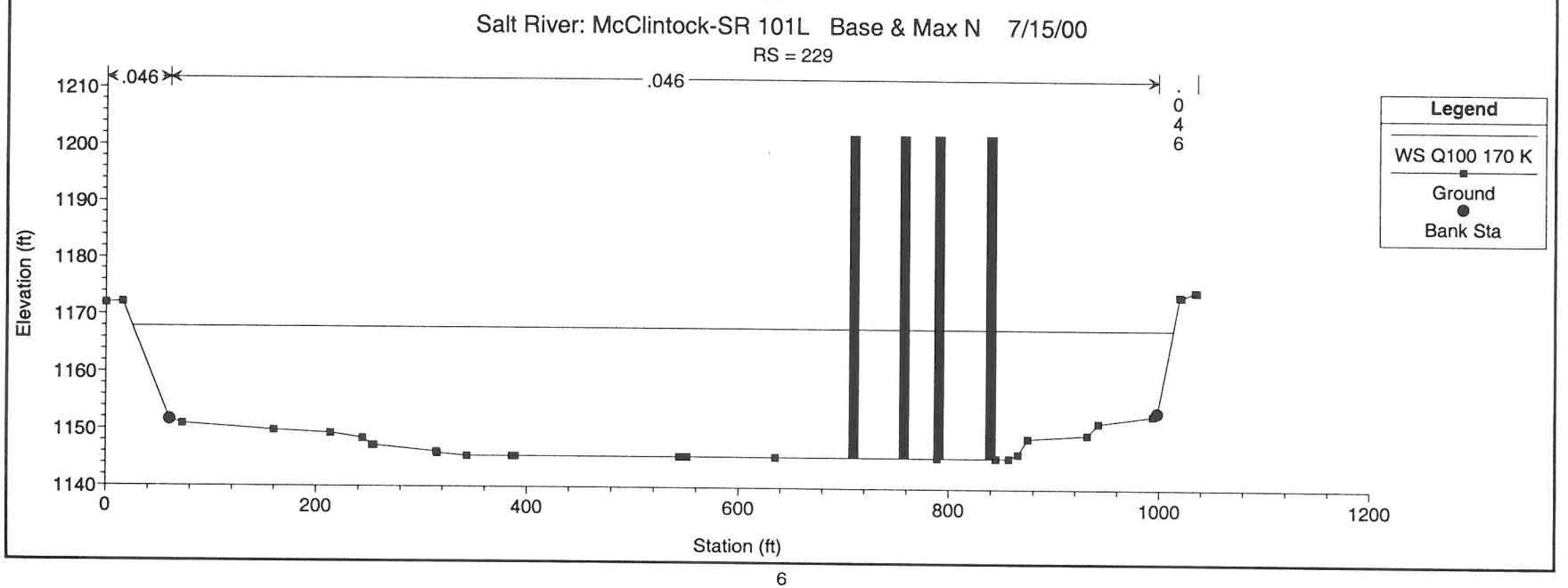

Salt River: McClintock-SR 101L Base & Max N 7/15/00
RS = 234
.046
.046
.046
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
100
200
300
400
500
600
700
800
Station (ft)
Legend
WS Q100 170 K
Ground
Bank Sta

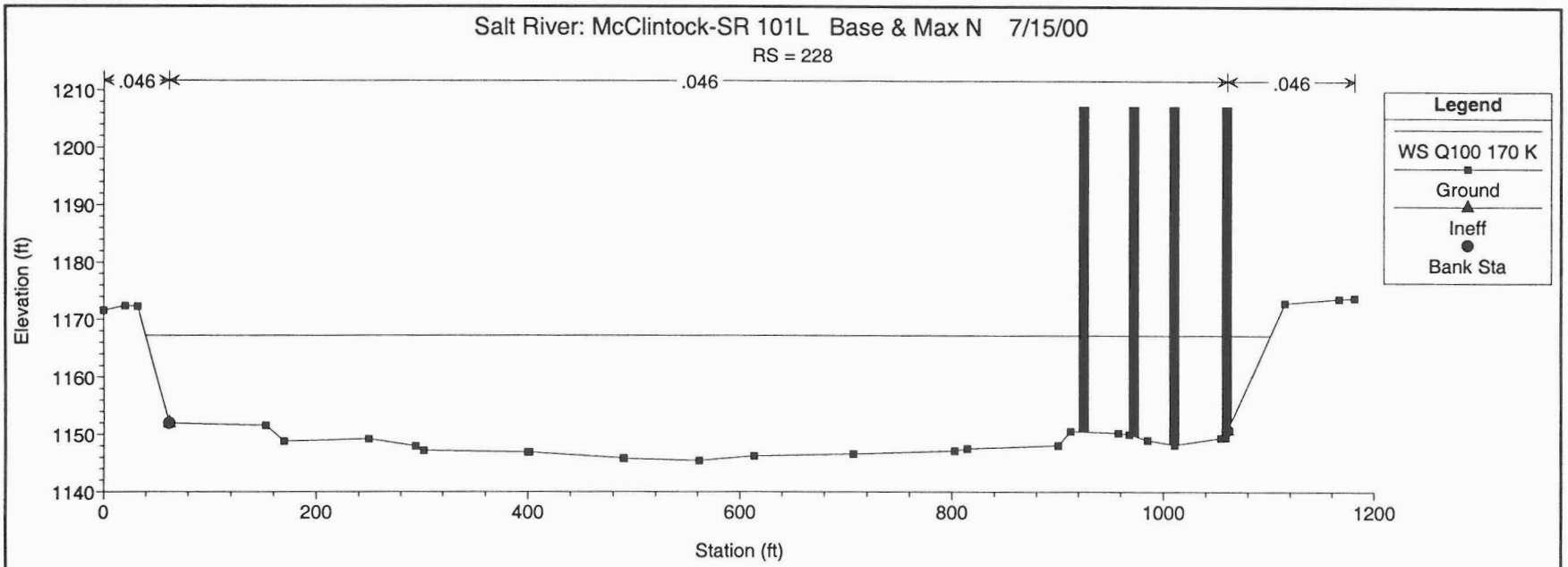

Salt River: McClintock-SR 101L Base & Max N 7/15/00
RS = 233
.046
.046
.046
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
100
200
300
400
500
600
700
800
Station (ft)
Legend
WS Q100 170 K
Ground
Bank Sta

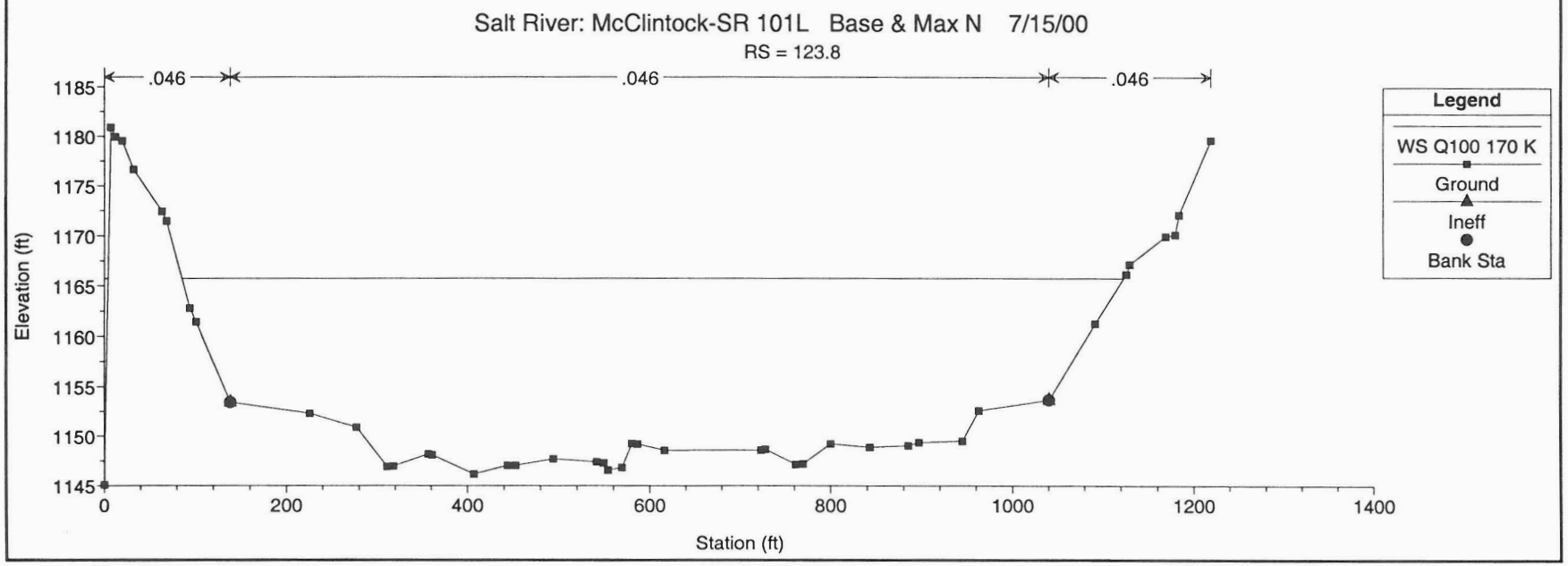

Salt River: McClintock-SR 101L Base & Max N 7/15/00
RS = 232
.046
.046
.046
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)

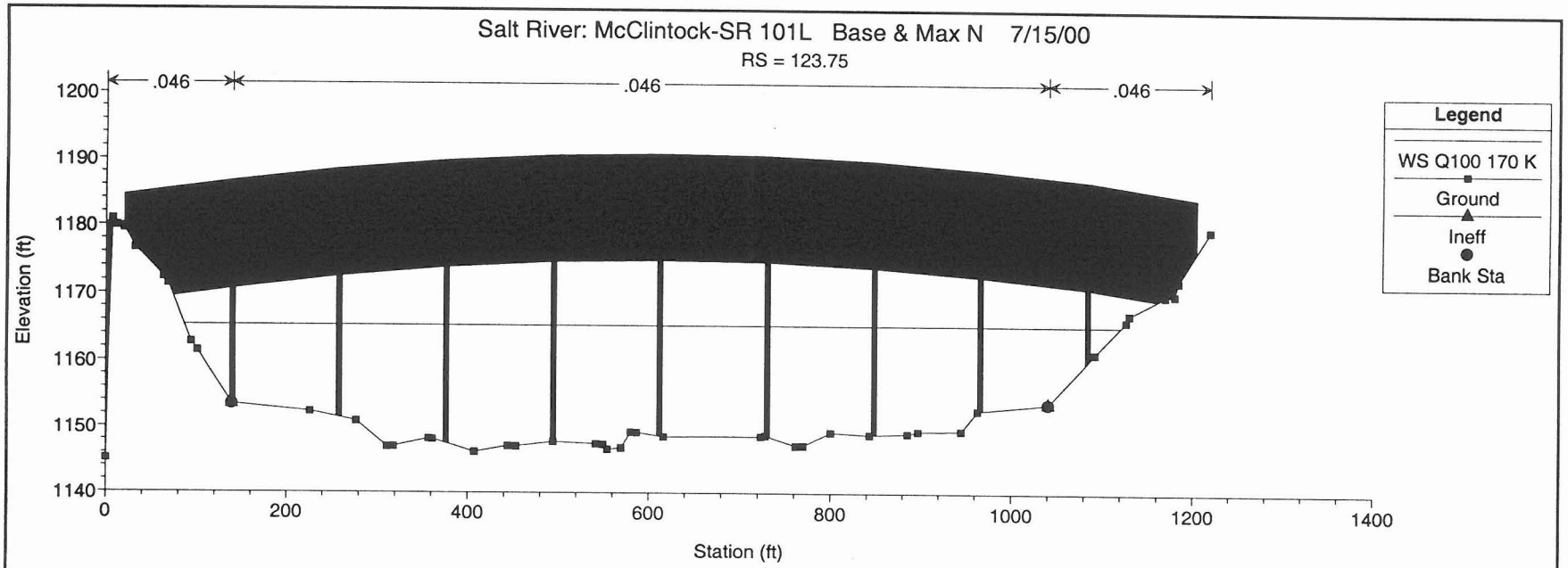

Salt River: McClintock-SR 101L Base & Max N 7/15/00
RS = 231
.046
.046
.046
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)

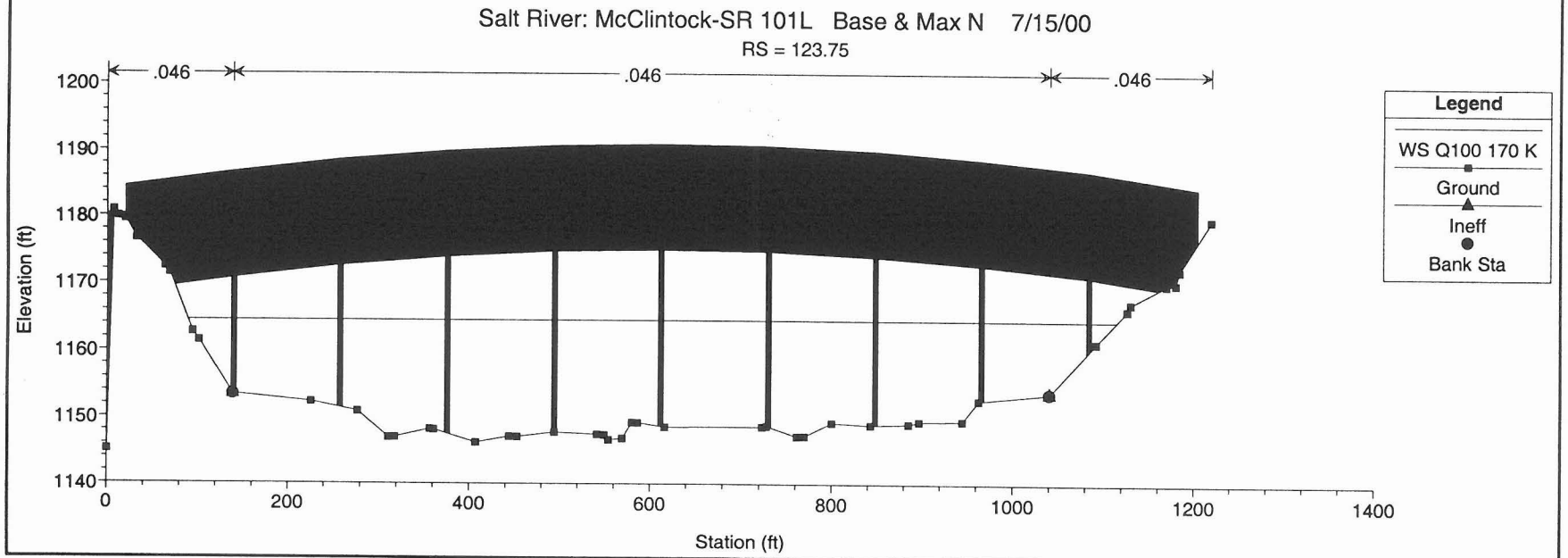

Salt River: McClintock-SR 101L Base & Max N 7/15/00
RS = 230
.046
.046
.046
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)

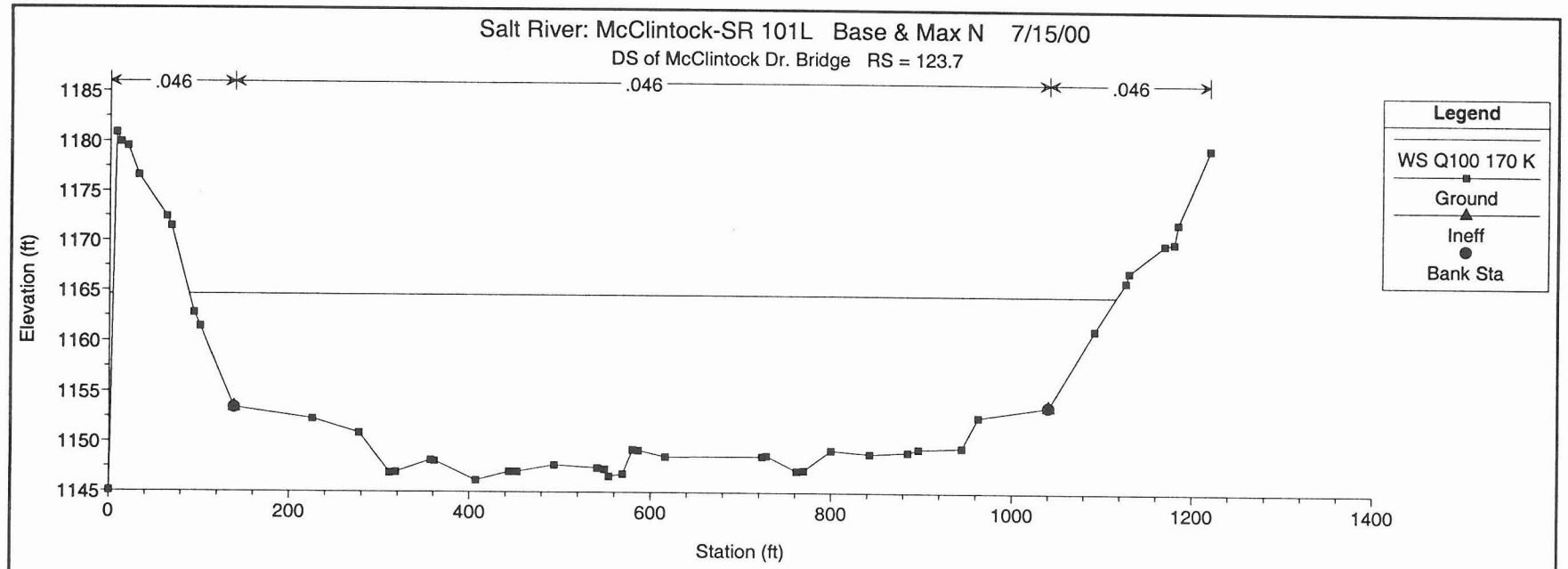

Salt River: McClintock-SR 101L Base & Max N 7/15/00
RS = 229
.046
.046
.046
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)

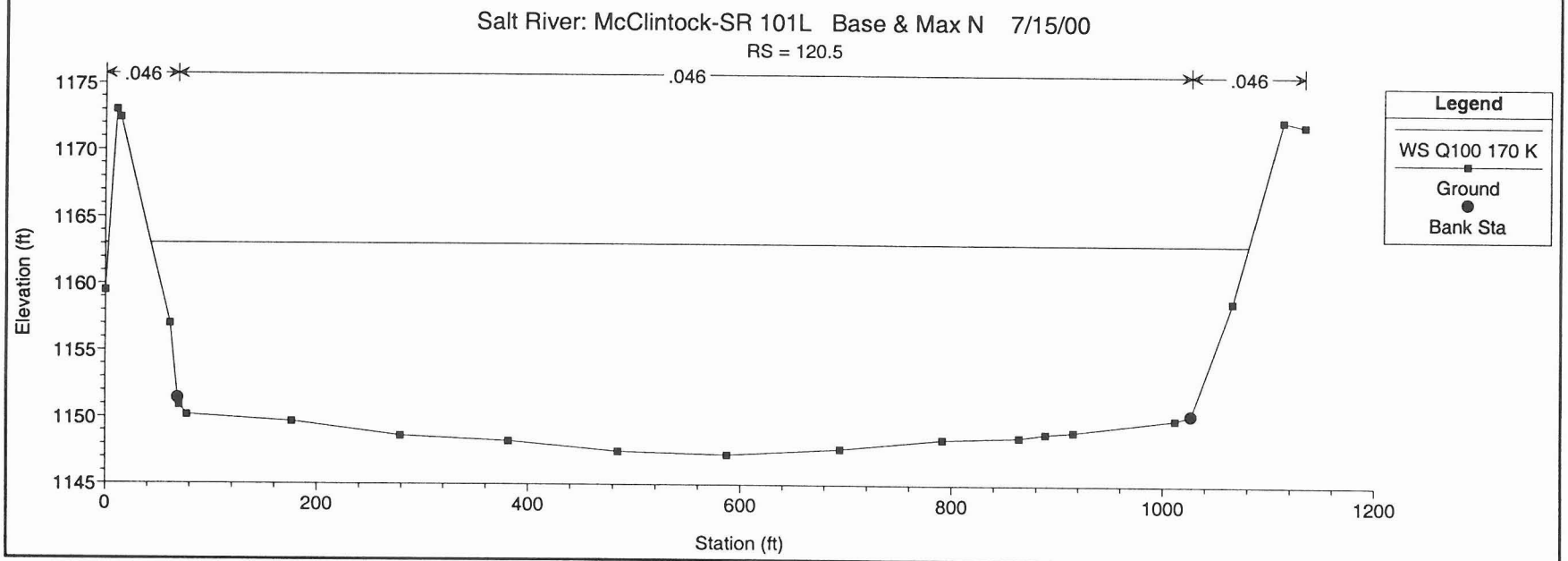

Salt River: McClintock-SR 101L Base & Max N 7/15/00
RS = 228
.046
.046
.046
Elevation (ft)
Station (ft)
Legend
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base & Max N 7/15/00
RS = 123.8
.046
.046
.046
Elevation (ft)
Station (ft)
Legend
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base & Max N 7/15/00
RS = 123.75
.046
.046
.046
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base & Max N 7/15/00
RS = 123.75
.046
.046
.046
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base & Max N 7/15/00
DS of McClintock Dr. Bridge RS = 123.7
.046
.046
.046
Elevation (ft)
1185
1180
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 170 K
Ground
Ineff
Bank Sta

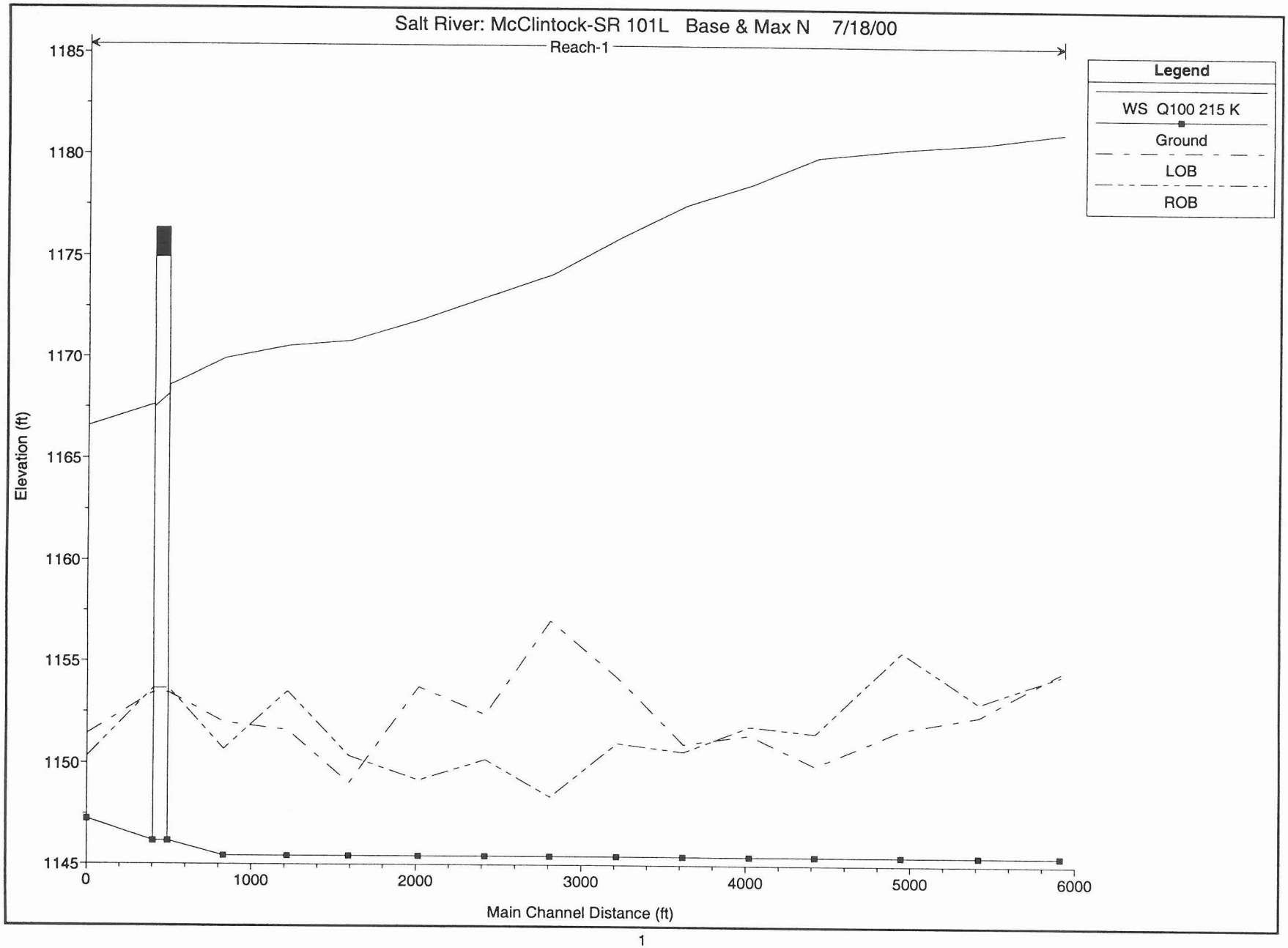

Salt River: McClintock-SR 101L Base & Max N 7/15/00
RS = 120.5
.046
.046
.046
Elevation (ft)
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS Q100 170 K
Ground
Bank Sta

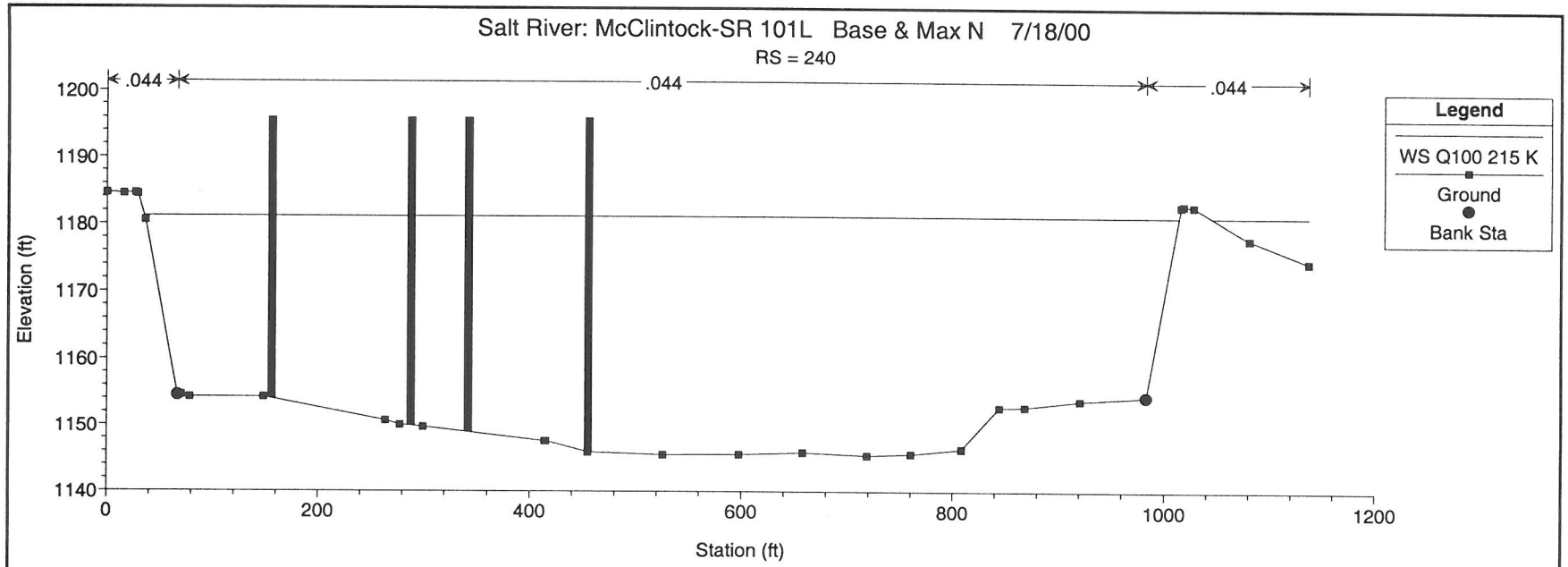
Q_{100} = 215,000 cfs, Survyed Topo & Overtopping n Value (n = 0.044)

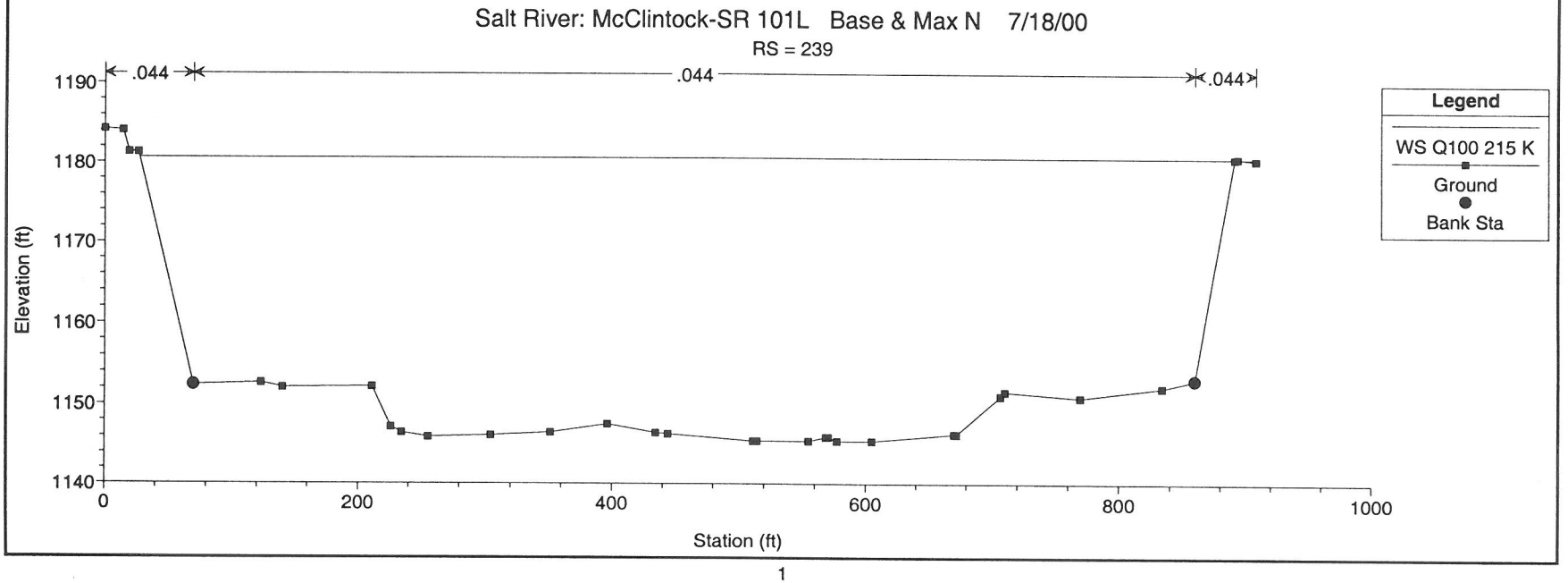
Plan Title: BaseMaxN

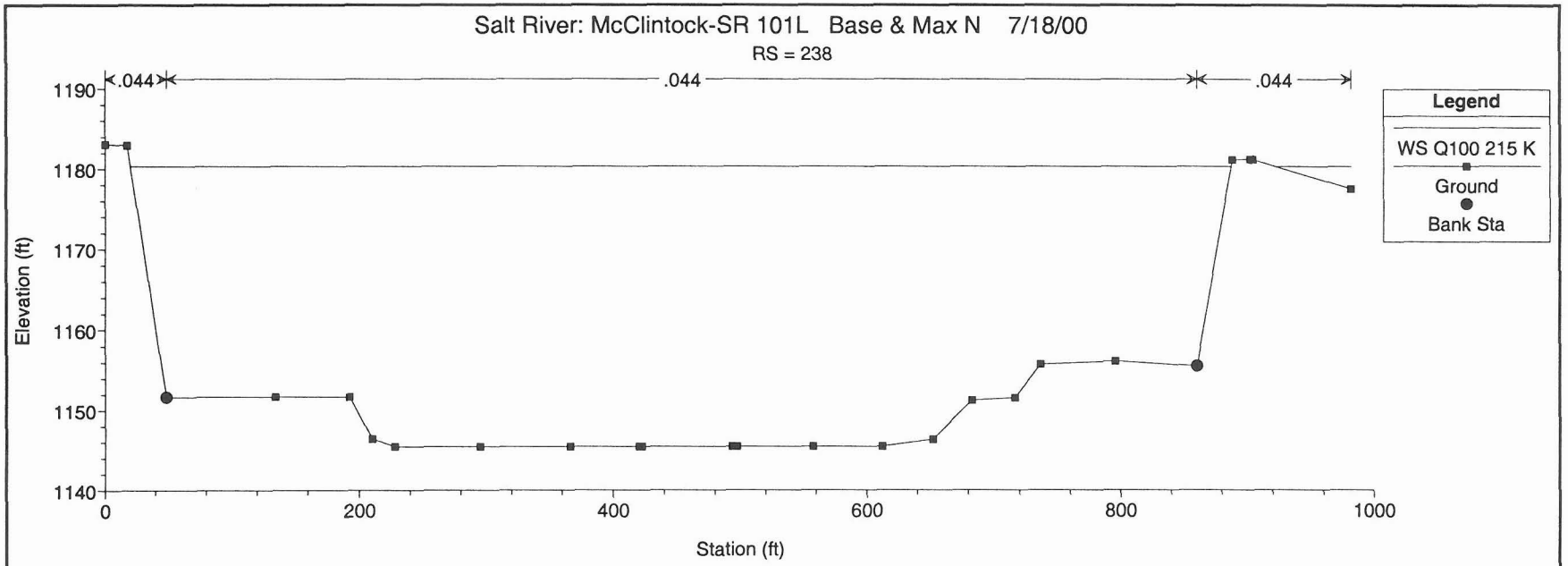
HEC-RAS Plan: BaseMaxN River: RIVER-1 Reach: Reach-1

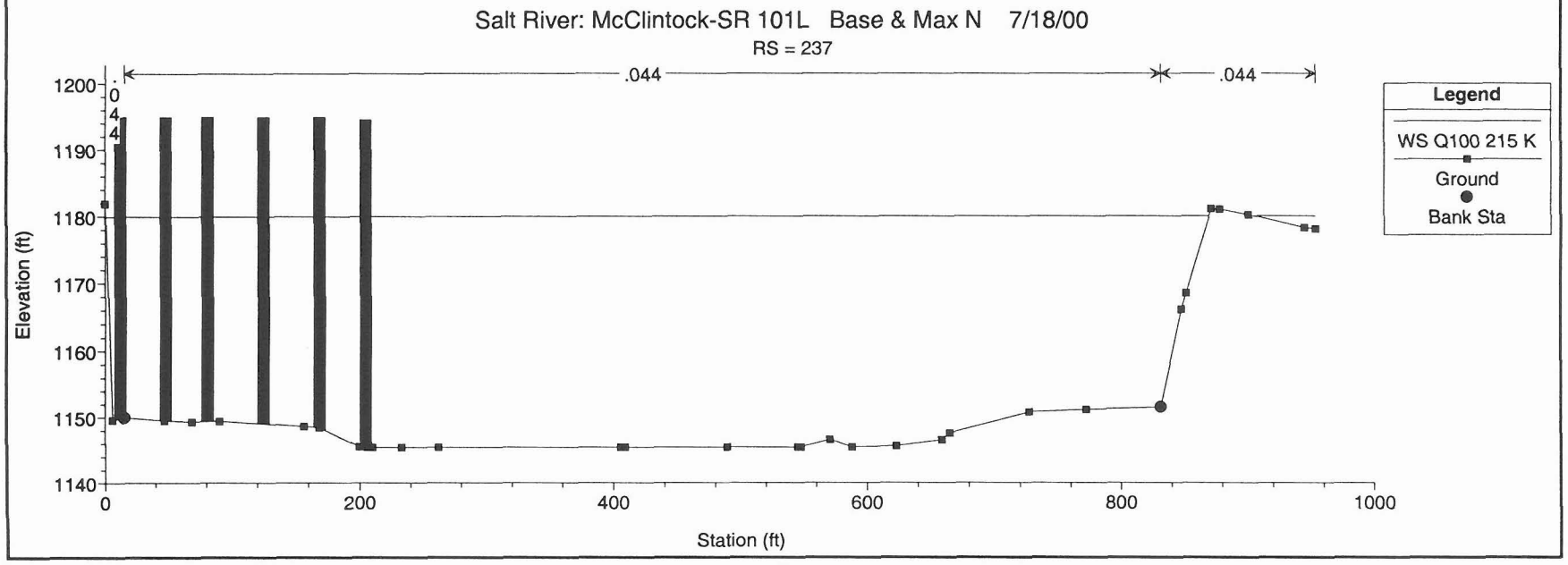
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	240	215000.00	1145.43	1181.17		1182.01	0.000667	7.43	29555.87	1042.62	0.23
Reach-1	239	215000.00	1145.43	1180.63		1181.68	0.000589	8.29	26473.74	877.16	0.26
Reach-1	238	215000.00	1145.43	1180.35		1181.40	0.000606	8.29	26429.38	928.04	0.26
Reach-1	237	215000.00	1145.43	1179.90		1181.00	0.000980	8.44	25836.83	863.33	0.26
Reach-1	236	215000.00	1145.43	1178.56		1180.41	0.001741	11.02	19879.45	702.11	0.35
Reach-1	235	215000.00	1145.43	1177.52		1179.62	0.002121	10.31	18752.04	678.48	0.32
Reach-1	234	215000.00	1145.43	1175.91		1178.57	0.002926	13.19	16572.08	632.52	0.44
Reach-1	233	215000.00	1145.43	1174.12		1177.20	0.003670	14.18	15376.74	631.58	0.50
Reach-1	232	215000.00	1145.43	1173.03		1175.77	0.003148	13.40	16338.98	684.69	0.47
Reach-1	231	215000.00	1145.43	1171.86		1174.47	0.003092	13.04	16702.73	721.96	0.47
Reach-1	230	215000.00	1145.43	1170.80		1173.17	0.002746	12.48	17613.00	786.26	0.45
Reach-1	229	215000.00	1145.43	1170.56		1172.12	0.001747	10.07	21582.41	960.64	0.37
Reach-1	228	215000.00	1145.43	1169.93	1159.40	1171.44	0.001682	9.94	21953.50	1035.61	0.37
Reach-1	123.8	215000.00	1146.17	1168.57	1161.40	1170.71	0.002403	11.90	18718.98	1077.80	0.48
Reach-1	123.75	Bridge									
Reach-1	123.7	215000.00	1146.17	1167.64	1161.40	1170.01	0.002850	12.54	17719.43	1061.53	0.52
Reach-1	120.5	215000.00	1147.26	1166.59	1160.10	1168.83	0.002719	12.12	18114.22	1066.26	0.50

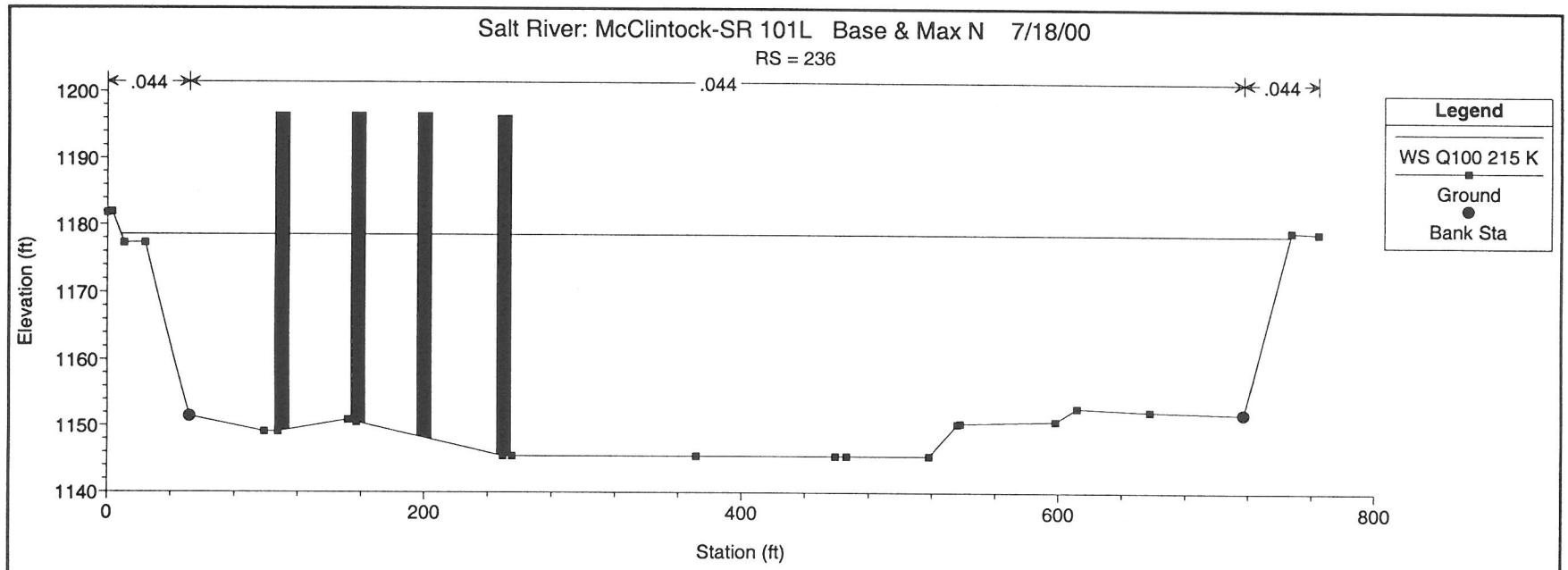

Salt River: McClintock-SR 101L Base & Max N 7/18/00
Reach-1
Legend
WS Q100 215 K
Ground
LOB
ROB
Elevation (ft)
1185
1180
1175
1170
1165
1160
1155
1150
1145
0
1000
2000
3000
4000
5000
6000
Main Channel Distance (ft)

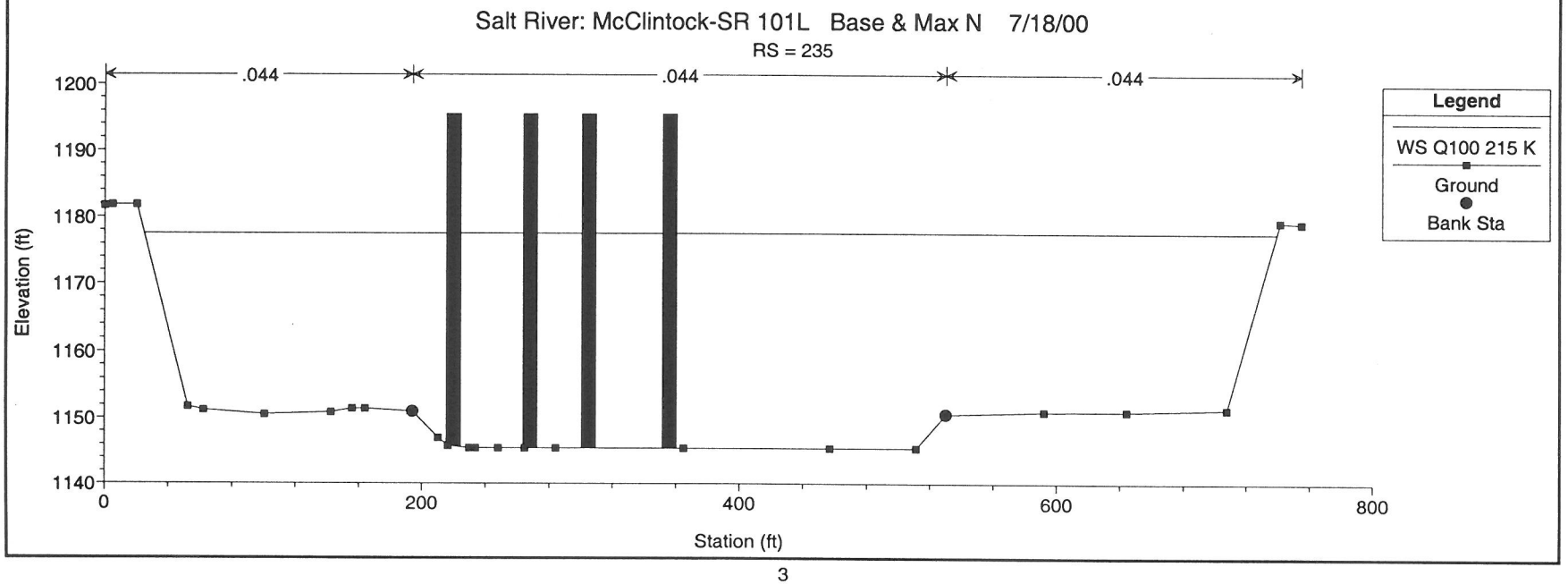

Salt River: McClintock-SR 101L Base & Max N 7/18/00
RS = 240
.044
.044
.044
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)

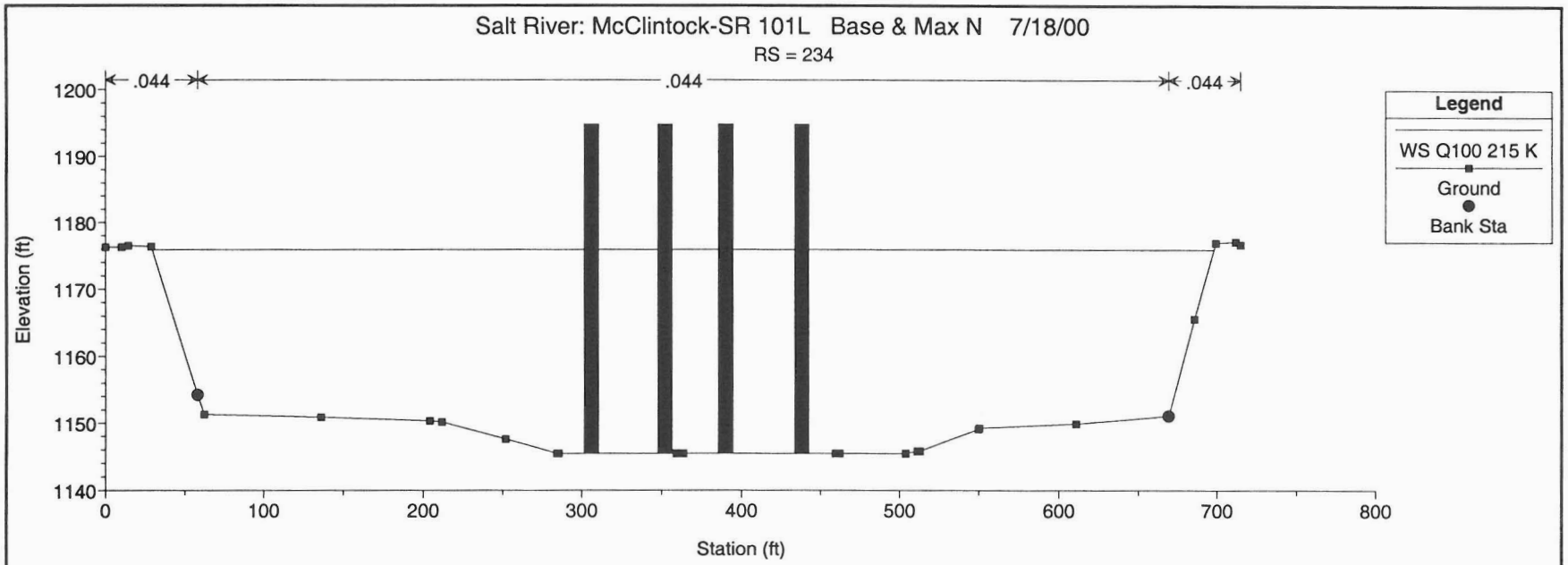

Salt River: McClintock-SR 101L Base & Max N 7/18/00
RS = 239
.044
.044
.044
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)

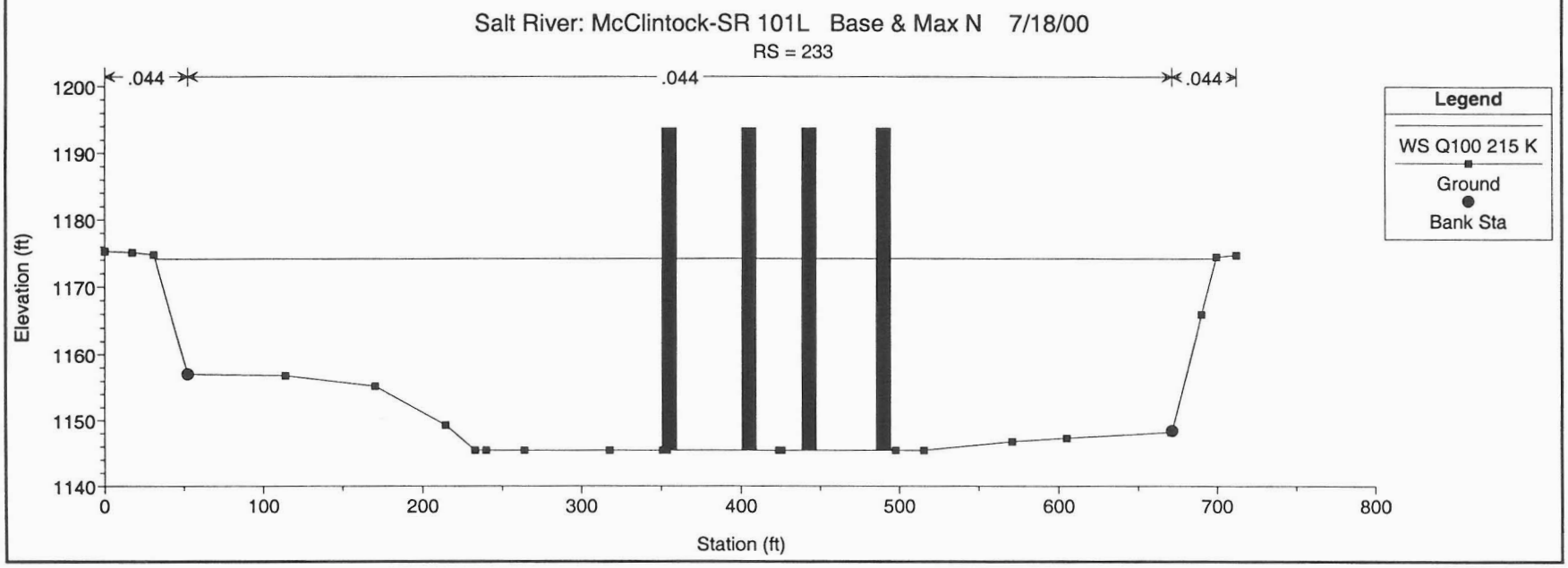

Salt River: McClintock-SR 101L Base & Max N 7/18/00
RS = 238
.044
.044
.044
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)

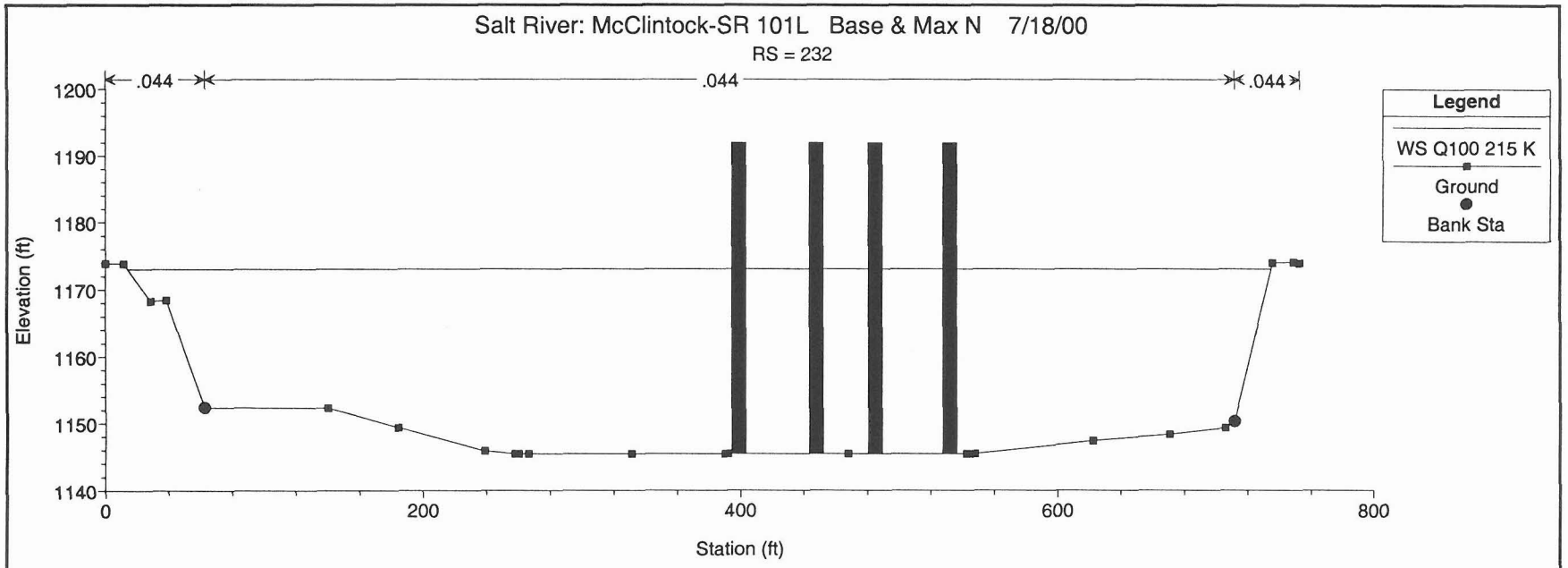

Salt River: McClintock-SR 101L Base & Max N 7/18/00
RS = 237
.044
.044
.044
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)

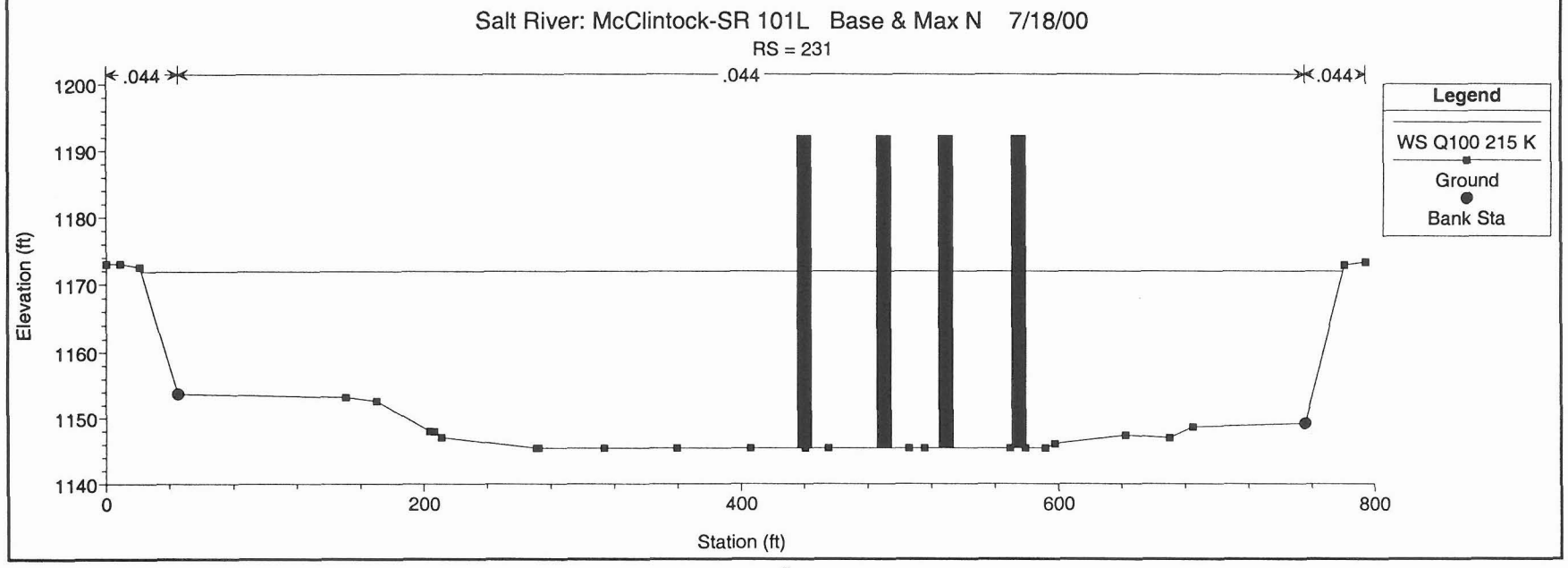

Salt River: McClintock-SR 101L Base & Max N 7/18/00
RS = 236
.044
.044
.044
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)

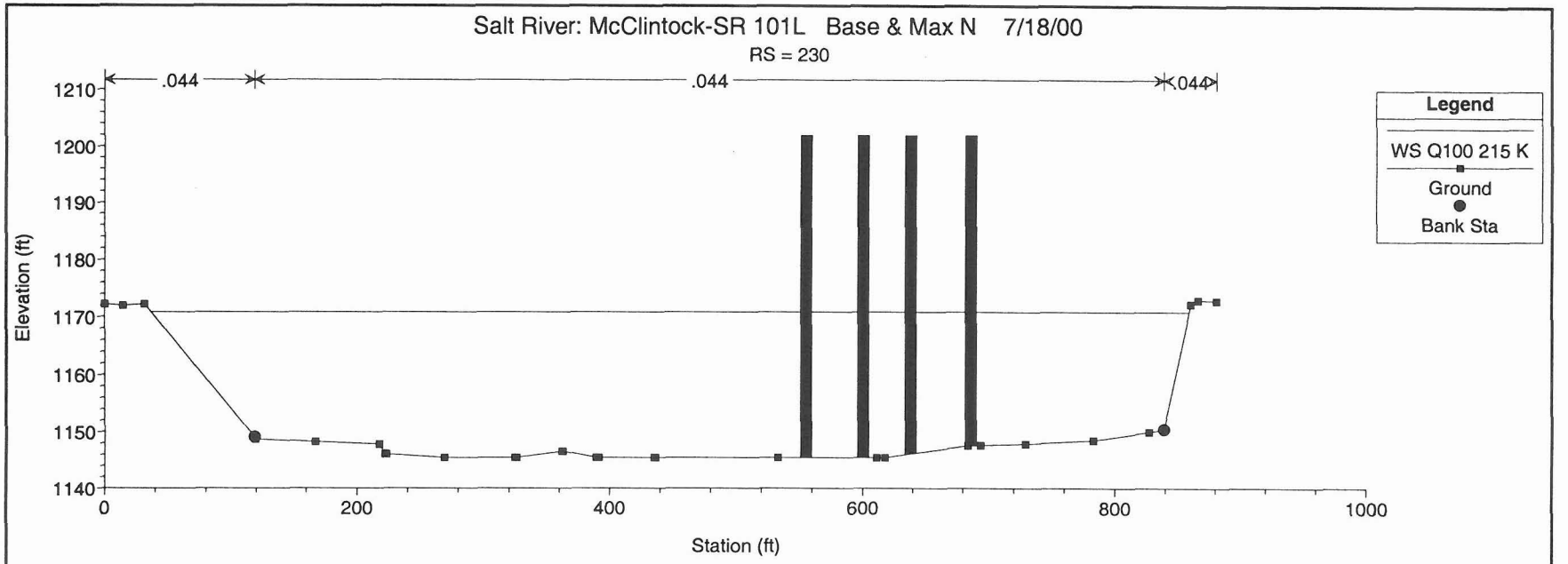

Salt River: McClintock-SR 101L Base & Max N 7/18/00
RS = 235
.044
.044
.044
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)

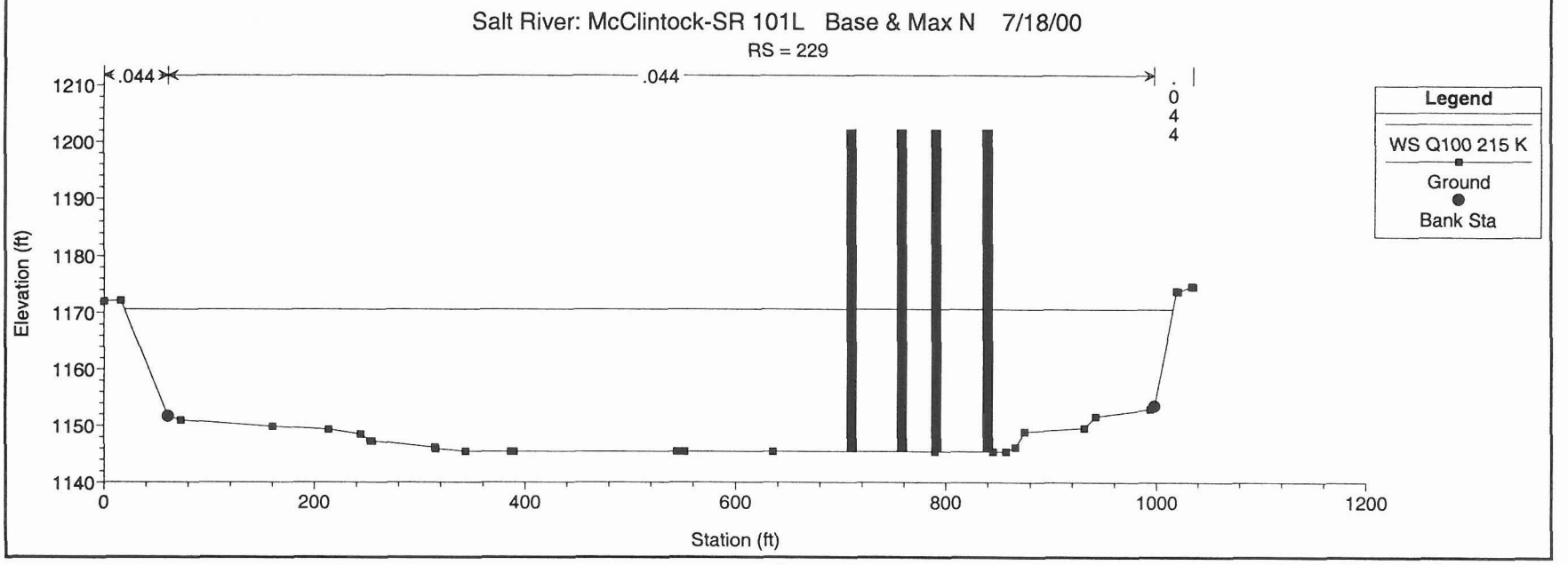

Salt River: McClintock-SR 101L Base & Max N 7/18/00
RS = 234
.044
.044
.044
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
Station (ft)

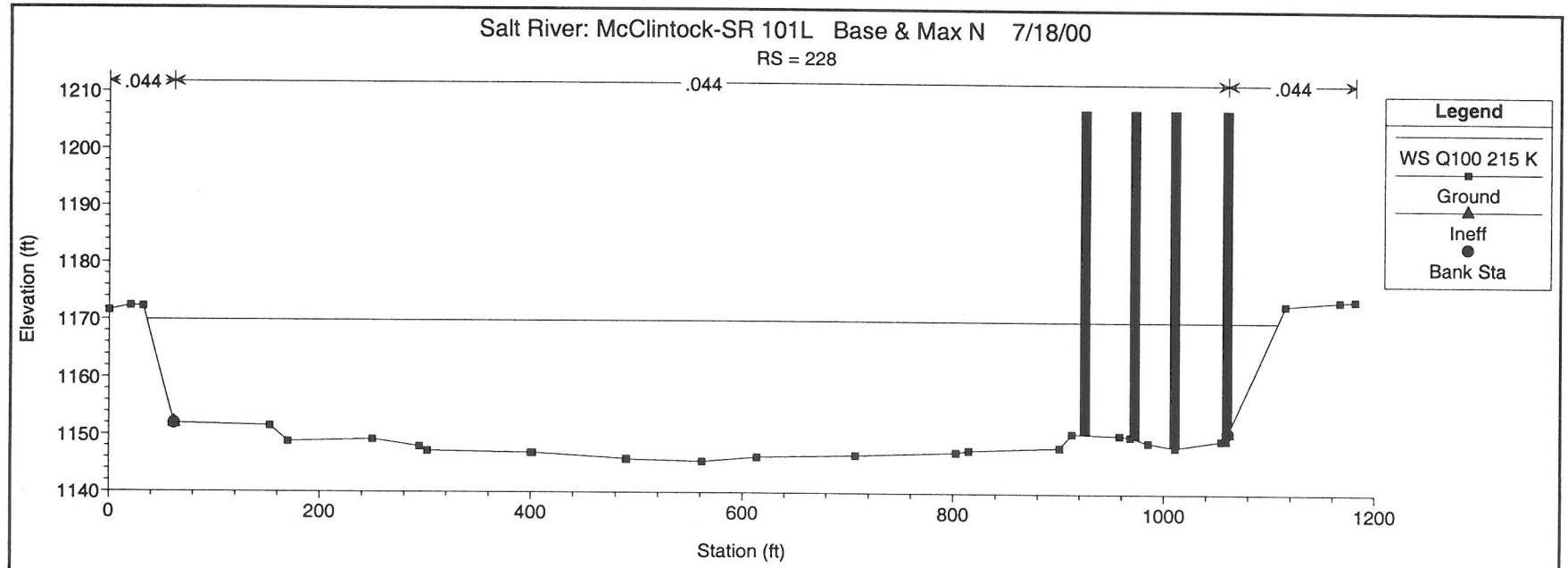

Salt River: McClintock-SR 101L Base & Max N 7/18/00
RS = 233
.044
.044
.044
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
Station (ft)

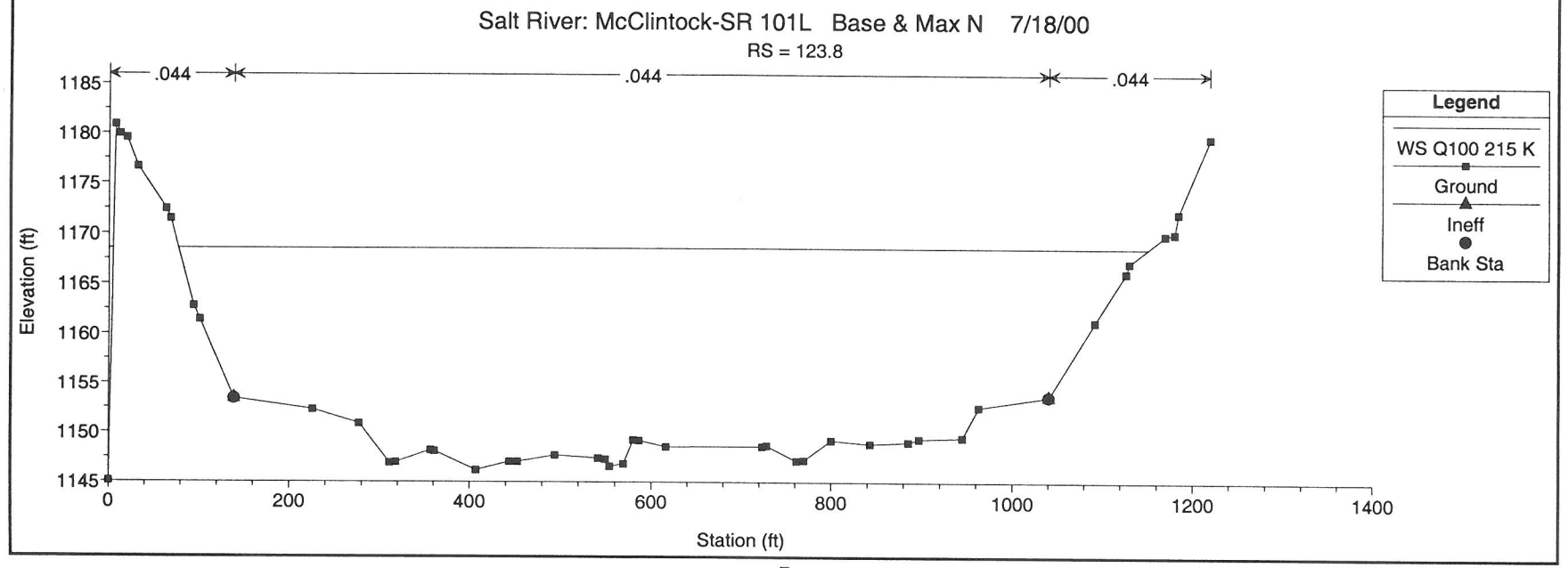

Salt River: McClintock-SR 101L Base & Max N 7/18/00
RS = 232
.044
.044
.044
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)

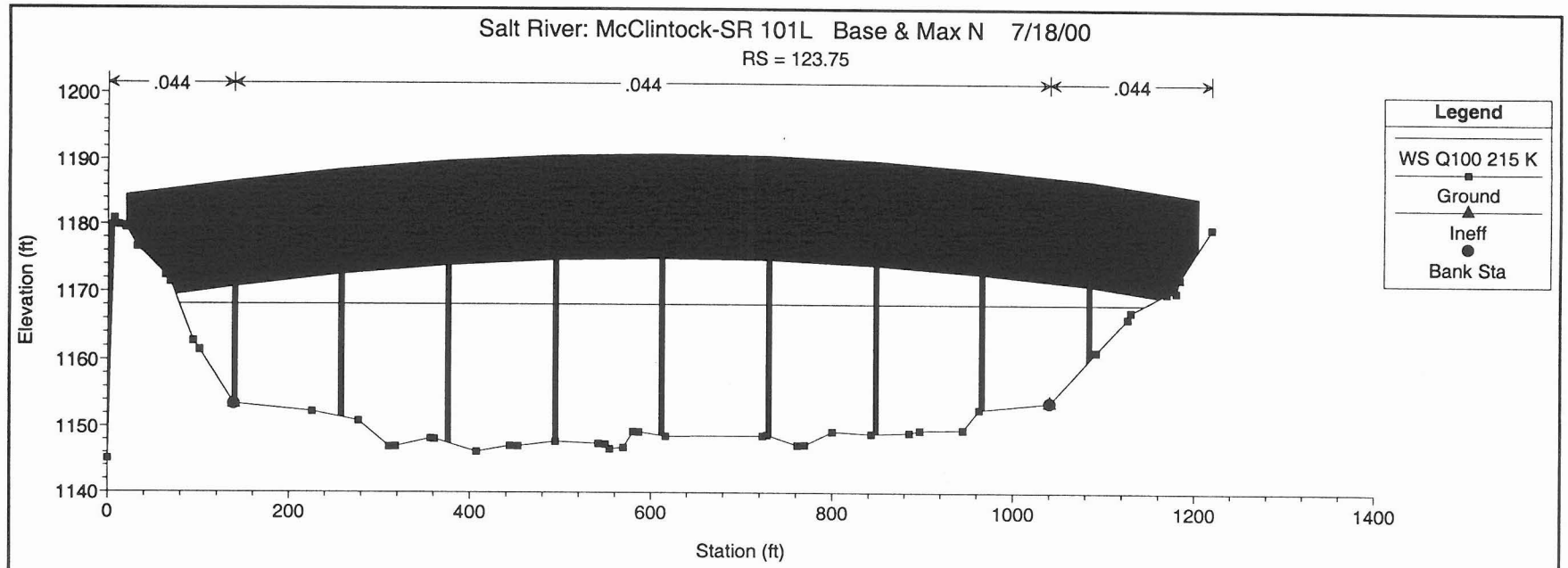

Salt River: McClintock-SR 101L Base & Max N 7/18/00
RS = 231
.044
.044
.044
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)

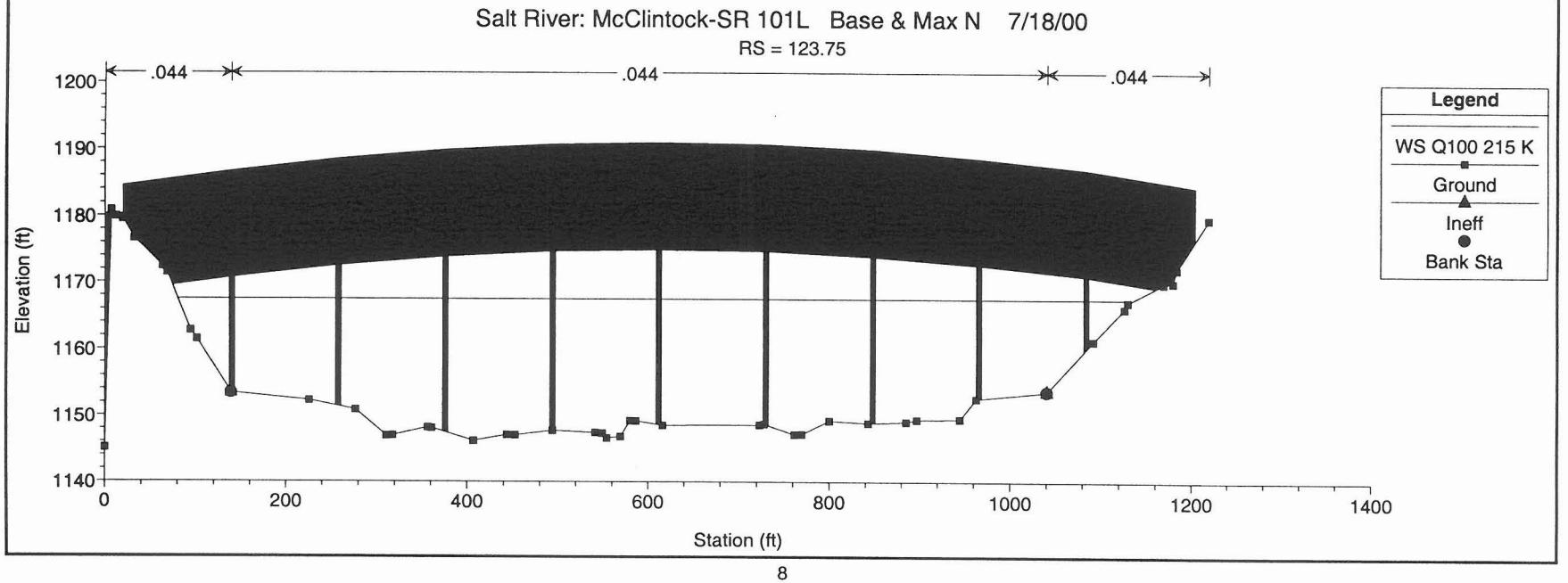

Salt River: McClintock-SR 101L Base & Max N 7/18/00
RS = 230
.044
.044
.044
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)

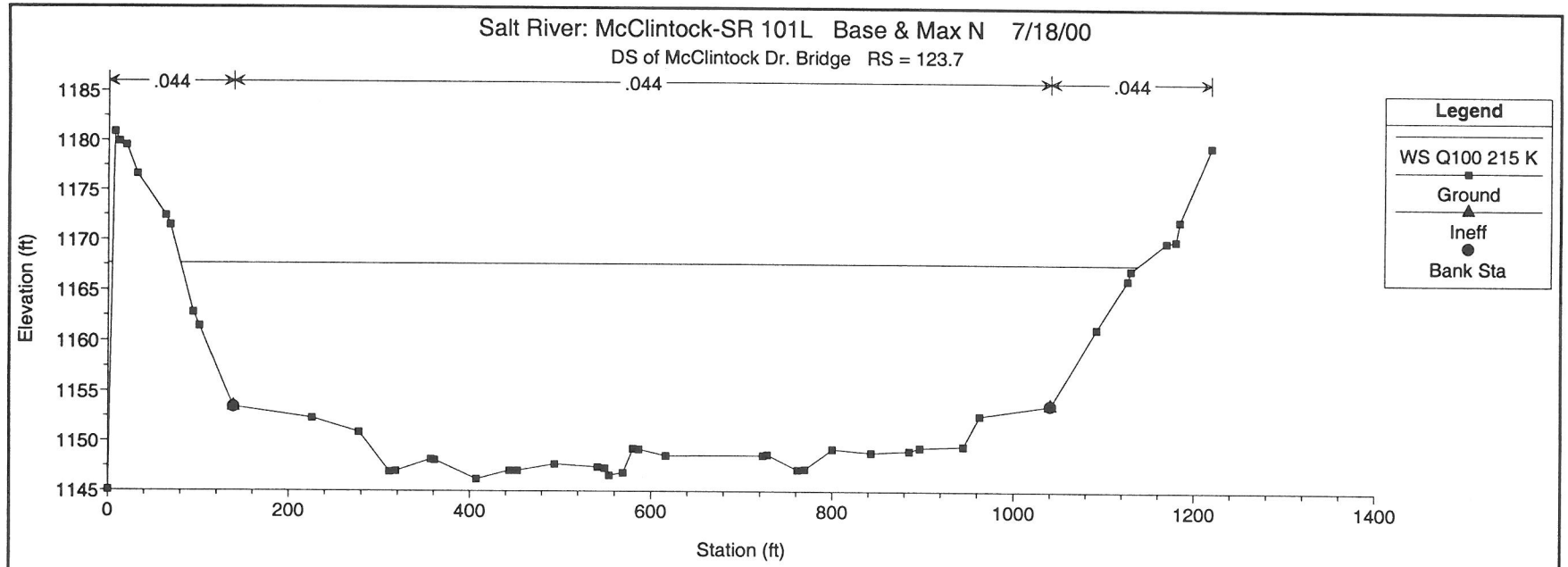

Salt River: McClintock-SR 101L Base & Max N 7/18/00
RS = 229
.044
.044
.044
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)

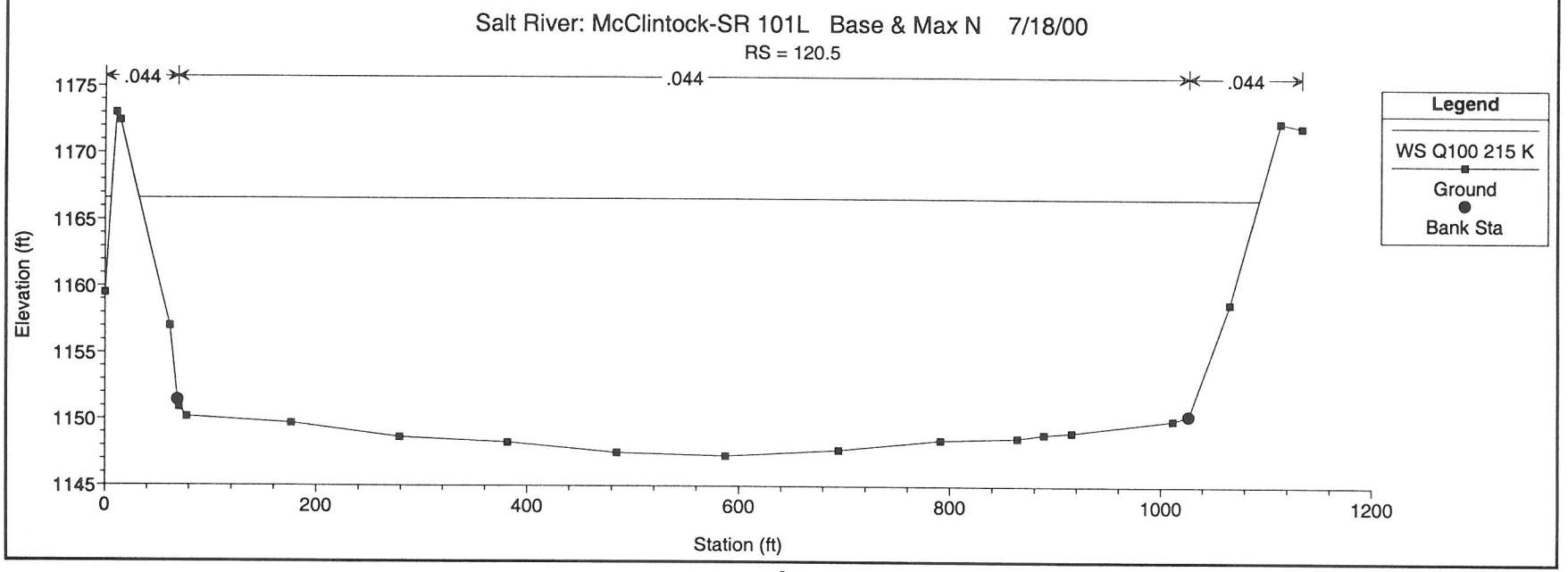

Salt River: McClintock-SR 101L Base & Max N 7/18/00
RS = 228
.044
.044
.044
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS Q100 215 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base & Max N 7/18/00
RS = 123.8
.044
.044
.044
Elevation (ft)
1185
1180
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 215 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base & Max N 7/18/00
RS = 123.75
.044
.044
.044
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 215 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base & Max N 7/18/00
RS = 123.75
.044
.044
.044
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 215 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Base & Max N 7/18/00
DS of McClintock Dr. Bridge RS = 123.7
.044
.044
.044
Elevation (ft)
1185
1180
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 215 K
Ground
Ineff
Bank Sta

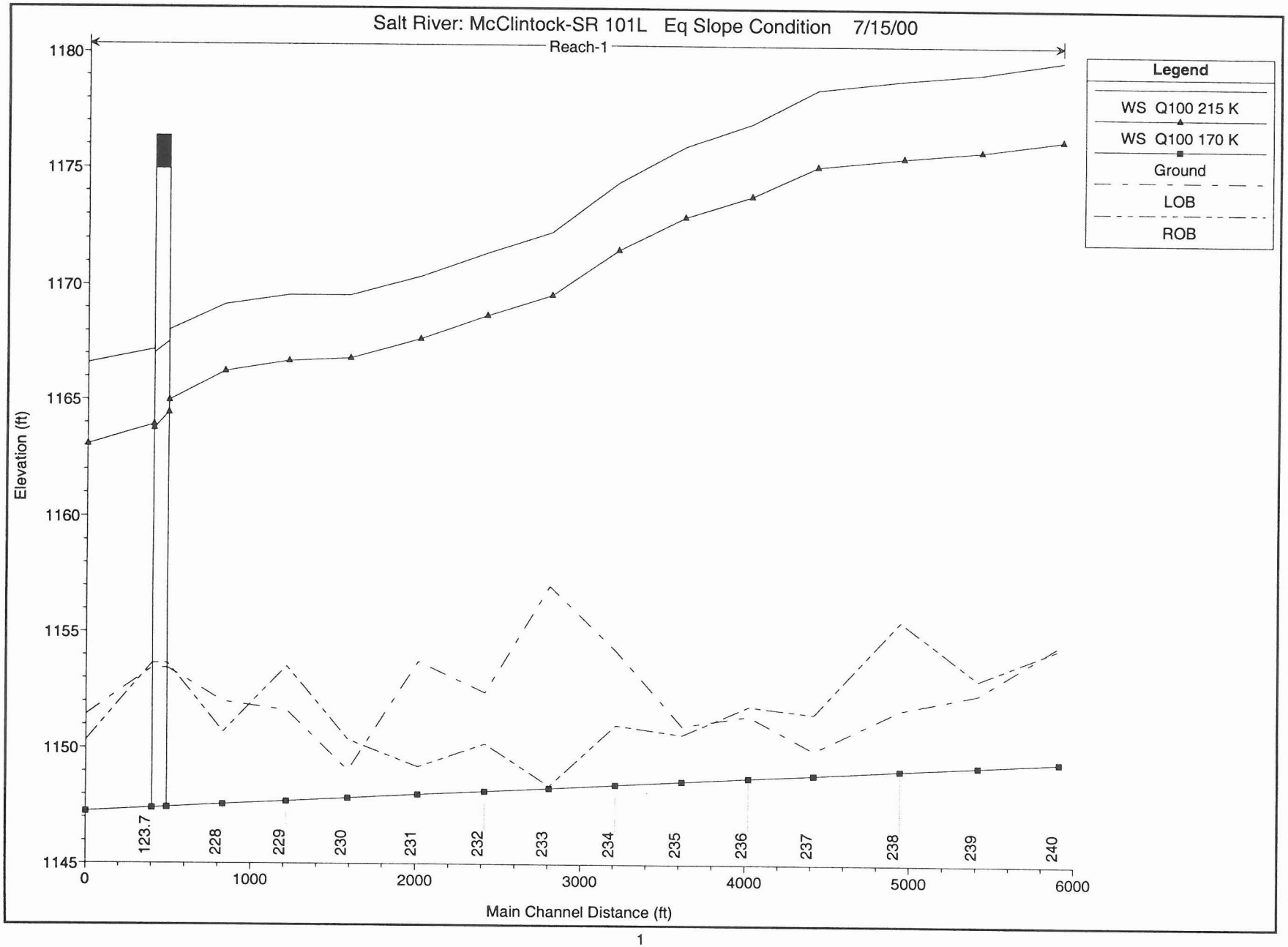

Salt River: McClintock-SR 101L Base & Max N 7/18/00
RS = 120.5
.044
.044
.044
Elevation (ft)
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS Q100 215 K
Ground
Bank Sta

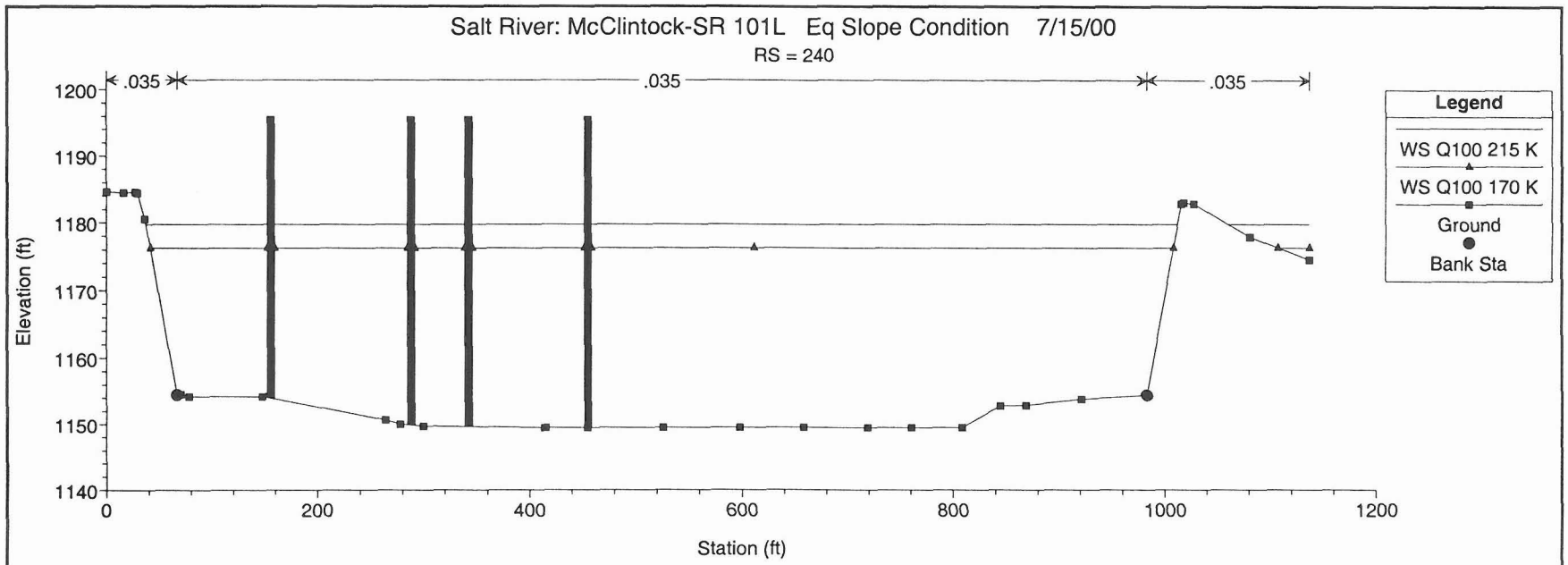
Q_{100} = 215,000 cfs and 172,000 cfs, Eq. Slope Condition
n =0.035

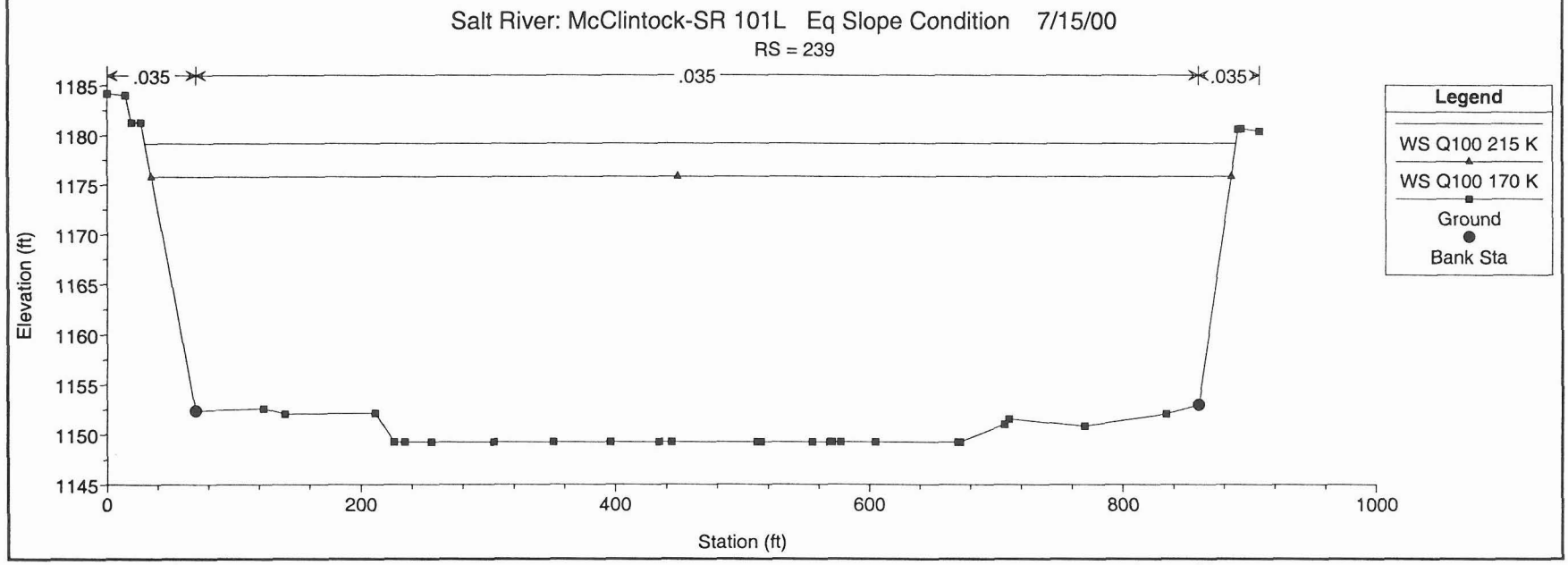
Plan Title: Eq Slope Condition

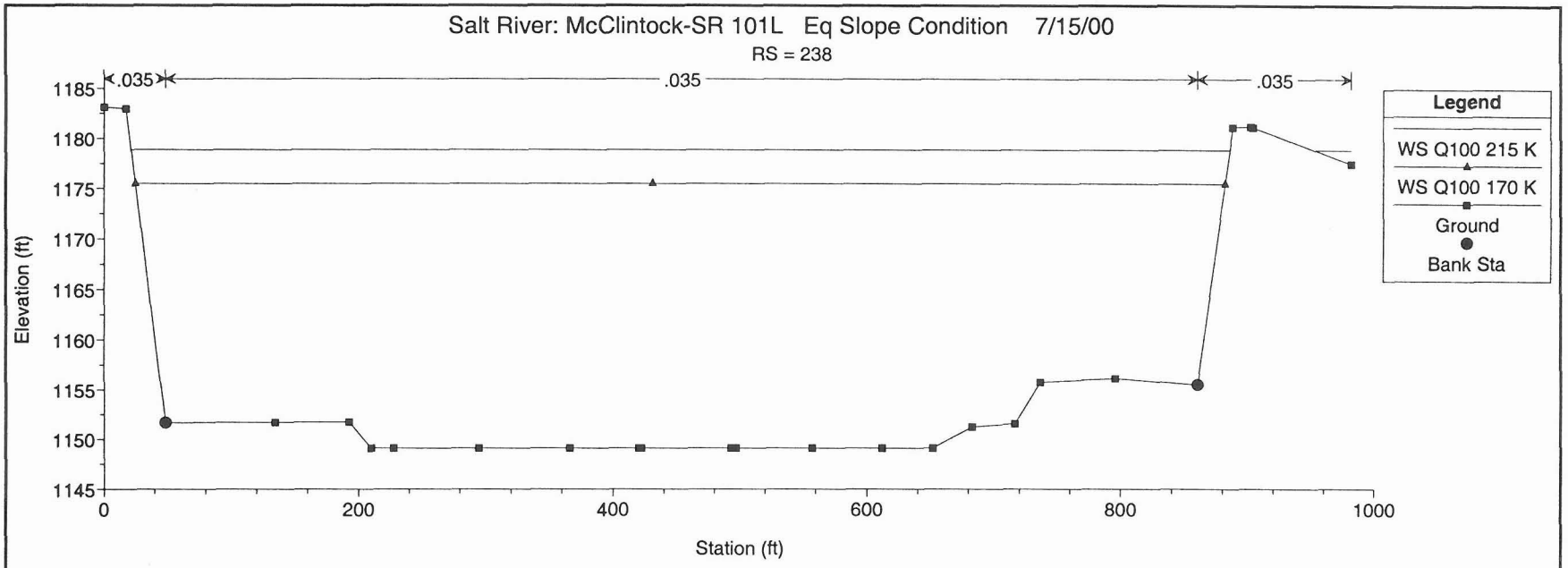
HEC-RAS Plan: Eq Slope River: RIVER-1 Reach: Reach-1

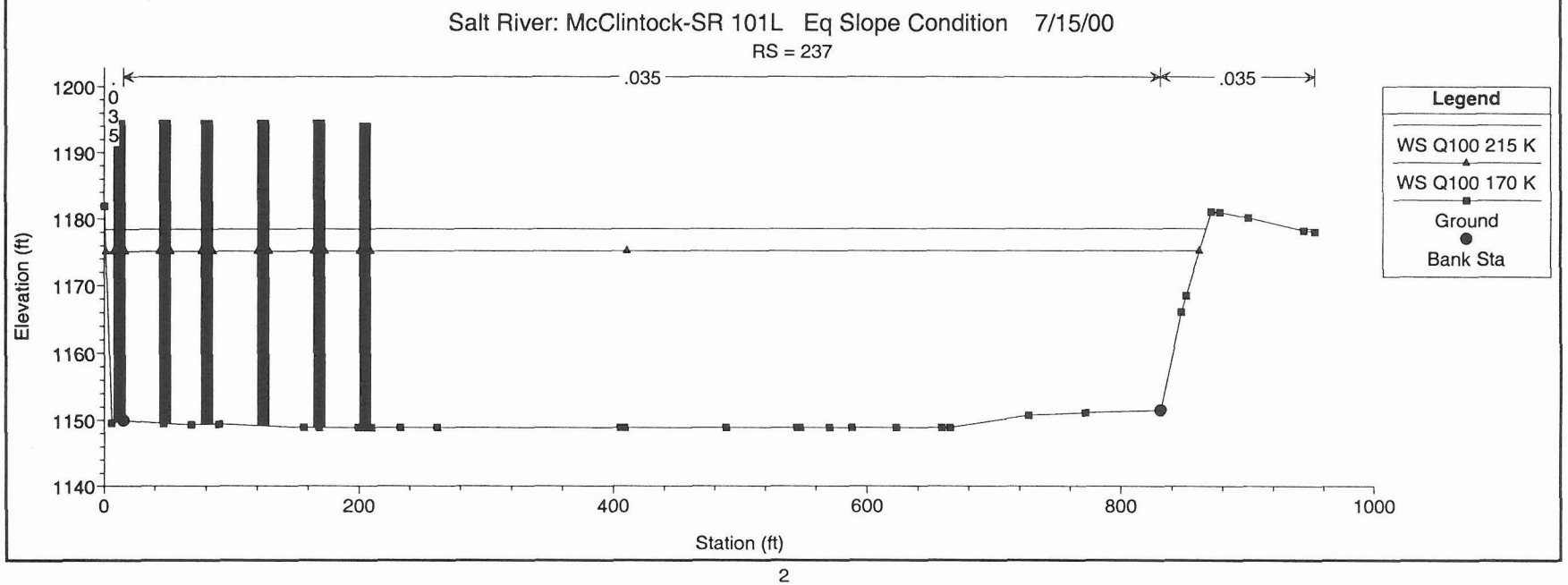
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	240	215000.00	1149.45	1179.73		1180.77	0.000588	8.27	26487.20	1023.29	0.27
Reach-1	240	172000.00	1149.45	1176.26		1177.14	0.000563	7.56	23031.15	968.53	0.26
Reach-1	239	215000.00	1149.26	1179.17		1180.47	0.000535	9.24	23730.30	859.86	0.30
Reach-1	239	172000.00	1149.26	1175.77		1176.85	0.000522	8.40	20828.33	850.92	0.29
Reach-1	238	215000.00	1149.09	1178.87		1180.21	0.000568	9.32	23428.57	893.62	0.31
Reach-1	238	172000.00	1149.09	1175.48		1176.60	0.000561	8.50	20490.03	857.54	0.30
Reach-1	237	215000.00	1148.89	1178.46		1179.84	0.000884	9.47	22984.33	828.03	0.31
Reach-1	237	172000.00	1148.89	1175.11		1176.24	0.000816	8.58	20268.78	806.63	0.30
Reach-1	236	215000.00	1148.75	1176.97		1179.29	0.001542	12.31	17740.47	684.73	0.42
Reach-1	236	172000.00	1148.75	1173.82		1175.74	0.001441	11.19	15597.63	677.86	0.40
Reach-1	235	215000.00	1148.60	1175.96		1178.59	0.001804	11.32	16821.94	674.94	0.38
Reach-1	235	172000.00	1148.60	1172.93		1175.09	0.001701	10.49	14789.74	668.05	0.38
Reach-1	234	215000.00	1148.45	1174.39		1177.68	0.002475	14.66	14904.23	628.71	0.52
Reach-1	234	172000.00	1148.45	1171.53		1174.24	0.002307	13.30	13113.60	621.51	0.50
Reach-1	233	215000.00	1148.30	1172.28		1176.40	0.003541	16.41	13280.05	627.31	0.62
Reach-1	233	172000.00	1148.30	1169.59		1173.04	0.003392	15.00	11601.52	621.09	0.60
Reach-1	232	215000.00	1148.15	1171.39		1174.98	0.002941	15.33	14268.45	677.95	0.57
Reach-1	232	172000.00	1148.15	1168.69		1171.70	0.002811	14.01	12455.62	666.86	0.56
Reach-1	231	215000.00	1148.01	1170.37		1173.74	0.002854	14.82	14682.54	718.44	0.57
Reach-1	231	172000.00	1148.01	1167.66		1170.52	0.002803	13.64	12744.08	712.04	0.56
Reach-1	230	215000.00	1147.85	1169.56		1172.51	0.002424	13.94	15755.52	780.35	0.53
Reach-1	230	172000.00	1147.85	1166.81		1169.33	0.002393	12.86	13625.72	767.28	0.52
Reach-1	229	215000.00	1147.71	1169.56		1171.49	0.001528	11.21	19390.18	957.43	0.43
Reach-1	229	172000.00	1147.71	1166.68		1168.36	0.001564	10.43	16648.36	948.14	0.43
Reach-1	228	215000.00	1147.57	1169.16	1160.00	1170.89	0.001306	10.59	20593.02	1032.65	0.41
Reach-1	228	172000.00	1147.57	1166.24	1158.41	1167.74	0.001363	9.89	17588.73	1021.27	0.41
Reach-1	123.8	215000.00	1147.44	1168.03	1161.49	1170.33	0.001704	12.32	18052.73	1068.44	0.50
Reach-1	123.8	172000.00	1147.44	1164.97	1159.81	1167.13	0.002024	11.91	14835.35	1033.81	0.53
Reach-1	123.75	Bridge									
Reach-1	123.7	215000.00	1147.41	1167.18	1161.51	1169.72	0.002003	12.94	17139.49	1053.66	0.54
Reach-1	123.7	172000.00	1147.41	1163.92	1159.84	1166.43	0.002578	12.83	13745.76	1023.14	0.59
Reach-1	120.5	215000.00	1147.26	1166.59	1160.10	1168.83	0.001720	12.12	18114.22	1066.26	0.50
Reach-1	120.5	172000.00	1147.26	1163.07	1158.53	1165.32	0.002302	12.13	14406.35	1040.47	0.56

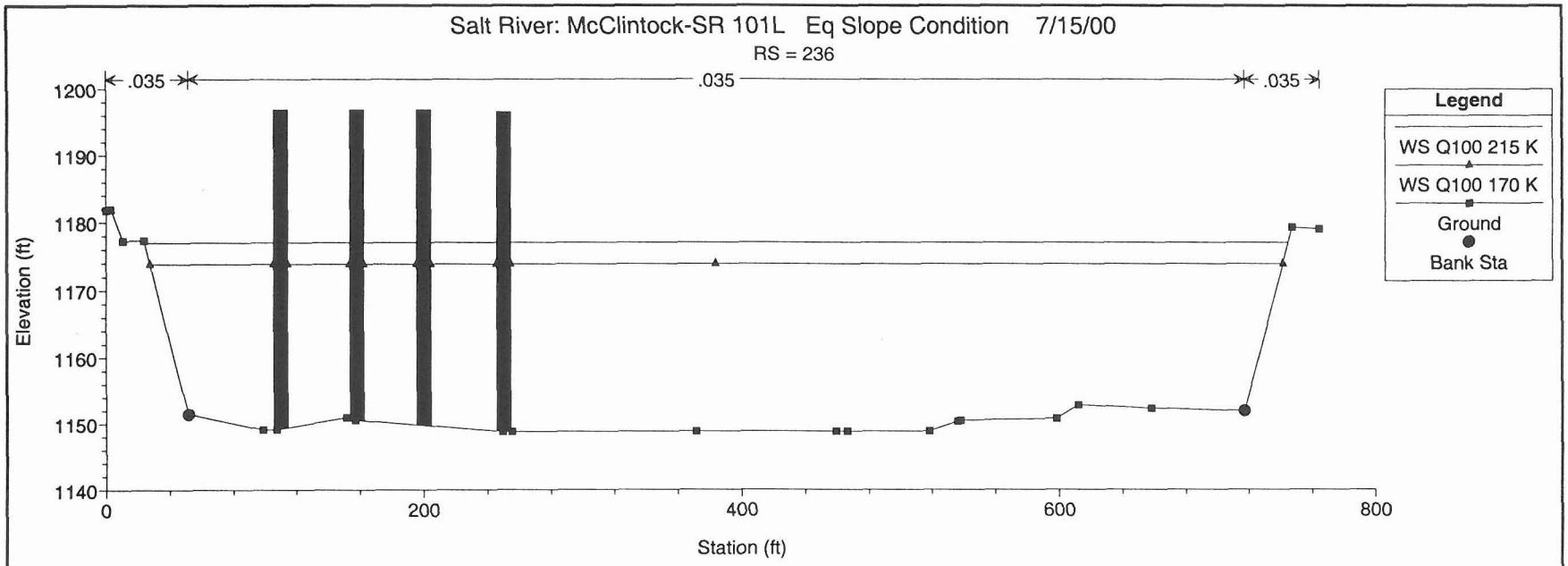

Salt River: McClintock-SR 101L Eq Slope Condition 7/15/00
Reach-1
Legend
WS Q100 215 K
WS Q100 170 K
Ground
LOB
ROB
Elevation (ft)
1180
1175
1170
1165
1160
1155
1150
1145
0
1000
2000
3000
4000
5000
6000
Main Channel Distance (ft)
123.7
228
229
230
231
232
233
234
235
236
237
238
239
240

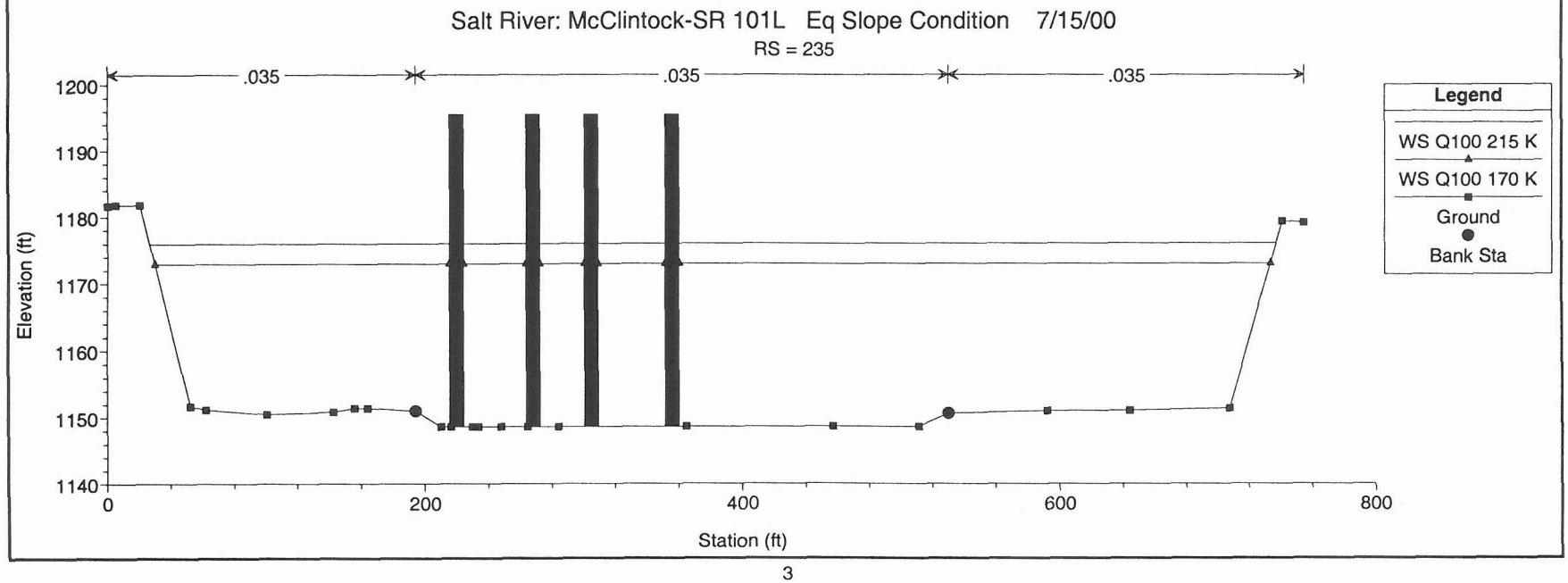

Salt River: McClintock-SR 101L Eq Slope Condition 7/15/00
RS = 240
.035
.035
.035
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

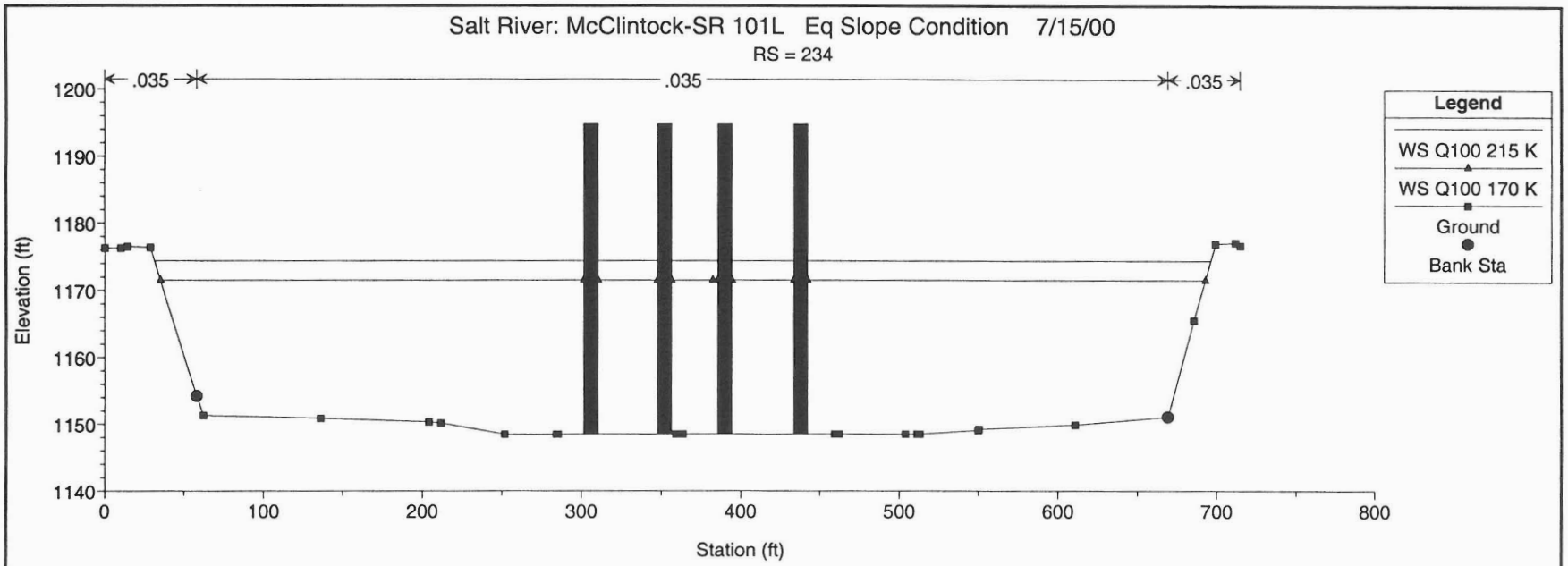

Salt River: McClintock-SR 101L Eq Slope Condition 7/15/00
RS = 239
.035
.035
.035
Elevation (ft)
1185
1180
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

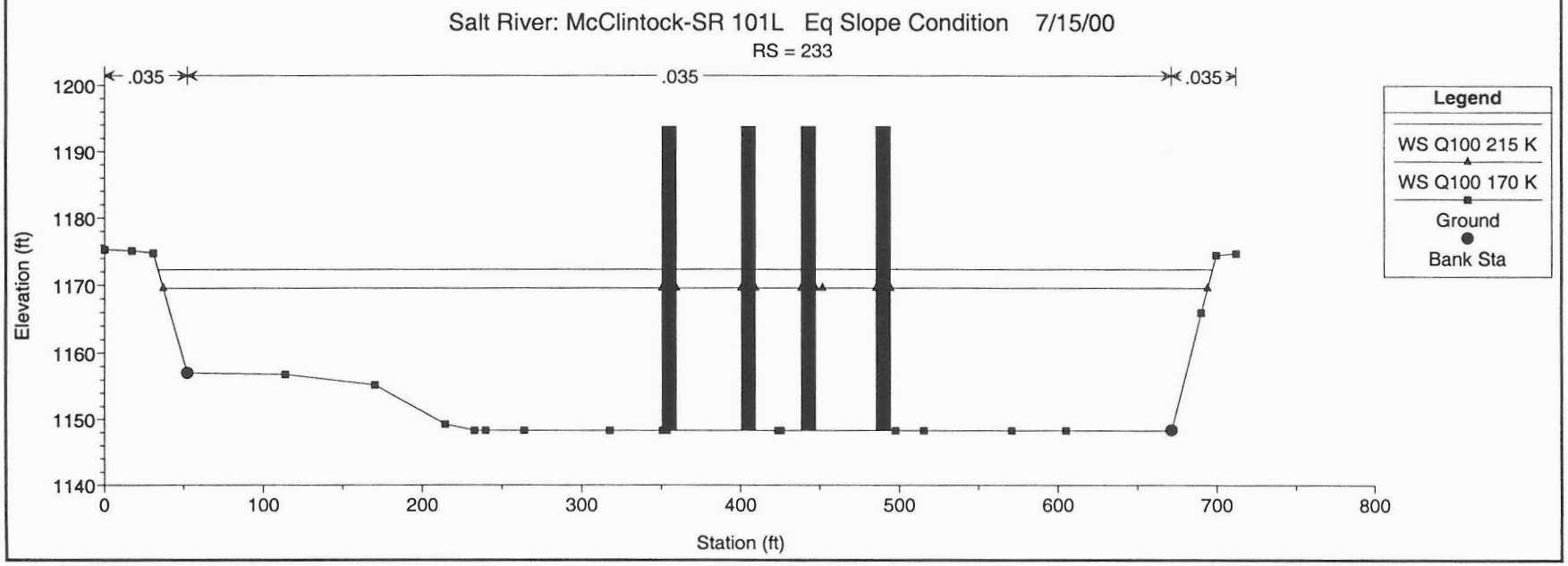

Salt River: McClintock-SR 101L Eq Slope Condition 7/15/00
RS = 238
.035
.035
.035
Elevation (ft)
1185
1180
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

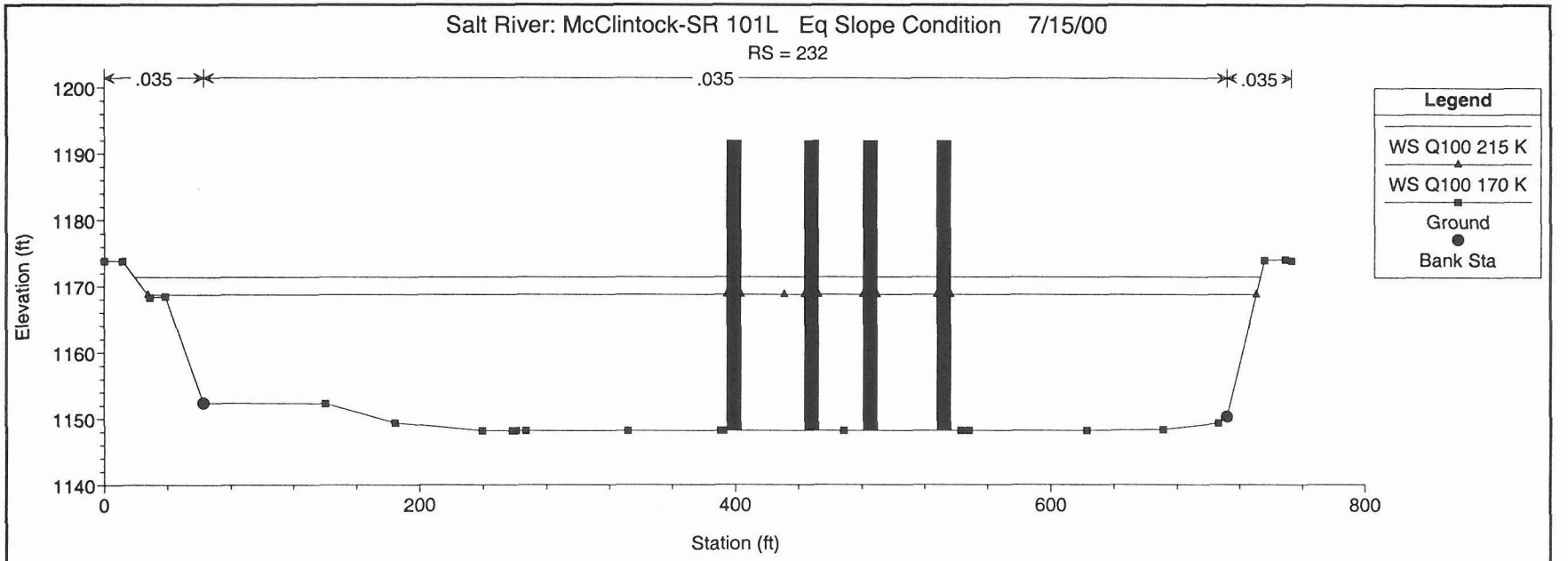

Salt River: McClintock-SR 101L Eq Slope Condition 7/15/00
RS = 237
.035
.035
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

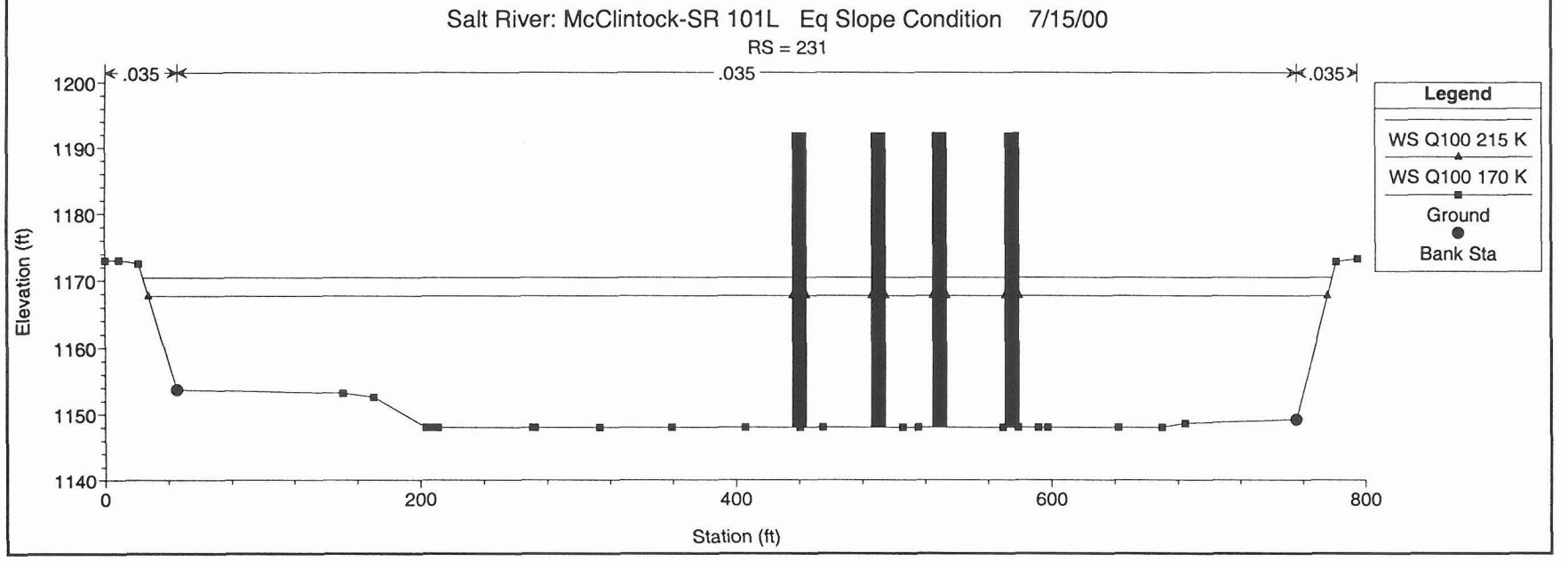

Salt River: McClintock-SR 101L Eq Slope Condition 7/15/00
RS = 236
.035
.035
.035
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

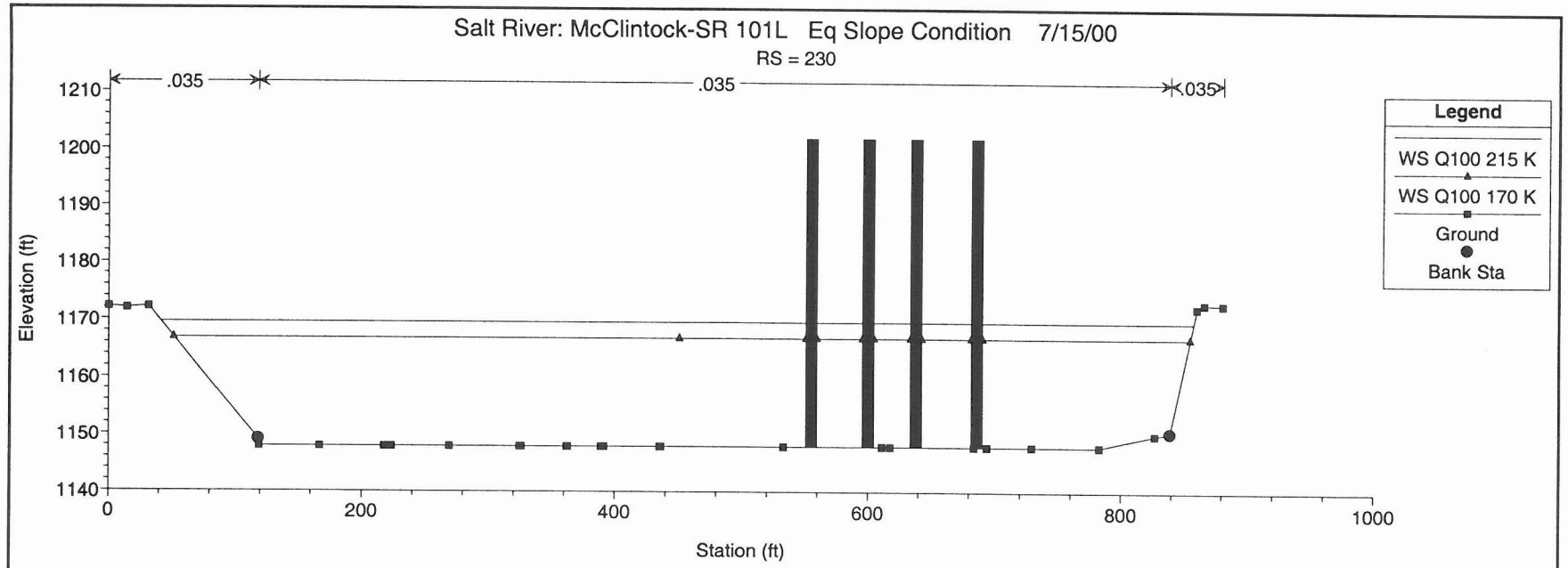

Salt River: McClintock-SR 101L Eq Slope Condition 7/15/00
RS = 235
.035
.035
.035
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

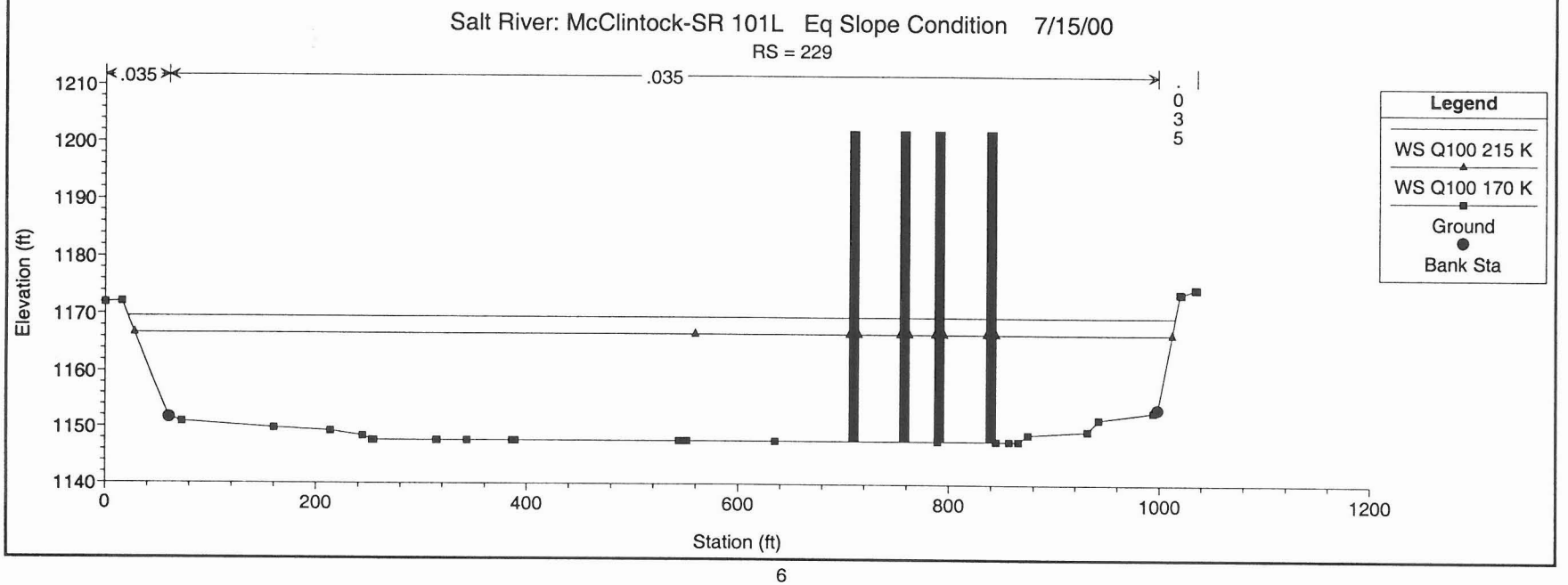

Salt River: McClintock-SR 101L Eq Slope Condition 7/15/00
RS = 234
.035
.035
.035
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
100
200
300
400
500
600
700
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

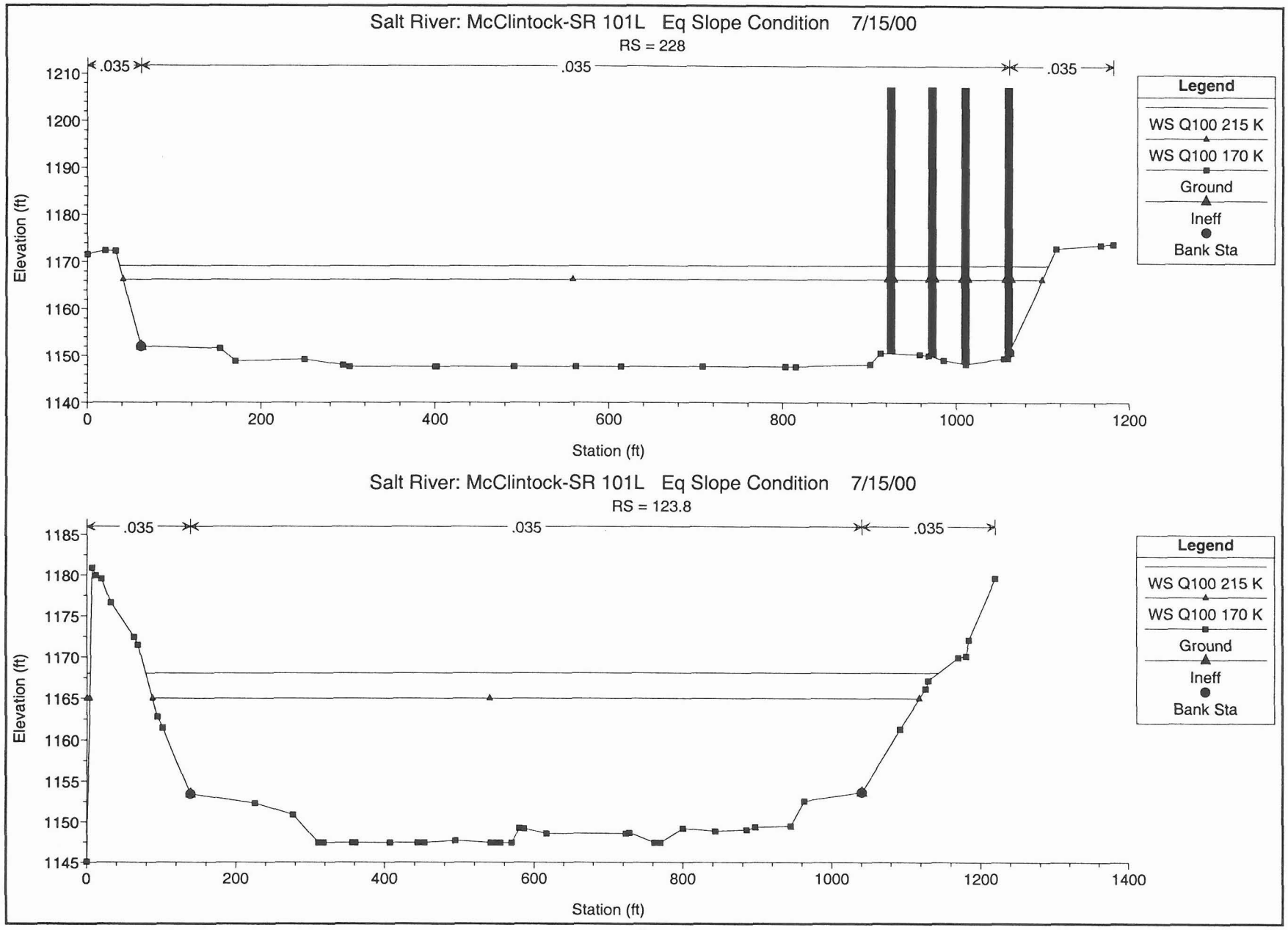

Salt River: McClintock-SR 101L Eq Slope Condition 7/15/00
RS = 233
.035
.035
.035
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
100
200
300
400
500
600
700
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

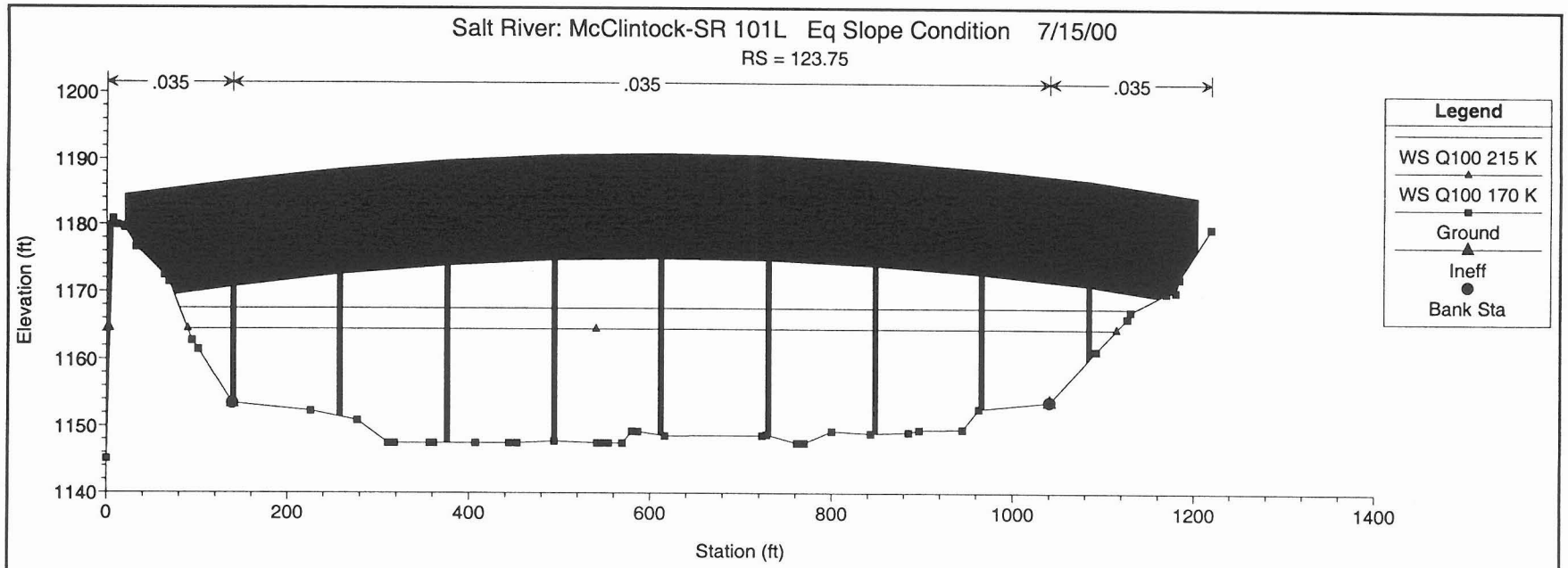

Salt River: McClintock-SR 101L Eq Slope Condition 7/15/00
RS = 232
.035
.035
.035
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

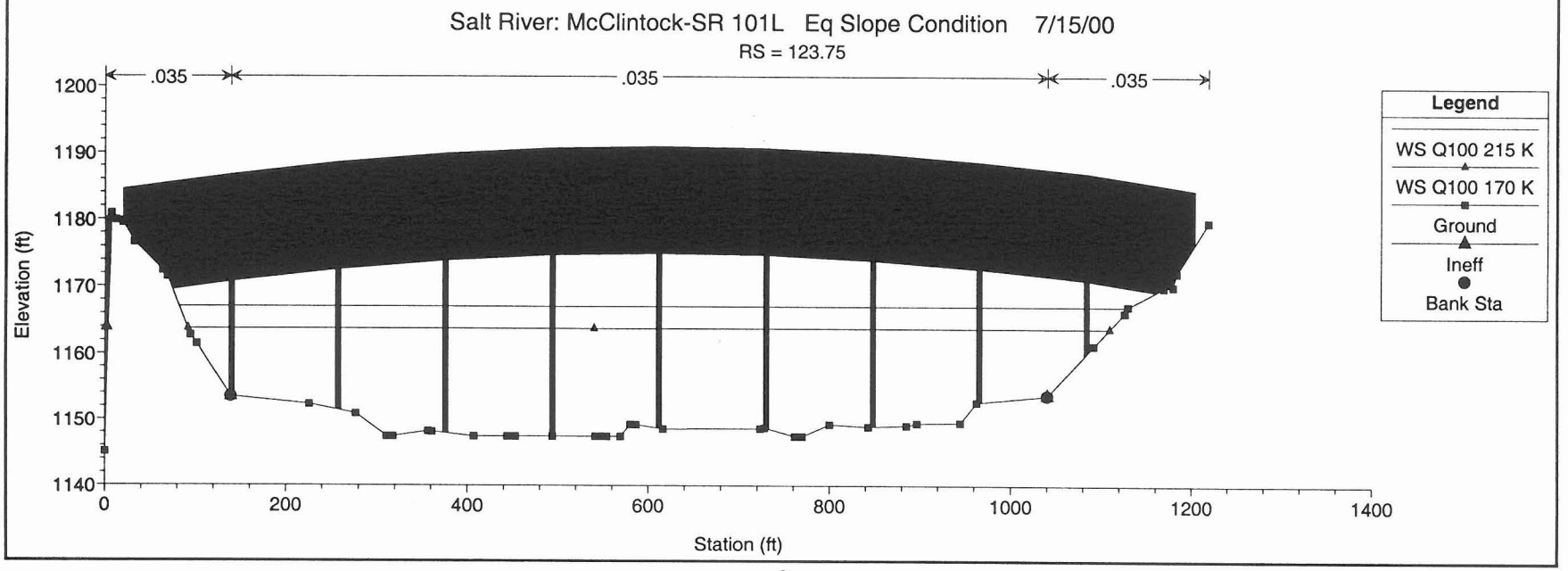

Salt River: McClintock-SR 101L Eq Slope Condition 7/15/00
RS = 231
.035
.035
.035
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

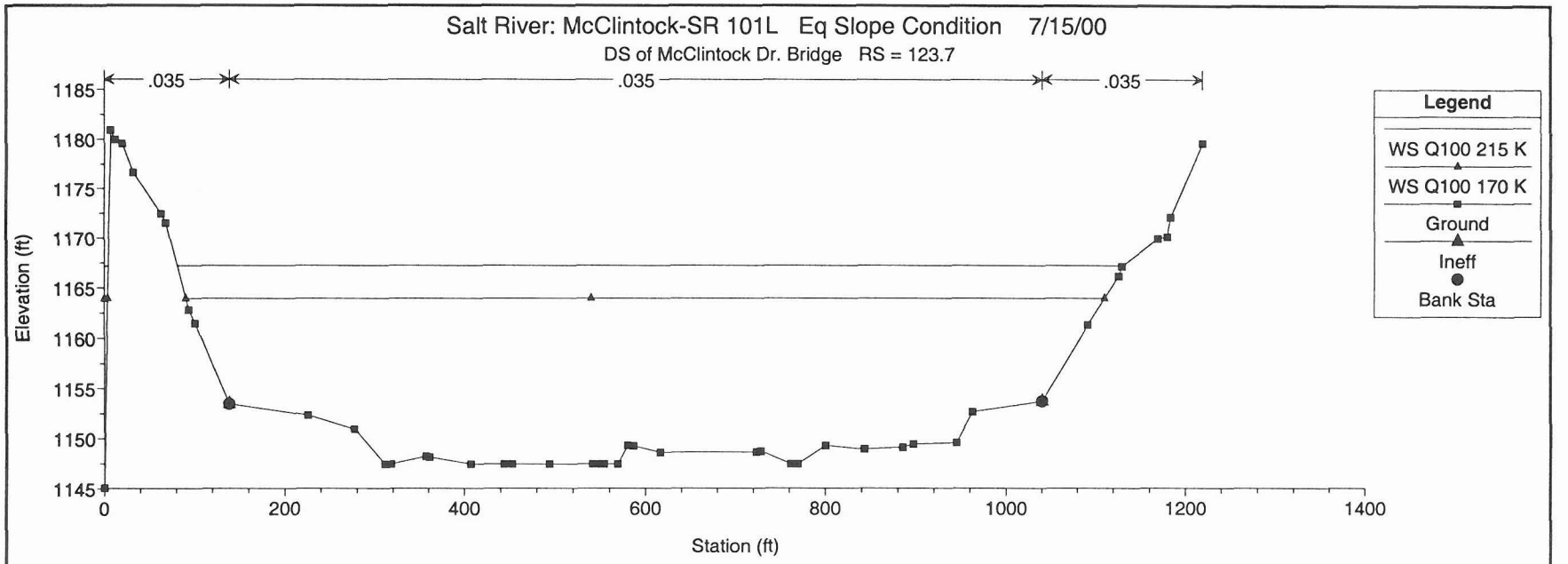

Salt River: McClintock-SR 101L Eq Slope Condition 7/15/00
RS = 230
.035
.035
.035
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)

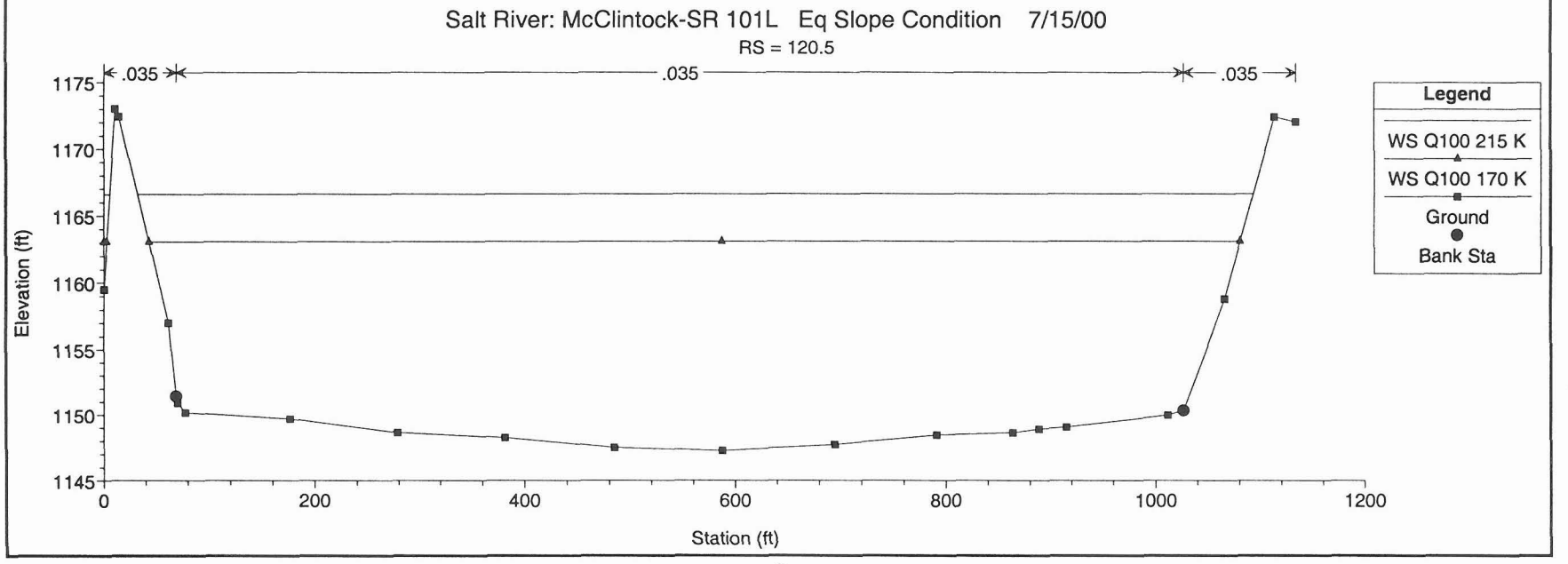

Salt River: McClintock-SR 101L Eq Slope Condition 7/15/00
RS = 229
.035
.035
.035
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)


Salt River: McClintock-SR 101L Eq Slope Condition 7/15/00
RS = 228
.035
.035
.035
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta
Salt River: McClintock-SR 101L Eq Slope Condition 7/15/00
RS = 123.8
.035
.035
.035
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Eq Slope Condition 7/15/00
RS = 123.75
.035
.035
.035
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Eq Slope Condition 7/15/00
RS = 123.75
.035
.035
.035
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Eq Slope Condition 7/15/00
DS of McClintock Dr. Bridge RS = 123.7
.035
.035
.035
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta

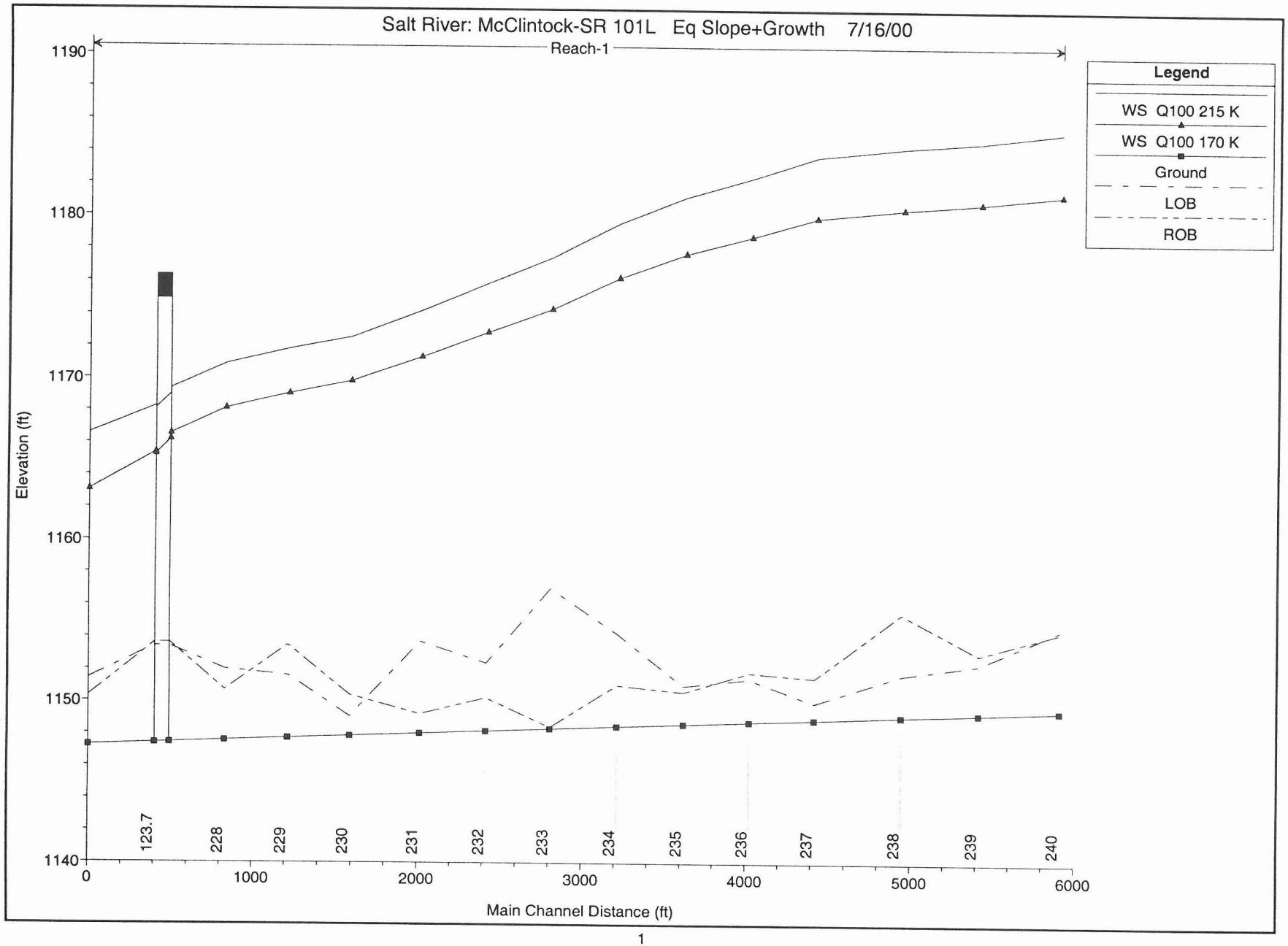

Salt River: McClintock-SR 101L Eq Slope Condition 7/15/00
RS = 120.5
.035
.035
.035
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

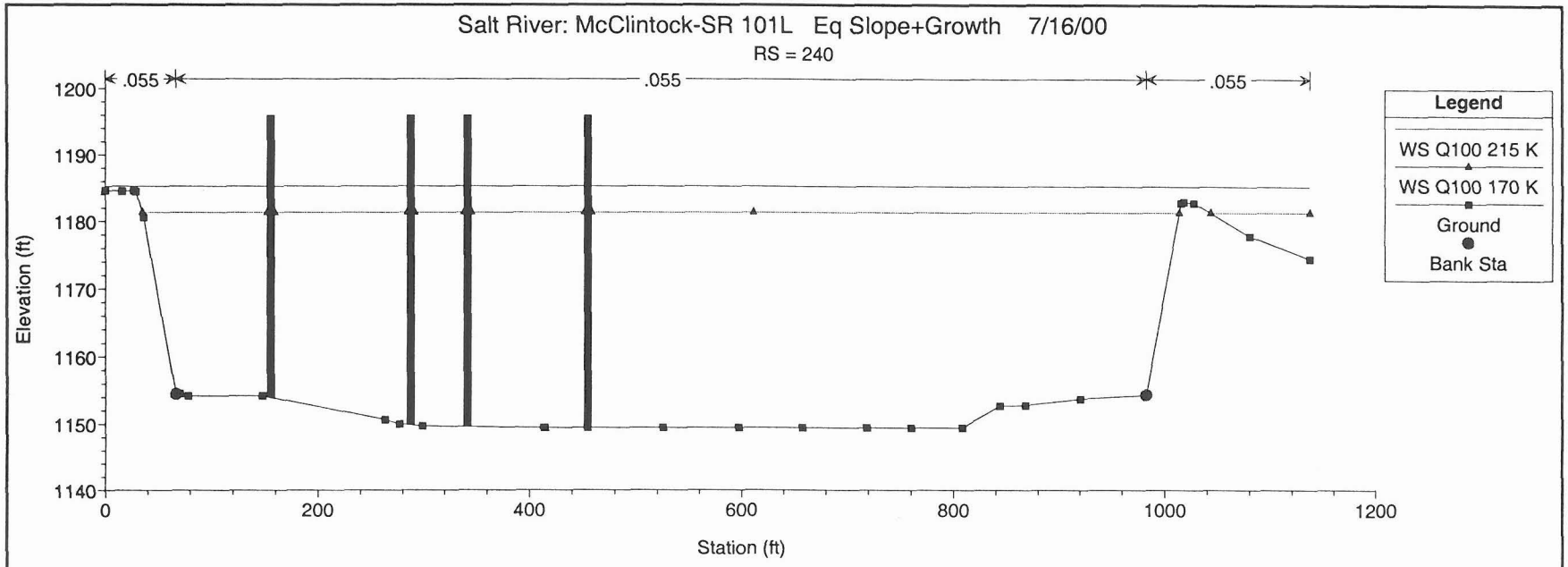
Q_{100} = 215,000 cfs and 172,000 cfs, Eq. Slope Condition
n =0.055

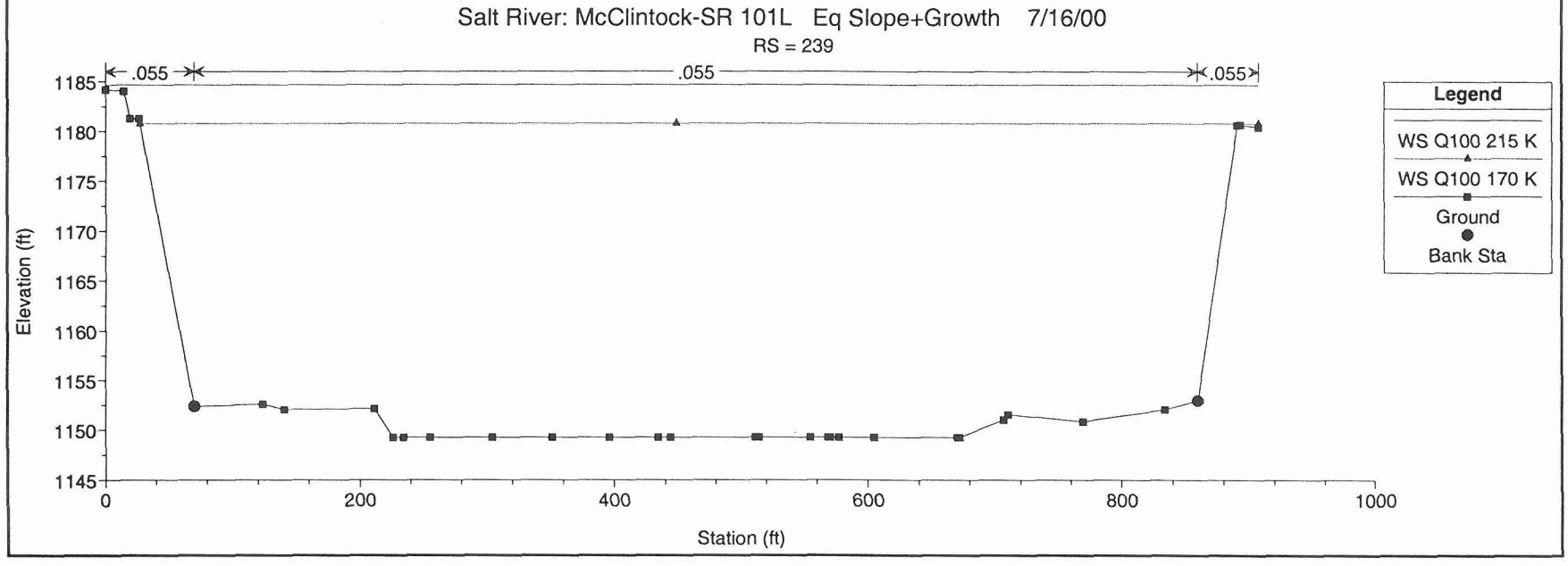
Plan Title: Eq. Slope + Growth

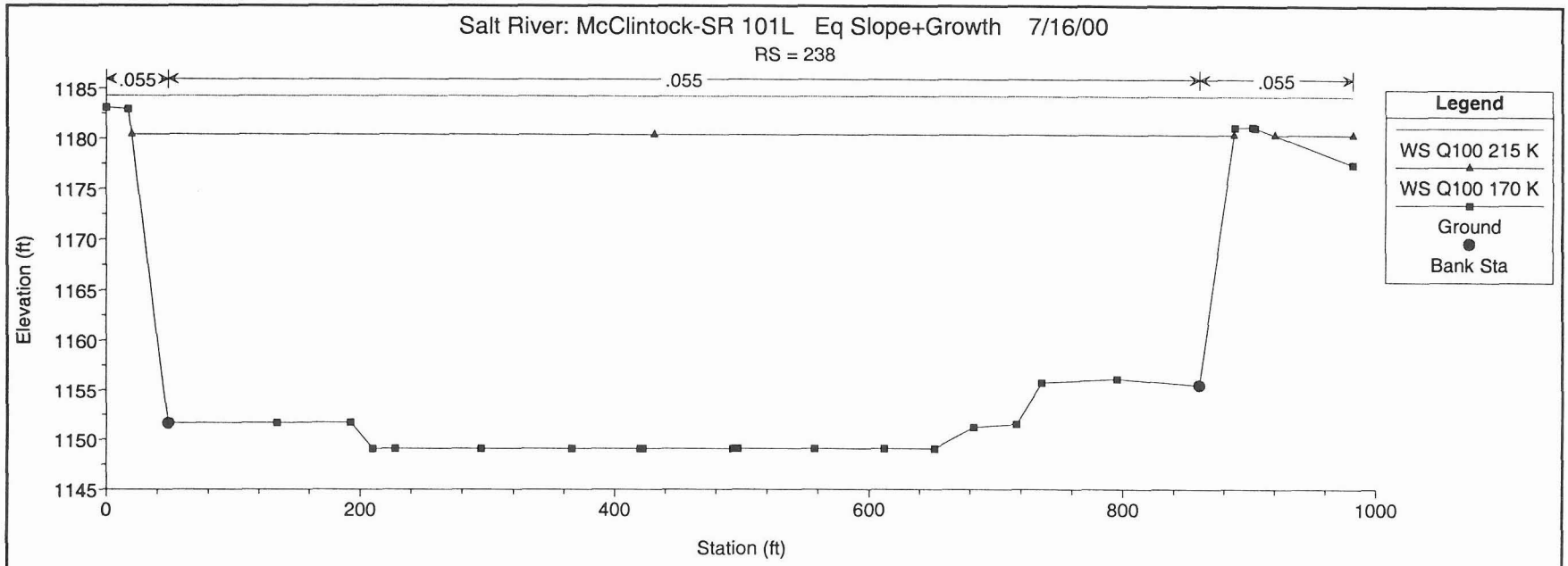
HEC-RAS Plan: Eq Slope+Gro River: RIVER-1 Reach: Reach-1

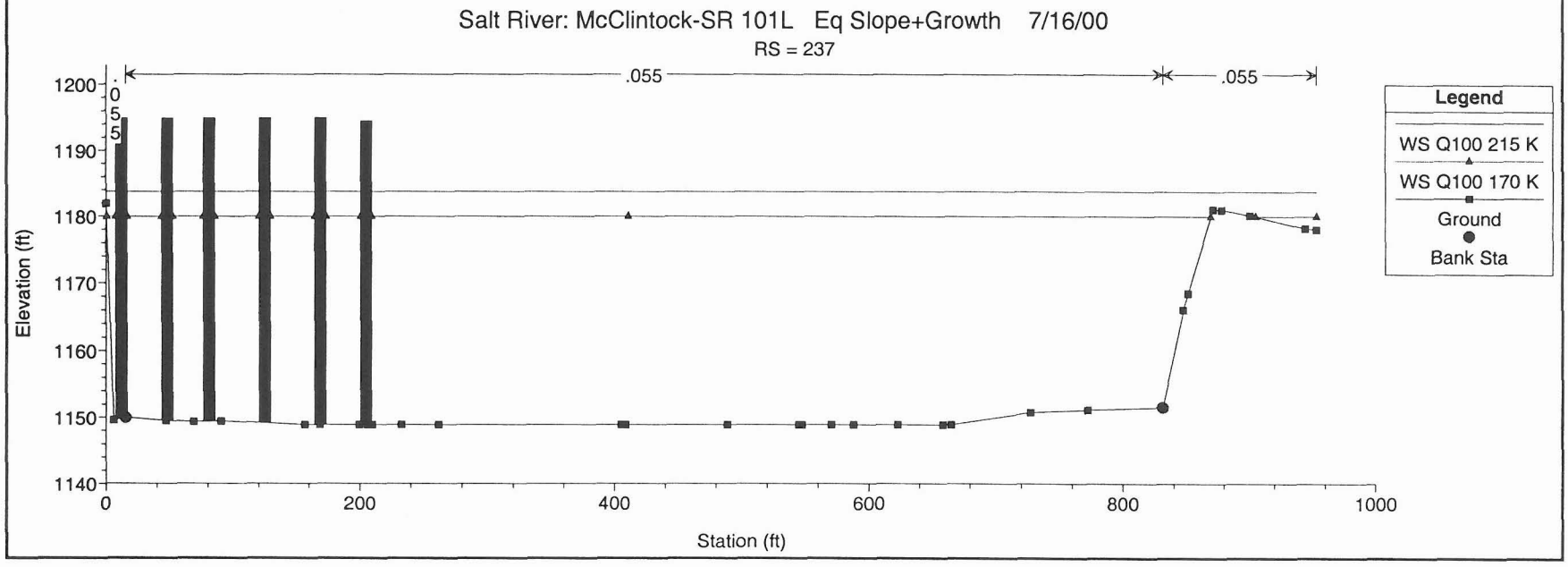
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	240	215000.00	1149.45	1185.24		1185.96	0.000835	6.88	32354.02	1109.13	0.21
Reach-1	240	172000.00	1149.45	1181.32		1181.91	0.000783	6.25	28131.76	1044.67	0.20
Reach-1	239	215000.00	1149.26	1184.64		1185.56	0.000736	7.74	28569.83	907.62	0.23
Reach-1	239	172000.00	1149.26	1180.78		1181.53	0.000705	7.00	25127.45	880.64	0.22
Reach-1	238	215000.00	1149.09	1184.27		1185.20	0.000771	7.78	28557.27	981.75	0.24
Reach-1	238	172000.00	1149.09	1180.42		1181.19	0.000748	7.06	24842.12	929.83	0.23
Reach-1	237	215000.00	1148.89	1183.70		1184.67	0.001333	7.98	27596.02	899.07	0.24
Reach-1	237	172000.00	1148.89	1179.89		1180.69	0.001210	7.21	24199.00	863.09	0.23
Reach-1	236	215000.00	1148.75	1182.36		1183.94	0.002194	10.21	21589.18	728.47	0.32
Reach-1	236	172000.00	1148.75	1178.73		1180.03	0.002017	9.24	18966.39	702.58	0.30
Reach-1	235	215000.00	1148.60	1181.17		1182.97	0.002568	9.18	20393.00	698.03	0.28
Reach-1	235	172000.00	1148.60	1177.66		1179.15	0.002338	8.40	17975.74	678.82	0.28
Reach-1	234	215000.00	1148.45	1179.52		1181.74	0.003462	12.08	18279.57	678.80	0.39
Reach-1	234	172000.00	1148.45	1176.21		1178.02	0.003153	10.90	16051.07	633.28	0.37
Reach-1	233	215000.00	1148.30	1177.41		1180.08	0.004603	13.23	16631.42	676.21	0.45
Reach-1	233	172000.00	1148.30	1174.31		1176.51	0.004265	11.99	14559.44	632.02	0.43
Reach-1	232	215000.00	1148.15	1175.86		1178.31	0.004131	12.68	17392.45	716.88	0.43
Reach-1	232	172000.00	1148.15	1172.86		1174.87	0.003809	11.47	15274.71	684.02	0.41
Reach-1	231	215000.00	1148.01	1174.20		1176.61	0.004225	12.53	17495.93	758.50	0.44
Reach-1	231	172000.00	1148.01	1171.33		1173.30	0.003929	11.33	15371.64	720.70	0.42
Reach-1	230	215000.00	1147.85	1172.57		1174.82	0.004013	12.22	18142.29	827.43	0.43
Reach-1	230	172000.00	1147.85	1169.81		1171.65	0.003693	11.01	15951.33	781.54	0.42
Reach-1	229	215000.00	1147.71	1171.83		1173.39	0.002725	10.09	21570.00	964.75	0.37
Reach-1	229	172000.00	1147.71	1169.03		1170.34	0.002618	9.20	18885.39	955.73	0.36
Reach-1	228	215000.00	1147.57	1170.89	1160.00	1172.35	0.002495	9.75	22387.70	1039.38	0.36
Reach-1	228	172000.00	1147.57	1168.11	1158.41	1169.34	0.002440	8.93	19509.07	1028.56	0.35
Reach-1	123.8	215000.00	1147.44	1169.36	1161.49	1171.34	0.003321	11.46	19485.51	1091.54	0.45
Reach-1	123.8	172000.00	1147.44	1166.55	1159.81	1168.30	0.003583	10.76	16480.74	1048.42	0.46
Reach-1	123.75	Bridge									
Reach-1	123.7	215000.00	1147.41	1168.25	1161.51	1170.49	0.004052	12.18	18274.33	1072.25	0.49
Reach-1	123.7	172000.00	1147.41	1165.38	1159.80	1167.43	0.004576	11.59	15255.43	1038.07	0.51
Reach-1	120.5	215000.00	1147.26	1166.59	1160.10	1168.83	0.004249	12.12	18114.22	1066.26	0.50
Reach-1	120.5	172000.00	1147.26	1163.07	1158.53	1165.32	0.005684	12.13	14406.35	1040.47	0.56

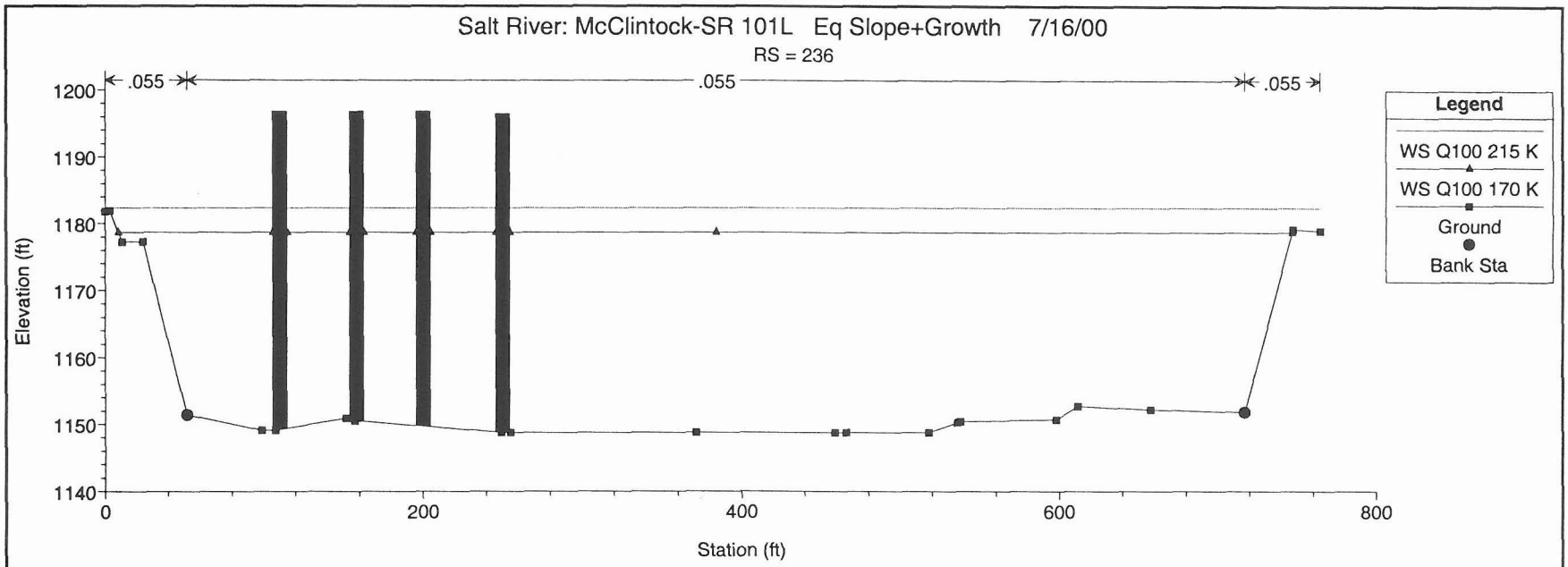

Salt River: McClintock-SR 101L Eq Slope+Growth 7/16/00
Reach-1
Legend
WS Q100 215 K
WS Q100 170 K
Ground
LOB
ROB
Elevation (ft)
1190
1180
1170
1160
1150
1140
0
1000
2000
3000
4000
5000
6000
Main Channel Distance (ft)
123.7
228
229
230
231
232
233
234
235
236
237
238
239
240

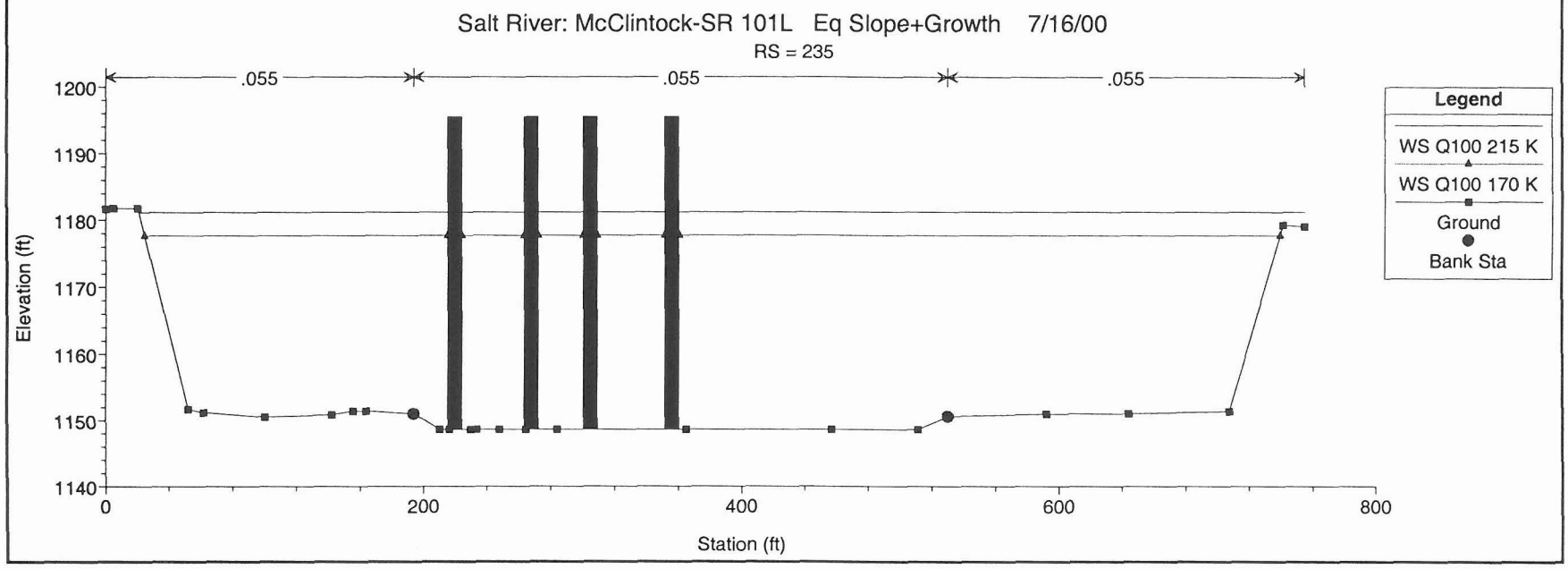

Salt River: McClintock-SR 101L Eq Slope+Growth 7/16/00
RS = 240
.055
.055
.055
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

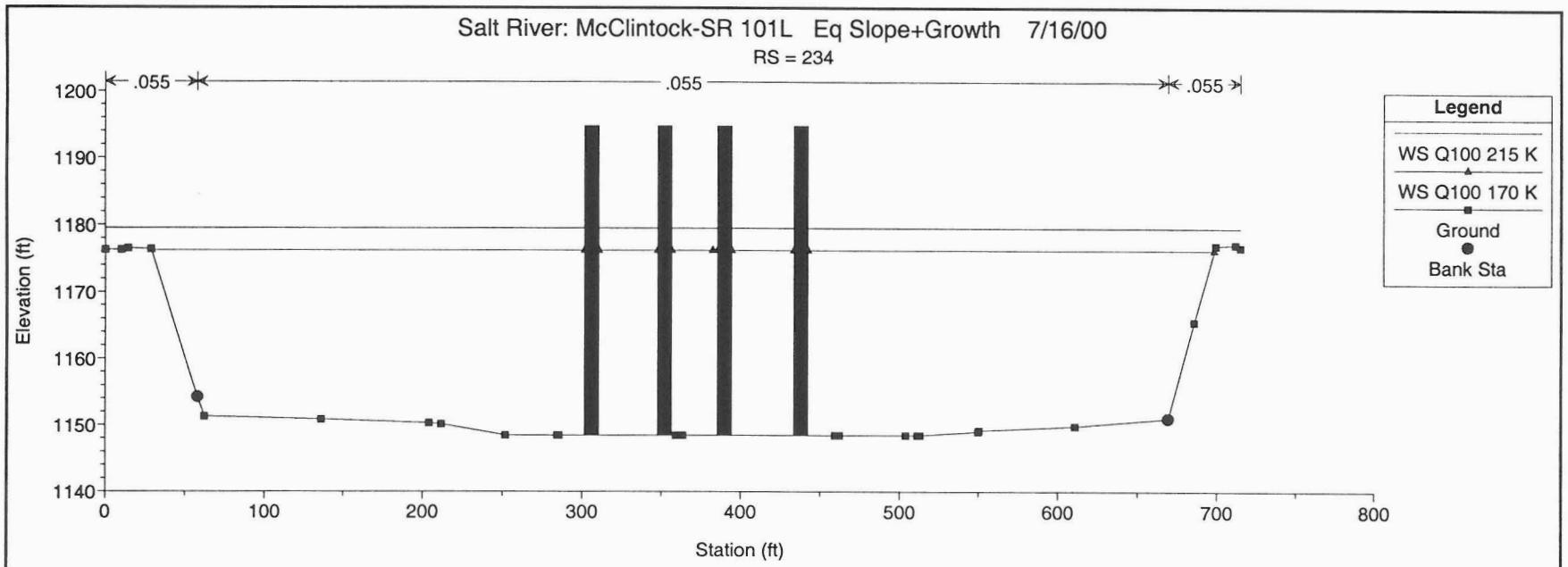

Salt River: McClintock-SR 101L Eq Slope+Growth 7/16/00
RS = 239
.055
.055
.055
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

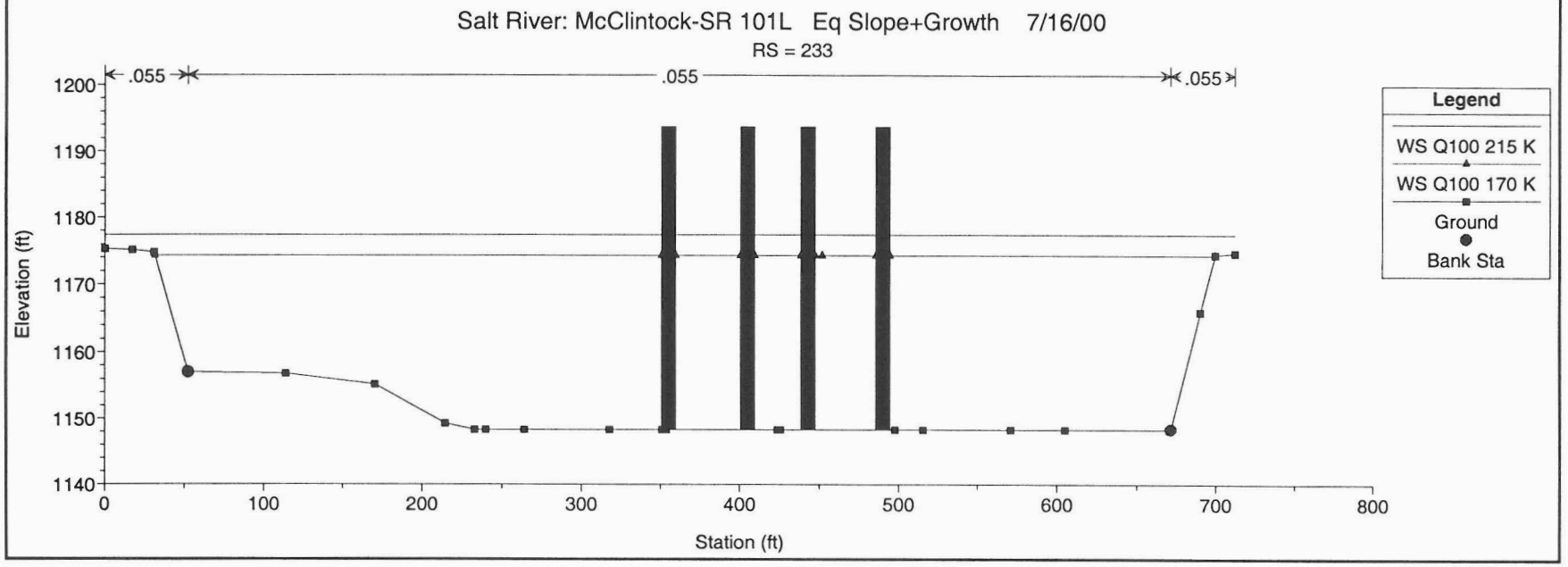

Salt River: McClintock-SR 101L Eq Slope+Growth 7/16/00
RS = 238
.055
.055
.055
Elevation (ft)
1185
1180
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

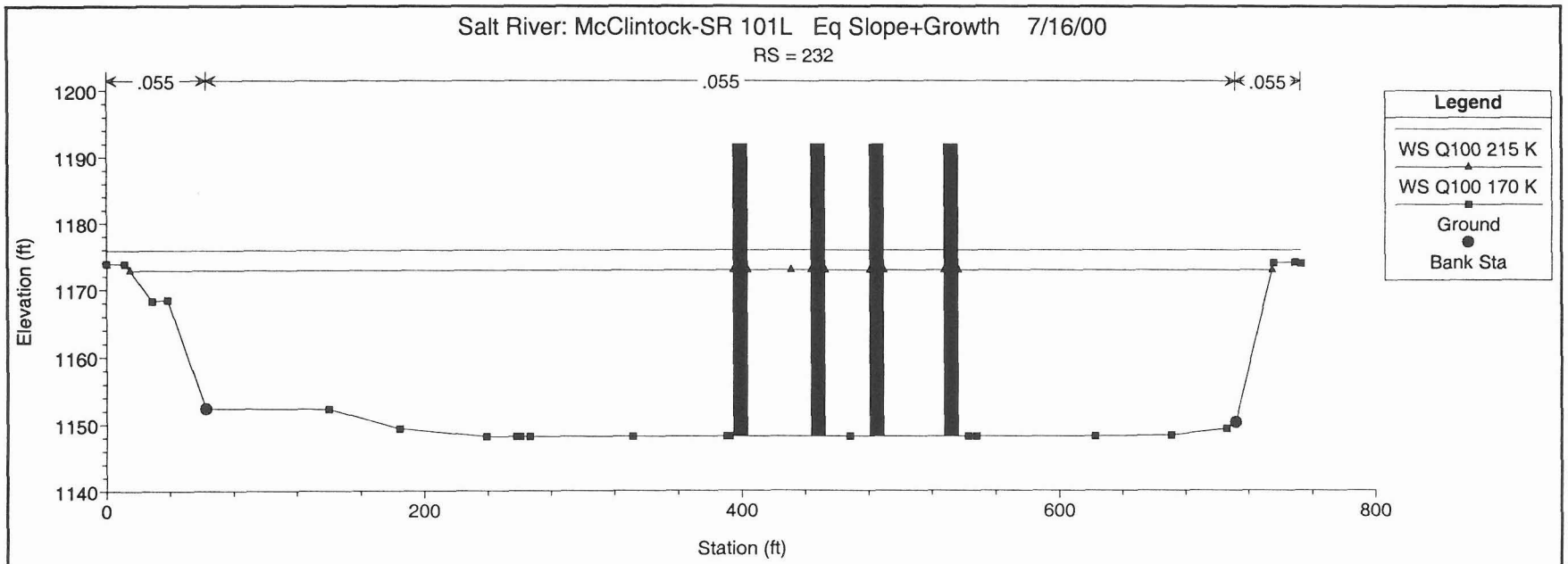

Salt River: McClintock-SR 101L Eq Slope+Growth 7/16/00
RS = 237
.055
.055
.055
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

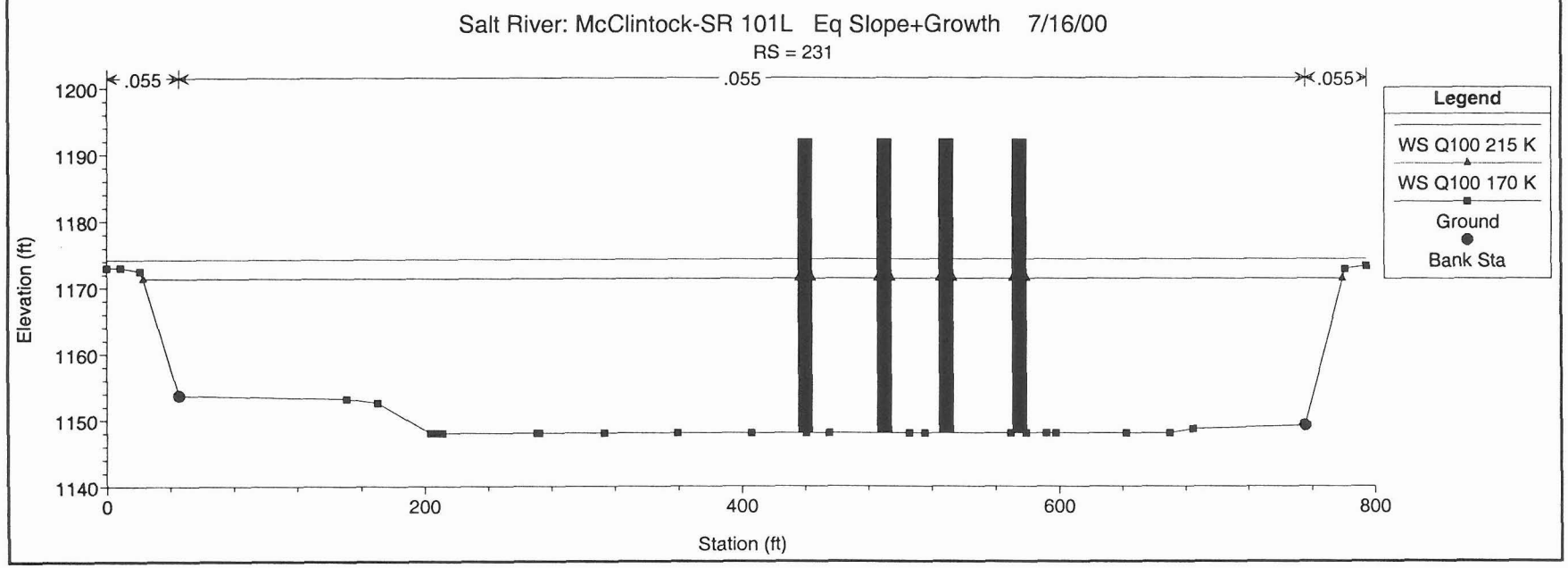

Salt River: McClintock-SR 101L Eq Slope+Growth 7/16/00
RS = 236
.055
.055
.055
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

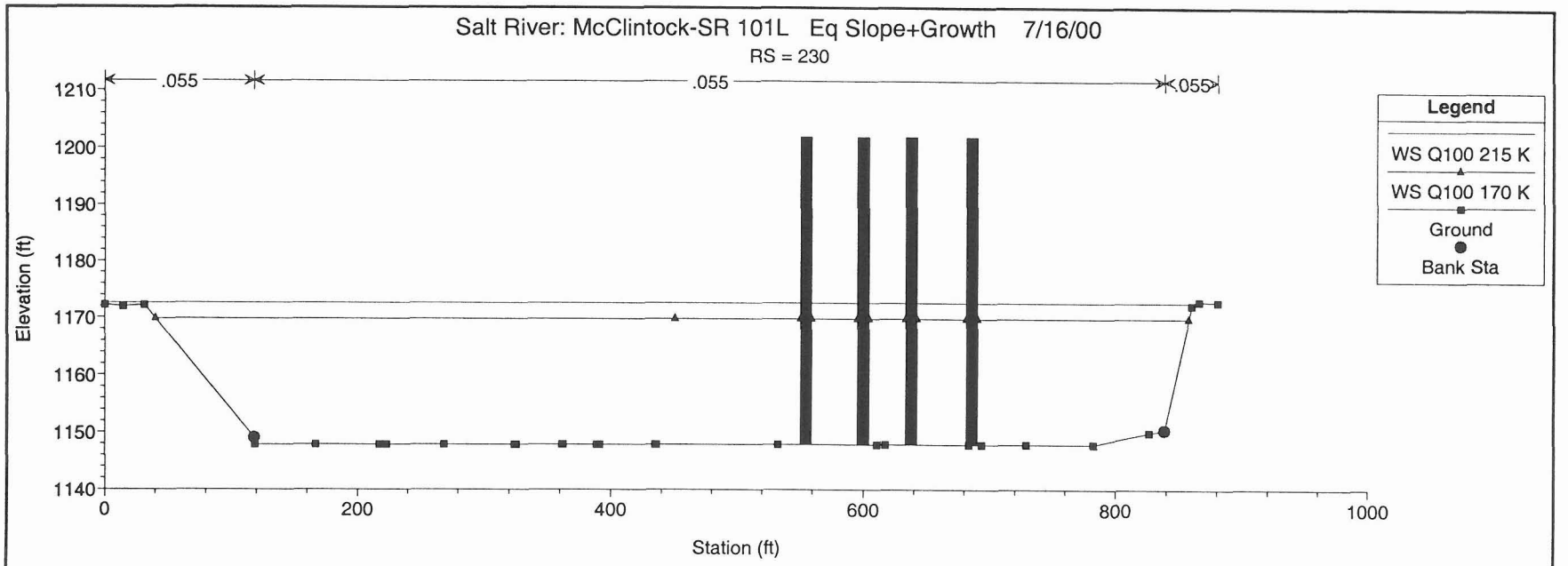

Salt River: McClintock-SR 101L Eq Slope+Growth 7/16/00
RS = 235
.055
.055
.055
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

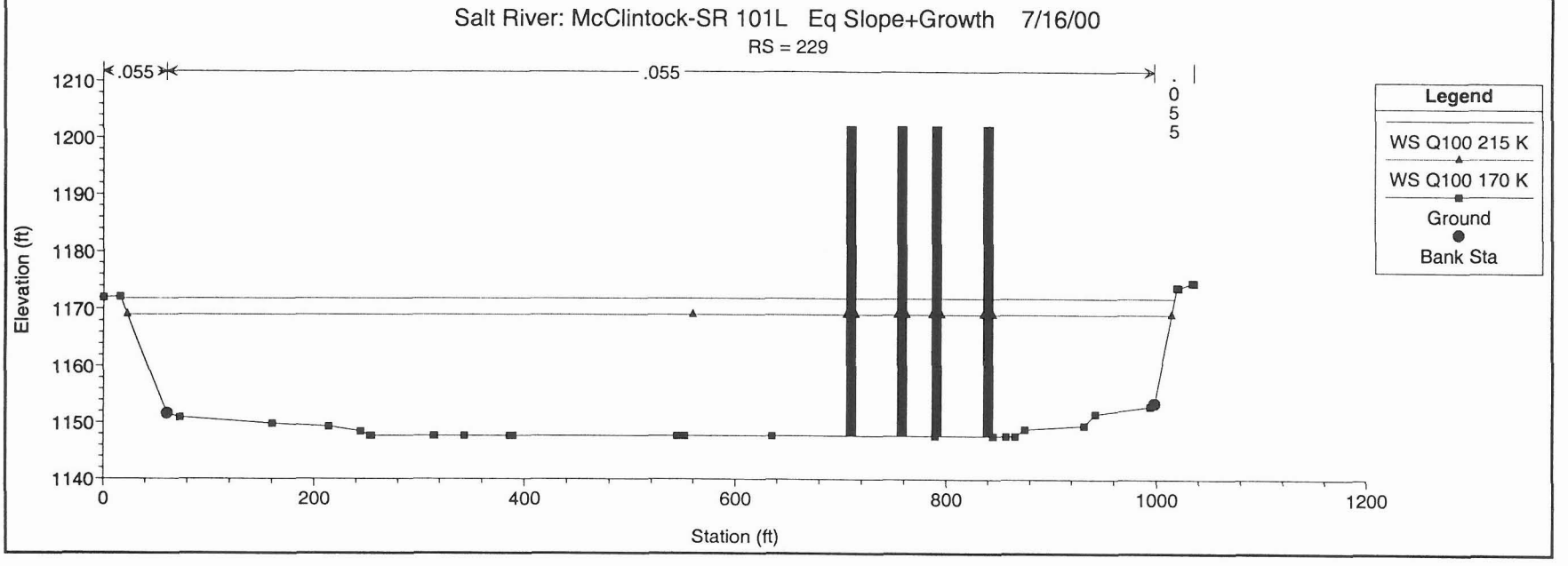

Salt River: McClintock-SR 101L Eq Slope+Growth 7/16/00
RS = 234
.055
.055
.055
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
100
200
300
400
500
600
700
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

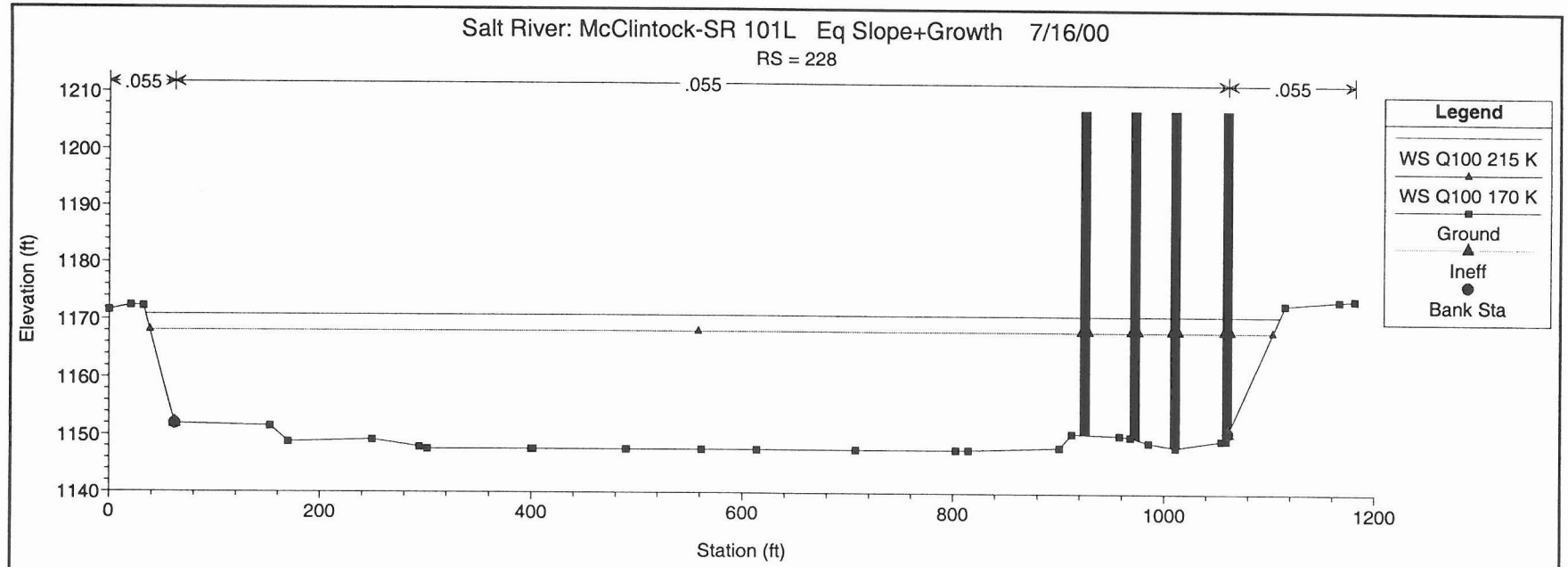

Salt River: McClintock-SR 101L Eq Slope+Growth 7/16/00
RS = 233
.055
.055
.055
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
100
200
300
400
500
600
700
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

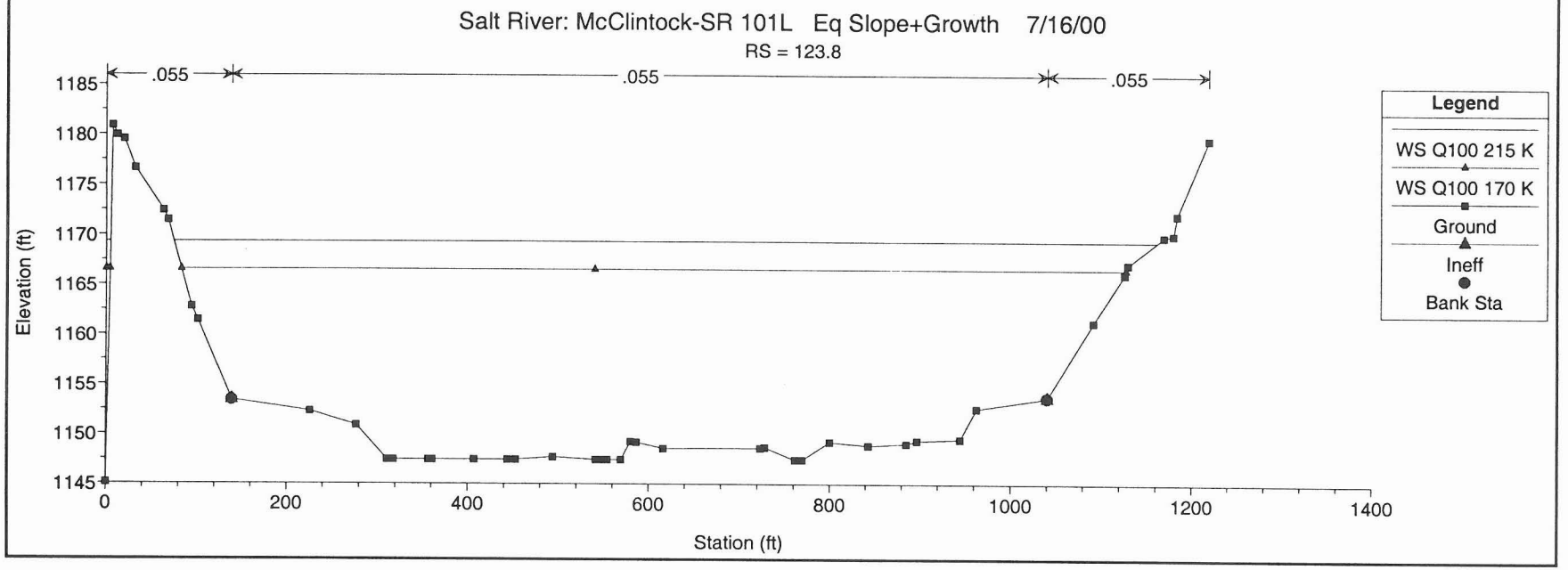

Salt River: McClintock-SR 101L Eq Slope+Growth 7/16/00
RS = 232
.055
.055
.055
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

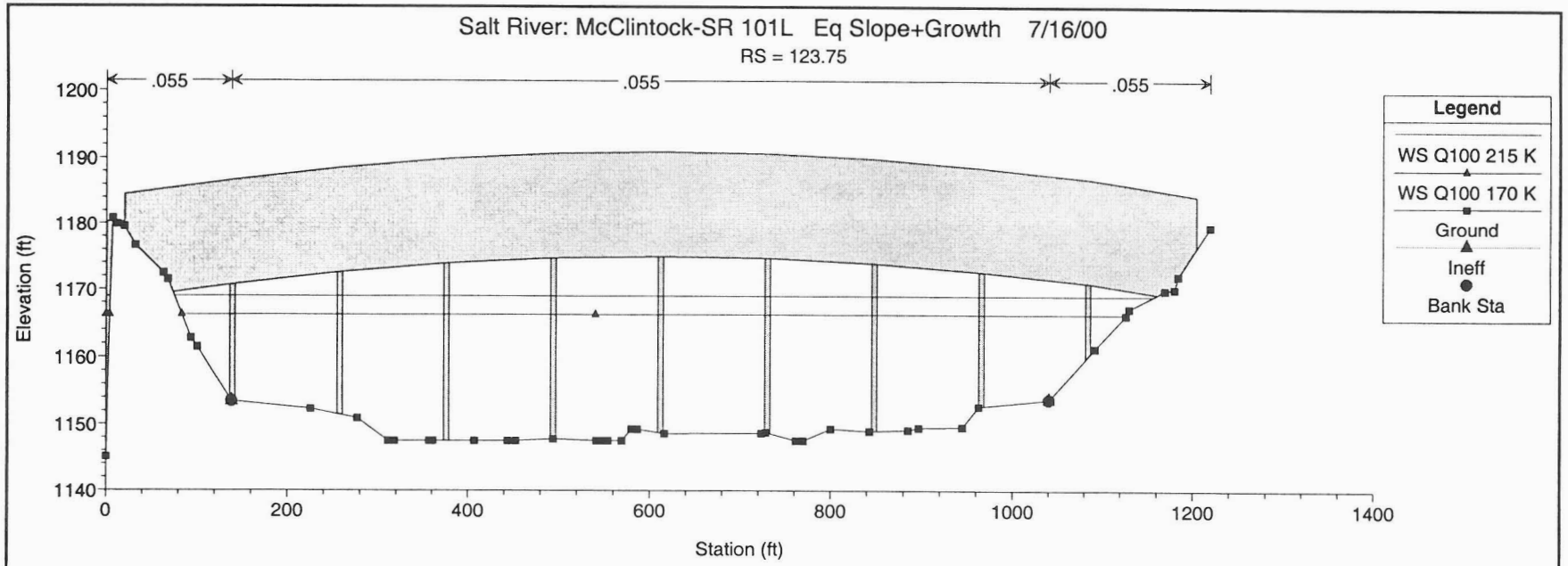

Salt River: McClintock-SR 101L Eq Slope+Growth 7/16/00
RS = 231
.055
.055
.055
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

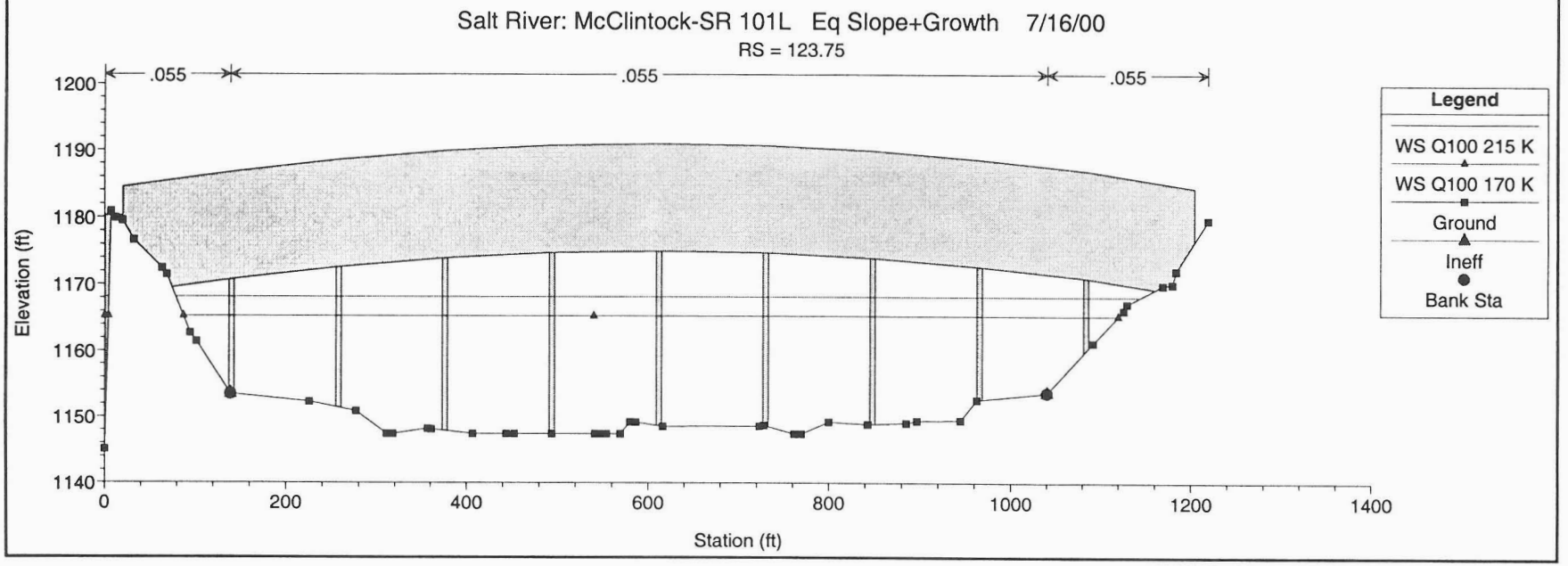

Salt River: McClintock-SR 101L Eq Slope+Growth 7/16/00
RS = 230
.055
.055
.055
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

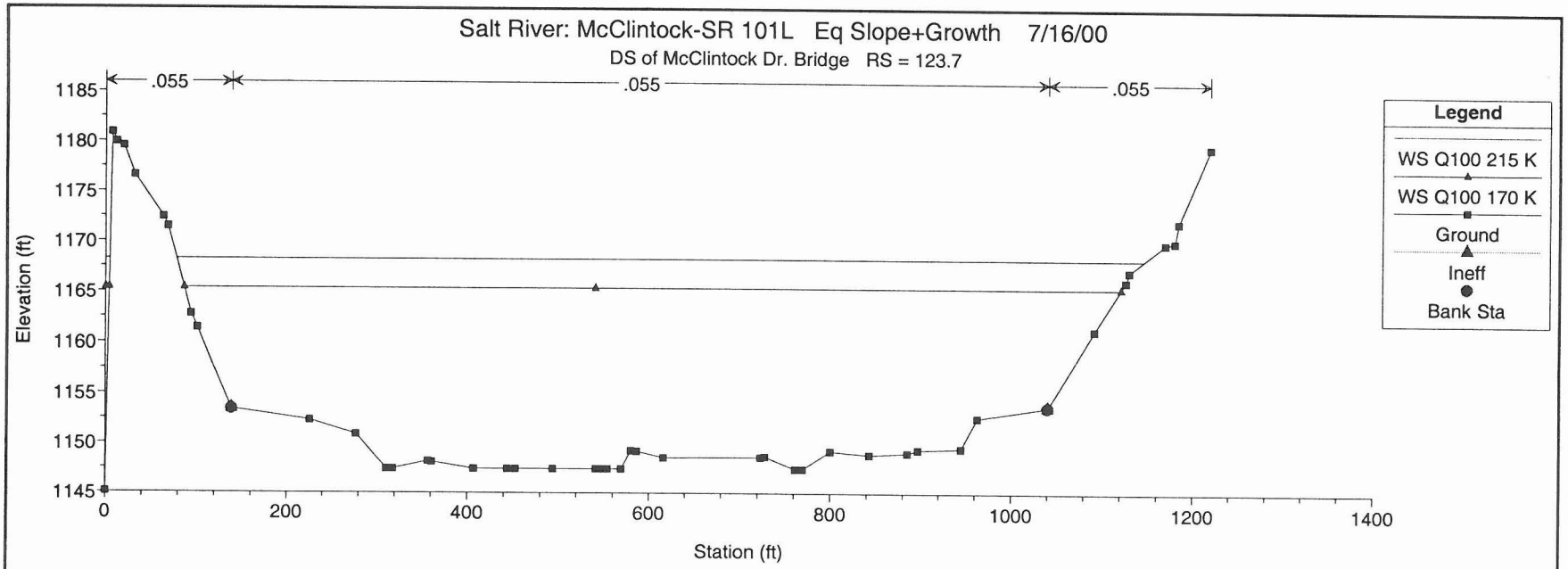

Salt River: McClintock-SR 101L Eq Slope+Growth 7/16/00
RS = 229
.055
.055
.055
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

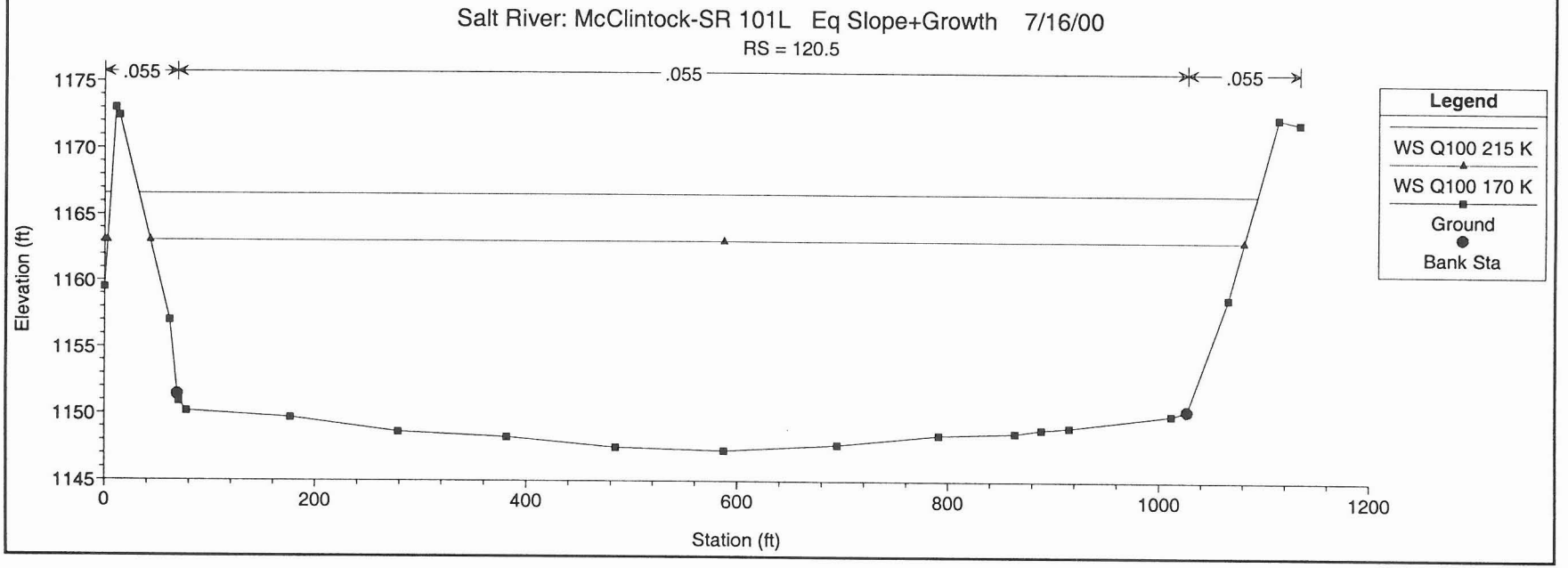

Salt River: McClintock-SR 101L Eq Slope+Growth 7/16/00
RS = 228
.055
.055
.055
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Eq Slope+Growth 7/16/00
RS = 123.8
.055
.055
.055
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Eq Slope+Growth 7/16/00
RS = 123.75
.055
.055
.055
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Eq Slope+Growth 7/16/00
RS = 123.75
.055
.055
.055
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Eq Slope+Growth 7/16/00
DS of McClintock Dr. Bridge RS = 123.7
.055
.055
.055
Elevation (ft)
1185
1180
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta

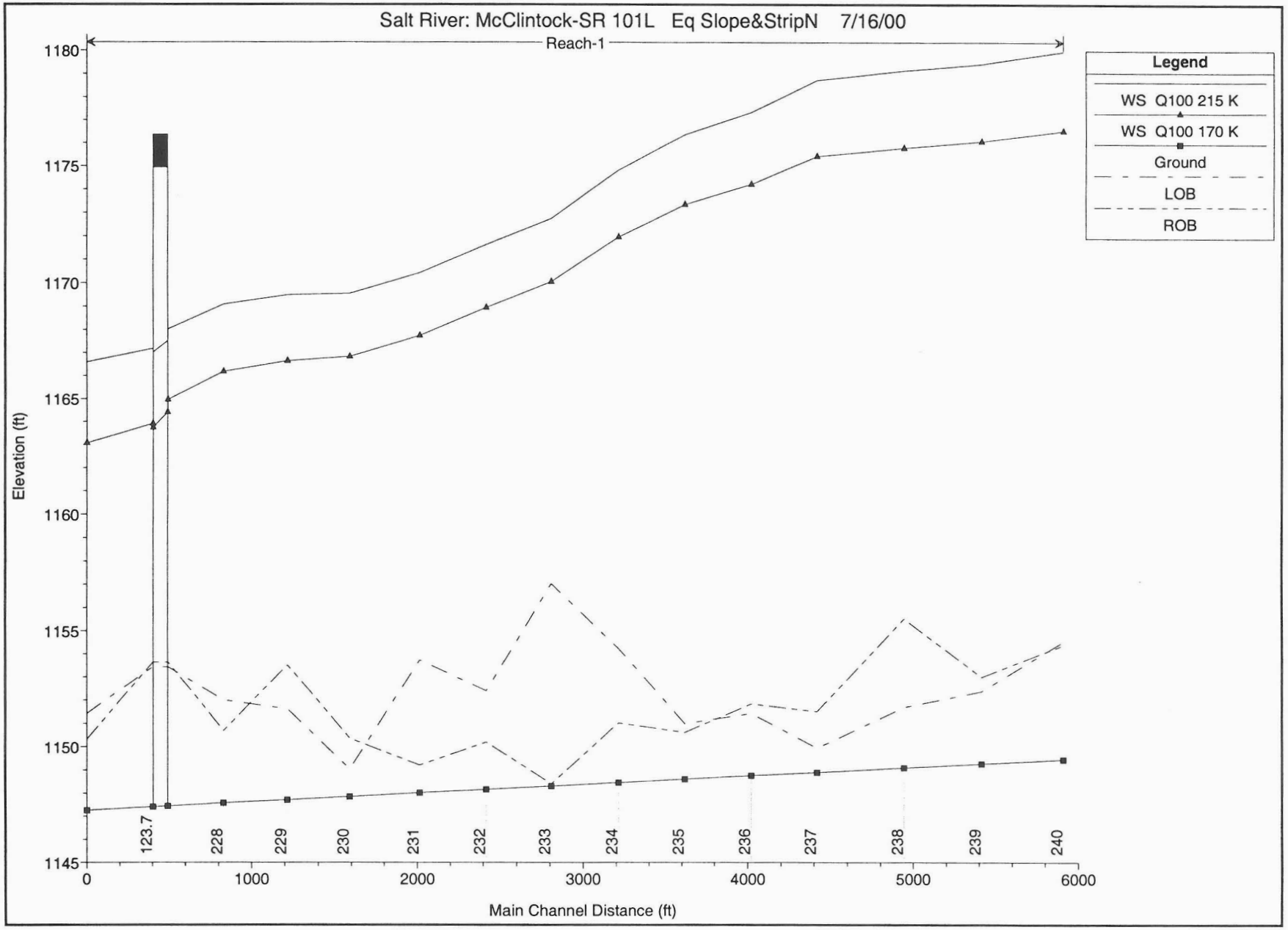

Salt River: McClintock-SR 101L Eq Slope+Growth 7/16/00
RS = 120.5
.055
.055
.055
Elevation (ft)
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

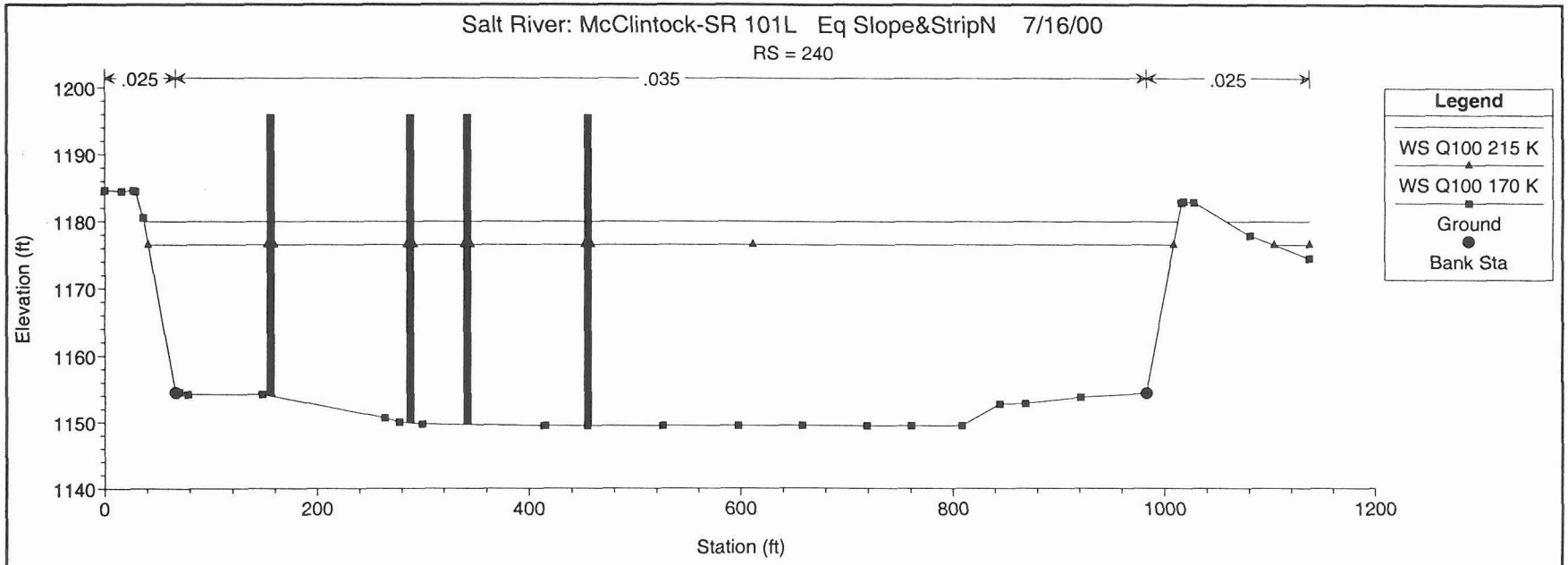
Q_{100} = 215,000 cfs and 172,000 cfs, Eq. Slope Condition Strip n

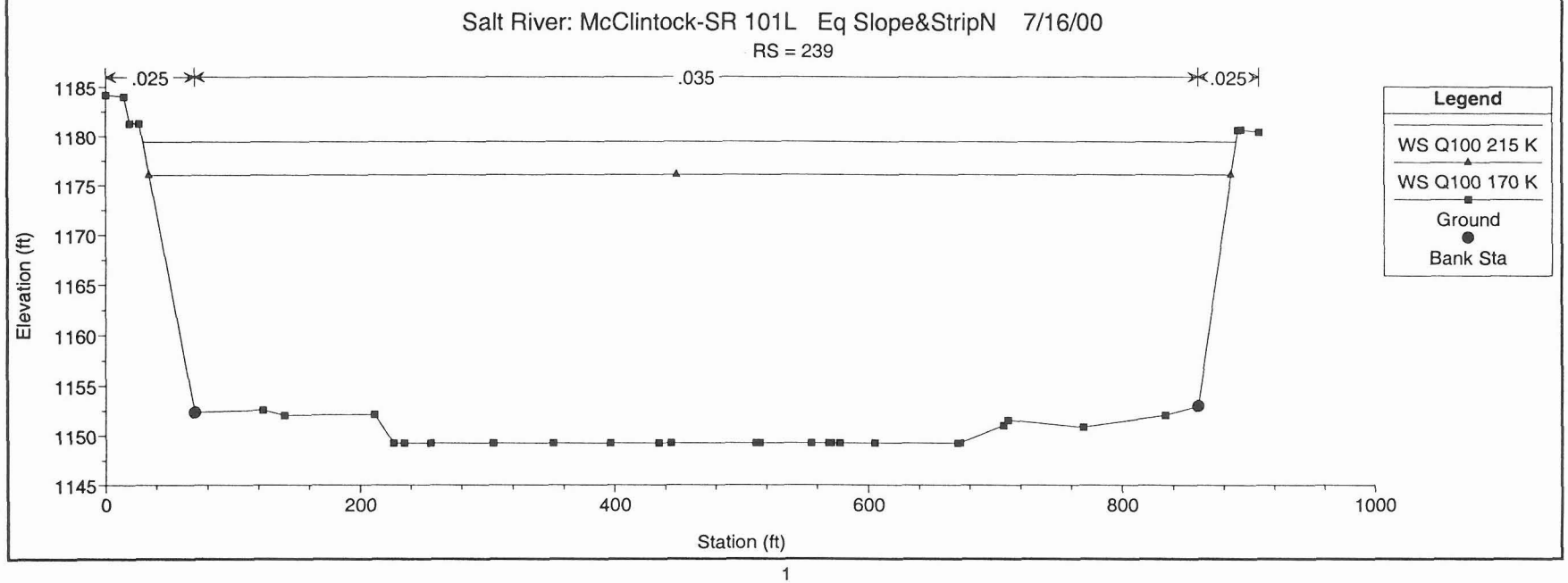
Plan Title: Eq.SlopeStripN

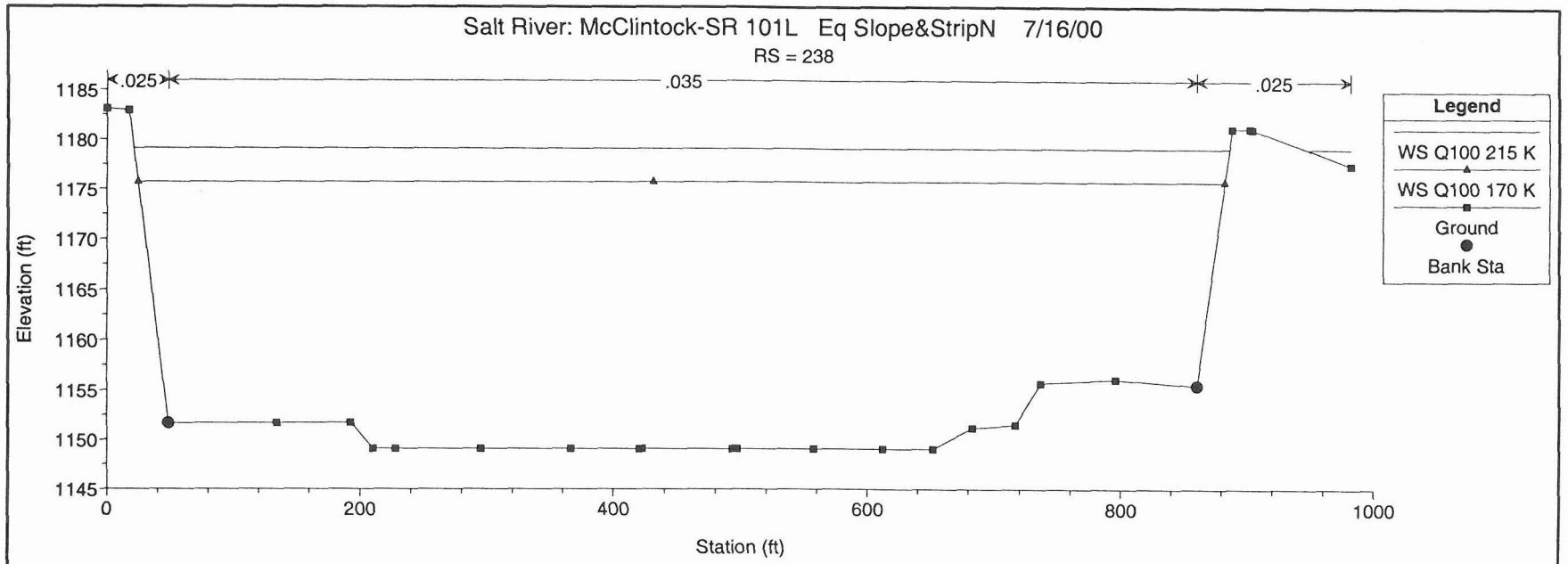
HEC-RAS Plan: Eq.S&StripN River: RIVER-1 Reach: Reach-1

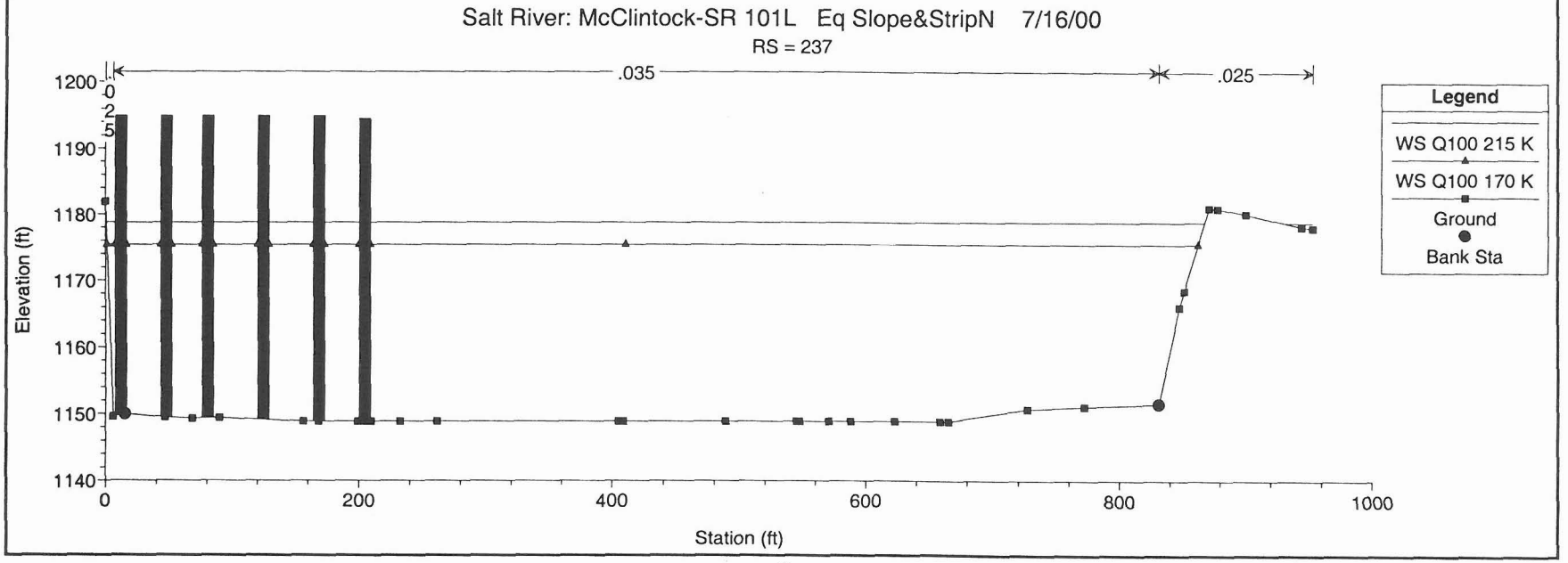
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	240	215000.00	1149.45	1179.96		1180.97	0.000565	8.14	26721.63	1026.30	0.27
Reach-1	240	172000.00	1149.45	1176.51		1177.36	0.000541	7.44	23267.23	973.14	0.26
Reach-1	239	215000.00	1149.26	1179.42		1180.68	0.000511	9.08	23947.03	860.53	0.30
Reach-1	239	172000.00	1149.26	1176.04		1177.09	0.000497	8.25	21055.90	851.62	0.29
Reach-1	238	215000.00	1149.09	1179.13		1180.43	0.000544	9.18	23662.48	899.71	0.30
Reach-1	238	172000.00	1149.09	1175.76		1176.84	0.000535	8.37	20728.57	858.13	0.30
Reach-1	237	215000.00	1148.89	1178.73		1180.07	0.000851	9.33	23210.44	834.67	0.30
Reach-1	237	172000.00	1148.89	1175.40		1176.50	0.000782	8.44	20503.70	807.14	0.29
Reach-1	236	215000.00	1148.75	1177.32		1179.55	0.001479	12.03	17981.13	696.27	0.40
Reach-1	236	172000.00	1148.75	1174.19		1176.02	0.001377	10.92	15843.78	678.65	0.39
Reach-1	235	215000.00	1148.60	1176.35		1178.86	0.001856	11.49	17086.01	675.83	0.39
Reach-1	235	172000.00	1148.60	1173.33		1175.38	0.001753	10.65	15052.18	668.95	0.38
Reach-1	234	215000.00	1148.45	1174.81		1177.93	0.002507	14.25	15165.39	629.75	0.50
Reach-1	234	172000.00	1148.45	1171.93		1174.51	0.002360	12.93	13366.75	622.53	0.48
Reach-1	233	215000.00	1148.30	1172.73		1176.64	0.003664	15.90	13566.14	628.37	0.59
Reach-1	233	172000.00	1148.30	1170.03		1173.29	0.003471	14.53	11877.42	622.11	0.58
Reach-1	232	215000.00	1148.15	1171.61		1175.12	0.003475	15.12	14422.07	678.88	0.56
Reach-1	232	172000.00	1148.15	1168.94		1171.86	0.003328	13.79	12619.69	667.87	0.54
Reach-1	231	215000.00	1148.01	1170.40		1173.73	0.003154	14.68	14706.84	718.52	0.56
Reach-1	231	172000.00	1148.01	1167.72		1170.53	0.003083	13.51	12785.90	712.18	0.55
Reach-1	230	215000.00	1147.85	1169.55		1172.45	0.002386	13.71	15746.37	780.30	0.52
Reach-1	230	172000.00	1147.85	1166.81		1169.29	0.002388	12.67	13630.50	767.31	0.51
Reach-1	229	215000.00	1147.71	1169.49		1171.43	0.001619	11.25	19321.47	957.20	0.43
Reach-1	229	172000.00	1147.71	1166.63		1168.32	0.001656	10.46	16600.34	947.98	0.43
Reach-1	228	215000.00	1147.57	1169.09	1159.98	1170.81	0.001307	10.57	20517.01	1032.36	0.41
Reach-1	228	172000.00	1147.57	1166.18	1158.37	1167.68	0.001366	9.89	17529.27	1021.05	0.41
Reach-1	123.8	215000.00	1147.44	1168.02	1161.50	1170.26	0.001659	12.15	18040.99	1068.25	0.50
Reach-1	123.8	172000.00	1147.44	1164.95	1159.84	1167.07	0.001987	11.80	14821.35	1033.67	0.53
Reach-1	123.75	Bridge									
Reach-1	123.7	215000.00	1147.41	1167.18	1161.52	1169.65	0.001952	12.77	17132.67	1053.55	0.53
Reach-1	123.7	172000.00	1147.41	1163.91	1159.85	1166.38	0.002536	12.72	13736.76	1023.05	0.59
Reach-1	120.5	215000.00	1147.26	1166.59	1160.09	1168.79	0.001686	11.99	18114.22	1066.26	0.50
Reach-1	120.5	172000.00	1147.26	1163.07	1158.52	1165.30	0.002267	12.03	14406.35	1040.47	0.56

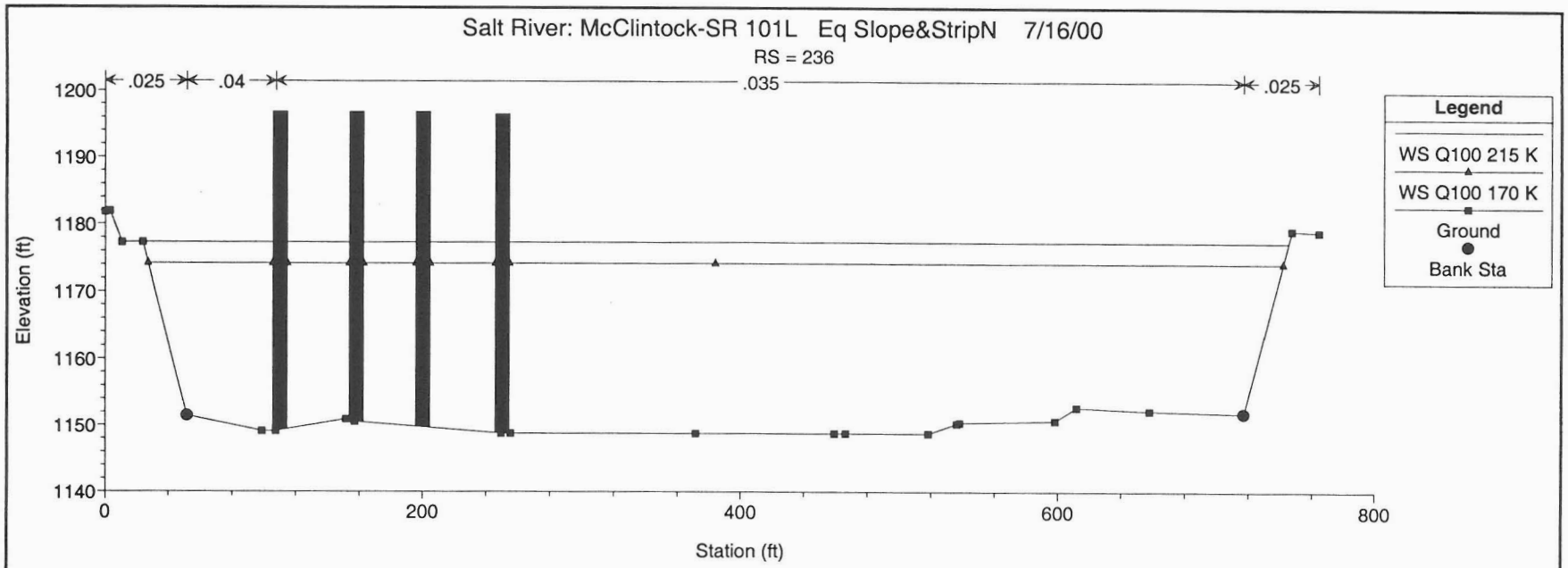

Salt River: McClintock-SR 101L Eq Slope&StripN 7/16/00
Reach-1
Legend
WS Q100 215 K
WS Q100 170 K
Ground
LOB
ROB
Elevation (ft)
1180
1175
1170
1165
1160
1155
1150
1145
0
1000
2000
3000
4000
5000
6000
Main Channel Distance (ft)
123.7
228
229
230
231
232
233
234
235
236
237
238
239
240

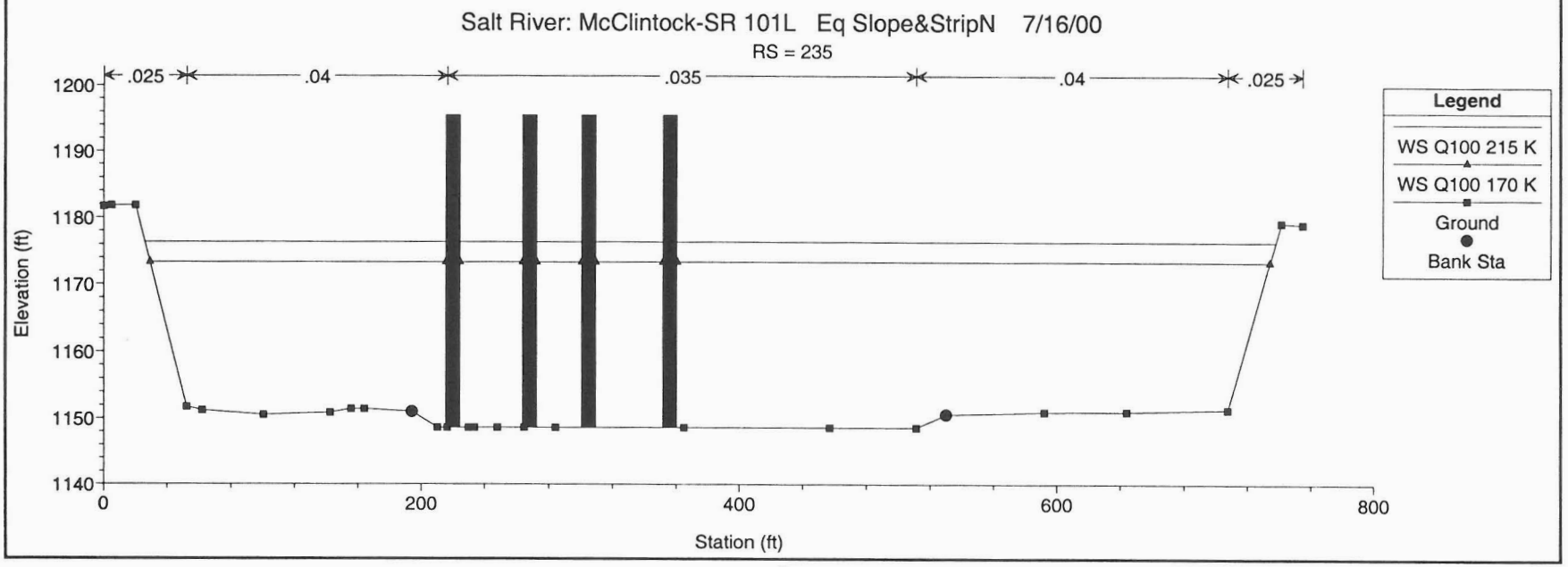

Salt River: McClintock-SR 101L Eq Slope&StripN 7/16/00
RS = 240
.025
.035
.025
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

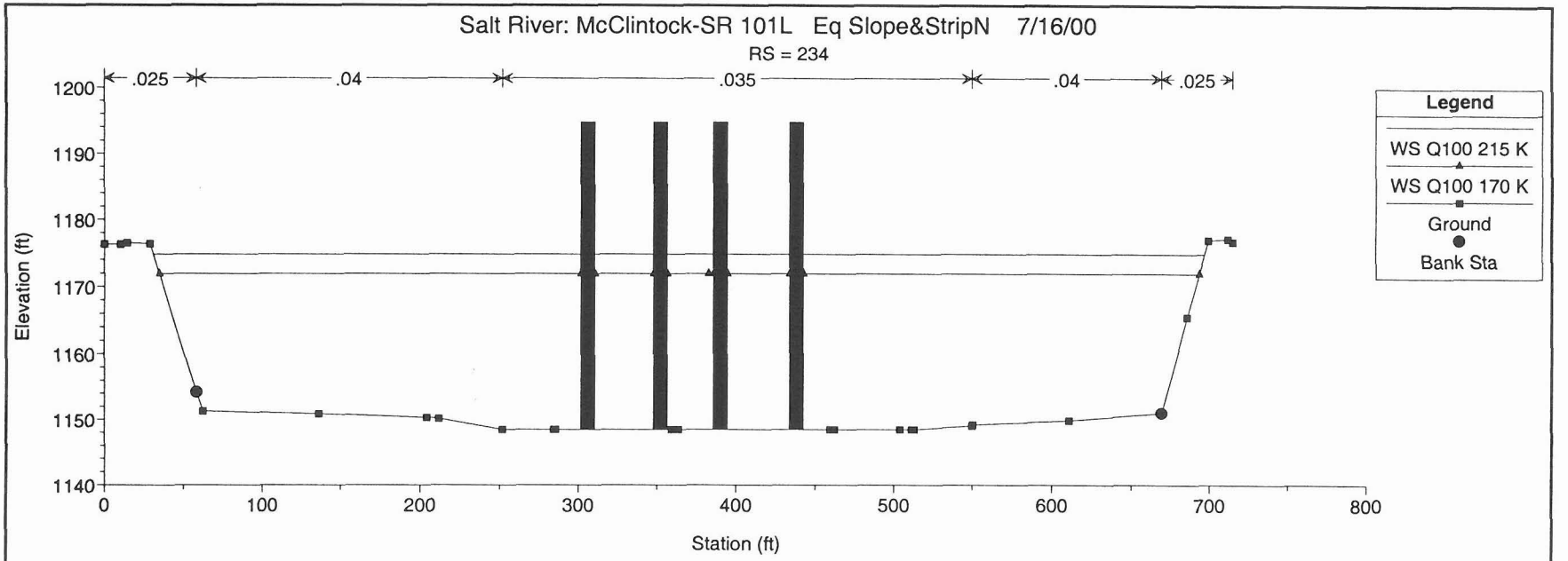

Salt River: McClintock-SR 101L Eq Slope&StripN 7/16/00
RS = 239
.025
.035
.025
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

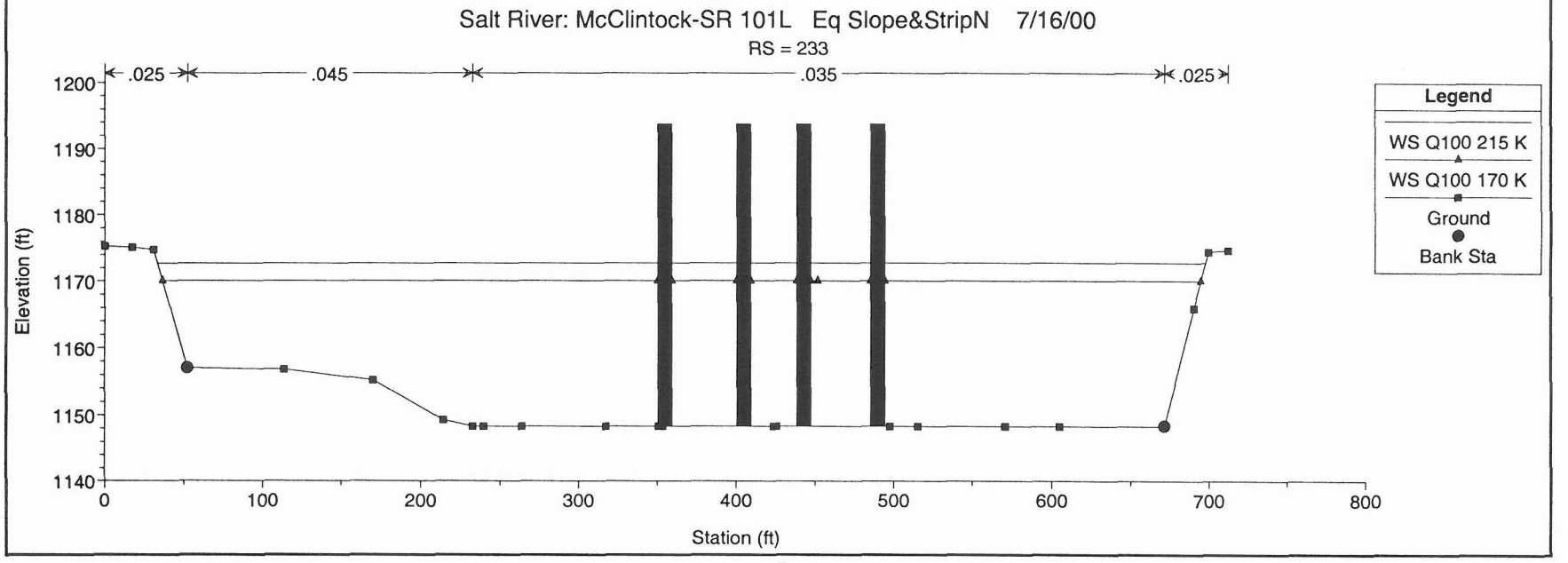

Salt River: McClintock-SR 101L Eq Slope&StripN 7/16/00
RS = 238
.025
.035
.025
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1185
1180
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
Station (ft)

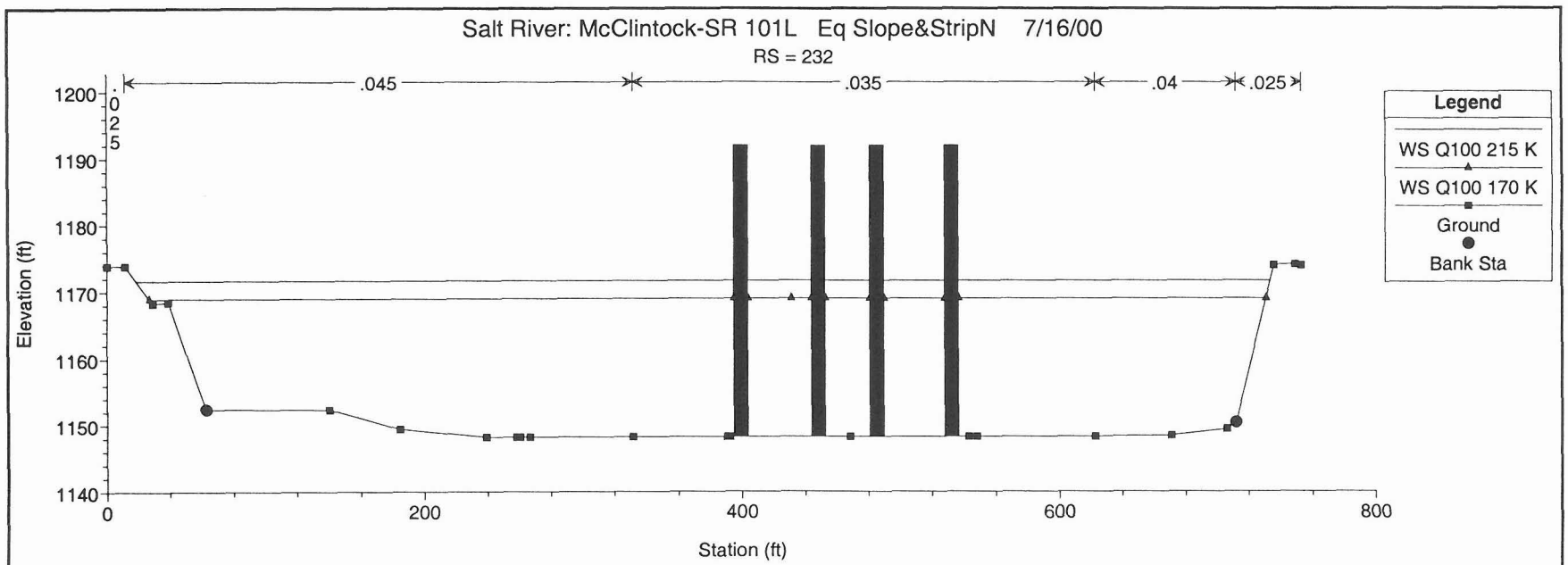

Salt River: McClintock-SR 101L Eq Slope&StripN 7/16/00
RS = 237
.035
.025
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)

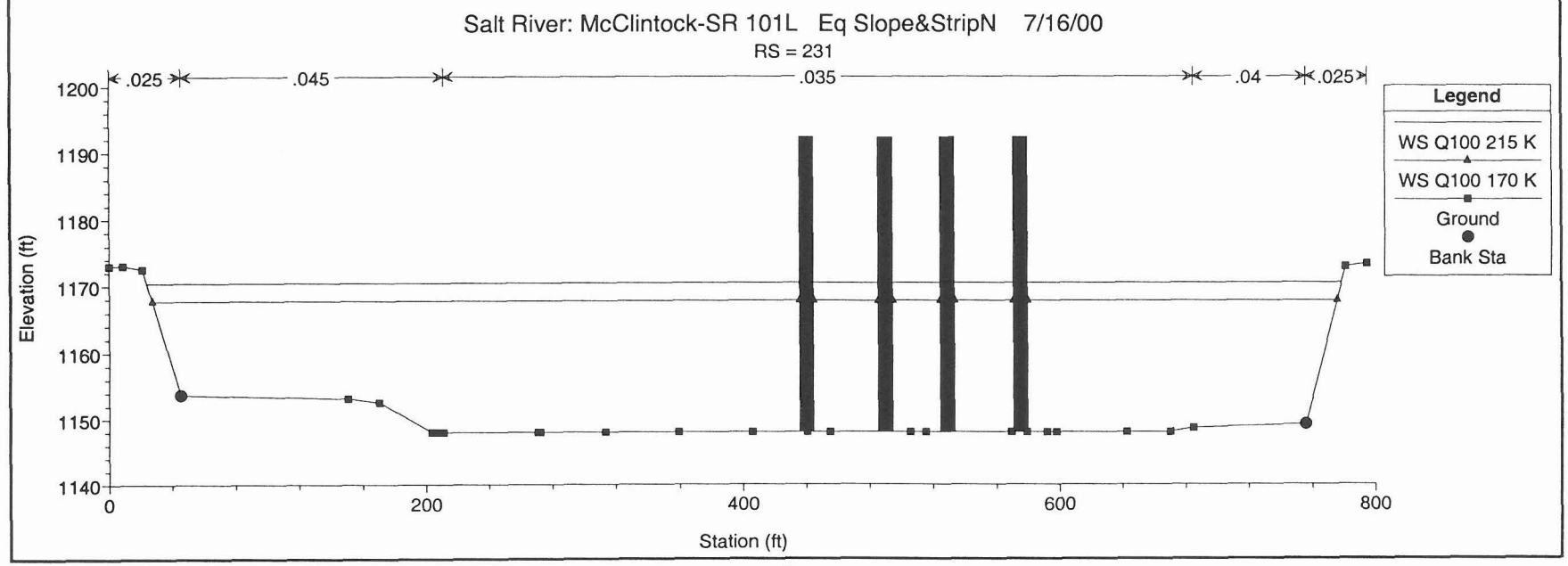

Salt River: McClintock-SR 101L Eq Slope&StripN 7/16/00
RS = 236
.025
.04
.035
.025
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

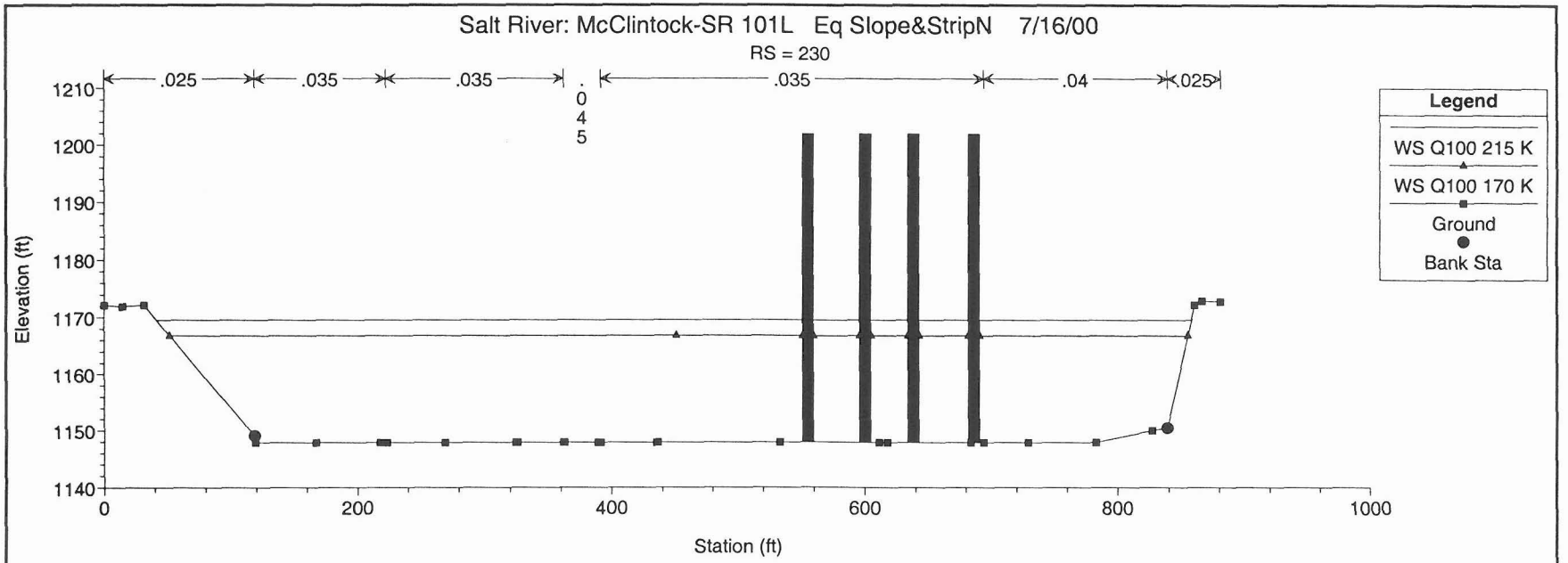

Salt River: McClintock-SR 101L Eq Slope&StripN 7/16/00
RS = 235
.025
.04
.035
.04
.025
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

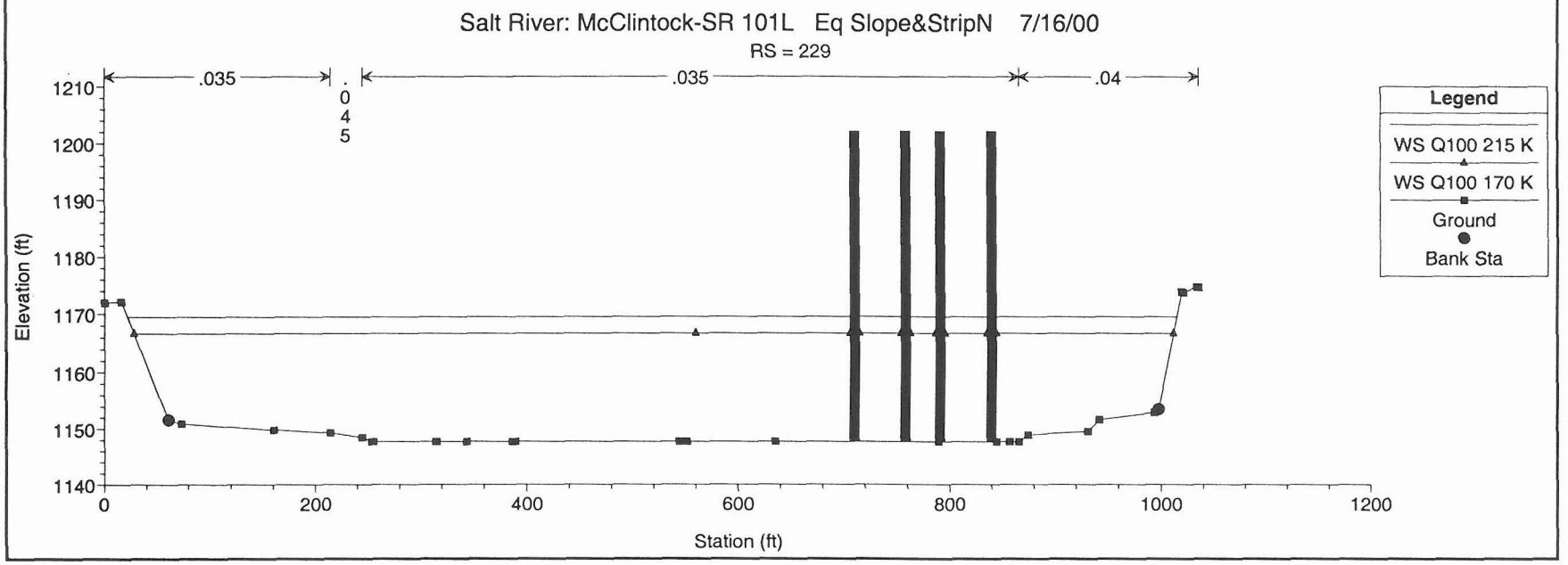

Salt River: McClintock-SR 101L Eq Slope&StripN 7/16/00
RS = 234
.025
.04
.035
.04
.025
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
100
200
300
400
500
600
700
800
Station (ft)

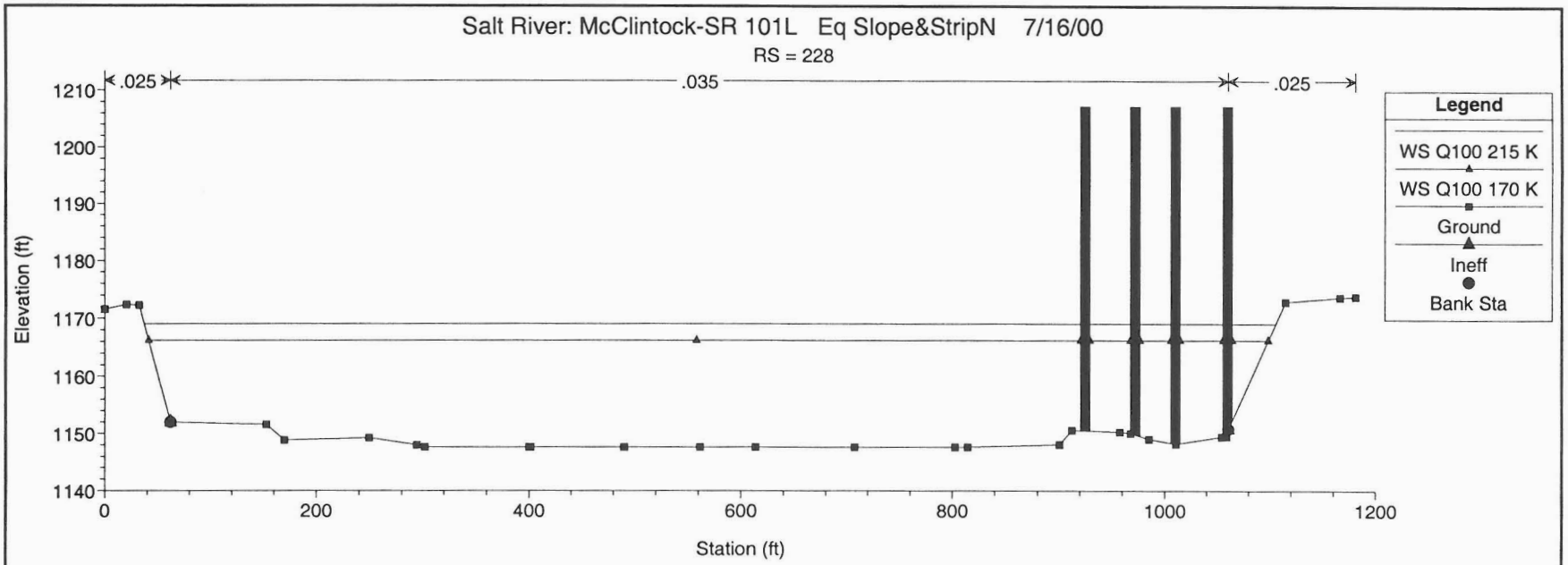

Salt River: McClintock-SR 101L Eq Slope&StripN 7/16/00
RS = 233
.025
.045
.035
.025
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
100
200
300
400
500
600
700
800
Station (ft)

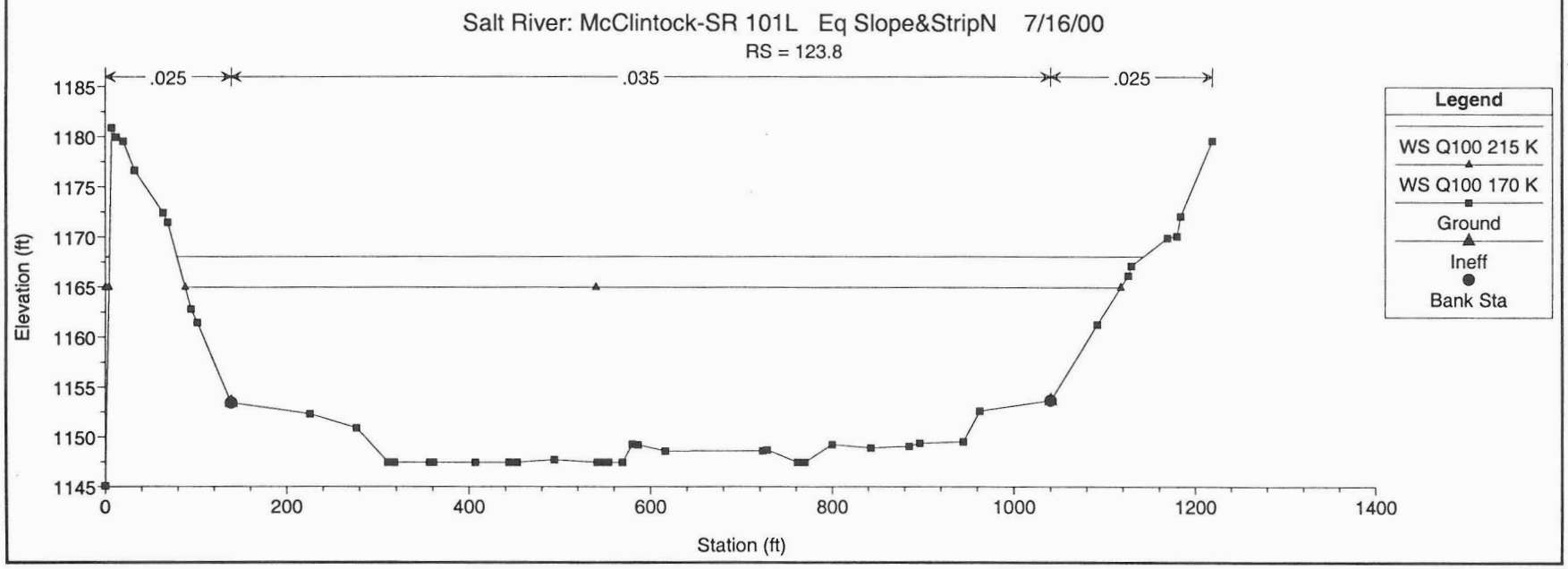

Salt River: McClintock-SR 101L Eq Slope&StripN 7/16/00
RS = 232
.025
.045
.035
.04
.025
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)

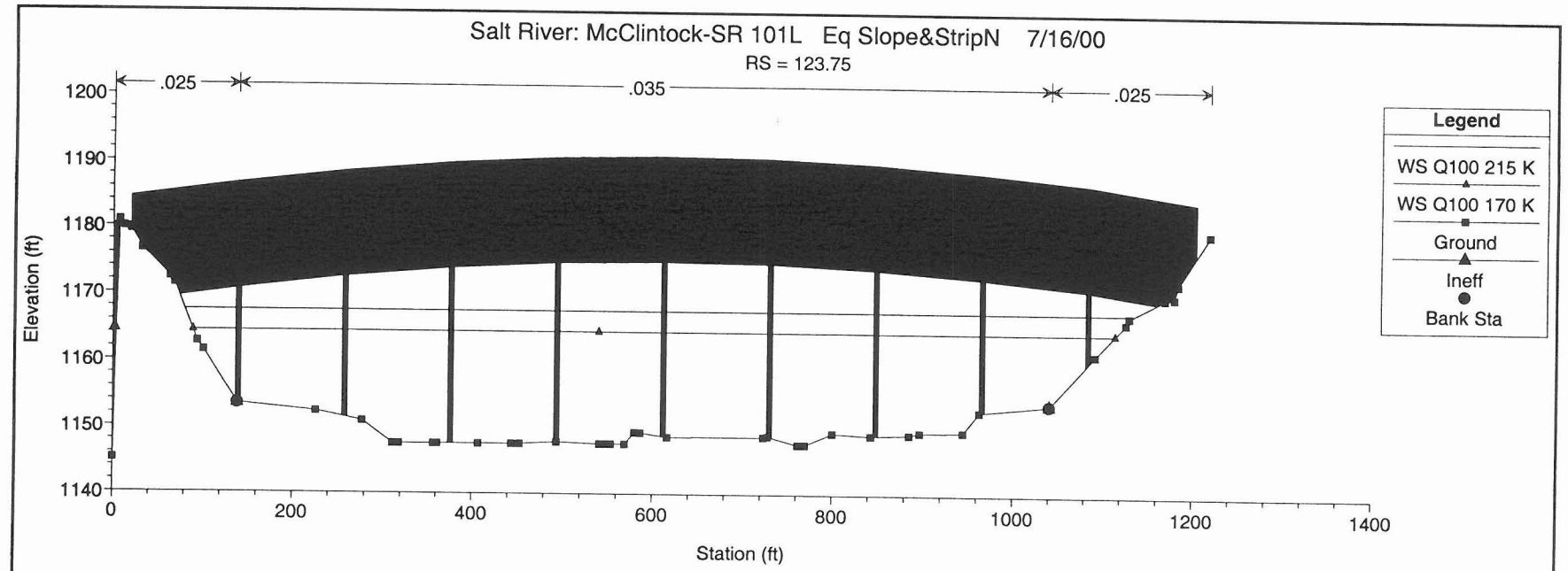

Salt River: McClintock-SR 101L Eq Slope&StripN 7/16/00
RS = 231
.025
.045
.035
.04
.025
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)

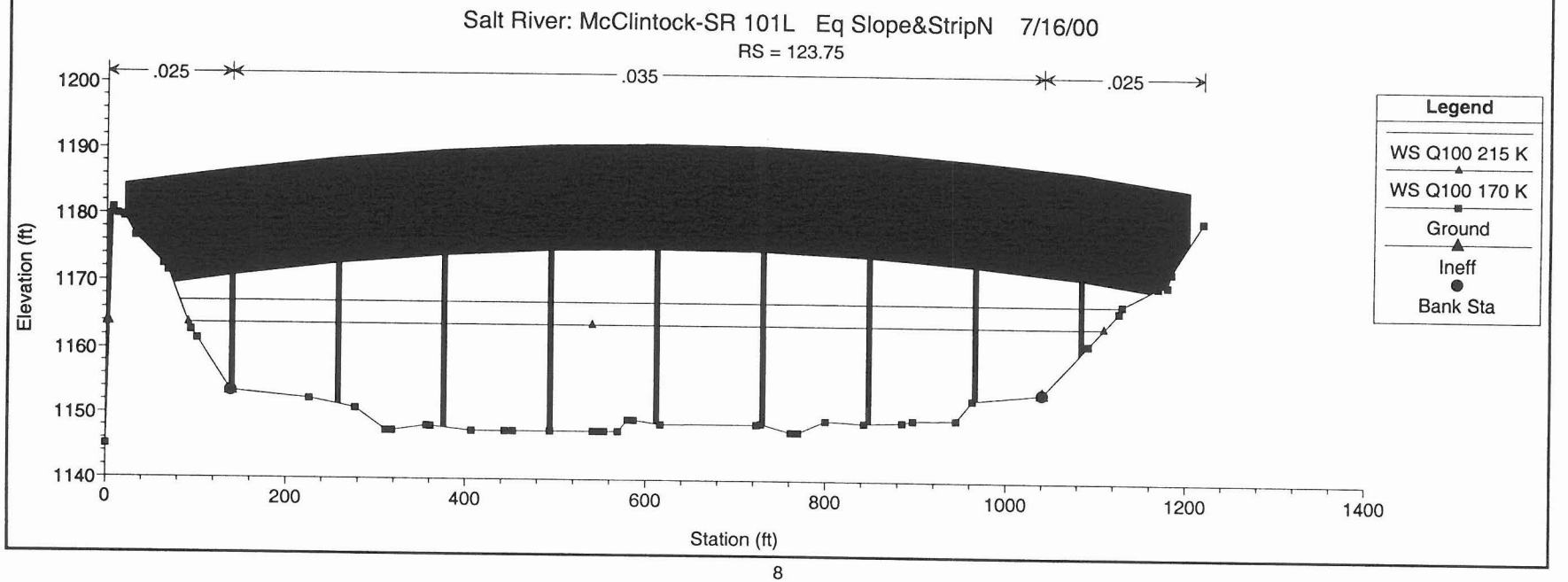

Salt River: McClintock-SR 101L Eq Slope&StripN 7/16/00
RS = 230
.025
.035
.035
.045
.035
.04
.025
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)

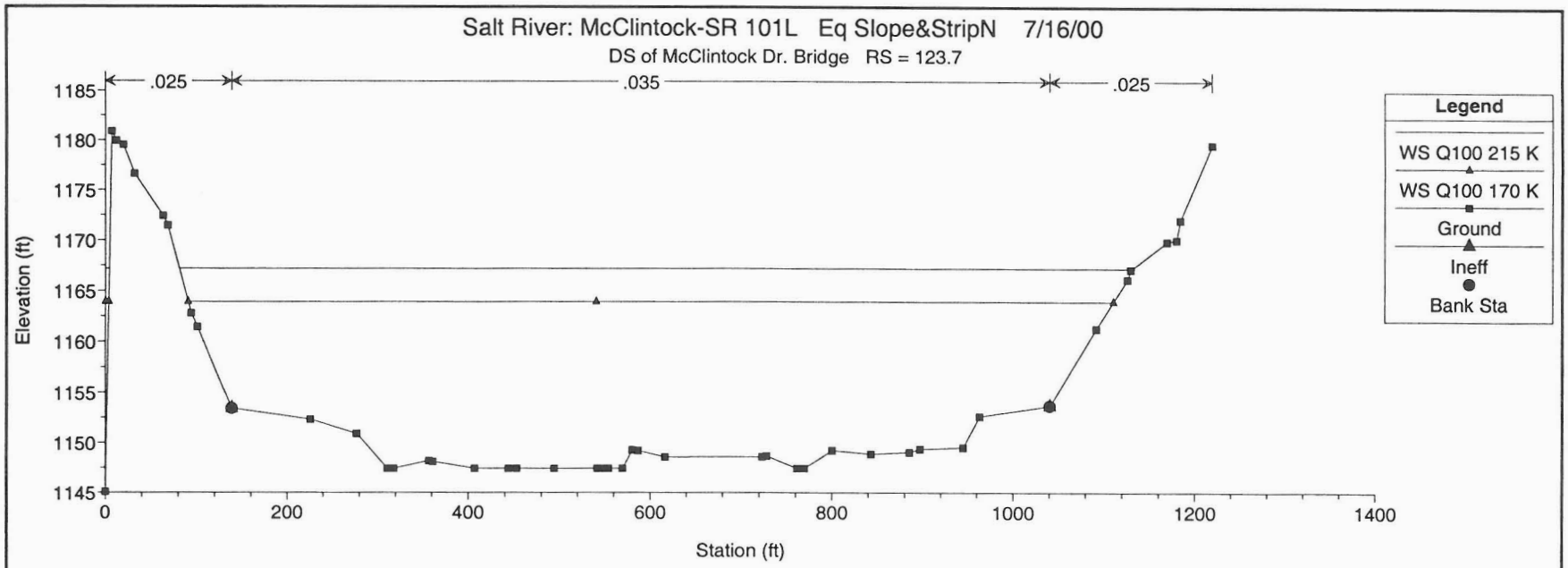

Salt River: McClintock-SR 101L Eq Slope&StripN 7/16/00
RS = 229
.035
.045
.035
.04
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)

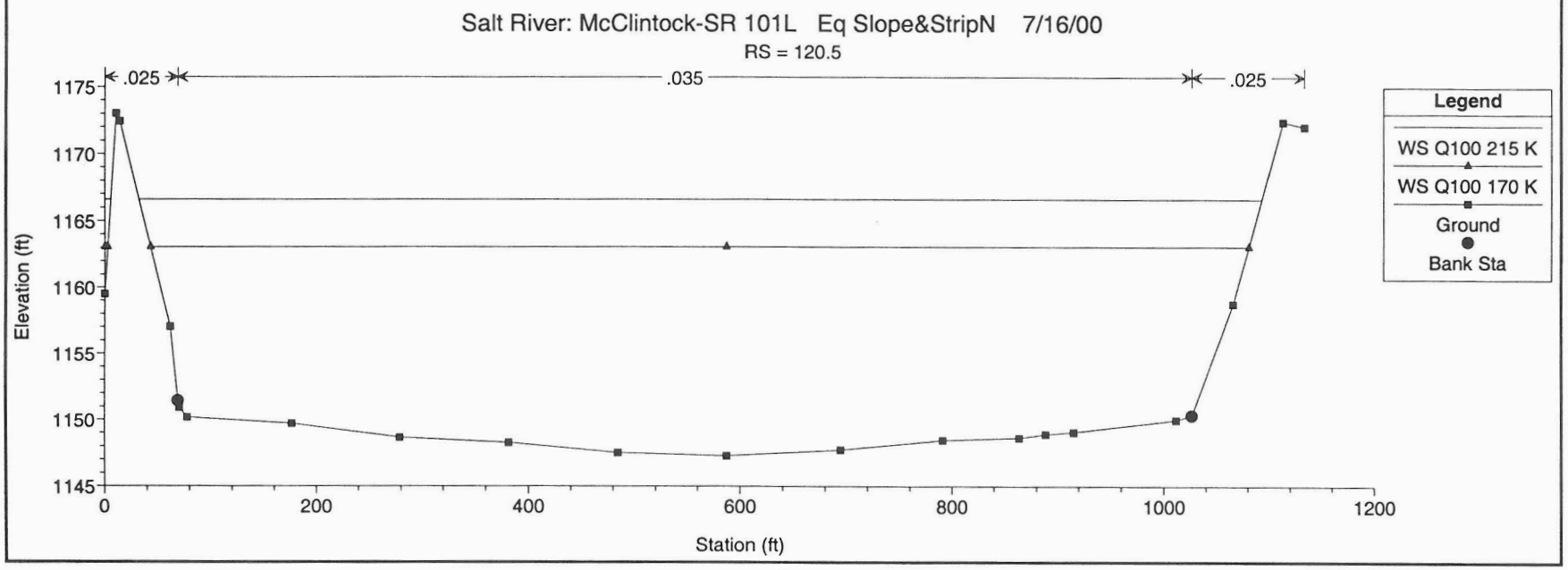

Salt River: McClintock-SR 101L Eq Slope&StripN 7/16/00
RS = 228
.025
.035
.025
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Eq Slope&StripN 7/16/00
RS = 123.8
.025
.035
.025
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Eq Slope&StripN 7/16/00
RS = 123.75
.025
.035
.025
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Eq Slope&StripN 7/16/00
RS = 123.75
.025
.035
.025
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Eq Slope&StripN 7/16/00
DS of McClintock Dr. Bridge RS = 123.7
.025
.035
.025
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Eq Slope&StripN 7/16/00
RS = 120.5
.025
.035
.025
Elevation (ft)
Station (ft)
Legend
WS Q100 215 K
WS Q100 170 K
Ground
Bank Sta

Q_{100} = 215,000 cfs and 172,000 cfs, Eq. Slope Condition
Max N

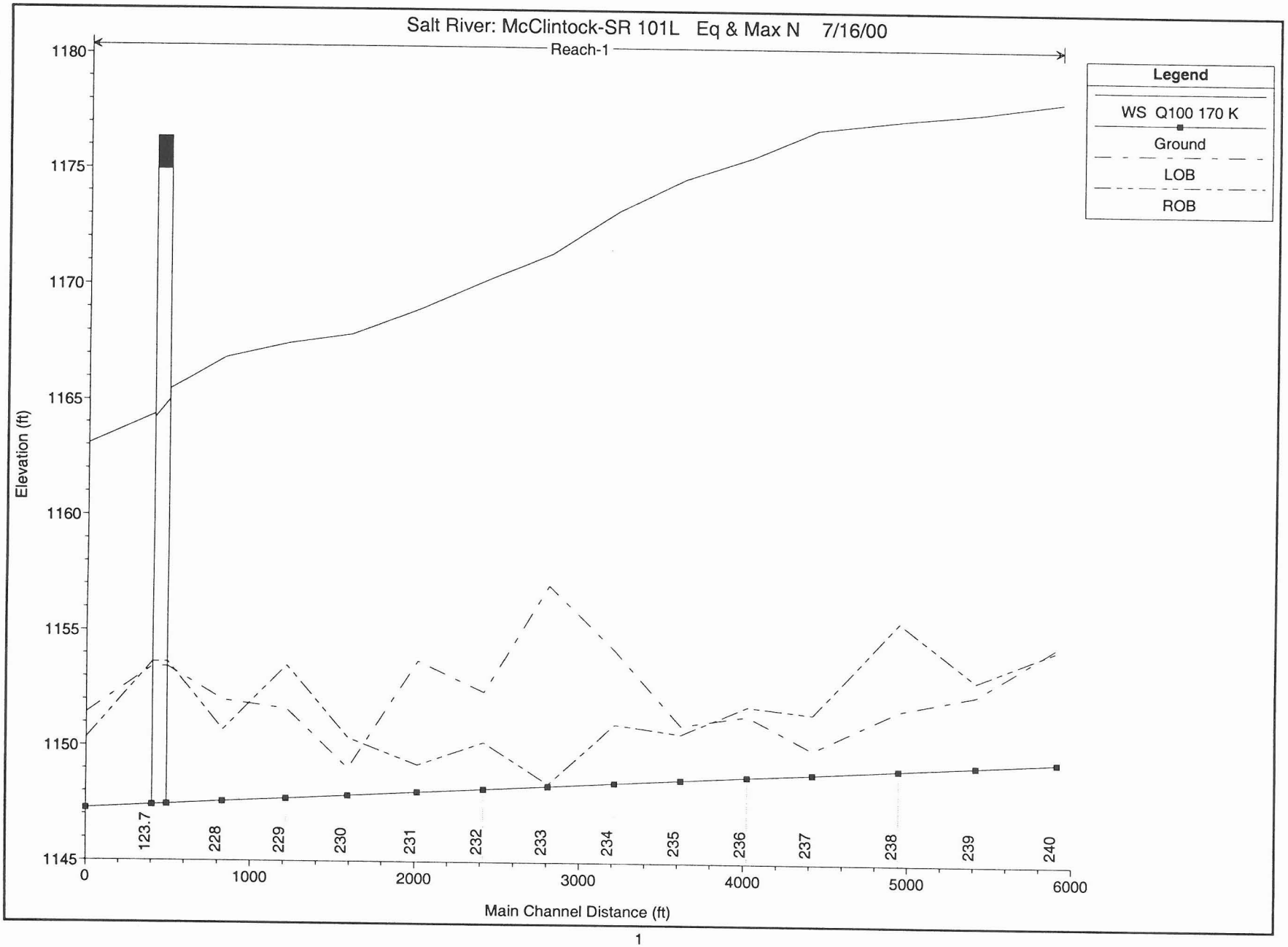
Plan Title: Eq.MaxN

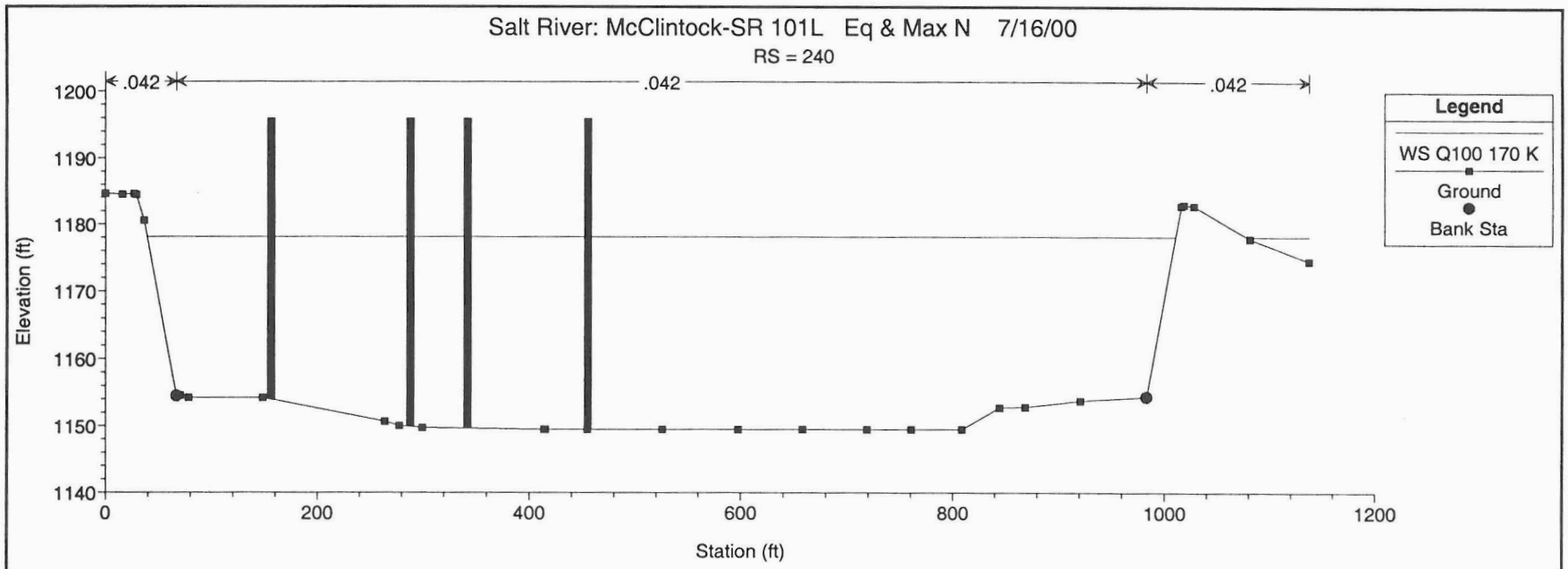
HEC-RAS Plan: Eq. & Max N River: RIVER-1 Reach: Reach-1

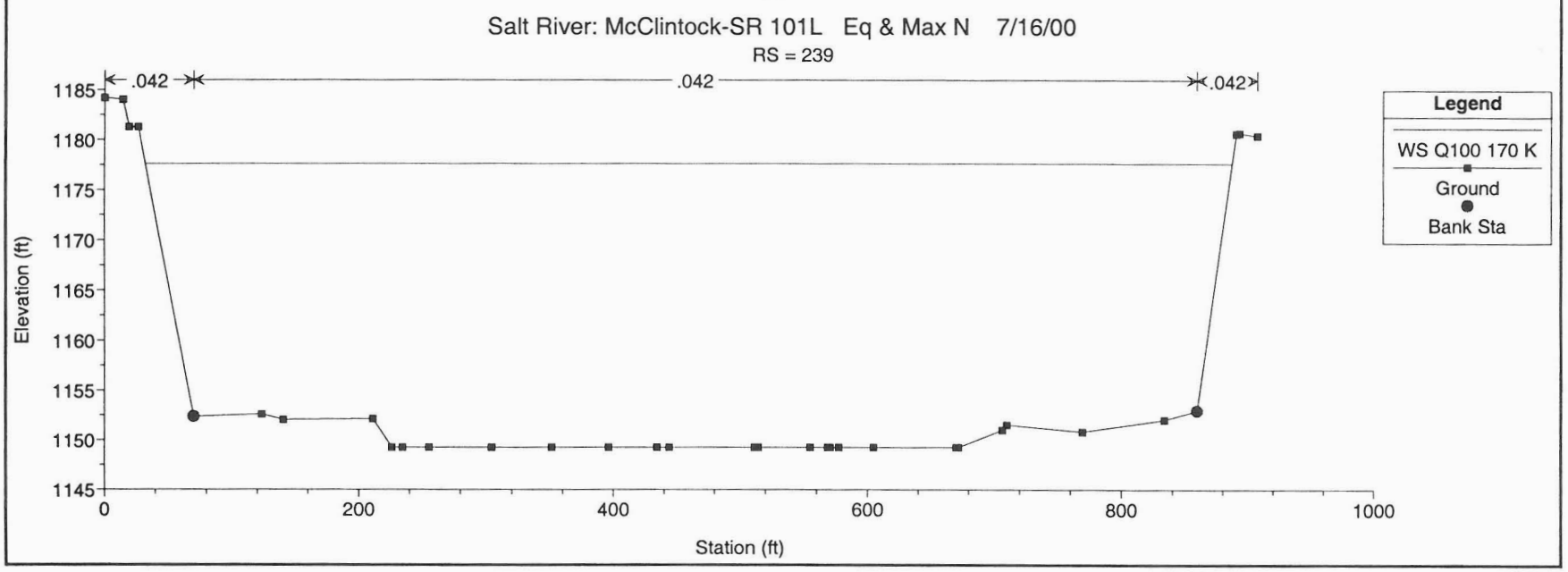
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	240	215000.00	1149.45	1178.00		1179.20	0.000490	8.82	24743.07	1000.64	0.30
Reach-1	239	215000.00	1149.26	1177.46		1178.94	0.000451	9.83	22263.41	855.35	0.33
Reach-1	238	215000.00	1149.09	1177.20		1178.71	0.000480	9.93	21963.45	861.14	0.34
Reach-1	237	215000.00	1148.89	1176.86		1178.40	0.000719	10.03	21680.90	809.70	0.34
Reach-1	236	215000.00	1148.75	1175.27		1177.92	0.001292	13.17	16576.89	681.00	0.46
Reach-1	235	215000.00	1148.60	1174.33		1177.32	0.001517	12.23	15724.72	671.23	0.43
Reach-1	234	215000.00	1148.45	1172.74		1176.53	0.002099	15.74	13867.90	624.55	0.58
Reach-1	233	215000.00	1148.30	1170.44		1175.38	0.003182	17.94	12132.09	623.06	0.70
Reach-1	232	215000.00	1148.15	1169.88		1174.05	0.002509	16.48	13252.46	671.76	0.64
Reach-1	231	215000.00	1148.01	1169.14		1172.96	0.002362	15.76	13799.61	715.54	0.62
Reach-1	230	215000.00	1147.85	1168.66		1171.89	0.001905	14.58	15054.16	776.07	0.56
Reach-1	229	215000.00	1147.71	1168.93		1170.99	0.001155	11.56	18788.46	955.40	0.45
Reach-1	228	215000.00	1147.57	1168.70	1160.00	1170.51	0.000964	10.83	20117.44	1030.86	0.42
Reach-1	123.8	215000.00	1147.44	1167.70	1161.49	1170.08	0.001245	12.56	17693.35	1062.57	0.52
Reach-1	123.75	Bridge									
Reach-1	123.7	215000.00	1147.41	1166.92	1161.51	1169.54	0.001447	13.15	16864.54	1050.99	0.55
Reach-1	120.5	215000.00	1147.26	1166.59	1160.10	1168.83	0.001181	12.12	18114.22	1066.26	0.50

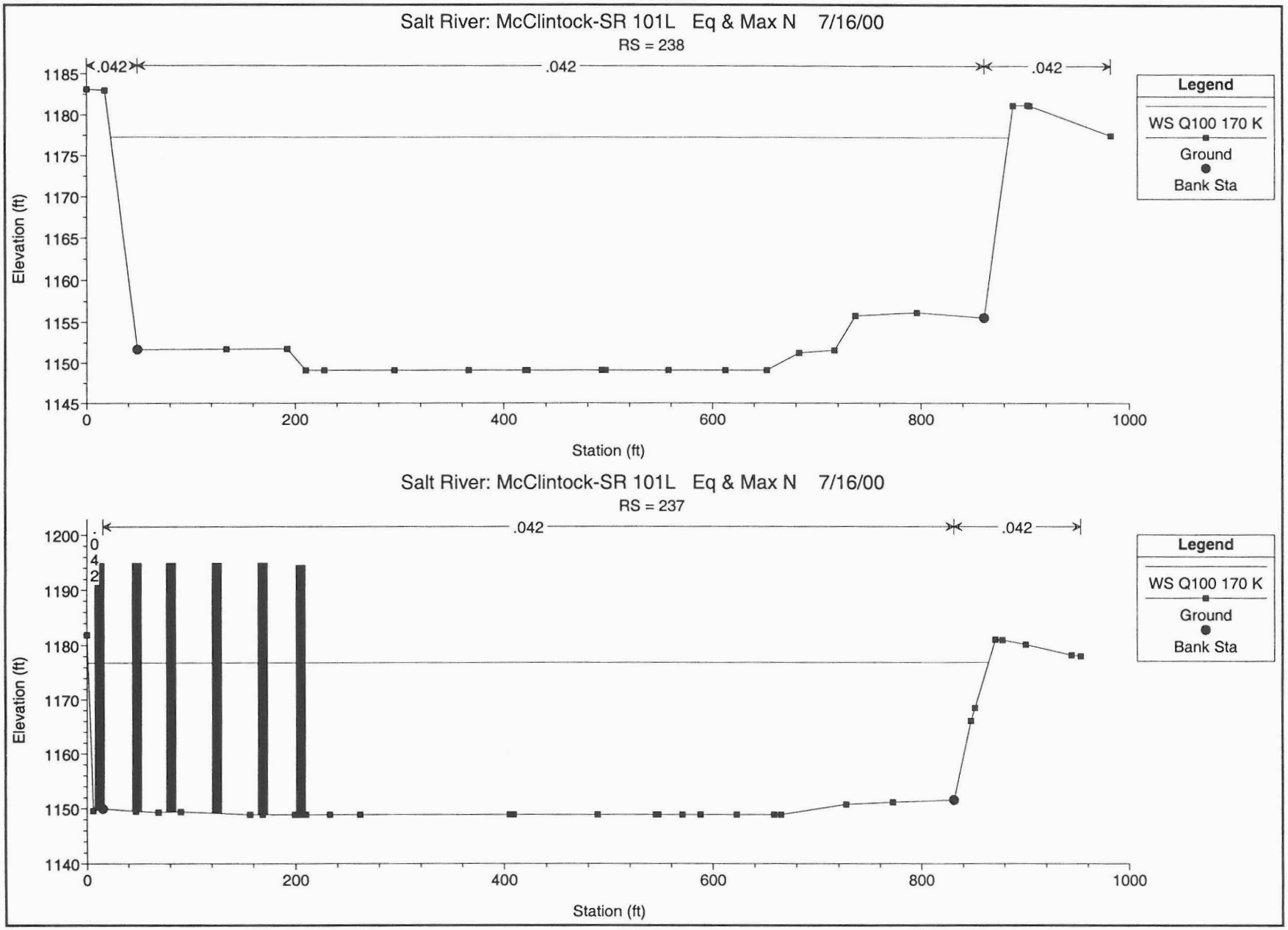
HEC-RAS Plan: Eq. & Max N River: RIVER-1 Reach: Reach-1

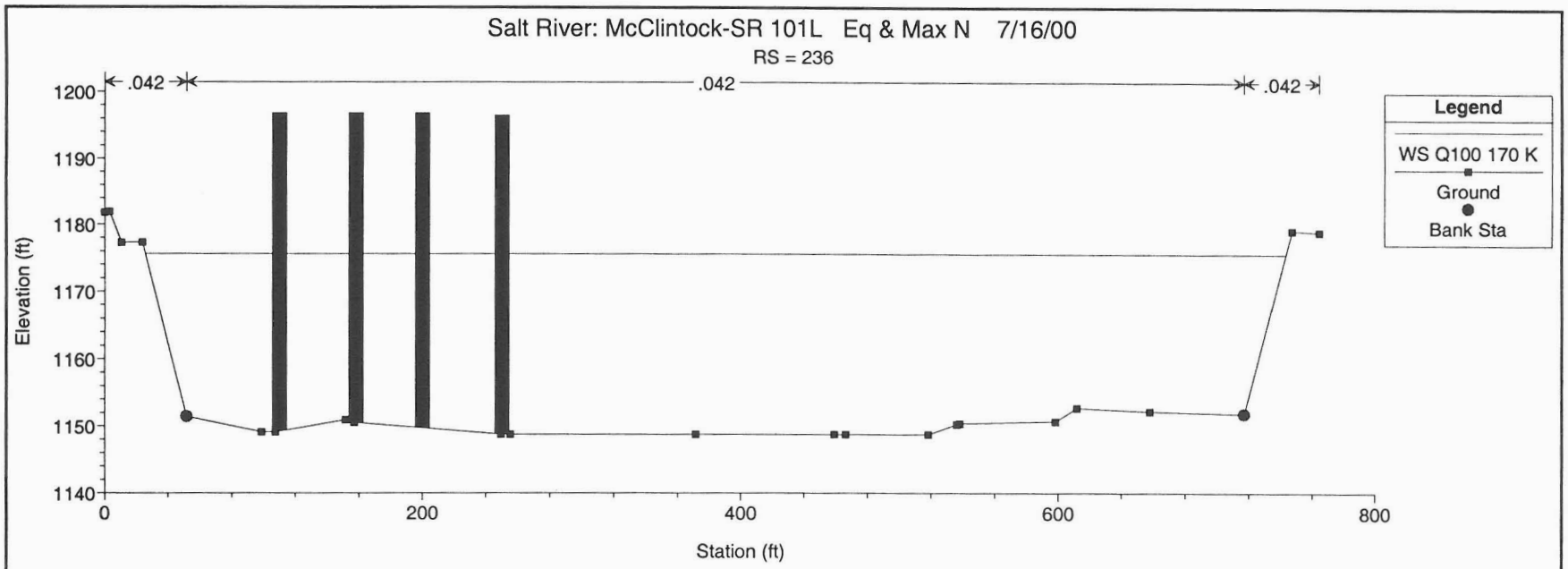
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	240	172000.00	1149.45	1178.09		1178.85	0.000651	7.03	24833.02	1001.82	0.24
Reach-1	239	172000.00	1149.26	1177.59		1178.53	0.000596	7.83	22376.41	855.70	0.26
Reach-1	238	172000.00	1149.09	1177.27		1178.23	0.000638	7.92	22023.58	861.28	0.27
Reach-1	237	172000.00	1148.89	1176.83		1177.82	0.000968	8.03	21658.37	809.65	0.27
Reach-1	236	172000.00	1148.75	1175.61		1177.26	0.001664	10.39	16811.11	681.75	0.36
Reach-1	235	172000.00	1148.60	1174.65		1176.52	0.001954	9.63	15940.83	671.96	0.33
Reach-1	234	172000.00	1148.45	1173.24		1175.56	0.002638	12.31	14182.02	625.82	0.45
Reach-1	233	172000.00	1148.30	1171.36		1174.25	0.003720	13.71	12707.92	625.20	0.53
Reach-1	232	172000.00	1148.15	1170.23		1172.80	0.003198	12.96	13487.98	673.20	0.50
Reach-1	231	172000.00	1148.01	1168.99		1171.47	0.003244	12.70	13696.04	715.19	0.50
Reach-1	230	172000.00	1147.85	1167.87		1170.11	0.002896	12.15	14439.68	772.30	0.48
Reach-1	229	172000.00	1147.71	1167.48		1169.01	0.001963	9.98	17405.05	950.72	0.40
Reach-1	228	172000.00	1147.57	1166.85	1158.41	1168.26	0.001759	9.56	18217.41	1023.66	0.39
Reach-1	123.8	172000.00	1147.44	1165.46	1159.85	1167.48	0.002616	11.52	15350.11	1038.87	0.51
Reach-1	123.75	Bridge									
Reach-1	123.7	172000.00	1147.41	1164.36	1159.84	1166.71	0.003353	12.43	14194.86	1027.61	0.57
Reach-1	120.5	172000.00	1147.26	1163.07	1158.53	1165.32	0.003314	12.13	14406.35	1040.47	0.56

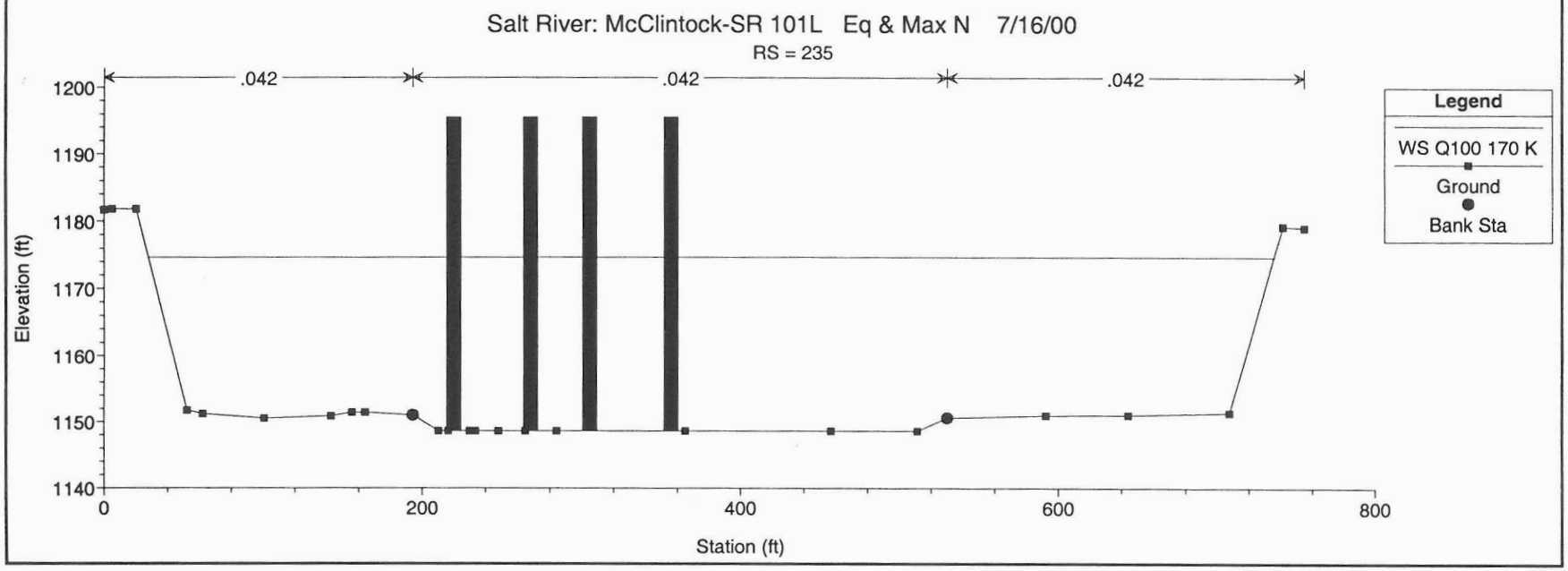

Salt River: McClintock-SR 101L Eq & Max N 7/16/00
Reach-1
Legend
WS Q100 170 K
Ground
LOB
ROB
Elevation (ft)
1180
1175
1170
1165
1160
1155
1150
1145
0
1000
2000
3000
4000
5000
6000
Main Channel Distance (ft)
123.7
228
229
230
231
232
233
234
235
236
237
238
239
240

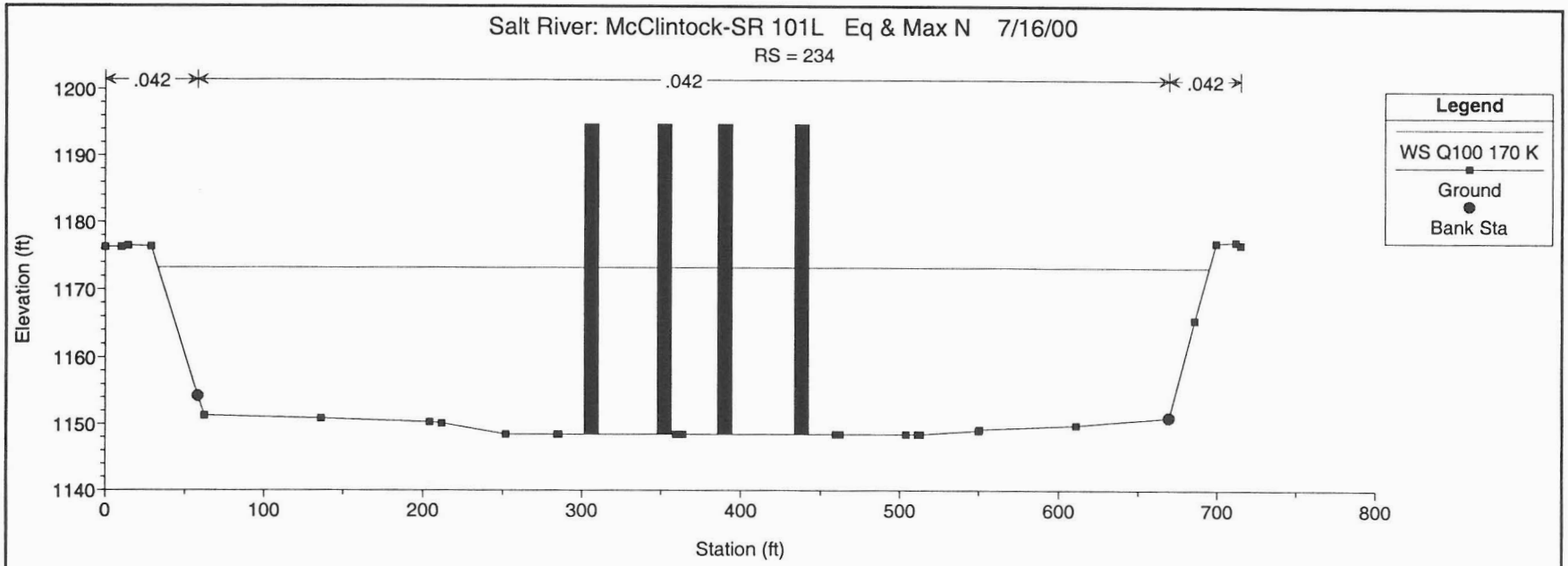

Salt River: McClintock-SR 101L Eq & Max N 7/16/00
RS = 240
.042
.042
.042
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)

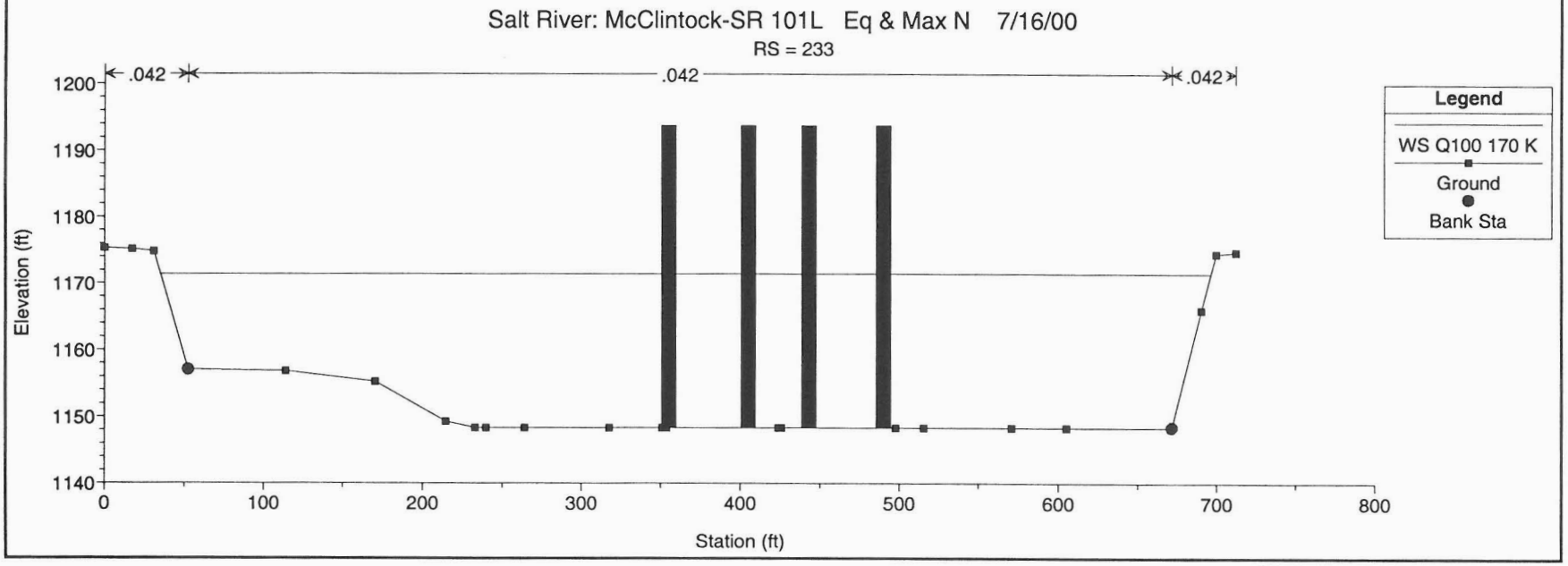

Salt River: McClintock-SR 101L Eq & Max N 7/16/00
RS = 239
.042
.042
.042
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1185
1180
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
Station (ft)

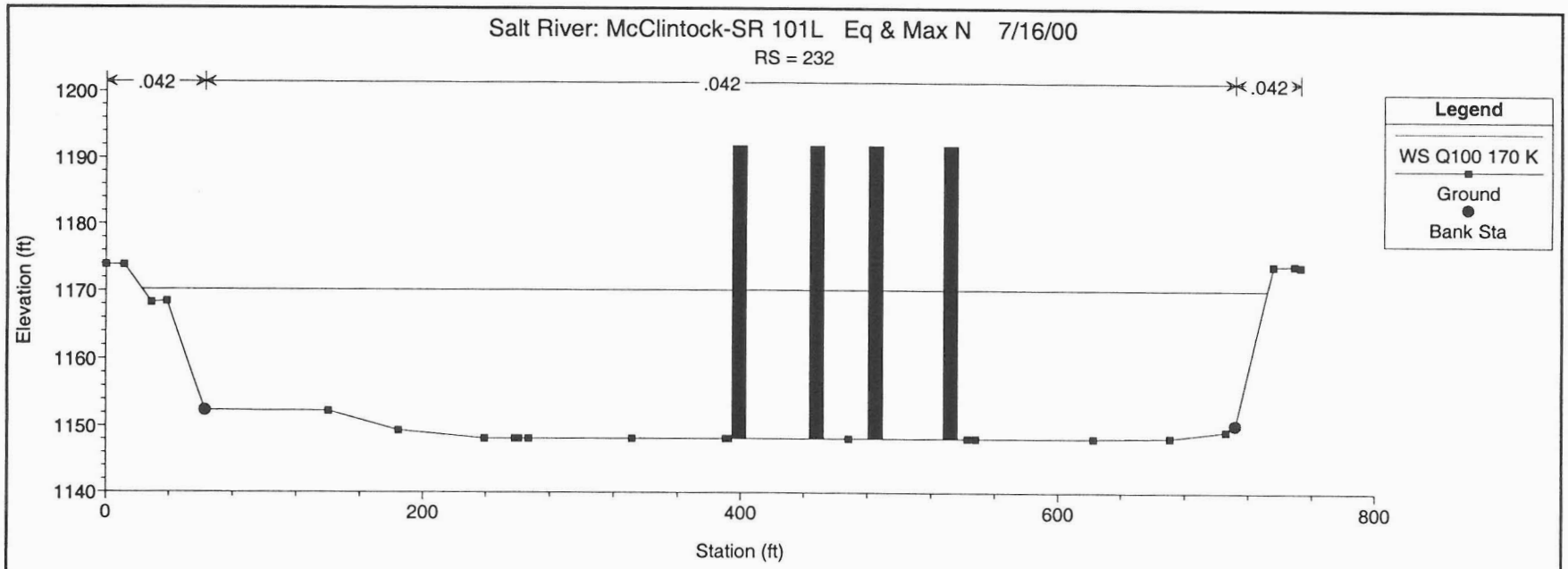

Salt River: McClintock-SR 101L Eq & Max N 7/16/00
RS = 238
.042
.042
.042
Elevation (ft)
Station (ft)
Legend
WS Q100 170 K
Ground
Bank Sta
Salt River: McClintock-SR 101L Eq & Max N 7/16/00
RS = 237
.042
.042
.042
Elevation (ft)
Station (ft)
Legend
WS Q100 170 K
Ground
Bank Sta

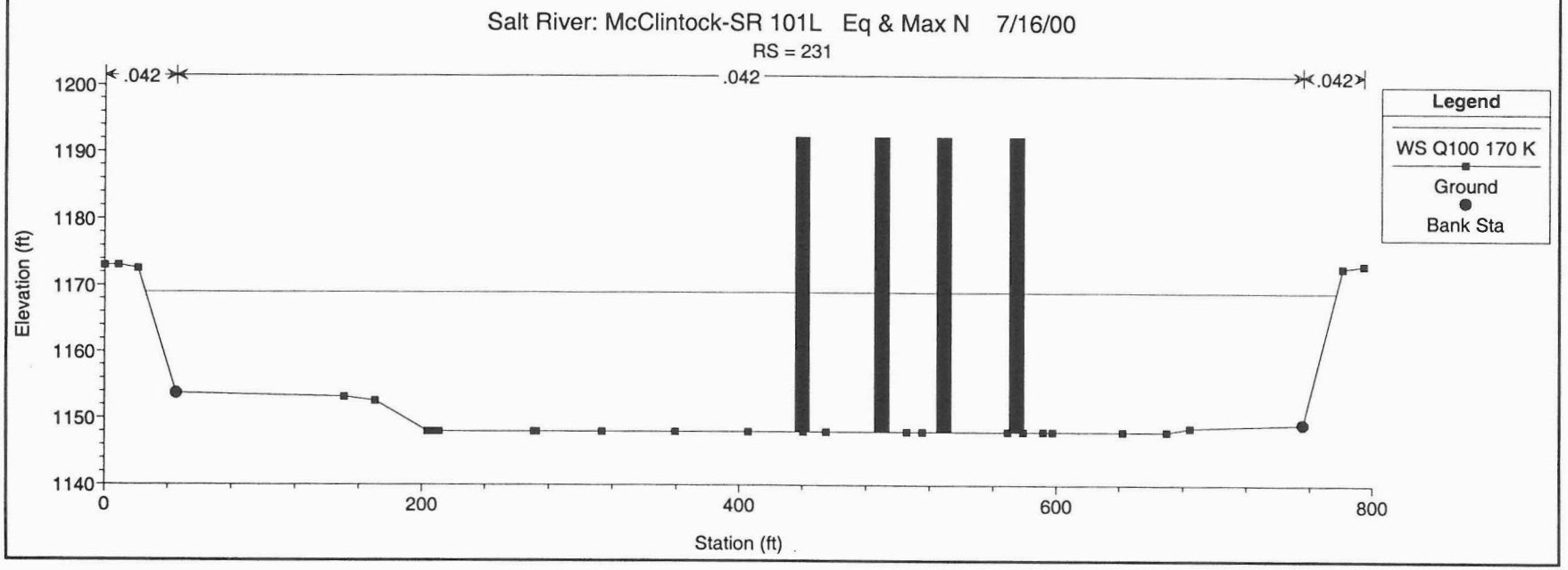

Salt River: McClintock-SR 101L Eq & Max N 7/16/00
RS = 236
.042
.042
.042
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)
Legend
WS Q100 170 K
Ground
Bank Sta

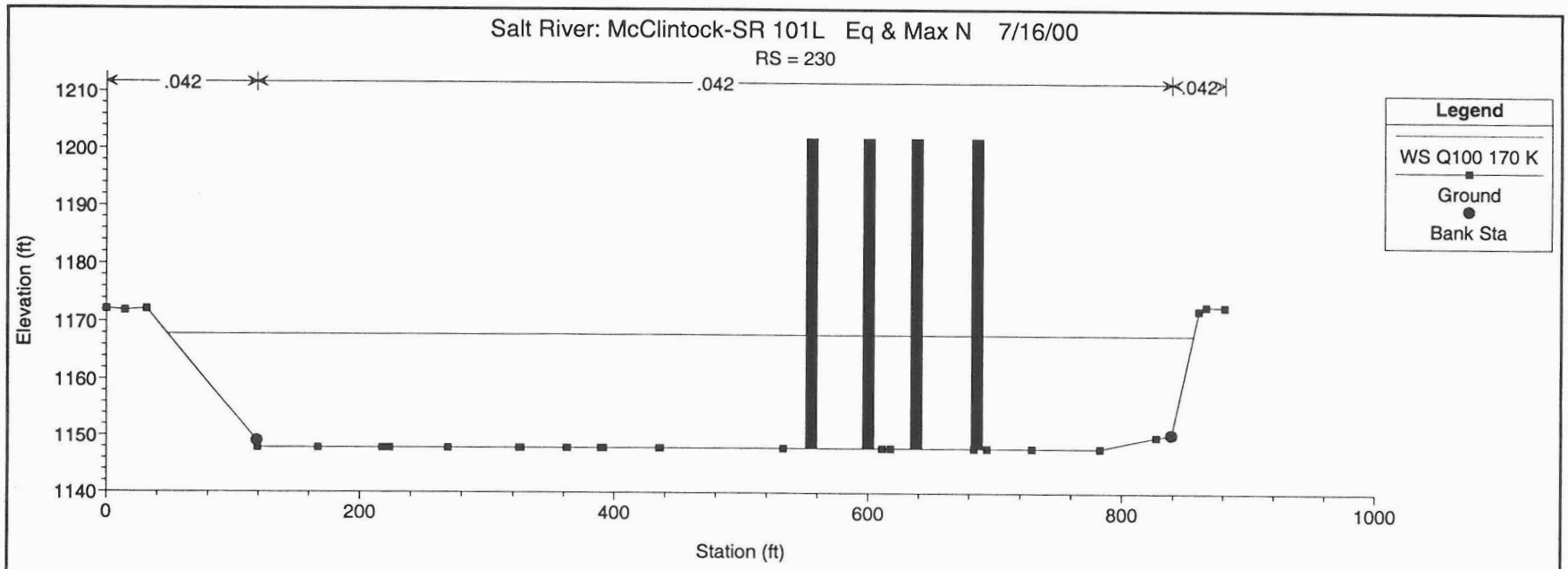

Salt River: McClintock-SR 101L Eq & Max N 7/16/00
RS = 235
.042
.042
.042
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)
Legend
WS Q100 170 K
Ground
Bank Sta

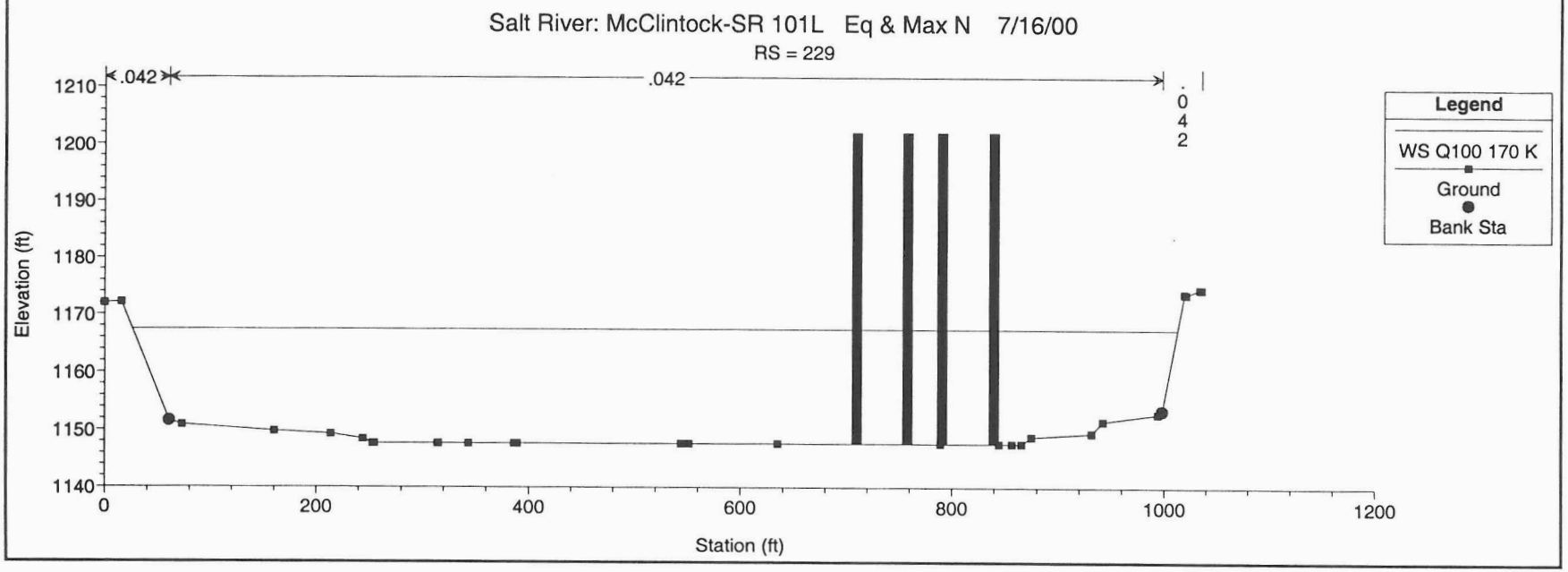

Salt River: McClintock-SR 101L Eq & Max N 7/16/00
RS = 234
.042
.042
.042
Elevation (ft)
Station (ft)
Legend
WS Q100 170 K
Ground
Bank Sta

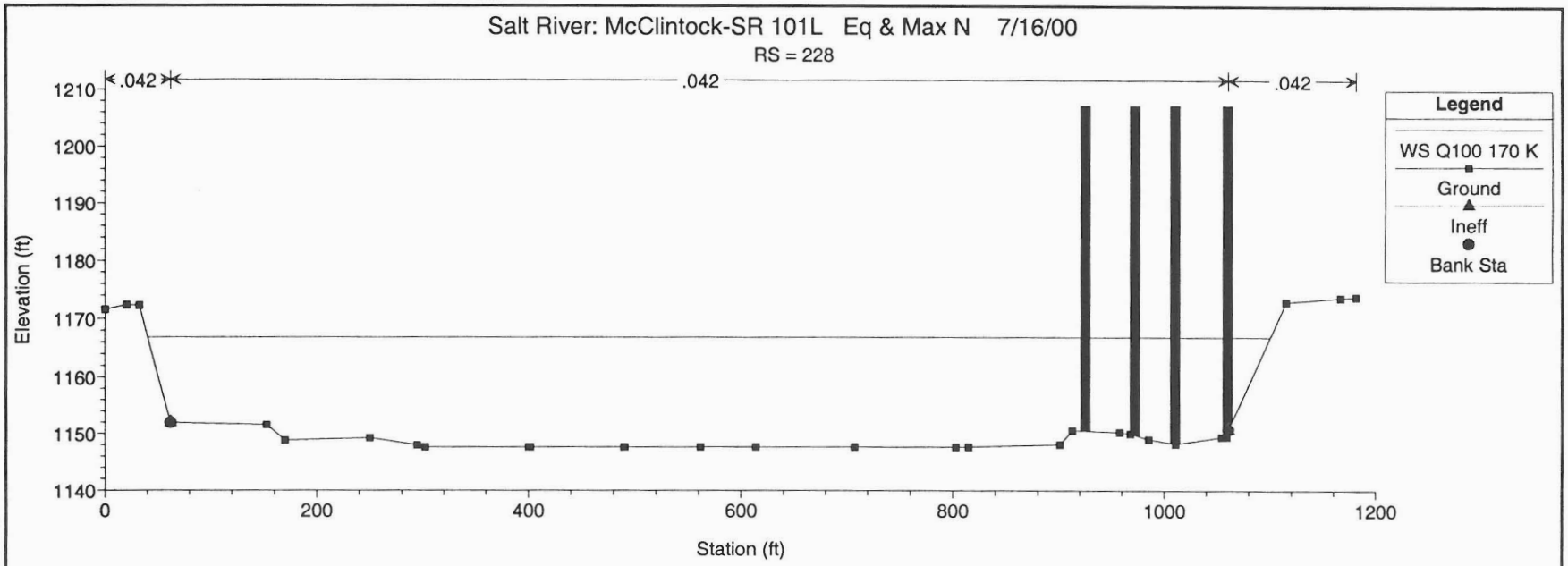

Salt River: McClintock-SR 101L Eq & Max N 7/16/00
RS = 233
.042
.042
.042
Elevation (ft)
Station (ft)
Legend
WS Q100 170 K
Ground
Bank Sta

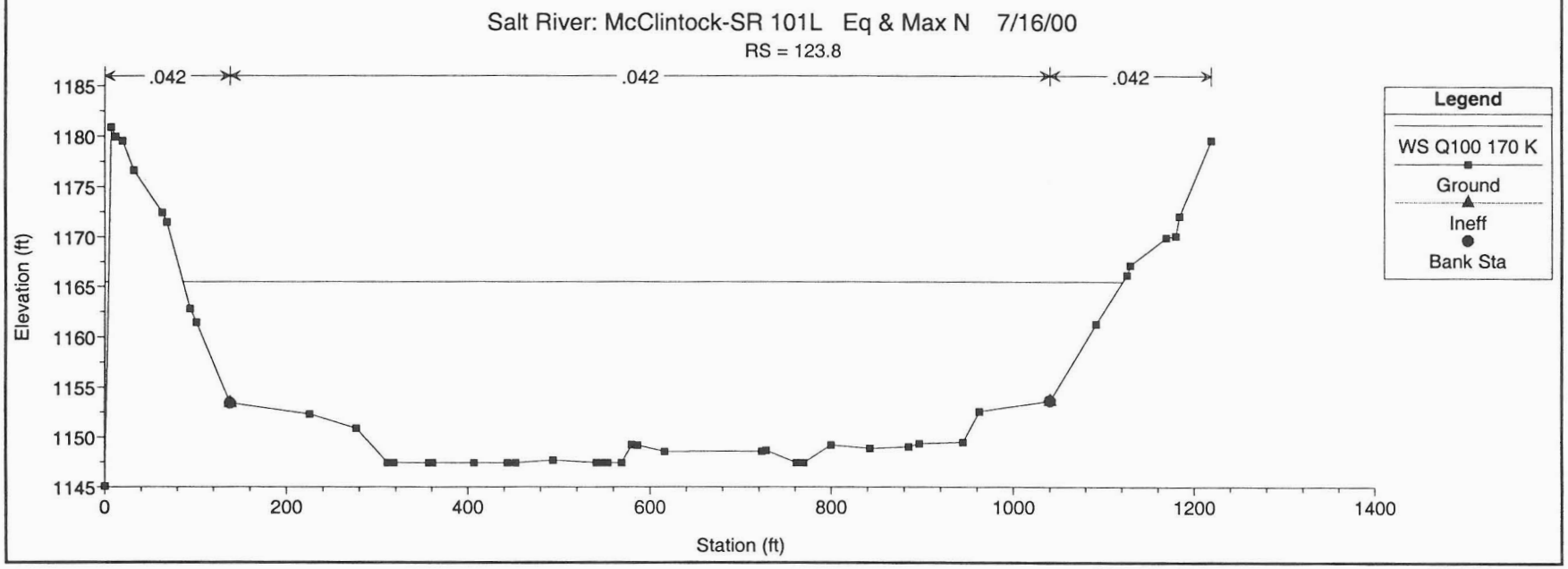

Salt River: McClintock-SR 101L Eq & Max N 7/16/00
RS = 232
.042
.042
.042
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)

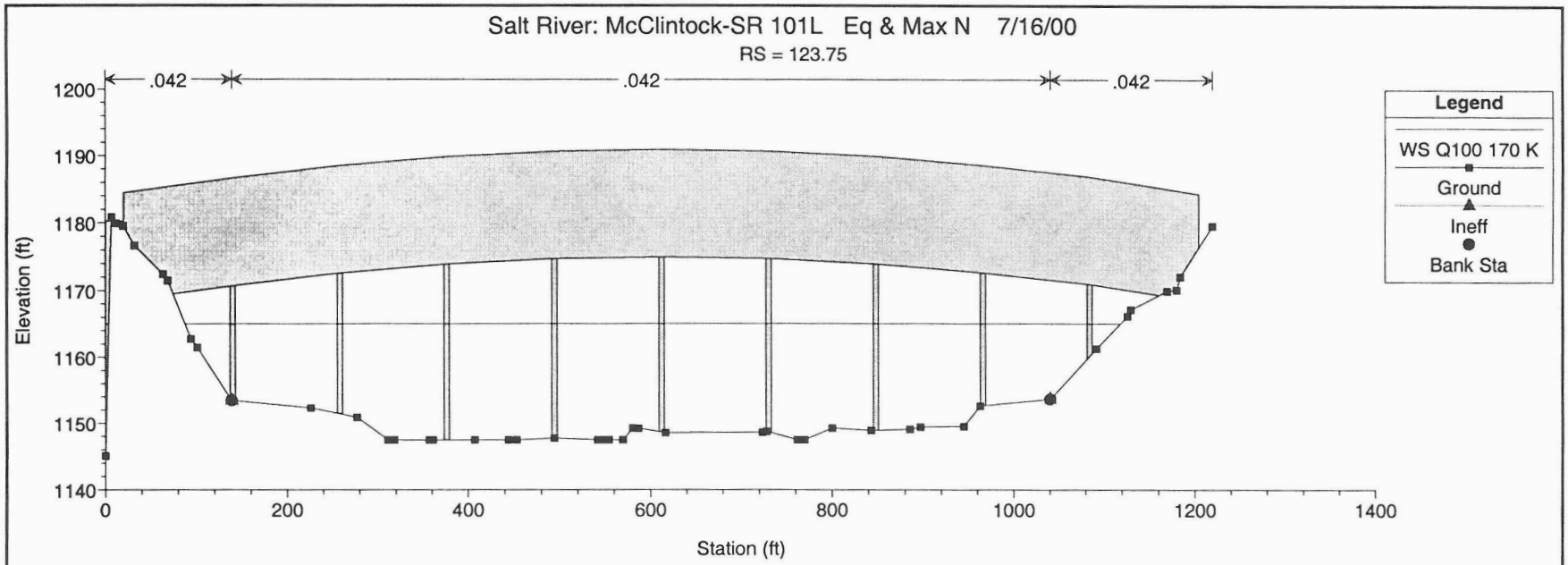

Salt River: McClintock-SR 101L Eq & Max N 7/16/00
RS = 231
.042
.042
.042
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)

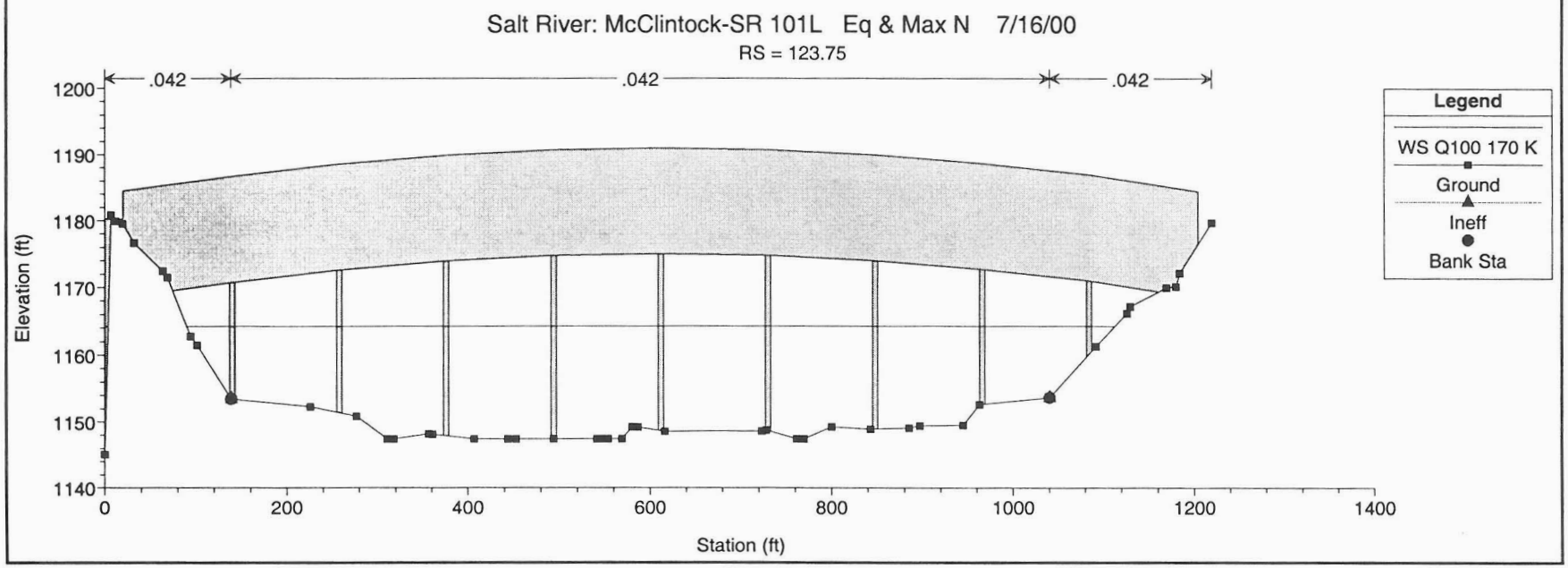

Salt River: McClintock-SR 101L Eq & Max N 7/16/00
RS = 230
.042
.042
.042
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)

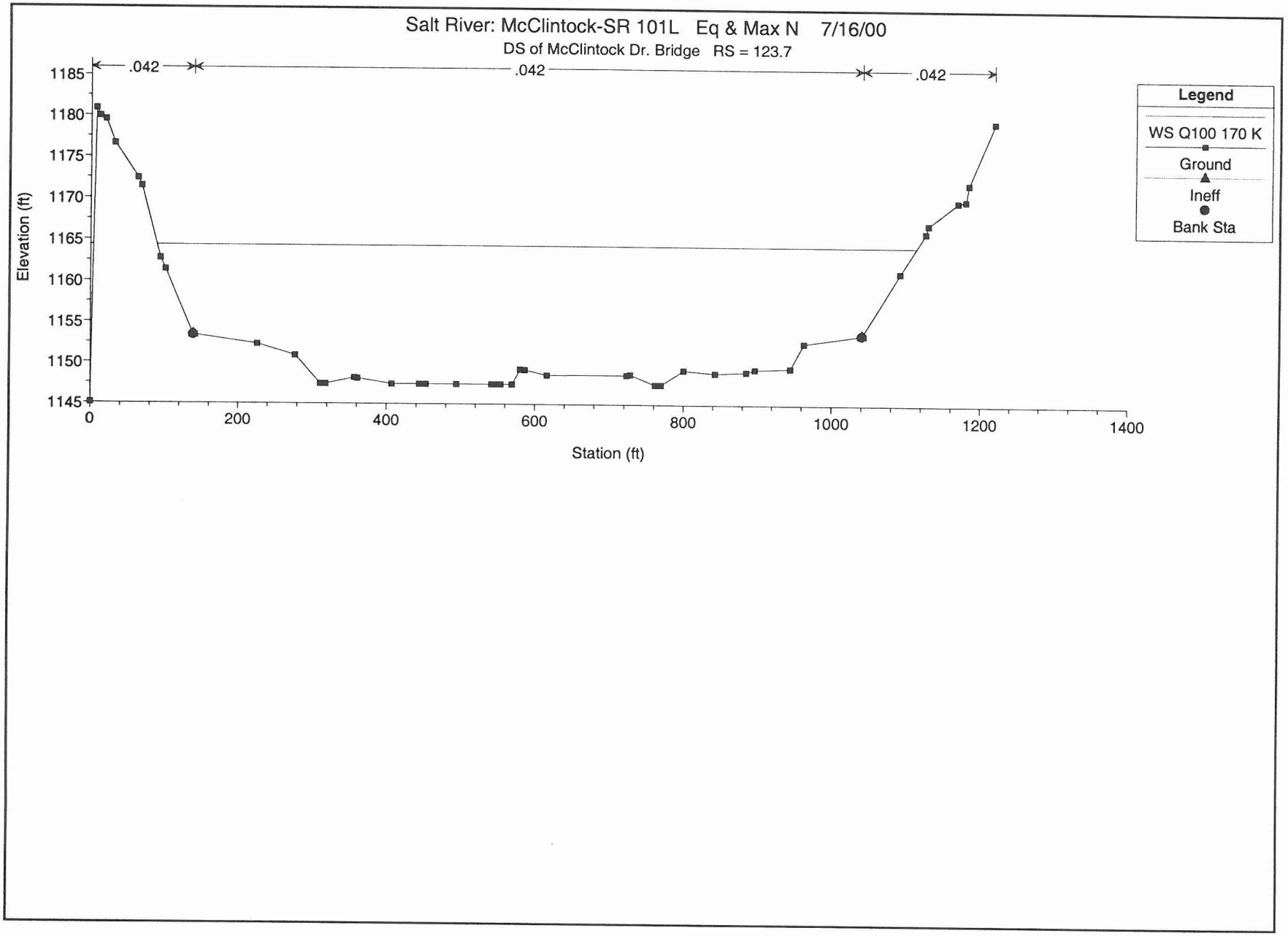

Salt River: McClintock-SR 101L Eq & Max N 7/16/00
RS = 229
.042
.042
.042
Legend
WS Q100 170 K
Ground
Bank Sta
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)


Salt River: McClintock-SR 101L Eq & Max N 7/16/00
RS = 228
.042
.042
.042
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Eq & Max N 7/16/00
RS = 123.8
.042
.042
.042
Elevation (ft)
1185
1180
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Eq & Max N 7/16/00
RS = 123.75
.042
.042
.042
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 170 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Eq & Max N 7/16/00
RS = 123.75
.042
.042
.042
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 170 K
Ground
Ineff
Bank Sta

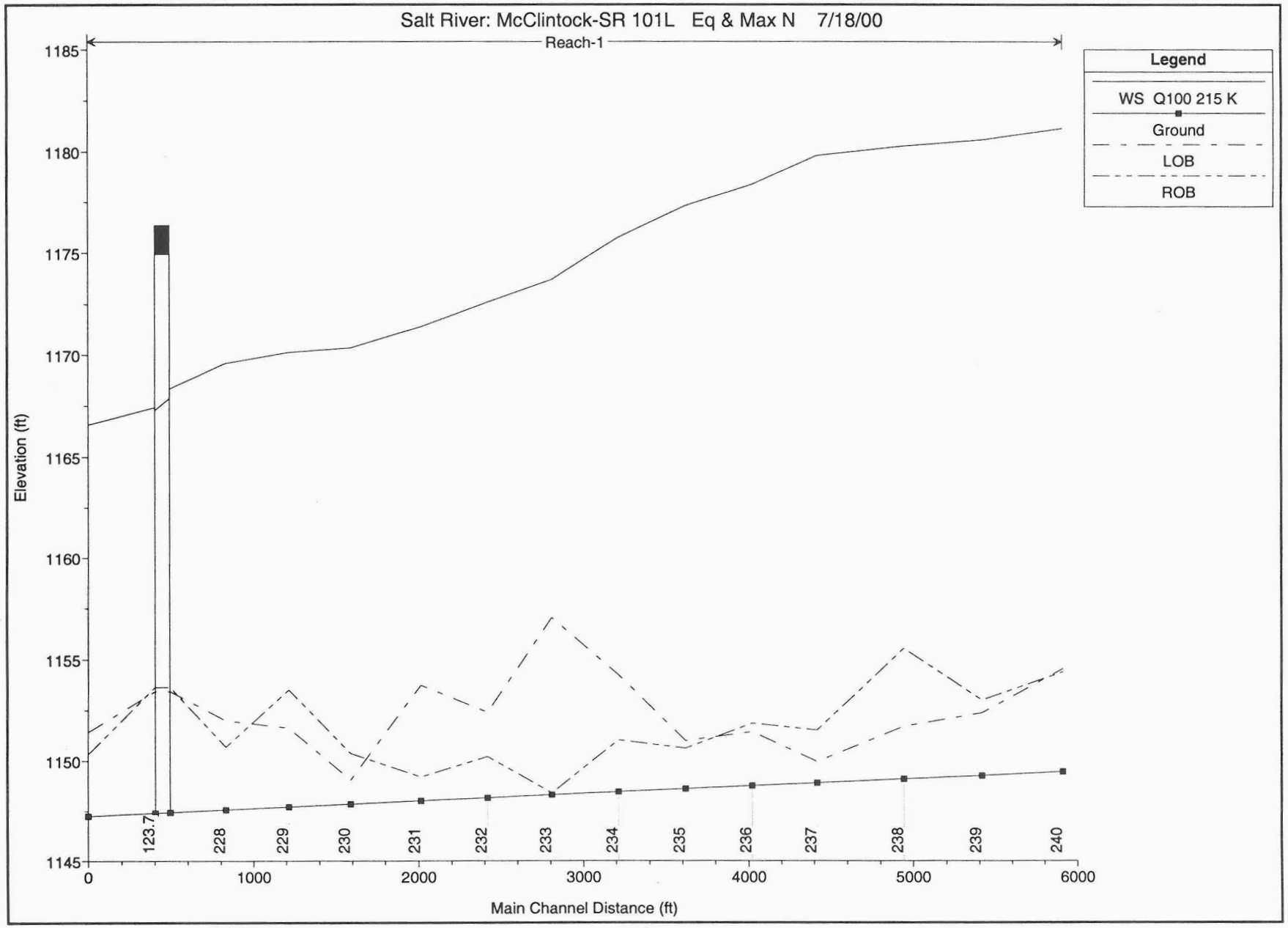

Salt River: McClintock-SR 101L Eq & Max N 7/16/00
DS of McClintock Dr. Bridge RS = 123.7
.042
.042
.042
Elevation (ft)
1185
1180
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 170 K
Ground
Ineff
Bank Sta

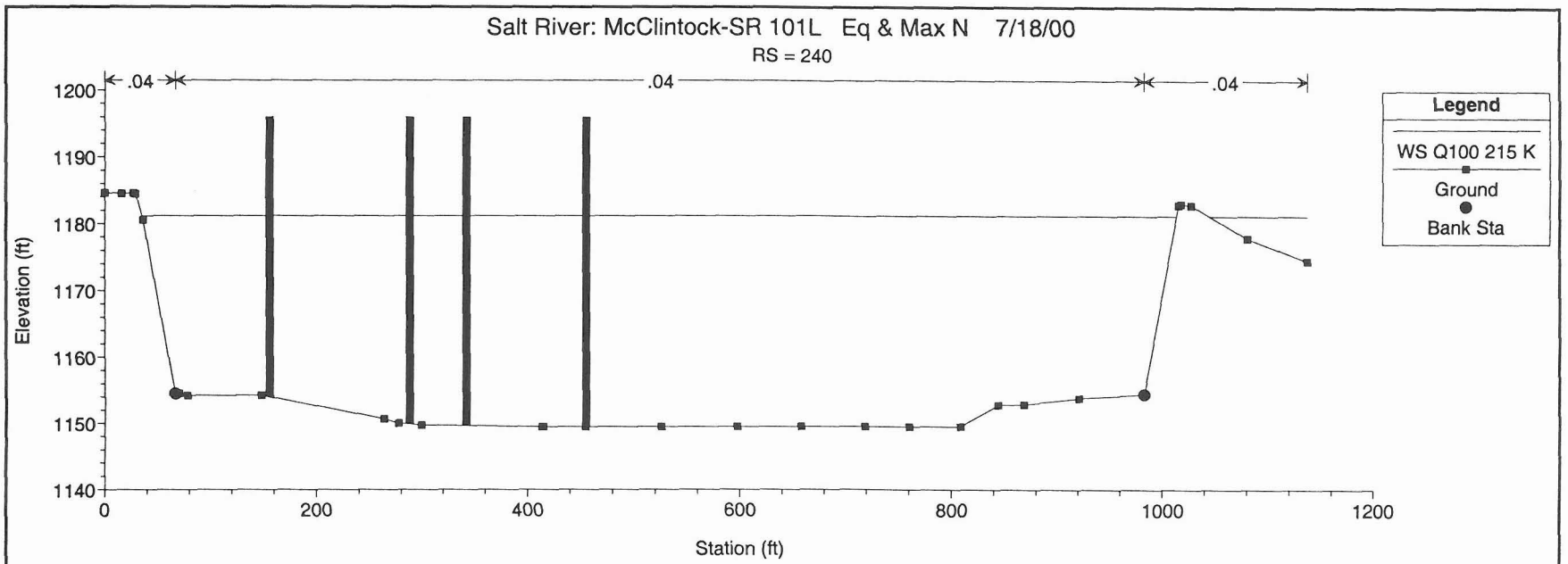
Q_{100} = 215,000 cfs, Eq. Slope Condition & Overtopping n Value (n = 0.040)

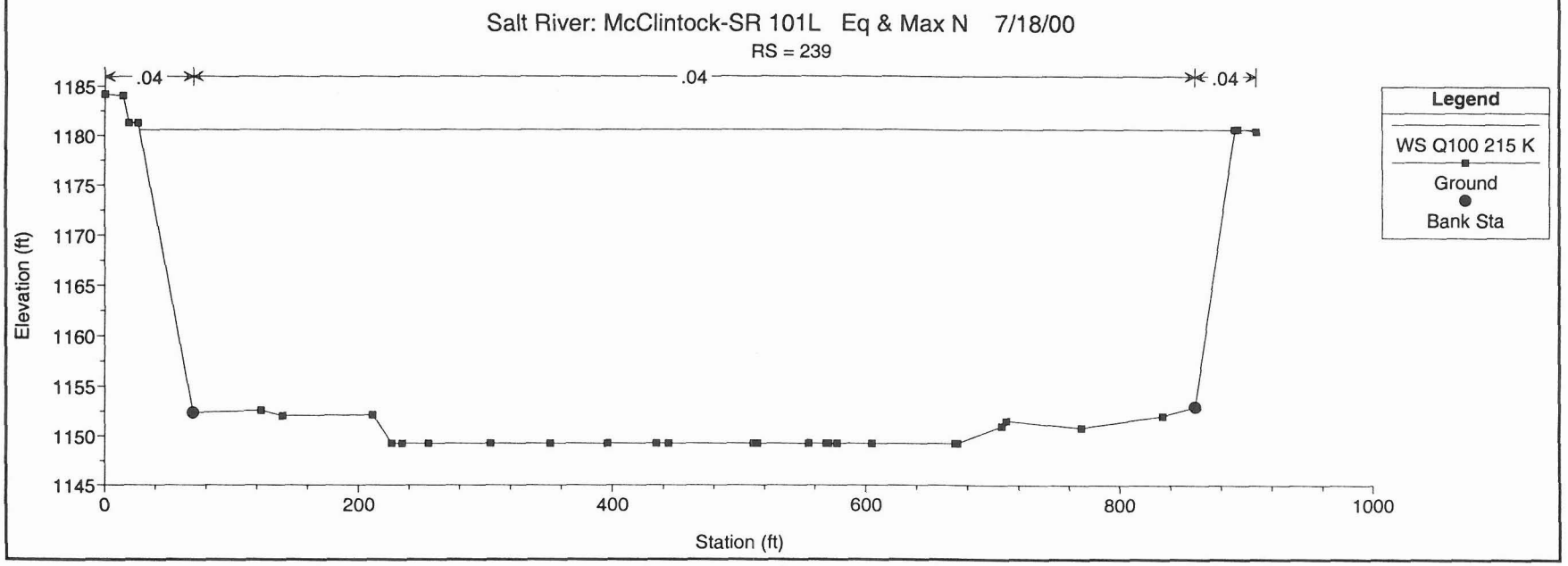
Plan Title: Eq.MaxN

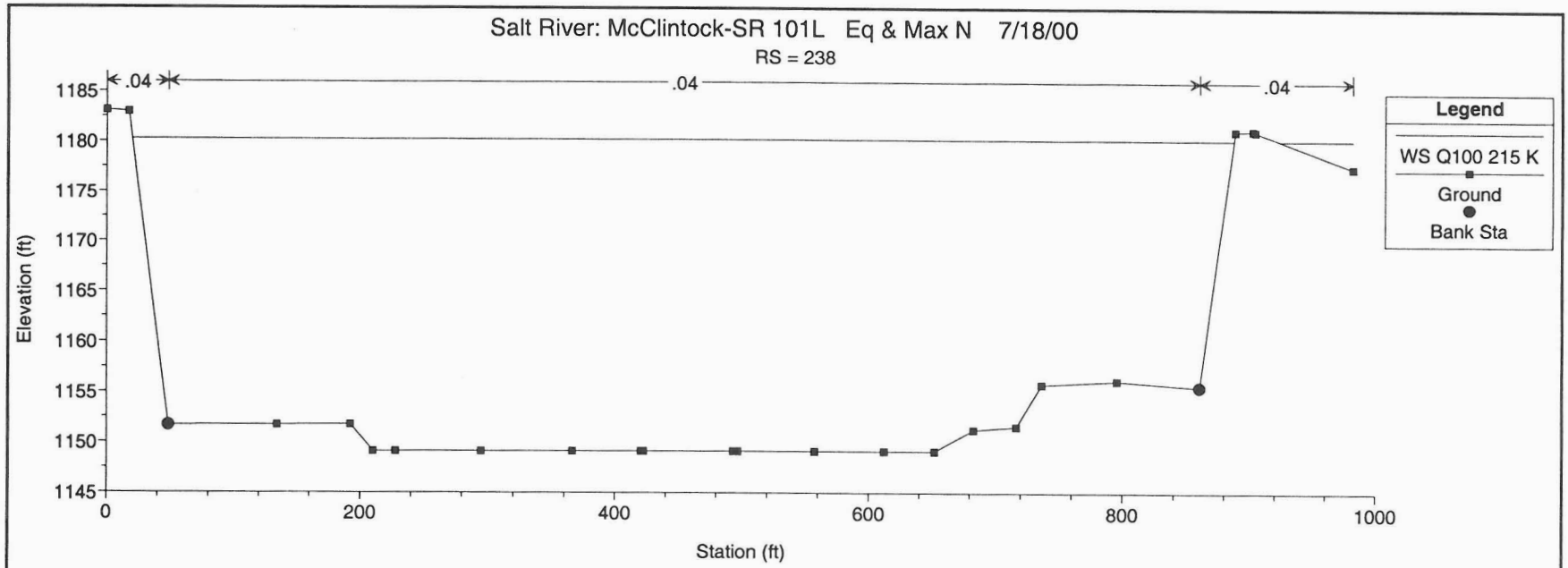
HEC-RAS Plan: Eq. & Max N River: RIVER-1 Reach: Reach-1

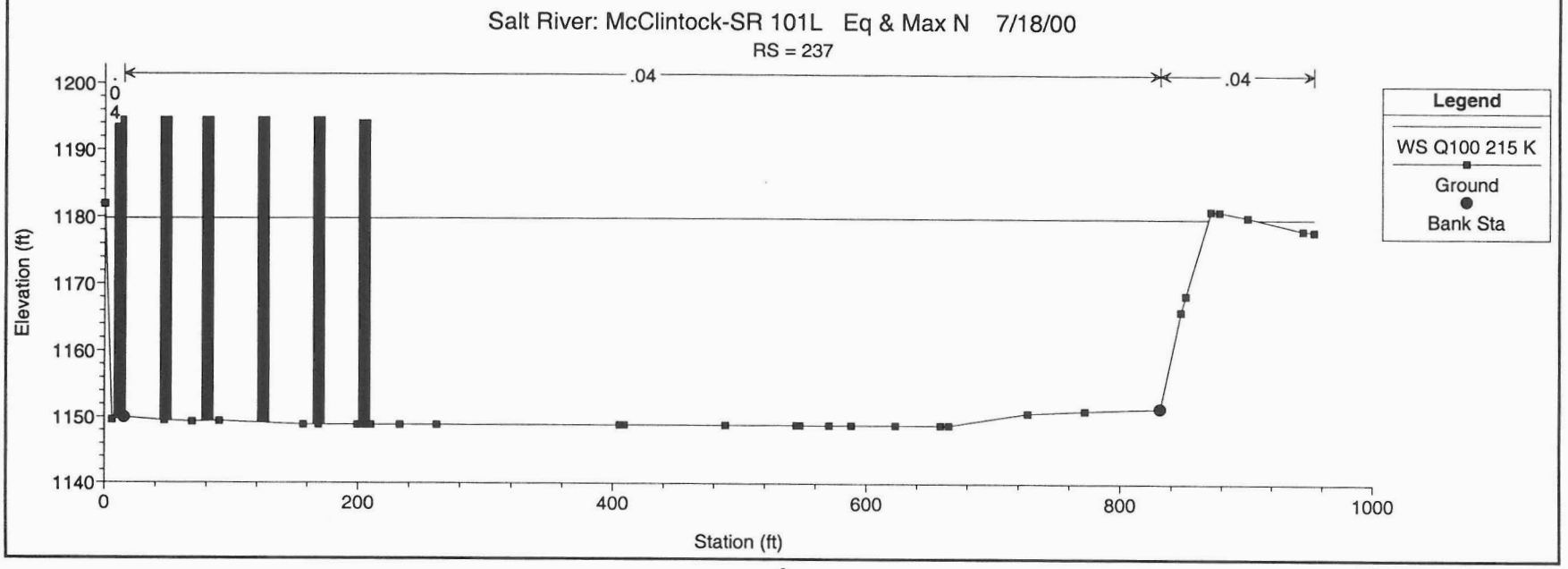
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	240	215000.00	1149.45	1181.15		1182.10	0.000659	7.86	27958.77	1042.39	0.25
Reach-1	239	215000.00	1149.26	1180.58		1181.76	0.000594	8.79	24950.02	873.16	0.28
Reach-1	238	215000.00	1149.09	1180.26		1181.47	0.000629	8.87	24694.29	926.11	0.29
Reach-1	237	215000.00	1148.89	1179.80		1181.05	0.001009	9.04	24116.82	860.76	0.29
Reach-1	236	215000.00	1148.75	1178.36		1180.45	0.001734	11.71	18708.68	701.56	0.39
Reach-1	235	215000.00	1148.60	1177.30		1179.68	0.002013	10.66	17730.28	678.00	0.35
Reach-1	234	215000.00	1148.45	1175.74		1178.68	0.002752	13.88	15751.10	632.09	0.48
Reach-1	233	215000.00	1148.30	1173.67		1177.30	0.003829	15.41	14155.49	630.53	0.56
Reach-1	232	215000.00	1148.15	1172.57		1175.80	0.003271	14.53	15074.66	682.82	0.53
Reach-1	231	215000.00	1148.01	1171.37		1174.44	0.003230	14.14	15399.09	720.79	0.53
Reach-1	230	215000.00	1147.85	1170.32		1173.06	0.002837	13.44	16350.54	783.97	0.50
Reach-1	229	215000.00	1147.71	1170.11		1171.94	0.001838	10.92	19917.66	959.21	0.41
Reach-1	228	215000.00	1147.57	1169.57	1160.00	1171.23	0.001602	10.38	21017.39	1034.24	0.40
Reach-1	123.8	215000.00	1147.44	1168.34	1161.49	1170.56	0.002104	12.11	18382.09	1073.80	0.49
Reach-1	123.75	Bridge									
Reach-1	123.7	215000.00	1147.41	1167.43	1161.51	1169.89	0.002498	12.76	17394.79	1057.87	0.53
Reach-1	120.5	215000.00	1147.26	1166.59	1160.10	1168.83	0.002247	12.12	18114.22	1066.26	0.50

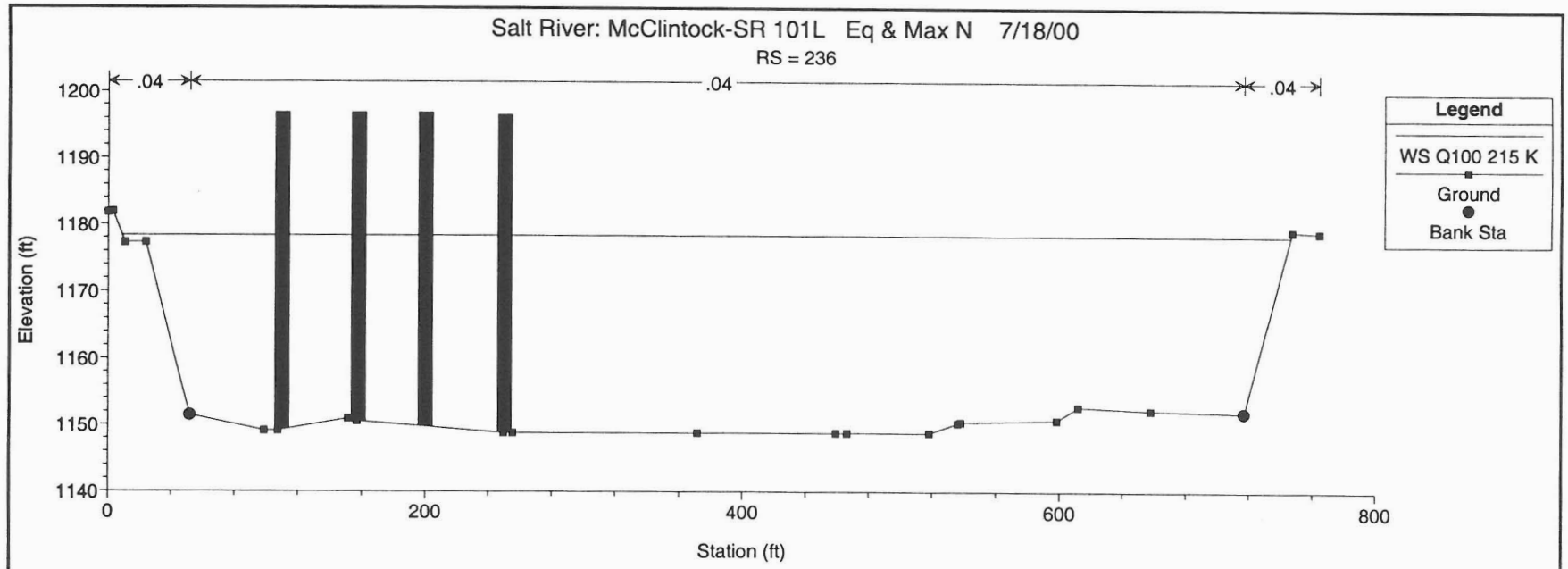

Salt River: McClintock-SR 101L Eq & Max N 7/18/00
Reach-1
Legend
WS Q100 215 K
Ground
LOB
ROB
Elevation (ft)
1185
1180
1175
1170
1165
1160
1155
1150
1145
0
1000
2000
3000
4000
5000
6000
Main Channel Distance (ft)
123.7
228
229
230
231
232
233
234
235
236
237
238
239
240

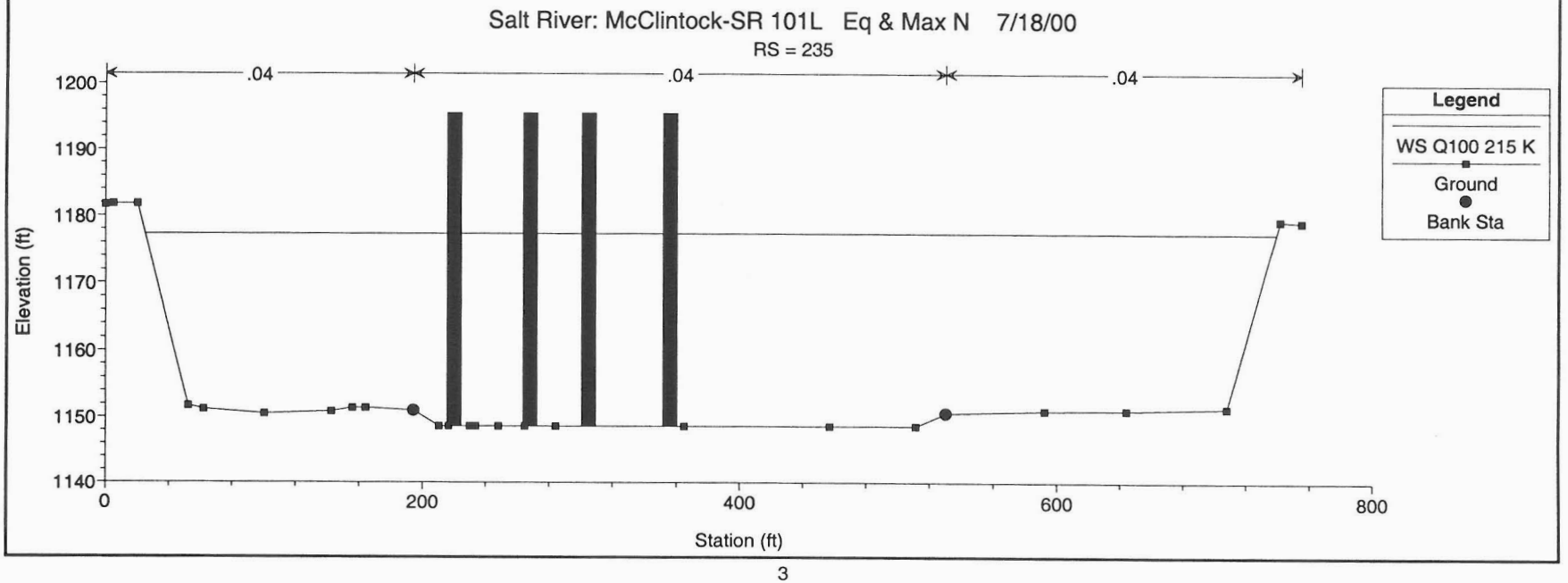

Salt River: McClintock-SR 101L Eq & Max N 7/18/00
RS = 240
.04
.04
.04
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)

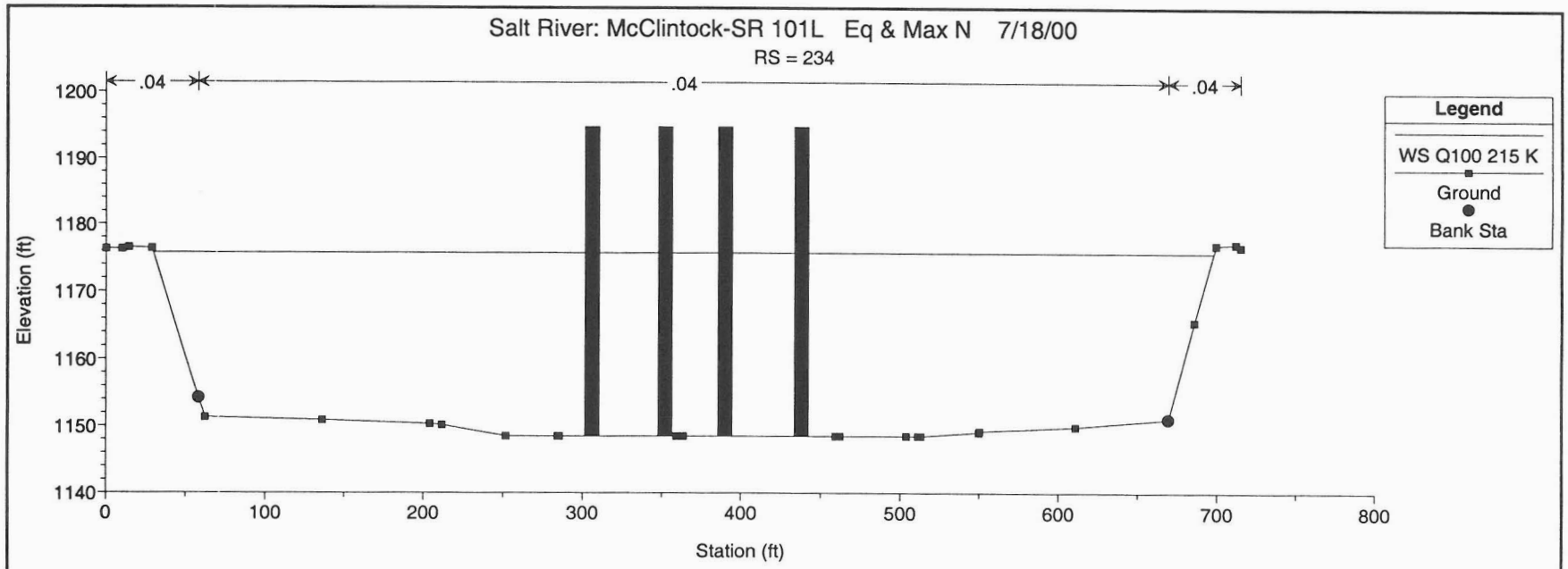

Salt River: McClintock-SR 101L Eq & Max N 7/18/00
RS = 239
.04
.04
.04
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1185
1180
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
Station (ft)

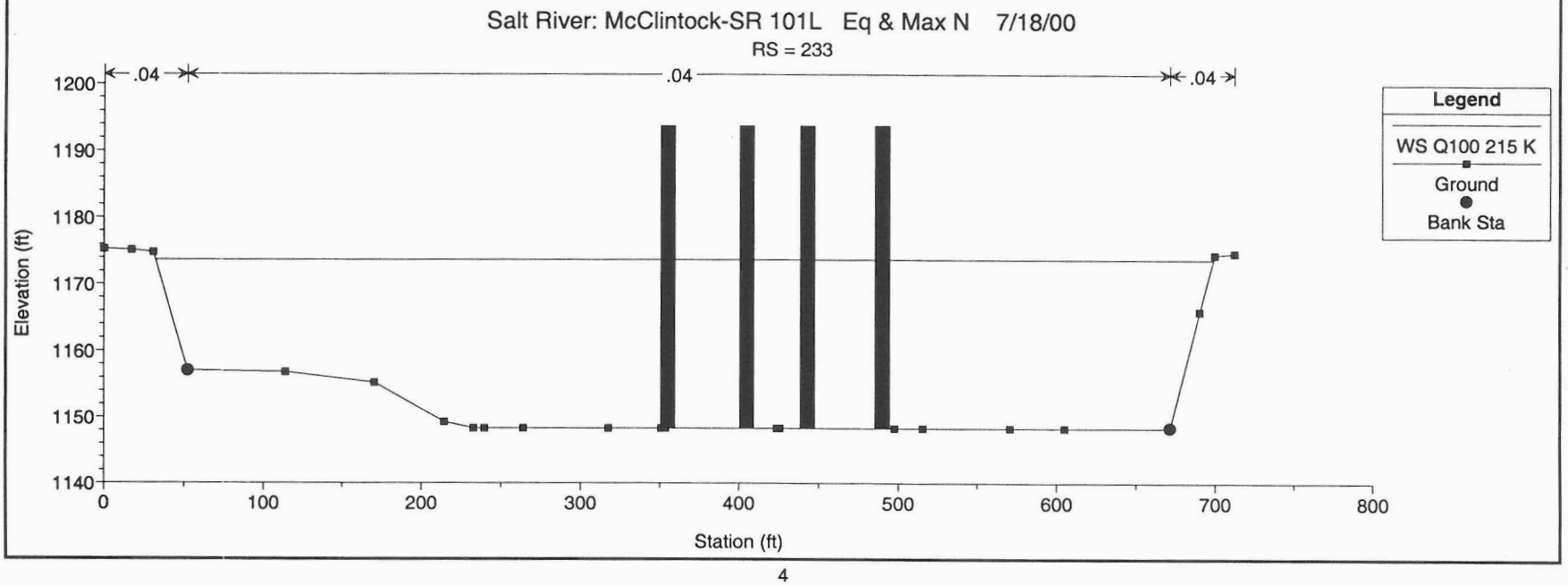

Salt River: McClintock-SR 101L Eq & Max N 7/18/00
RS = 238
.04
.04
.04
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1185
1180
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
Station (ft)

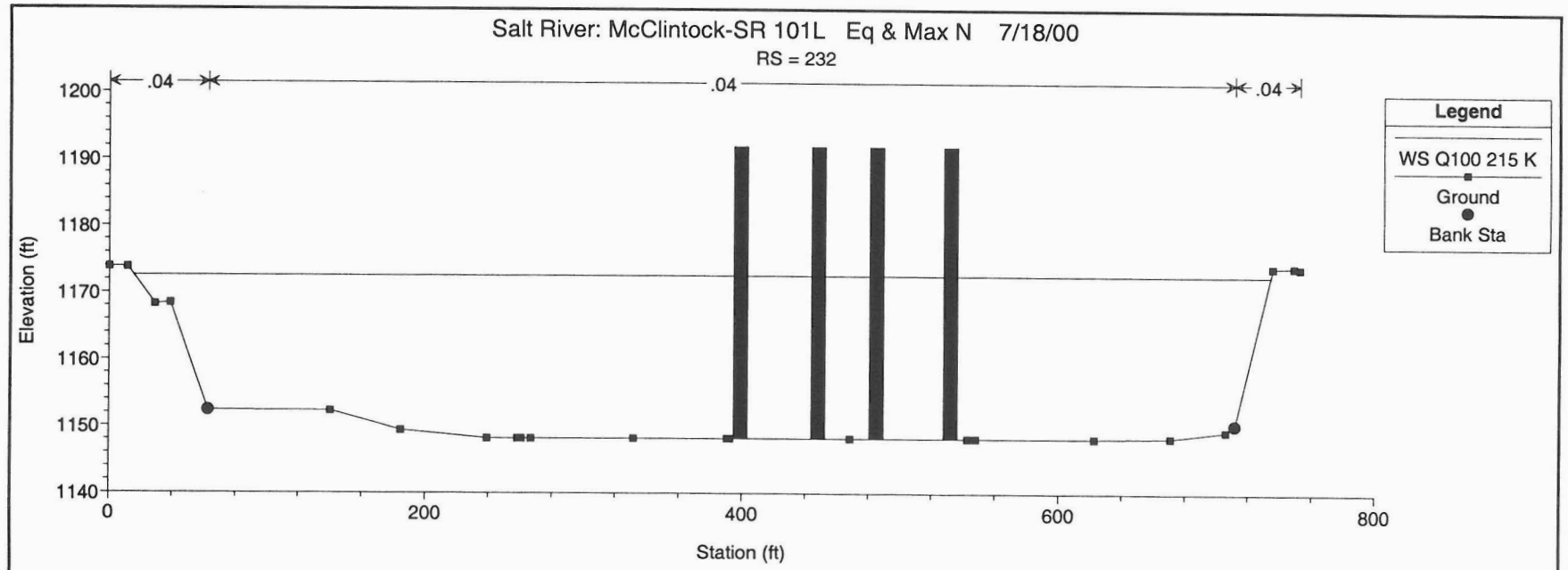

Salt River: McClintock-SR 101L Eq & Max N 7/18/00
RS = 237
.04
.04
.04
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)

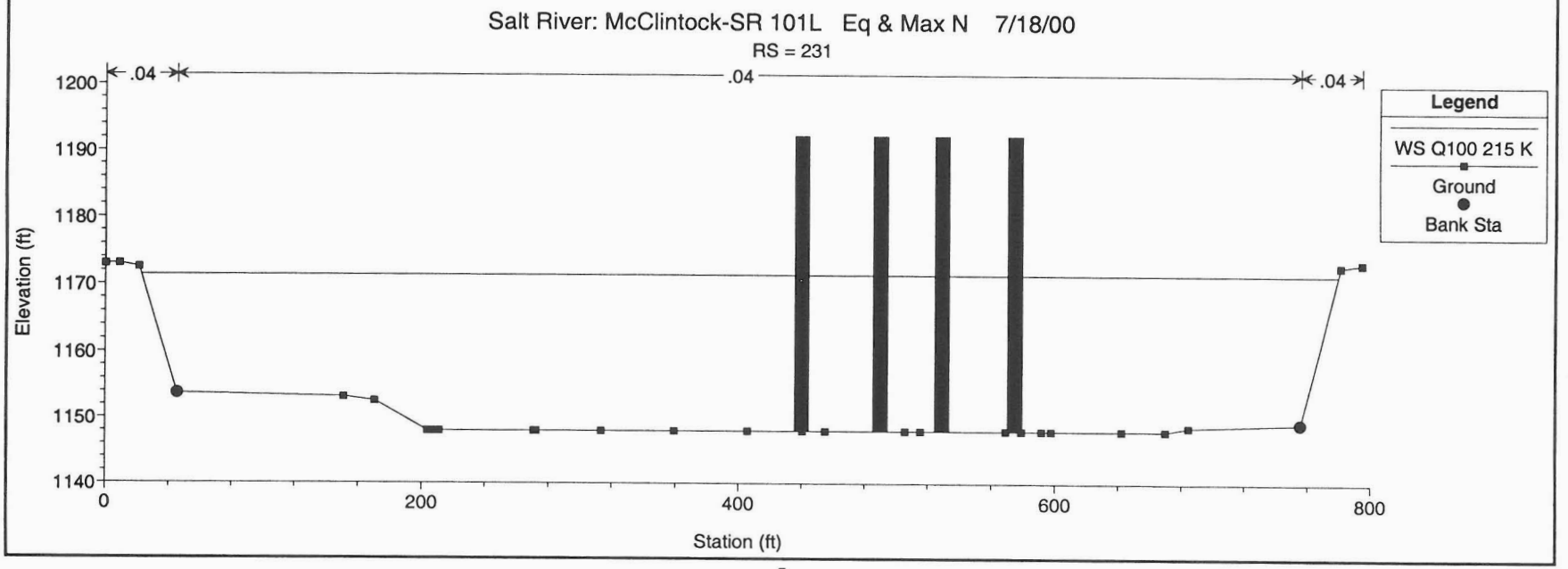

Salt River: McClintock-SR 101L Eq & Max N 7/18/00
RS = 236
.04
.04
.04
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)

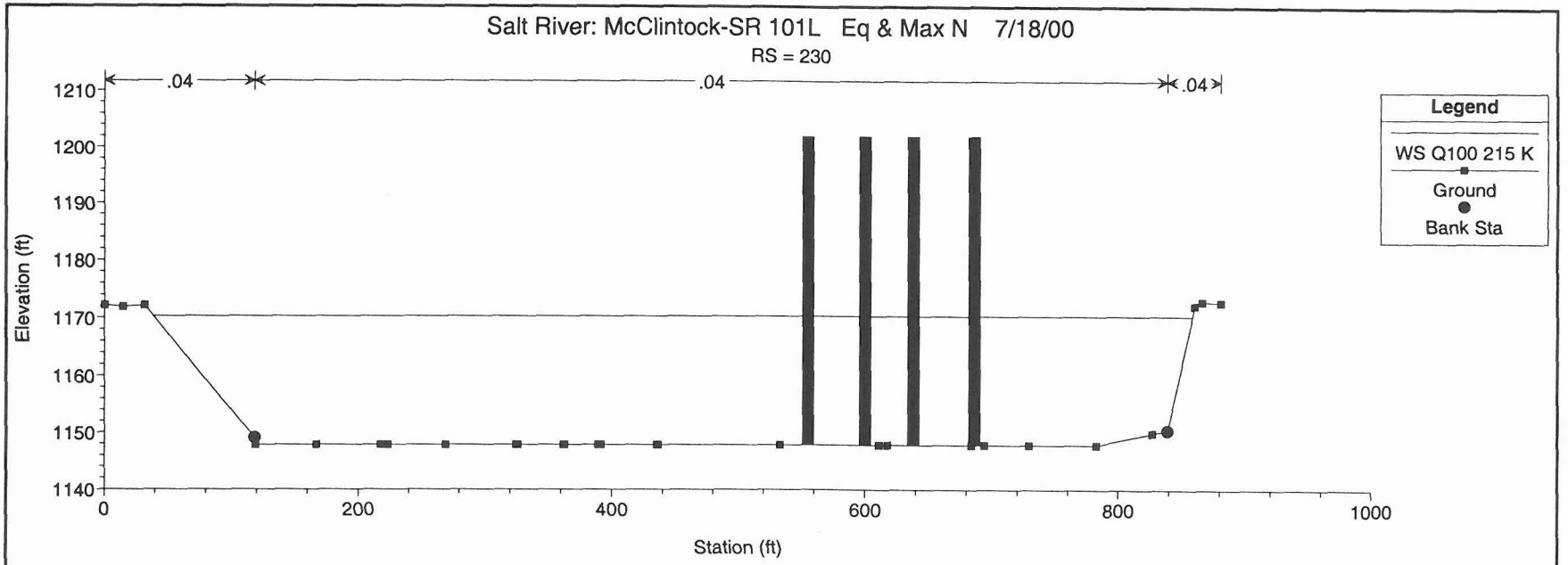

Salt River: McClintock-SR 101L Eq & Max N 7/18/00
RS = 235
.04
.04
.04
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)

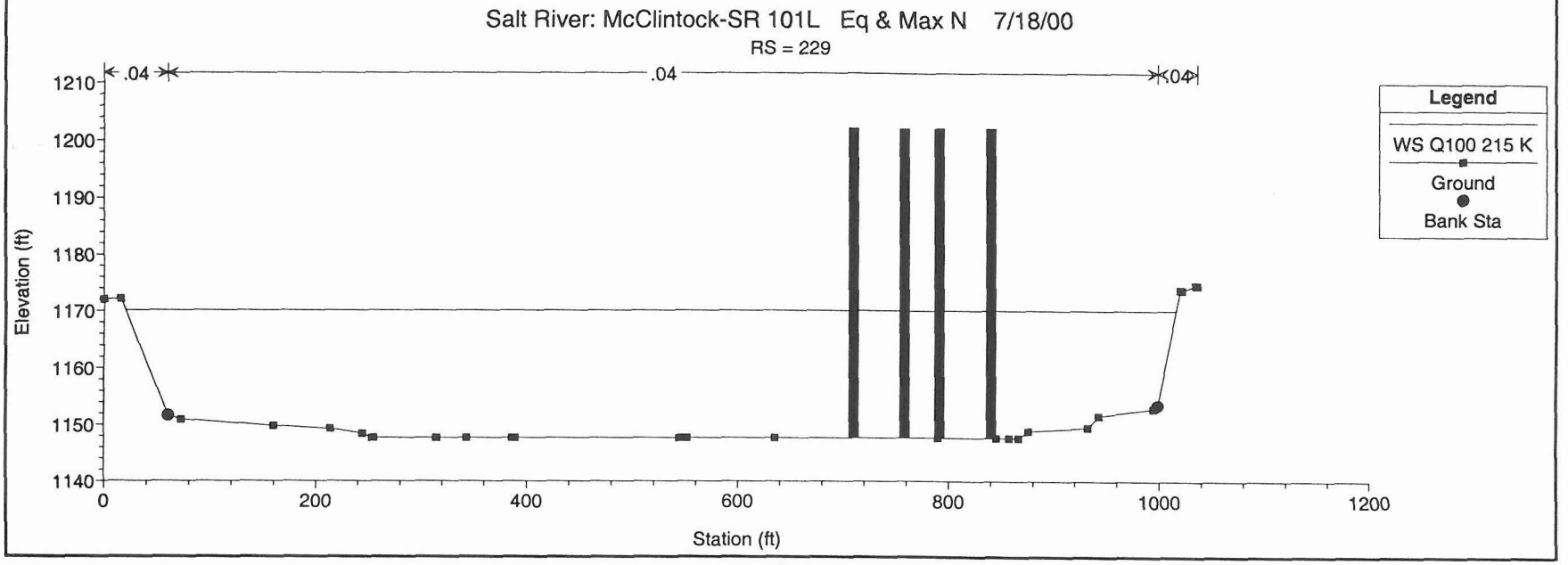

Salt River: McClintock-SR 101L Eq & Max N 7/18/00
RS = 234
.04
.04
.04
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
100
200
300
400
500
600
700
800
Station (ft)
Legend
WS Q100 215 K
Ground
Bank Sta

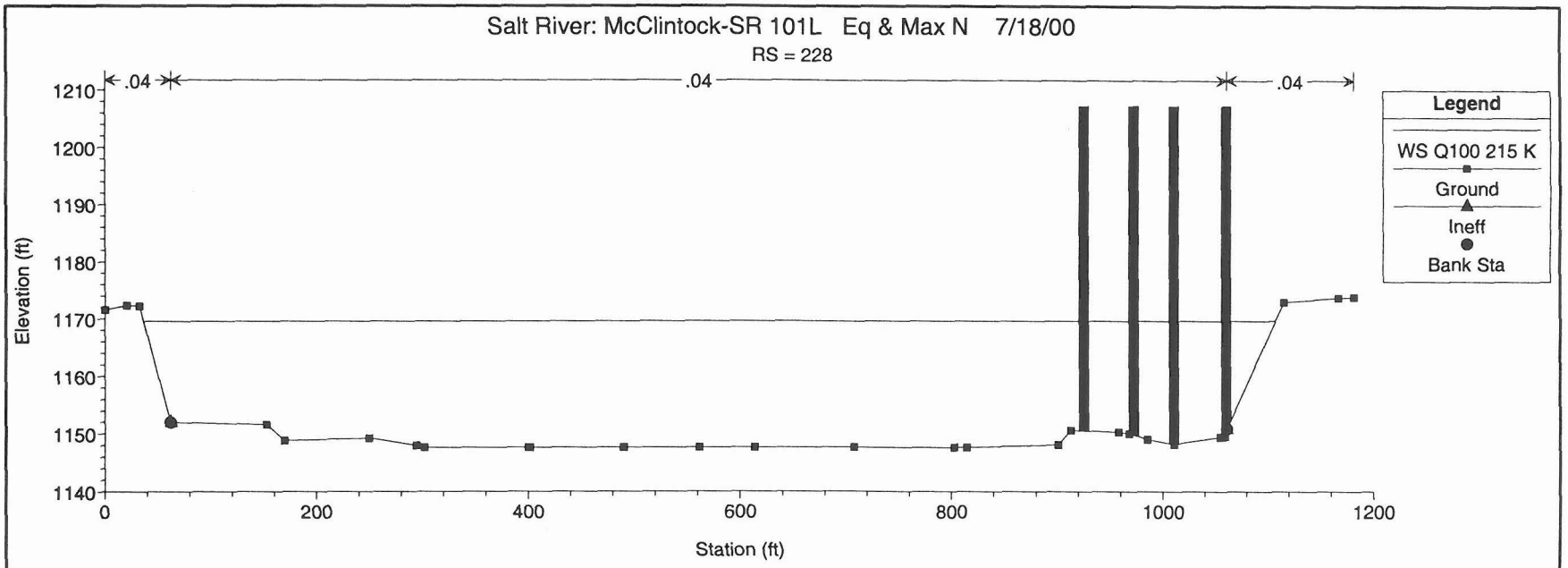

Salt River: McClintock-SR 101L Eq & Max N 7/18/00
RS = 233
.04
.04
.04
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
100
200
300
400
500
600
700
800
Station (ft)
Legend
WS Q100 215 K
Ground
Bank Sta

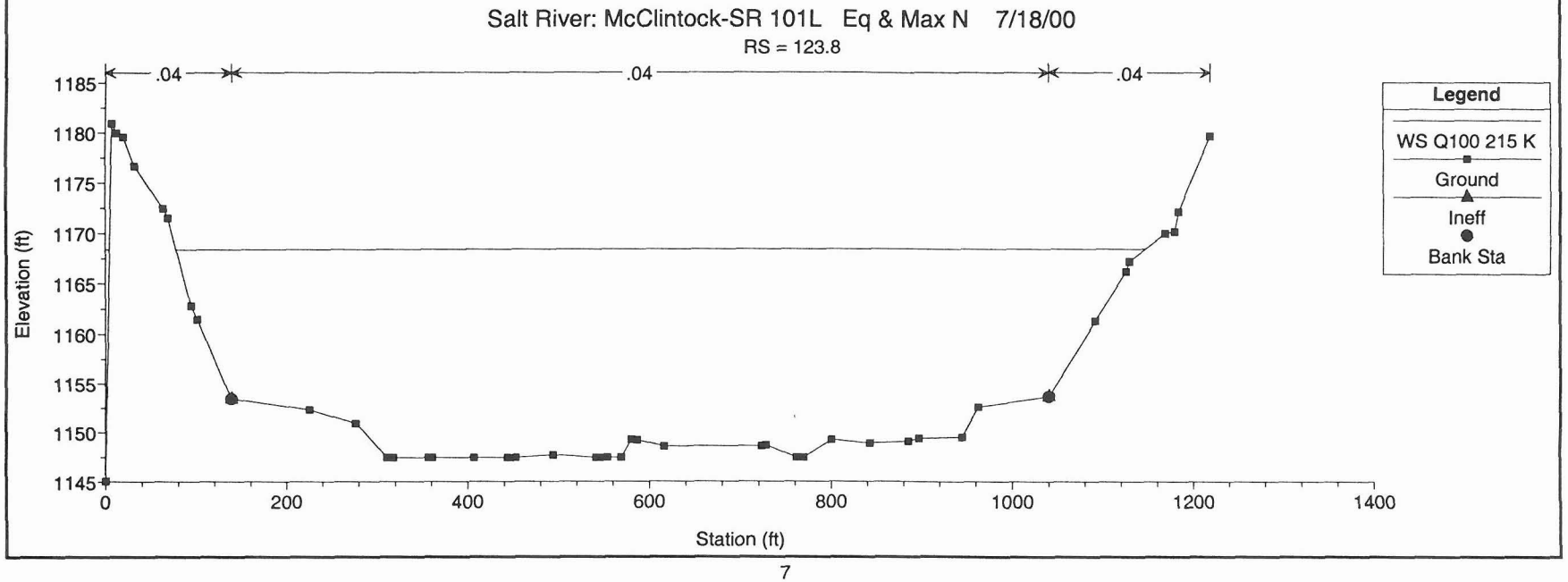

Salt River: McClintock-SR 101L Eq & Max N 7/18/00
RS = 232
.04
.04
.04
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)

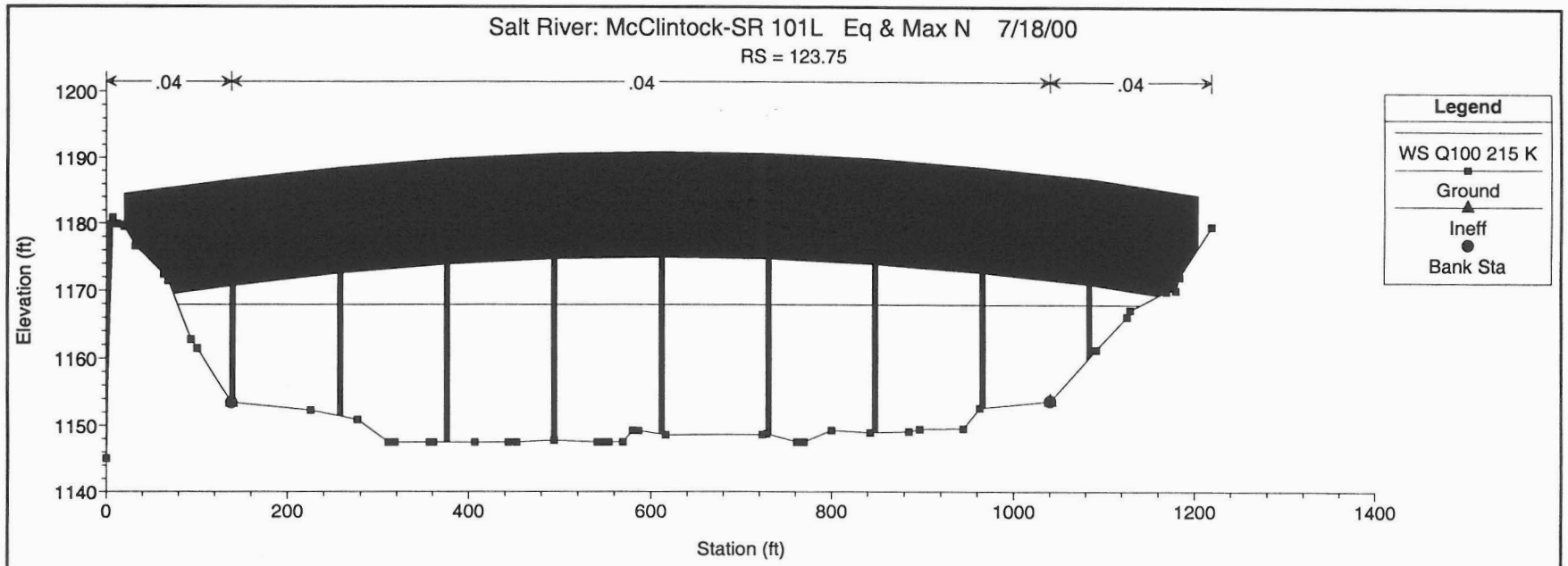

Salt River: McClintock-SR 101L Eq & Max N 7/18/00
RS = 231
.04
.04
.04
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
Station (ft)

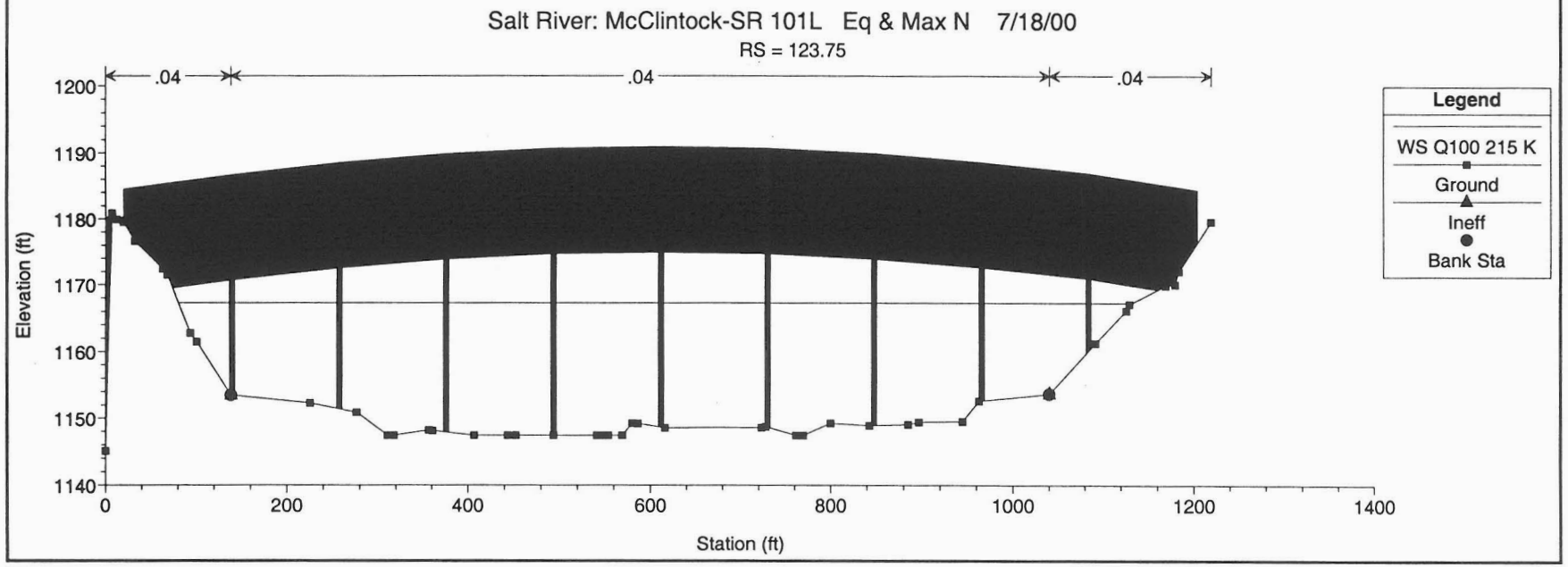

Salt River: McClintock-SR 101L Eq & Max N 7/18/00
RS = 230
.04
.04
.04
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
Station (ft)

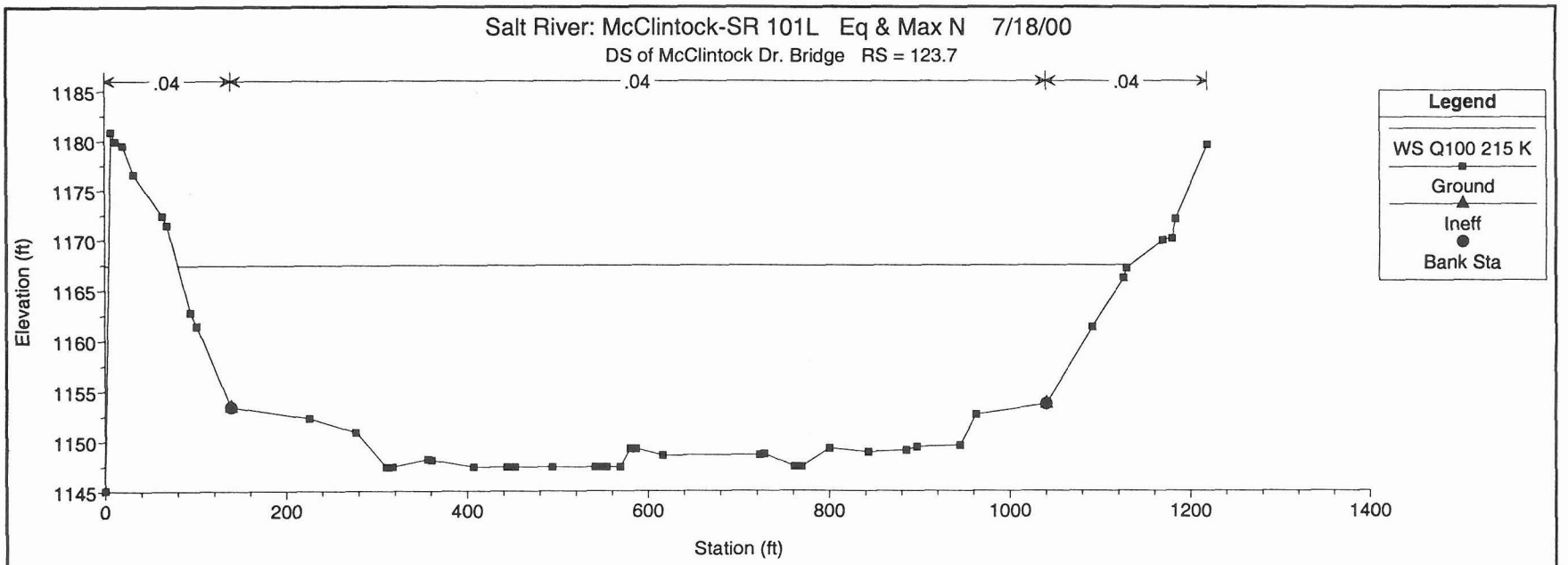

Salt River: McClintock-SR 101L Eq & Max N 7/18/00
RS = 229
.04
.04
.04
Legend
WS Q100 215 K
Ground
Bank Sta
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)

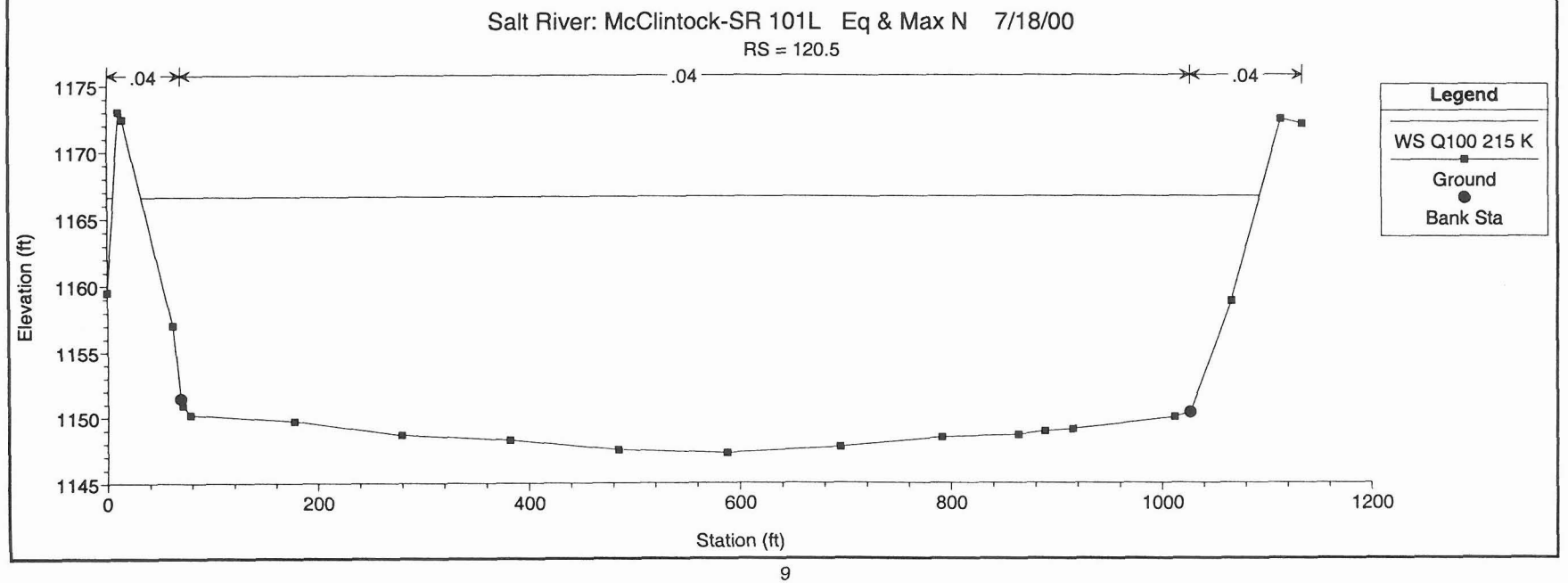

Salt River: McClintock-SR 101L Eq & Max N 7/18/00
RS = 228
.04
.04
.04
Elevation (ft)
1210
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS Q100 215 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Eq & Max N 7/18/00
RS = 123.8
.04
.04
.04
Elevation (ft)
1185
1180
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 215 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Eq & Max N 7/18/00
RS = 123.75
.04
.04
.04
Legend
WS Q100 215 K
Ground
Ineff
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
1400
Station (ft)


Salt River: McClintock-SR 101L Eq & Max N 7/18/00
RS = 123.75
.04
.04
.04
Legend
WS Q100 215 K
Ground
Ineff
Bank Sta
Elevation (ft)
1200
1190
1180
1170
1160
1150
1140
0
200
400
600
800
1000
1200
1400
Station (ft)


Salt River: McClintock-SR 101L Eq & Max N 7/18/00
DS of McClintock Dr. Bridge RS = 123.7
.04
.04
.04
Elevation (ft)
1185
1180
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
1200
1400
Station (ft)
Legend
WS Q100 215 K
Ground
Ineff
Bank Sta


Salt River: McClintock-SR 101L Eq & Max N 7/18/00
RS = 120.5
.04
.04
.04
Elevation (ft)
1175
1170
1165
1160
1155
1150
1145
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS Q100 215 K
Ground
Bank Sta

Appendix C: Local Pier Scour Calculations

PREMIER
ENGINEERING CORPORATION

Local Pier Scour
HEC-18 Procedures

		By:	KD
Project:	FCDMC On-Call	**Date:**	Jun-00
		Checked:	
Subject:	***Local Pier Scour Equation***	**Premier Project No.:**	9952

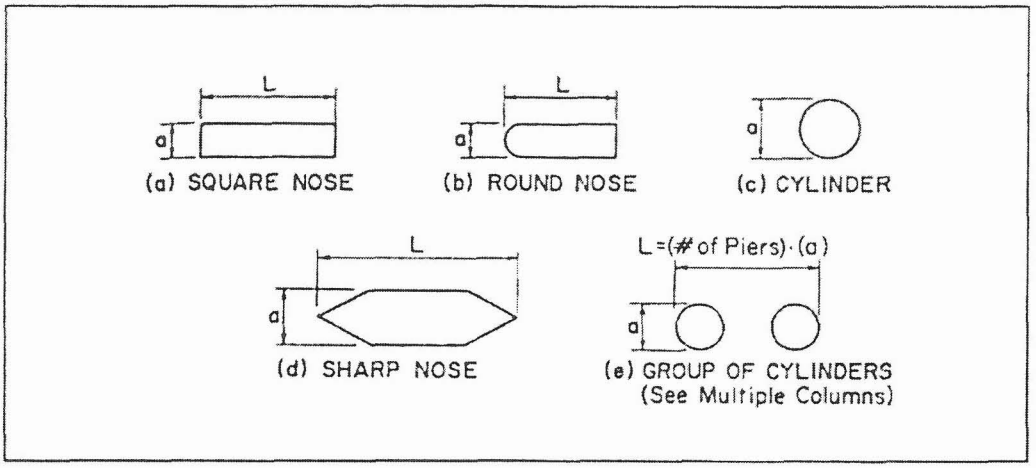
The CSU equattion was used to determine the local scour piers.
The equation is:

Ys = [2*K1*K2*K3*K4*(a/Y1)^0.65*(Fr1)^0.43]*Y1

Where:

K1	Correction factor for pier shape (see Figure 7 and Table 2)
K2	Correction factor for flow angle of attack (see Table 3)
K3	Correction factor for bed condition (see Table 4)
K4	Correction Factor for armouring by the bed material
a	Pier width
Y1	Max. Flow depth directly upstream of pier.
Fr1	Froude number directly upstream of the pier.

Figure 7: Common Pier Shapes



The following Tables were used to determine the correction factors.

HEC-18 Table 2

Correction Factor for Angle of Attack, **K1**

Type	K1
Square Nose	1.1
Round Nose	1
Circular Column	1
Group of Cylinders	1
Sharp Nose	0.9

K2 = (cos (Theta) + L/a*sin(Theta))^.65 or **HEC-18 Table 3**

HEC-18 Table 4
Increase in Equilibrium Pier Scour Depths, **K3**, for the Bed Condition

Bed Condition	Dune Height	K3
Clear Water Scour	N/A	1.1
Plane Bed & Anti-Dune	N/A	1.1
Sm. Dunes		1.1
Med. Dunes		1.2
Large Dunes		1.3

HEC-18 Table 5 Limits for Bed Material Size and **K4** Values

Factor	Min Bed Material Size	Min K4 Value	V_R>1.0
K4	D50>=0.06 m	0.7	1

PREMIER
ENGINEERING CORPORATION

Local Pier Scour
HEC-18 Procedures

Project: FCDMC On-Call
Subject: *Surveyed Topo and n = 0.035*
Local Pier Scour Calculations

By: KD
Date: Jun-00
Checked:
Premier Project No.: 9952

Q100 = 215,000 **cfs**

Fr. HEC-RAS Salt.prj

Cross Section	Vel (fps)	Depth (ft)	Froude	Pier Type	Description	Bed Condition	Description	L	a	Angle of Attack	D_{50} (in)	K1	K2	K3	K4	Ys (ft)
240	8.07	34.22	0.27	1	Square Nose	2	Plane Bed & Anti-Dune	14	14	0	0.6	1.1	1	1.1	1	26.38
239	8.67	33.82	0.28	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
238	8.65	33.61	0.28	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
237	9.41	33.07	0.3	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.20
236	12.29	31.6	0.41	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.87
235	11.45	30.5	0.45	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	33.79
234	15.13	28.73	0.53	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	35.50
233	16.54	26.73	0.61	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	36.77
232	15.37	25.88	0.56	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	35.04
231	14.8	24.91	0.55	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	34.31
230	13.9	24.15	0.52	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	33.13
229	9.88	24.66	0.37	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.83
228	10.47	24.07	0.4	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.56
123.8	11.92	23.44	0.49	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.56
123.7	12.86	22.09	0.54	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	25.08
120.5	12.12	19.33	0.51	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00

Max Scour Depth 36.77 ft
Sta at Max Scour 233
Pier Diameter 9 ft

Velocity 16.54 fps
Flow Depth 26.73 ft
Froude 0.61

NOTES
1 For circular pier groups, if the clear spacing is greater than 16 feet, the pier can be treated separately for scour, for pier groups with spacing less than this refer to HEC-18 figure 7 to determine L.
2 Refer to HEC-18 Figure 7
3 If D50 > .06 m (0.2 ft or 2.4 inches) then K4 = 0.7 else K4 =1

Q100 = 172,000 **cfs**

Fr. HEC-RAS Salt.prj

Cross Section	Vel (fps)	Depth (ft)	Froude	Pier Type	Description	Bed Condition	Description	L	a	Angle of Attack	D_{50} (in)	K1	K2	K3	K4	Ys (ft)
240	7.36	30.61	0.25	3	Circular Column	2	Plane Bed & Anti-Dune	14	14	0	0.6	1	1	1.1	1	22.31
239	7.86	30.26	0.27	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
238	7.86	30.05	0.27	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
237	8.49	29.59	0.28	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	27.26
236	11.14	28.33	0.39	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	30.96
235	10.67	27.37	0.36	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.55
234	13.73	25.79	0.51	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	33.62
233	15.06	23.97	0.59	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	34.89
232	13.97	23.14	0.54	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	33.17
231	13.52	22.18	0.54	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.69
230	12.73	21.4	0.5	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	31.23
229	9.08	21.75	0.36	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	27.27
228	9.7	21.17	0.39	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	27.96
123.8	11.41	20.42	0.5	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	23.60
123.7	12.72	18.83	0.59	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.64
120.5	12.13	15.81	0.56	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00

Max Scour Depth 34.89 ft
Sta at Max Scour 233
Pier Diameter 9 ft

Velocity 15.06 fps
Flow Depth 23.97 ft
Froude 0.59

NOTES
1 For circular pier groups, if the clear spacing is greater than 16 feet, the pier can be treated separately for scour, for pier groups with spacing less than this refer to HEC-18 figure 7 to determine L.
2 Refer to HEC-18 Figure 7
3 If D50 > .06 m (0.2 ft or 2.4 inches) then K4 = 0.7 else K4 =1

PREMIER
ENGINEERING CORPORATION

Local Pier Scour
HEC-18 Procedures

Project: FCDMC On-Call
Subject: *Surveyed Topo n = 0.055*
Local Pier Scour Calculations

By: KD
Date: Jun-00
Checked:
Premier Project No.: 9952

Q100 = 215,000 **cfs**

Fr. HEC-RAS Salt.prj

Cross Section	Vel (fps)	Depth (ft)	Froude	Pier Type	Description	Bed Condition	Description	L	a	Angle of Attack	D_{50} (in)	K1	K2	K3	K4	Ys (ft)
240	6.76	38.73	0.2	3	Circular Column	2	Plane Bed & Anti-Dune	14	14	0	0.6	1	1	1.1	1	22.01
239	7.58	38.17	0.23	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
238	7.58	37.84	0.23	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
237	7.75	37.32	0.23	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	27.17
236	10.02	36.04	0.31	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	30.51
235	9.29	34.9	0.28	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.88
234	11.98	33.21	0.38	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.37
233	12.85	31.3	0.43	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	33.43
232	12.27	29.88	0.41	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.23
231	12.07	28.39	0.42	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	31.99
230	11.75	26.93	0.41	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	31.08
229	9.56	26.34	0.34	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.45
228	9.51	25.46	0.35	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.47
123.8	11.42	24.24	0.45	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	23.95
123.7	12.1	23.17	0.49	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.46
120.5	12.12	19.33	0.5	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
	12.12	19.33	0.5													

Max Scour Depth 33.43 ft
Sta at Max Scour 233
Pier Diameter 9 ft

Velocity 12.85 fps
Flow Depth 31.3 ft
Froude 0.43

NOTES
1 For circular pier groups, if the clear spacing is greater than 16 feet, the pier can be treated separately for scour, for pier groups with spacing less than this refer to HEC-18 figure 7 to determine L.
2 Refer to HEC-18 Figure 7
3 If D50 > .06 m (0.2 ft or 2.4 inches) then K4 = 0.7 else K4 =1

Q100 = 172,000 **cfs**

Fr. HEC-RAS Salt.prj

Cross Section	Vel (fps)	Depth (ft)	Froude	Pier Type	Description	Bed Condition	Description	L	a	Angle of Attack	D_{50} (in)	K1	K2	K3	K4	Ys (ft)
240	6.12	35.79	0.19	3	Circular Column	2	Plane Bed & Anti-Dune	14	14	0	0.6	1	1	1.1	1	20.95
239	6.6	35.37	0.2	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
238	6.59	35.1	0.21	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
237	7.18	34.54	0.22	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	25.94
236	9.25	33.4	0.29	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.87
235	8.45	32.29	0.26	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	27.22
234	11.2	30.72	0.38	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	31.50
233	12.11	28.81	0.42	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.15
232	11.53	27.39	0.4	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	30.93
231	11.33	25.89	0.41	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	30.65
230	10.97	24.44	0.4	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.72
229	8.94	23.8	0.34	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	27.46
228	8.85	22.93	0.34	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	27.10
123.8	10.42	21.87	0.44	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	22.88
123.7	11.51	20.3	0.51	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	23.76
120.5	12.13	15.81	0.56	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00

Max Scour Depth 32.15 ft
Sta at Max Scour 233
Pier Diameter 9 ft

Velocity 12.11 fps
Flow Depth 28.81 ft
Froude 0.42

NOTES
1 For circular pier groups, if the clear spacing is greater than 16 feet, the pier can be treated separately for scour, for pier groups with spacing less than this refer to HEC-18 figure 7 to determine L.
2 Refer to HEC-18 Figure 7
3 If D50 > .06 m (0.2 ft or 2.4 inches) then K4 = 0.7 else K4 =1

PREMIER
ENGINEERING CORPORATION

Local Pier Scour
HEC-18 Procedures

Project: FCDMC On-Call
Subject: *Surveyed Topo and Strip n Value*
Local Pier Scour Calculations

By: KD
Date: Jun-00
Checked:
Premier Project No.: 9952

Q100 = 215,000 **cfs**

Fr. HEC-RAS Salt.prj

Cross Section	Vel (fps)	Depth (ft)	Froude	Pier Type	Description	Bed Condition	Description	L	a	Angle of Attack	D_{50} (in)	K1	K2	K3	K4	Ys (ft)
240	7.93	34.51	0.25	3	Circular Column	2	Plane Bed & Anti-Dune	14	14	0	0.6	1	1	1.1	1	23.27
239	8.52	34.12	0.27	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
238	8.52	33.92	0.27	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
237	9.26	33.4	0.29	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.87
236	12.03	32	0.39	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.31
235	11.5	30.94	0.37	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	31.21
234	14.67	29.23	0.5	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	34.83
233	15.99	27.27	0.58	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	36.23
232	15.1	26.21	0.54	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	34.65
231	14.57	25.08	0.54	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	34.12
230	13.58	24.29	0.5	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.64
229	10.36	24.51	0.38	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.10
228	10.46	24	0.4	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.53
123.8	11.75	23.43	0.47	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.12
123.7	12.69	22.09	0.53	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.88
120.5	11.99	19.33	0.5	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00

Max Scour Depth 36.23 ft
Sta at Max Scour 233
Pier Diameter 9 ft

Velocity 15.99 fps
Flow Depth 27.27 ft
Froude 0.58

NOTES
1 For circular pier groups, if the clear spacing is greater than 16 feet, the pier can be treated separately for scour, for pier groups with spacing less than this refer to HEC-18 figure 7 to determine L.
2 Refer to HEC-18 Figure 7
3 If D50 > .06 m (0.2 ft or 2.4 inches) then K4 = 0.7 else K4 =1

Q100 = 172,000 **cfs**

Fr. HEC-RAS Salt.prj

Cross Section	Vel (fps)	Depth (ft)	Froude	Pier Type	Description	Bed Condition	Description	L	a	Angle of Attack	D_{50} (in)	K1	K2	K3	K4	Ys (ft)
240	7.24	30.91	0.24	3	Circular Column	2	Plane Bed & Anti-Dune	14	14	0	0.6	1	1	1.1	1	22.00
239	7.72	30.57	0.26	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
238	7.74	30.38	0.26	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
237	8.35	29.93	0.28	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	27.37
236	10.87	28.74	0.38	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	30.77
235	10.73	27.81	0.36	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.72
234	13.31	26.27	0.49	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	33.26
233	14.56	24.49	0.56	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	34.37
232	13.7	23.47	0.52	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.80
231	13.32	22.35	0.53	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.51
230	12.45	21.55	0.49	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	31.03
229	9.51	21.64	0.38	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	27.86
228	9.7	21.1	0.39	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	27.93
123.8	11.3	20.4	0.49	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	23.39
123.7	12.62	18.82	0.58	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.45
120.5	12.03	15.81	0.56	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00

Max Scour Depth 34.37 ft
Sta at Max Scour 233
Pier Diameter 9 ft

Velocity 14.56 fps
Flow Depth 24.49 ft
Froude 0.56

NOTES
1 For circular pier groups, if the clear spacing is greater than 16 feet, the pier can be treated separately for scour, for pier groups with spacing less than this refer to HEC-18 figure 7 to determine L.
2 Refer to HEC-18 Figure 7
3 If D50 > .06 m (0.2 ft or 2.4 inches) then K4 = 0.7 else K4 =1

PREMIER
ENGINEERING CORPORATION

Local Pier Scour
HEC-18 Procedures

Project: FCDMC On-Call

Subject: *Surveyed Topo and Max N value*
Local Pier Scour Calculations

By: KD
Date: Jun-00
Checked:
Premier Project No.: 9952

Q100 = 215,000 **cfs**

Fr. HEC-RAS Salt.prj

Cross Section	Vel (fps)	Depth (ft)	Froude	Pier Type	Description	Bed Condition	Description	L	a	Angle of Attack	D_{50} (in)	K1	K2	K3	K4	Ys (ft)
240	8.57	32.5	0.28	3	Circular Column	2	Plane Bed & Anti-Dune	14	14	0	0.6	1	1	1.1	1	23.92
239	9.19	32.12	0.3	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
238	9.17	31.95	0.3	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
237	9.93	31.44	0.32	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.49
236	13.1	29.88	0.44	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	33.22
235	12.38	28.85	0.41	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	31.83
234	16.26	27.02	0.58	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	36.12
233	17.93	24.97	0.68	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	37.62
232	16.37	24.49	0.61	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	35.66
231	15.57	23.82	0.59	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	34.81
230	14.41	23.39	0.54	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	33.30
229	10.12	24.12	0.38	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.94
228	10.68	23.64	0.41	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.69
123.8	12.12	23.13	0.49	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.44
123.7	13.06	21.84	0.55	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	25.18
120.5	12.12	19.33	0.5	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00

Max Scour Depth 37.62 ft
Sta at Max Scour 233
Pier Diameter 9 ft

Velocity 17.93 fps
Flow Depth 24.97 ft
Froude 0.68

NOTES
1 For circular pier groups, if the clear spacing is greater than 16 feet, the pier can be treated separately for scour, for pier groups with spacing less than this refer to HEC-18 figure 7 to determine L.
2 Refer to HEC-18 Figure 7
3 If D50 > .06 m (0.2 ft or 2.4 inches) then K4 = 0.7 else K4 =1

Q100 = 172,000 **cfs**

Fr. HEC-RAS Salt.prj

Cross Section	Vel (fps)	Depth (ft)	Froude	Pier Type	Description	Bed Condition	Description	L	a	Angle of Attack	D_{50} (in)	K1	K2	K3	K4	Ys (ft)
240	6.62	33.47	0.21	3	Circular Column	2	Plane Bed & Anti-Dune	14	14	0	0.6	1	1	1.1	1	21.36
239	7.11	33.08	0.23	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
238	7.11	32.83	0.23	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
237	7.72	32.3	0.25	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	26.77
236	10	31.13	0.33	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.78
235	9.34	30.08	0.3	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.24
234	12.22	28.5	0.43	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.35
233	13.29	26.63	0.49	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	33.42
232	12.56	25.39	0.46	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	31.99
231	12.31	24.07	0.47	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	31.69
230	11.84	22.83	0.45	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	30.53
229	8.6	22.84	0.33	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	26.72
228	9.24	22.08	0.37	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	27.74
123.8	10.9	21.14	0.47	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	23.26
123.7	12.11	19.53	0.54	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.02
120.5	12.13	15.81	0.56	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00

Max Scour Depth 33.42 ft
Sta at Max Scour 233
Pier Diameter 9 ft

Velocity 13.29 fps
Flow Depth 26.63 ft
Froude 0.49

NOTES
1 For circular pier groups, if the clear spacing is greater than 16 feet, the pier can be treated separately for scour, for pier groups with spacing less than this refer to HEC-18 figure 7 to determine L.
2 Refer to HEC-18 Figure 7
3 If D50 > .06 m (0.2 ft or 2.4 inches) then K4 = 0.7 else K4 =1

PREMIER
ENGINEERING CORPORATION

Local Pier Scour
HEC-18 Procedures

Project: FCDMC On-Call

Subject: ***Surveyed Topo Overtopping n***
Local Pier Scour Calculations

By: KD
Date: Jul-00
Checked:
Premier Project No.: 9952

Q100 = **215,000** **cfs** N = 0.044

Fr. HEC-RAS Salt.prj

Cross Section	Vel (fps)	Depth (ft)	Froude	Pier Type	Description	Bed Condition	Description	L	a	Angle of Attack	D_{50} (in)	K1	K2	K3	K4	**Ys (ft)**
240	7.39	36.86	0.23	3	Circular Column	2	Plane Bed & Anti-Dune	14	14	0	0.6	1	1	1.1	1	22.97
239	7.99	36.41	0.24	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
238	7.98	36.16	0.25	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
237	8.73	35.57	0.26	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.16
236	11.28	34.19	0.35	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	31.56
235	10.23	33.03	0.32	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	30.00
234	13.77	31.27	0.46	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	34.41
233	14.91	29.25	0.52	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	35.43
232	14.02	28.05	0.49	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	34.03
231	13.64	26.75	0.49	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	33.47
230	13.02	25.59	0.47	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.37
229	9.9	25.52	0.36	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.84
228	10.12	24.79	0.38	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.22
123.8	11.58	23.98	0.46	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.09
123.7	12.54	22.54	0.52	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.85
120.5	12.12	19.33	0.5	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00

Max Scour Depth	**35.43**	ft	**Velocity**	14.91	fps
Sta at Max Scour	**233**		**Flow Depth**	29.25	ft
Pier Diameter	**9**	ft	**Froude**	0.52	

NOTES

1 For circular pier groups, if the clear spacing is greater than 16 feet, the pier can be treated separately for scour, for pier groups with spacing less than this refer to HEC-18 figure 7 to determine L.

2 Refer to HEC-18 Figure 7

3 If D50 > .06 m (0.2 ft or 2.4 inches) then K4 = 0.7 else K4 =1

PREMIER
ENGINEERING CORPORATION

Local Pier Scour
HEC-18 Procedures

Project: FCDMC On-Call

Subject: ***Equilibrium Slope Condition and n = 0.035***
Local Pier Scour Calculations

By: KD
Date: Jun-00
Checked:
Premier Project No.: 9952

Q100 = 215,000 **cfs**

Fr. HEC-RAS Salt.prj

Cross Section	Vel (fps)	Depth (ft)	Froude	Pier Type	Description	Bed Condition	Description	L	a	Angle of Attack	D_{50} (in)	K1	K2	K3	K4	Ys (ft)
240	8.22	31.31	0.27	3	Circular Column	2	Plane Bed & Anti-Dune	14	14	0	0.6	1	1	1.1	1	23.25
239	8.87	31.06	0.29	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
238	8.93	30.98	0.29	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
237	9.78	30.56	0.31	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.80
236	12.61	29.17	0.42	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.29
235	11.22	28.21	0.37	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	30.22
234	15.17	26.7	0.53	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	34.60
233	17.17	24.46	0.64	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	36.39
232	16	23.64	0.59	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	34.72
231	15.46	22.68	0.59	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	34.22
230	14.49	21.97	0.55	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.84
229	11.52	22.15	0.44	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.92
228	10.78	21.9	0.41	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.91
123.8	11.95	23.48	0.48	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.35
123.7	12.94	22.08	0.54	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	25.07
120.5	12.12	19.33	0.5	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00

Max Scour Depth 36.39 ft
Sta at Max Scour 233
Pier Diameter 9 ft

Velocity 17.17 fps
Flow Depth 24.46 ft
Froude 0.64

NOTES
1 For circular pier groups, if the clear spacing is greater than 16 feet, the pier can be treated separately for scour, for pier groups with spacing less than this refer to HEC-18 figure 7 to determine L.
2 Refer to HEC-18 Figure 7
3 If D50 > .06 m (0.2 ft or 2.4 inches) then K4 = 0.7 else K4 =1

Q100 = 172,000 **cfs**

Fr. HEC-RAS Salt.prj

Cross Section	Vel (fps)	Depth (ft)	Froude	Pier Type	Description	Bed Condition	Description	L	a	Angle of Attack	D_{50} (in)	K1	K2	K3	K4	Ys (ft)
240	7.52	27.73	0.26	3	Circular Column	2	Plane Bed & Anti-Dune	14	14	0	0.6	1	1	1.1	1	21.92
239	8.07	27.54	0.28	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
238	8.15	27.46	0.28	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
237	8.86	27.12	0.3	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	27.24
236	11.42	25.95	0.4	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	30.35
235	10.42	25.12	0.37	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.02
234	13.75	23.79	0.51	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.68
233	15.66	21.77	0.62	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	34.46
232	14.58	20.97	0.57	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.80
231	14.17	20	0.58	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.51
230	13.33	19.26	0.54	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	31.11
229	10.67	19.31	0.44	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.51
228	10.02	19.02	0.41	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	27.52
123.8	11.43	20.48	0.5	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	23.63
123.7	12.83	18.82	0.59	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.63
120.5	12.13	15.81	0.56	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00

Max Scour Depth 34.46 ft
Sta at Max Scour 233
Pier Diameter 9 ft

Velocity 15.66 fps
Flow Depth 21.77 ft
Froude 0.62

NOTES
1 For circular pier groups, if the clear spacing is greater than 16 feet, the pier can be treated separately for scour, for pier groups with spacing less than this refer to HEC-18 figure 7 to determine L.
2 Refer to HEC-18 Figure 7
3 If D50 > .06 m (0.2 ft or 2.4 inches) then K4 = 0.7 else K4 =1

PREMIER
ENGINEERING CORPORATION

Local Pier Scour
HEC-18 Procedures

Project: FCDMC On-Call
Subject: *Equilibrium Slope Condition and n = 0.055*
Local Pier Scour Calculations

By: KD
Date: Jun-00
Checked:
Premier Project No.: 9952

Q100 = 215,000 **cfs**

Fr. HEC-RAS Salt.prj

Cross Section	Vel (fps)	Depth (ft)	Froude	Pier Type	Description	Bed Condition	Description	L	a	Angle of Attack	D_{50} (in)	K1	K2	K3	K4	Ys (ft)
240	6.84	36.93	0.2	3	Circular Column	2	Plane Bed & Anti-Dune	14	14	0	0.6	1	1	1.1	1	21.65
239	7.46	36.61	0.22	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
238	7.47	36.46	0.22	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
237	8.22	35.97	0.24	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	27.32
236	10.41	34.73	0.32	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	30.54
235	9.19	33.59	0.28	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.50
234	12.46	31.98	0.4	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.65
233	13.74	29.83	0.46	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	33.84
232	13.15	28.31	0.44	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.60
231	12.99	26.66	0.45	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.23
230	12.67	25.06	0.45	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	31.54
229	10.4	24.42	0.38	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.06
228	9.95	23.61	0.37	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.40
123.8	11.17	24.75	0.44	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	23.90
123.7	12.18	23.15	0.49	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.45
120.5	12.12	19.33	0.5	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00

Max Scour Depth 33.84 ft
Sta at Max Scour 233
Pier Diameter 9 ft

Velocity 13.74 fps
Flow Depth 29.83 ft
Froude 0.46

NOTES
1 For circular pier groups, if the clear spacing is greater than 16 feet, the pier can be treated separately for scour, for pier groups with spacing less than this refer to HEC-18 figure 7 to determine L.
2 Refer to HEC-18 Figure 7
3 If D50 > .06 m (0.2 ft or 2.4 inches) then K4 = 0.7 else K4 =1

Q100 = 172,000 **cfs**

Fr. HEC-RAS Salt.prj

Cross Section	Vel (fps)	Depth (ft)	Froude	Pier Type	Description	Bed Condition	Description	L	a	Angle of Attack	D_{50} (in)	K1	K2	K3	K4	Ys (ft)
240	6.23	32.89	0.2	3	Circular Column	2	Plane Bed & Anti-Dune	14	14	0	0.6	1	1	1.1	1	20.79
239	6.75	32.63	0.21	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
238	6.8	32.48	0.22	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
237	7.44	32.06	0.23	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	25.76
236	9.47	30.99	0.31	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.94
235	8.29	30	0.27	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	26.97
234	11.32	28.6	0.38	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	30.72
233	12.51	26.67	0.44	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	31.93
232	11.9	25.27	0.42	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	30.71
231	11.76	23.75	0.44	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	30.66
230	11.42	22.29	0.43	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.69
229	9.46	21.62	0.37	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	27.53
228	9.1	20.82	0.36	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	26.86
123.8	10.45	21.92	0.44	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	22.90
123.7	11.59	20.28	0.51	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	23.75
120.5	12.13	15.81	0.56	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00

Max Scour Depth 31.93 ft
Sta at Max Scour 233
Pier Diameter 9 ft

Velocity 12.51 fps
Flow Depth 26.67 ft
Froude 0.44

NOTES
1 For circular pier groups, if the clear spacing is greater than 16 feet, the pier can be treated separately for scour, for pier groups with spacing less than this refer to HEC-18 figure 7 to determine L.
2 Refer to HEC-18 Figure 7
3 If D50 > .06 m (0.2 ft or 2.4 inches) then K4 = 0.7 else K4 =1

PREMIER
ENGINEERING CORPORATION

Local Pier Scour
HEC-18 Procedures

Project: FCDMC On-Call
Subject: *Equilibrium Slope Condition Strip n*
Local Pier Scour Calculations

By: KD
Date: Jun-00
Checked:
Premier Project No.: 9952

Q100 = 215,000 **cfs**

Fr. HEC-RAS Salt.prj

Cross Section	Vel (fps)	Depth (ft)	Froude	Pier Type	Description	Bed Condition	Description	L	a	Angle of Attack	D_{50} (in)	K1	K2	K3	K4	Ys (ft)
240	8.09	31.54	0.26	3	Circular Column	2	Plane Bed & Anti-Dune	14	14	0	0.6	1	1	1.1	1	22.93
239	8.72	31.31	0.28	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
238	8.8	31.24	0.29	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
237	9.63	30.84	0.31	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.90
236	12.31	29.53	0.41	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.10
235	11.43	28.61	0.38	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	30.72
234	14.72	27.14	0.51	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	34.23
233	16.58	24.97	0.61	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	35.90
232	15.75	23.9	0.58	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	34.60
231	15.28	22.72	0.58	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	33.99
230	14.23	21.96	0.54	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.57
229	11.56	22.07	0.44	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.88
228	10.77	21.82	0.41	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.87
123.8	11.78	23.46	0.47	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.13
123.7	12.77	22.08	0.53	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.87
120.5	11.99	19.33	0.5	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00

Max Scour Depth 35.90 ft
Sta at Max Scour 233
Pier Diameter 9 ft

Velocity 16.58 fps
Flow Depth 24.97 ft
Froude 0.61

NOTES
1 For circular pier groups, if the clear spacing is greater than 16 feet, the pier can be treated separately for scour, for pier groups with spacing less than this refer to HEC-18 figure 7 to determine L.
2 Refer to HEC-18 Figure 7
3 If D50 > .06 m (0.2 ft or 2.4 inches) then K4 = 0.7 else K4 =1

Q100 = 172,000 **cfs**

Fr. HEC-RAS Salt.prj

Cross Section	Vel (fps)	Depth (ft)	Froude	Pier Type	Description	Bed Condition	Description	L	a	Angle of Attack	D_{50} (in)	K1	K2	K3	K4	Ys (ft)
240	7.4	27.99	0.25	3	Circular Column	2	Plane Bed & Anti-Dune	14	14	0	0.6	1	1	1.1	1	21.63
239	7.92	27.81	0.27	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
238	8.02	27.74	0.28	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
237	8.72	27.41	0.3	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	27.34
236	11.14	26.32	0.39	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	30.17
235	10.61	25.54	0.37	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.19
234	13.34	24.23	0.49	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.33
233	15.11	22.28	0.59	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	34.01
232	14.32	21.25	0.56	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.71
231	14.01	20.08	0.57	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.31
230	13.11	19.27	0.53	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	30.87
229	10.71	19.26	0.44	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.49
228	10.02	18.96	0.41	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	27.48
123.8	11.32	20.47	0.5	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	23.62
123.7	12.72	18.81	0.59	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.63
120.5	12.03	15.81	0.56	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00

Max Scour Depth 34.01 ft
Sta at Max Scour 233
Pier Diameter 9 ft

Velocity 15.11 fps
Flow Depth 22.28 ft
Froude 0.59

NOTES
1 For circular pier groups, if the clear spacing is greater than 16 feet, the pier can be treated separately for scour, for pier groups with spacing less than this refer to HEC-18 figure 7 to determine L.
2 Refer to HEC-18 Figure 7
3 If D50 > .06 m (0.2 ft or 2.4 inches) then K4 = 0.7 else K4 =1

PREMIER
ENGINEERING CORPORATION

Local Pier Scour
HEC-18 Procedures

Project: FCDMC On-Call

Subject: *Equilibrium Slope Condition Max n*
Local Pier Scour Calculations

By: KD
Date: Jun-00
Checked:
Premier Project No.: 9952

Q100 = 215,000 **cfs** N = 0.029

Fr. HEC-RAS Salt.prj

Cross Section	Vel (fps)	Depth (ft)	Froude	Pier Type	Description	Bed Condition	Description	L	a	Angle of Attack	D_{50} (in)	K1	K2	K3	K4	Ys (ft)
240	8.76	29.59	0.29	3	Circular Column	2	Plane Bed & Anti-Dune	14	14	0	0.6	1	1	1.1	1	23.50
239	9.42	29.37	0.31	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
238	9.48	29.32	0.32	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
237	10.35	28.94	0.34	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.40
236	13.43	27.47	0.46	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.88
235	12.13	26.56	0.42	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	31.25
234	16.27	25.02	0.59	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	35.42
233	18.87	22.5	0.74	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	37.62
232	17.25	22.06	0.66	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	35.56
231	16.47	21.39	0.65	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	34.95
230	15.17	21.04	0.58	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	33.09
229	11.88	21.53	0.46	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	30.19
228	11.02	21.46	0.43	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.30
123.8	12.15	23.17	0.49	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.46
123.7	13.15	21.82	0.55	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	25.17
120.5	12.12	19.33	0.5	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00

Max Scour Depth 37.62 ft
Sta at Max Scour 233
Pier Diameter 9 ft

Velocity 18.87 fps
Flow Depth 22.5 ft
Froude 0.74

NOTES
1 For circular pier groups, if the clear spacing is greater than 16 feet, the pier can be treated separately for scour, for pier groups with spacing less than this refer to HEC-18 figure 7 to determine L.
2 Refer to HEC-18 Figure 7
3 If D50 > .06 m (0.2 ft or 2.4 inches) then K4 = 0.7 else K4 =1

Q100 = 172,000 **cfs** N = 0.043

Fr. HEC-RAS Salt.prj

Cross Section	Vel (fps)	Depth (ft)	Froude	Pier Type	Description	Bed Condition	Description	L	a	Angle of Attack	D_{50} (in)	K1	K2	K3	K4	Ys (ft)
240	6.94	29.84	0.23	3	Circular Column	2	Plane Bed & Anti-Dune	14	14	0	0.6	1	1	1.1	1	21.34
239	7.47	29.62	0.25	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
238	7.53	29.51	0.25	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
237	8.22	29.12	0.27	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	26.69
236	10.52	28.02	0.36	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.80
235	9.44	27.12	0.32	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.00
234	12.6	25.79	0.45	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	31.86
233	14.12	23.87	0.53	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	33.27
232	13.33	22.78	0.5	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	31.92
231	13.06	21.56	0.51	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	31.58
230	12.49	20.48	0.49	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	30.49
229	10.17	20.2	0.41	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.10
228	9.66	19.69	0.39	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	27.26
123.8	11.07	20.99	0.48	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	23.42
123.7	12.38	19.32	0.56	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.31
120.5	12.13	15.81	0.56	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00

Max Scour Depth 33.27 ft
Sta at Max Scour 233
Pier Diameter 9 ft

Velocity 14.12 fps
Flow Depth 23.87 ft
Froude 0.53

NOTES
1 For circular pier groups, if the clear spacing is greater than 16 feet, the pier can be treated separately for scour, for pier groups with spacing less than this refer to HEC-18 figure 7 to determine L.
2 Refer to HEC-18 Figure 7
3 If D50 > .06 m (0.2 ft or 2.4 inches) then K4 = 0.7 else K4 =1

PREMIER
ENGINEERING CORPORATION

Local Pier Scour
HEC-18 Procedures

Project: FCDMC On-Call

Subject: *Equilibrium Slope Condition Overtopping n*
Local Pier Scour Calculations

By: KD
Date: Jul-00
Checked:
Premier Project No.: 9952

Q100 = 215,000 **cfs** N = 0,040

Fr. HEC-RAS Salt.prj

Cross Section	Vel (fps)	Depth (ft)	Froude	Pier Type	Description	Bed Condition	Description	L	a	Angle of Attack	D_{50} (in)	K1	K2	K3	K4	Ys (ft)
240	7.82	32.76	0.25	3	Circular Column	2	Plane Bed & Anti-Dune	14	14	0	0.6	1	1	1.1	1	22.85
239	8.48	32.48	0.27	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
238	8.53	32.38	0.27	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00
237	9.33	31.94	0.29	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.42
236	12	30.6	0.39	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	31.81
235	10.55	29.59	0.34	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.63
234	14.4	28.06	0.49	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	34.04
233	16.08	25.92	0.58	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	35.60
232	15.13	24.89	0.54	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	34.03
231	14.72	23.72	0.55	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	33.73
230	13.96	22.75	0.52	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	32.45
229	11.22	22.7	0.42	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	29.58
228	10.57	22.3	0.4	3	Circular Column	2	Plane Bed & Anti-Dune	18	18	0	0.6	1	1	1.1	1	28.78
123.8	11.76	23.77	0.47	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.24
123.7	12.76	22.33	0.53	3	Circular Column	2	Plane Bed & Anti-Dune	12	12	0	0.6	1	1	1.1	1	24.97
120.5	12.12	19.33	0.5	3	Circular Column	2	Plane Bed & Anti-Dune	0	0	0	0.6	1	0	1.1	1	0.00

Max Scour Depth	**35.60**	ft	**Velocity**	16.08	fps
Sta at Max Scour	**233**		**Flow Depth**	25.92	ft
Pier Diameter	**9**	ft	**Froude**	0.58	

NOTES

1 For circular pier groups, if the clear spacing is greater than 16 feet, the pier can be treated separately for scour, for pier groups with spacing less than this refer to HEC-18 figure 7 to determine L.
2 Refer to HEC-18 Figure 7
3 If D50 > .06 m (0.2 ft or 2.4 inches) then K4 = 0.7 else K4 =1

Appendix D: Survey Notes

Salt River Evaluation Survey
Survey Performed by Surv Net Inc.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1,10008.619,10304.083,1170.016,BASE
101,10739.270,13026.793,1178.653,BC 260+00S
102,10662.263,12530.620,1175.732,STA MKR 255+00
103,10641.055,12301.723,1175.496,ABC 321+27.55  1184.22
104,10550.661,11532.844,1173.059,STA MKR 245+00S
105,10470.623,11040.740,1172.127,BC 240+00S
106,10404.785,10929.432,1171.877,ABC 307+56.83 1180.57
107,10222.781,10607.647,1171.646,STA MKR 235+00
108,10123.159,10417.338,1172.733,ABC 302+46.56 1181.31
109,10035.969,10144.627,1171.809,BC 230+00S
111,12010.156,14938.260,1182.203,BC 280+00N
112,11843.545,14461.383,1180.702,STA MKR 275+00
113,11659.908,13991.773,1181.272,BC 270+00N
114,11544.609,13503.300,1179.317,STA MKR 265+00
115,11427.001,13009.286,1177.656,BC 260+00N
116,11367.722,12509.559,1176.639,STA MKR 255+00
117,11319.083,12015.412,1174.423,STA MKR 250+00
118,11317.402,11514.269,1173.230,STA MKR 245+00
119,11318.793,11147.915,1173.091,ABC 309+69.30
120,11315.416,11012.876,1173.242,STA MKR 240+00
121,11281.512,10501.797,1174.587,STA MKR 235+00
122,12303.527,15194.231,1172.137,ABC 2863+00
123,10621.145,12029.002,1174.253,BC 250+00S
10,10000.000,10000.000,1172.078,ABC 298+30.03 1172.08 GRID
124,10008.515,9937.038,1181.972,E EDG/BRDG@TOP LEVEE
125,9947.715,9940.741,1180.814,MCHD BC 1180.91
201,9967.481,9632.657,1172.644,CP
501,9965.810,9633.035,1172.900,GRD
502,9968.678,9632.654,1172.277,GRD
110,10000.000,10000.000,1172.078,ABC 298+30.03 1172.08
503,10015.780,9942.042,1171.019,TOP LEVEE
504,10006.561,9943.041,1172.566,GRD
204,10098.337,10337.340,1172.257,CP
206,10307.423,10724.323,1172.417,CP
505,10309.157,10723.292,1172.302,TOP LEVEE
506,10292.458,10732.010,1172.137,E/RD
208,10466.401,11030.512,1172.114,CP
507,10468.471,11029.779,1172.115,TOP LEVEE
508,10451.464,11035.994,1171.861,E/RD
210,10543.865,11376.943,1172.504,CP
509,10546.061,11376.848,1172.386,TOP LEVEE
510,10530.503,11377.237,1173.054,E/RD
212,10588.147,11764.596,1173.404,CP
511,10577.439,11765.893,1173.764,E/RD
512,10590.061,11764.433,1173.310,TOP LEVEE
513,10597.280,11765.589,1168.229,FC LEVEE
514,10597.925,11765.666,1167.211,E/RD
515,10609.495,11765.696,1167.432,TOP LEVEE
214,10637.156,12161.779,1174.570,CP
516,10639.424,12161.622,1174.514,TOP LEVEE
517,10621.936,12163.672,1175.076,E/RD
216,10687.370,12589.108,1176.171,CP
518,10689.612,12588.937,1176.149,TOP LEVEE
519,10673.223,12590.260,1176.293,E/RD
520,10099.873,10336.535,1172.163,TOP LEVEE
521,10086.622,10342.162,1172.293,E/RD
126,11151.158,9861.657,1180.135,OS
127,11138.831,9859.527,1180.210,ABC 23-74-13
128,11151.166,9863.657,1180.145,E EDG/BRDG
203,11170.750,10166.120,1172.998,CP
205,11266.265,10473.389,1173.653,CP
207,11293.681,10907.429,1172.879,CP
209,11307.655,11362.116,1172.921,CP
522,11166.621,10167.800,1172.774,TOP LEVEE
523,11224.210,10158.116,1173.808,GRD
524,11256.990,10151.303,1174.146,GRD
525,10077.170,9921.154,1151.174,CL CLMN
526,10087.729,9923.740,1149.695,TOE
527,10194.045,9913.331,1148.131,CL CLMN
528,10251.652,9913.204,1146.833,LW FLOW
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529,10293.805,9910.243,1148.183,GRD
530,10311.854,9905.878,1147.338,CL CLMN
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532,10384.751,9904.256,1147.044,GRD
533,10429.768,9898.239,1147.801,CL CLMN
534,10482.026,9897.968,1147.446,TOP
535,10487.341,9897.688,1146.654,TOE
536,10503.803,9896.811,1146.918,TOE
537,10515.713,9896.083,1149.560,TOP
538,10547.652,9890.656,1148.918,CL CLMN
539,10665.669,9883.571,1148.939,CL CLMN
540,10702.449,9884.385,1147.245,GRD
541,10735.565,9881.919,1149.454,GRD
542,10782.564,9875.268,1149.118,CL CLMN
543,10819.919,9876.778,1149.241,GRD
544,10873.003,9872.762,1149.361,GRD
545,10893.042,9871.513,1152.805,GRD
546,10901.255,9868.347,1152.500,CL CLMN
547,10990.541,9865.760,1154.028,TOE LEVEE
548,10978.199,9889.265,1153.690,CL 9'D CLMN
549,10999.571,9864.864,1159.323,TOP LEVEE
550,11020.257,9861.812,1159.553,CL CLMN
551,11026.468,9889.910,1160.847,CL 9'D CLMN
552,11028.762,9863.337,1160.418,14'N TO TOE LVL
553,11065.457,9889.970,1166.703,CL 9'D CLMN
554,11077.650,9865.497,1169.983,TOP
555,11112.934,9888.201,1169.869,CL 9'D CLMN
556,11132.564,9864.981,1170.760,TOE
557,11150.452,9863.879,1178.009,TOP
558,11112.375,10166.091,1149.378,W EDG 9'D CLMN
559,11064.118,10165.632,1147.450,W EDG 9'D CLMN
560,11135.779,10170.849,1150.171,TOE LEVEE
561,11067.740,10182.835,1148.714,GRD
562,11024.436,10190.030,1150.026,GRD
563,11023.661,10165.586,1149.858,W EDG 9'D CLMN
564,10976.632,10165.246,1150.681,W EDG 9'D CLMN
565,10968.414,10198.837,1150.471,TOP
566,10954.190,10201.741,1147.442,TOE
567,10862.301,10215.535,1147.136,GRD
568,10768.200,10230.591,1146.626,GRD
569,10675.135,10245.200,1146.247,GRD
570,10624.313,10253.309,1145.110,GRD
571,10553.291,10265.009,1145.866,GRD
572,10465.258,10278.793,1146.869,GRD
573,10366.410,10294.560,1147.166,GRD
574,10321.370,10301.752,1148.372,GRD
575,10240.084,10314.709,1147.835,GRD
576,10135.443,10331.853,1147.703,TOE LEVEE
577,10076.668,9921.126,1151.519,CL CLMN
578,11264.316,10473.491,1173.739,TOP LEVEE
579,11279.618,10472.691,1174.609,E/RD
580,10336.999,10716.727,1150.300,TOE LEVEE
581,10349.760,10713.551,1149.578,GRD
582,10439.063,10690.365,1148.552,GRD
583,10493.666,10675.342,1148.033,TOP
584,10524.213,10667.530,1147.207,GRD
585,10583.338,10651.000,1146.062,E/WTR
586,10611.981,10644.856,1145.111,GRD
587,10654.521,10635.721,1141.330,GRD
588,10016.435,9632.045,1156.944,GB LEVEE
589,10024.065,9632.316,1151.027,TOE LEVEE
590,10032.327,9630.886,1150.165,TOP CNC GCS
591,10130.468,9620.349,1149.713,TOP CNC GCS
592,10232.561,9611.699,1148.641,TOP CNC GCS
593,10334.059,9601.183,1148.259,TOP CNC GCS
594,10436.907,9591.650,1147.441,TOP CNC GCS
595,10539.108,9582.127,1147.253,TOP CNC GCS
596,10640.463,9574.125,1147.687,TOP CNC GCS
597,10740.493,9564.362,1148.479,TOP CNC GCS
598,10777.573,9578.575,1148.126,OS
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599,10774.926,9566.871,1148.426,CL 9'D TWR
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601,10939.646,9549.157,1149.470,TOP CNC GCS
200,10820.162,9556.009,1148.696,TOP CNC GCS
602,11291.072,10907.603,1172.705,TOP LEVEE
603,11306.728,10907.027,1172.825,E/RD
604,11305.286,11362.064,1172.764,TOP LEVEE
605,11318.377,11361.866,1173.212,E/RD
211,11309.738,11771.987,1173.958,CP
606,11307.309,11771.856,1173.930,TOP LEVEE
607,11319.256,11772.140,1174.078,E/RD
213,11309.173,12157.098,1174.370,CP
608,11306.826,12156.906,1174.377,TOP LEVEE
609,11318.509,12158.208,1174.643,E/RD
610,10658.142,10625.094,1140.542,GRD
611,10806.664,10586.116,1143.371,GRD
612,10895.151,10577.727,1143.258,GRD
613,10985.477,10563.370,1143.221,GRD
614,10973.769,10589.790,1143.571,CL 9'D CLMN
615,11022.206,10589.946,1143.388,CL 9'D CLMN
616,11046.036,10546.408,1143.284,GRD
617,11060.527,10590.656,1142.344,CL 9' CLMN
618,11108.924,10590.675,1144.940,CL 9' CLMN
619,11109.058,10515.624,1144.920,GRD
620,11117.619,10512.919,1146.204,GRD
621,11126.882,10510.339,1149.052,GRD
622,11183.438,10495.067,1149.700,GRD
623,11237.279,10479.941,1150.915,GRD
624,11241.721,10478.865,1151.637,TOE LEVEE
625,11269.223,10911.190,1150.464,TOE LEVEE
626,11217.514,10918.320,1148.693,GRD
627,11162.098,10929.058,1148.041,GRD
628,11112.992,10932.488,1147.432,GRD
629,11107.285,10932.046,1146.075,GRD
630,11098.170,10932.031,1143.604,GRD
631,11107.911,10870.982,1144.560,CL 9'D CLMN
632,11060.001,10870.574,1140.609,CL 9'D CLMN
633,11042.510,10940.843,1143.478,GRD
634,11021.040,10870.122,1142.132,CL 9'D CLMN
635,10973.733,10869.403,1142.225,CL 9'D CLMN
636,10964.796,10955.522,1143.107,GRD
637,10868.693,10969.848,1141.925,GRD
638,10824.005,10976.028,1142.964,GRD
639,10797.632,10984.245,1146.601,GRD
640,10761.481,10989.170,1142.304,GRD
641,10705.352,10998.170,1141.375,GRD
642,10675.097,11001.041,1142.248,GRD
643,10658.659,11005.782,1146.041,E/WTR
644,10653.982,11006.983,1147.755,GRD
645,10558.568,11031.012,1148.660,GRD
646,10604.601,11023.221,1148.189,GRD
647,10497.914,11023.360,1148.337,TOE LEVEE
648,10576.791,11374.620,1148.543,TOE LEVEE
649,10650.835,11373.465,1148.645,GRD
650,10705.283,11372.130,1148.649,GRD
651,10729.438,11370.565,1147.878,GRD
652,10734.237,11370.077,1146.908,GRD
653,10738.665,11369.326,1146.206,E/WTR
654,10798.333,11369.558,1143.757,GRD
655,10842.059,11369.246,1143.013,GRD
656,10913.433,11366.557,1138.159,GRD
657,10964.649,11364.841,1139.821,GRD
658,10968.108,11430.005,1138.940,CL 9'D CLMN
659,11017.161,11430.167,1141.192,CL 9'D CLMN
660,11035.444,11364.569,1140.446,GRD
661,11056.202,11430.125,1141.692,CL 9'D CLMN
662,11103.299,11430.750,1141.156,CL 9'D CLMN
663,11104.062,11364.380,1142.142,GRD
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665,11126.925,11364.021,1147.159,GRD
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669,11283.628,11770.610,1150.143,TOE LEVEE
670,11277.687,11770.381,1149.193,GRD
671,11242.331,11772.268,1148.202,GRD
672,11192.711,11772.218,1146.968,GRD
673,11128.631,11770.325,1147.470,GRD
674,11124.274,11770.366,1145.967,E/WTR
675,11115.122,11773.569,1140.487,GRD
676,11102.940,11710.940,1140.193,CL 9'D CLMN
677,11054.440,11710.299,1138.166,CL 9'D CLMN
678,11041.078,11773.911,1136.350,GRD
679,11015.600,11710.356,1136.771,CL 9'D CLMN
680,10967.190,11709.877,1135.369,CL 9'D CLMN
681,10962.642,11772.454,1135.092,GRD
682,10899.878,11768.365,1144.084,GRD
683,10830.797,11771.435,1142.980,GRD
684,10788.994,11766.009,1144.126,GRD
685,10774.774,11767.506,1146.092,E/WTR
686,10767.557,11766.210,1148.611,GRD
687,10726.448,11766.013,1149.024,GRD
688,10637.787,11768.151,1148.880,TOE LEVEE
689,10670.024,12158.730,1149.134,TOE LEVEE
690,10753.252,12157.992,1149.808,GRD
691,10819.502,12161.067,1149.198,GRD
692,10826.284,12160.263,1146.109,E/WTR
693,10839.247,12159.392,1141.966,GRD
694,10865.755,12159.295,1141.566,GRD
695,10923.710,12159.419,1140.963,GRD
696,10958.945,12159.291,1138.296,GRD
697,10963.918,12134.169,1137.906,E EDGE9'D CLMN
698,11011.390,12134.580,1136.445,E EDGE9'D CLMN
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700,11051.076,12129.923,1136.324,CL 9'D CLMN
701,11098.938,12130.655,1140.973,CL 9'D CLMN
702,11107.307,12157.917,1140.115,GRD
703,11123.883,12158.757,1141.565,GRD
704,11133.506,12155.745,1146.151,E/WTR
705,11178.468,12159.558,1146.719,GRD
706,11212.123,12159.014,1147.266,GRD
707,11278.242,12155.379,1148.198,TOE LEVEE
215,11359.164,12533.776,1176.996,CP
708,11327.675,12536.369,1151.012,TOE LEVEE
709,11269.628,12542.387,1149.805,GRD
710,11209.483,12548.427,1149.199,GRD
711,11177.350,12548.898,1149.398,GRD
712,11171.997,12550.861,1145.948,E/WTR
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714,11121.842,12553.815,1144.232,GRD
715,11096.486,12550.712,1141.725,CL 9'D CLMN
716,11048.365,12545.724,1138.081,W EDG 9'D CLMN
717,11009.155,12545.499,1138.767,W EDG 9'D CLMN
718,10961.199,12545.241,1137.884,W EDG 9'D CLMN
719,11022.373,12563.794,1138.910,GRD
720,10948.944,12574.291,1140.886,GRD
721,10936.724,12572.171,1144.579,GRD
722,10914.917,12573.176,1147.432,GRD
723,10871.714,12575.746,1150.262,GRD
724,10798.095,12582.536,1150.897,GRD
725,10722.708,12588.078,1151.306,TOE LEVEE
726,11356.901,12534.380,1176.933,TOP LEVEE
727,11369.828,12531.809,1177.071,E/RD
217,11414.100,12935.247,1176.063,CP
728,11411.789,12935.982,1175.920,TOP LEVEE
729,11424.646,12932.668,1176.315,E/RD
730,11426.223,12931.190,1177.934,E/RD
731,11440.856,12928.445,1177.896,E/RD
732,11502.331,13351.169,1179.162,TOP LEVEE
733,11516.405,13349.715,1179.050,E/RD
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735,10718.989,12963.783,1178.019,E/RD
218,10731.014,12961.826,1178.149,CP
220,10781.587,13358.704,1181.883,CP
736,10783.360,13358.663,1181.939,TOP LEVEE
737,10768.110,13359.442,1181.928,E/RD
738,10769.019,12960.536,1150.871,TOE LEVEE
739,10825.402,12955.582,1150.590,GRD
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742,10935.696,12948.139,1142.983,GRD
743,10936.065,12961.420,1143.229,CL 9'D CLMN
744,10982.890,12958.909,1140.707,4' 90ø RT TO W FC CLMN
745,10999.466,12948.684,1141.329,GRD
746,11023.312,12962.577,1141.857,CL 9'D CLMN
747,11072.220,12967.810,1137.890,CL 9'D CLMN
748,11083.915,12950.212,1137.416,GRD
749,11152.480,12945.878,1138.617,GRD
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751,11241.473,12945.547,1146.285,E/WTR
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754,11383.848,12940.096,1151.126,TOE LEVEE
755,11470.884,13350.844,1151.263,TOE LEVEE
756,11407.113,13352.147,1150.923,GRD
757,11355.013,13352.821,1150.849,GRD
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759,11284.448,13351.371,1146.539,E/WTR
760,11274.376,13352.721,1142.567,GRD
761,11219.992,13355.286,1142.114,GRD
762,11127.984,13357.587,1139.038,GRD
763,11047.099,13358.102,1139.870,GRD
764,11011.152,13355.179,1140.294,GRD
765,11008.470,13381.333,1141.639,CL 9'D CLMN
766,10994.665,13357.262,1141.804,GRD
767,10976.988,13355.065,1146.162,E/WTR
768,10957.870,13355.096,1150.925,GRD
769,10954.326,13369.608,1151.223,CL 9'D CLMN
770,10912.578,13378.329,1151.003,CL 9'D CLMN
771,10920.049,13355.085,1151.493,GRD
772,10866.169,13367.860,1149.045,CL 9'D CLMN
773,10862.718,13355.640,1151.121,GRD
774,10815.692,13357.851,1151.718,TOE LEVEE
222,10723.966,13729.190,1181.886,CP
775,10726.231,13730.172,1181.870,TOP LEVEE
776,10717.276,13726.339,1181.925,TOP LEVEE
221,11589.438,13777.295,1181.029,CP
777,11587.436,13777.668,1180.994,TOP LEVEE
778,11600.305,13774.941,1180.921,E/RD
223,11725.818,14174.640,1181.206,CP
779,11723.359,14175.380,1181.147,TOP LEVEE
780,11736.409,14170.437,1181.258,E/RD
781,11874.782,14561.515,1180.509,E/RD
782,11862.312,14566.944,1180.581,TOP LEVEE
225,11864.662,14566.151,1180.668,CP
227,12079.640,15072.429,1183.005,CP
783,12077.362,15073.497,1182.814,TOP LEVEE
784,12088.260,15068.100,1182.829,E/RD
224,10880.912,14411.304,1183.020,CP
785,10882.999,14410.731,1182.957,TOP LEVEE
786,10869.920,14414.230,1183.145,E/RD
226,11045.903,14824.659,1184.028,CP
787,11047.626,14823.619,1183.892,TOP LEVEE
788,11035.725,14833.225,1183.990,E/RD
228,11120.841,15288.866,1184.448,CP
789,11123.025,15288.851,1184.324,TOP LEVEE
790,11107.752,15289.075,1184.365,E/RD
791,11553.237,13775.240,1151.304,TOE LEVEE
792,11490.726,13771.275,1150.370,GRD
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796,11344.195,13767.036,1145.633,GRD
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798,11291.728,13760.472,1146.705,GRD
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801,11127.139,13751.172,1142.663,GRD
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809,10768.854,13774.340,1149.187,CL 9'D CLMN
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812,10853.461,13735.708,1149.647,GRD
813,10769.504,13731.622,1149.563,TOE LEVEE
814,10758.054,13736.137,1168.196,10' STH TO GB
815,10913.171,14401.758,1151.677,TOE LEVEE
816,10995.343,14380.550,1151.763,GRD
817,11051.216,14363.178,1151.800,GRD
818,11068.450,14358.808,1146.465,E/WTR
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824,11399.962,14269.340,1141.712,GRD
825,11452.715,14251.381,1143.566,GRD
826,11493.265,14240.870,1146.332,E/WTR
827,11530.777,14228.219,1146.801,GRD
828,11551.619,14223.690,1151.356,GRD
829,11616.815,14205.869,1151.289,GRD
830,11690.791,14185.005,1150.046,TOE LEVEE
831,11832.447,14576.718,1152.629,TOE LEVEE
832,11746.192,14604.635,1150.570,GRD
833,11688.009,14623.844,1151.076,GRD
834,11671.026,14627.768,1146.714,GRD
835,11654.255,14633.819,1146.275,E/WTR
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840,11503.142,14678.725,1144.562,GRD
841,11436.885,14701.202,1146.373,E/WTR
842,11399.095,14712.611,1147.528,GRD
843,11354.111,14726.531,1146.402,E/WTR
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845,11256.292,14757.146,1145.811,GRD
846,11235.011,14765.254,1146.355,E/WTR
847,11226.406,14768.281,1147.140,GRD
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849,11135.509,14795.726,1152.496,GRD
850,11079.218,14812.634,1152.187,TOE LEVEE
851,11157.358,15280.998,1154.220,TOE LEVEE
852,11234.369,15264.143,1154.226,GRD
853,11233.593,15256.249,1153.813,CL 7'D CLMN
854,11319.580,15244.816,1150.287,GRD
855,11372.644,15268.475,1149.943,CL 7'D CLMN
856,11404.590,15175.740,1147.396,CL 7'D CLMN
857,11415.138,15230.069,1149.054,GRD
858,11493.756,15217.931,1147.505,GRD
859,11533.213,15216.090,1145.918,CL 7'CLMN
860,11524.961,15201.930,1146.203,E/WTR
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862,11670.553,15164.285,1145.406,GRD
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863,11726.509,15150.203,1145.722,GRD
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866,11874.015,15120.431,1146.428,E/WTR
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868,11908.487,15110.293,1152.724,GRD
869,11981.743,15095.610,1152.995,GRD
870,12043.451,15080.111,1153.288,TOE LEVEE
229,12209.715,15585.966,1170.714,CP
232,12210.719,15596.200,1170.651,CP
871,12242.537,15595.453,1182.221,GRD
872,12232.038,15595.591,1182.213,TOP LEVEE
873,12208.119,15596.200,1170.631,TOP LEVEE
874,12188.335,15595.938,1153.418,TOE LEVEE
875,12107.215,15587.076,1152.235,CL 7'D CLMN
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877,12033.404,15590.533,1150.986,GRD
878,11966.921,15585.860,1150.956,CL 7'D CLMN
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880,11944.892,15589.691,1147.044,GRD
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883,11929.428,15591.216,1151.710,GRD
884,11920.565,15591.038,1153.266,GRD
885,11917.157,15591.255,1151.995,GRD
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888,11697.798,15587.124,1149.872,GRD
889,11686.764,15583.212,1149.469,CL 7'D CLMN
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891,11577.315,15585.668,1148.051,GRD
892,11562.561,15585.753,1148.741,GRD
893,11547.260,15581.942,1148.548,CL 7'D CLMN
894,11534.601,15585.433,1148.372,GRD
895,11501.932,15585.532,1148.679,GRD
896,11487.473,15585.034,1148.631,GRD
897,11453.525,15584.656,1148.902,GRD
898,11424.205,15584.229,1148.235,GRD
899,11407.034,15580.525,1148.987,CL 7'D CLMN
900,11355.402,15584.218,1149.690,GRD
901,11329.451,15583.406,1152.821,GRD
902,11267.672,15579.283,1154.104,CL 7'D CLMN
903,11204.125,15582.294,1157.099,GRD
904,11176.800,15582.092,1156.548,TOE LEVEE
905,11141.817,15581.822,1184.526,TOP LEVEE
906,11127.298,15577.785,1185.131,CL 7'D CLMN
907,10977.141,9542.286,1150.290,TOE LEVEE
908,10989.914,9540.115,1158.064,TOP LEVEE
909,11016.260,9538.914,1158.774,TOE LEVEE
910,11063.372,9533.618,1172.409,TOP LEVEE
911,11081.942,9532.458,1172.043,GRD
913,10734.907,13765.820,1149.187,CL 9'D CLMN
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