

POST-CONSTRUCTION CHANNEL MONITORING OF SALT RIVER, PHASE ONE

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Introduction:

In compliance with the Salt River Ecosystem Restoration Project Adaptive Management Plan, cross-sectional and longitudinal surveys were conducted across the project area during October and November 2014. The cross-sectional surveys were conducted on the main channel of the lower Salt River, and of the newly excavated slough channels, in both the northern and southern regions excavated during the Summer of 2013 (Figure 1). A longitudinal survey was conducted of the lower main Salt River channel from Cutoff Slough to the Riverside Ranch barn. This effort concentrates on Phase One of the restoration Project in the Estuarine and Salt Marsh portions. All elevations are geo-referenced, in feet, to the 1988 North American Vertical Datum (NAVD88).

In 2013 the Salt River Ecosystem Restoration Project converted 330 acres of dairy ranch into a salt marsh estuary. Two and a half miles of the Salt River channel was excavated, expanded, and deepened. Over 3-miles of new slough channels were excavated and enhanced. These new channels are being monitored using cross-surveys for sediment deposition or erosion. The results of the surveys are designed to help determine any necessary management actions.

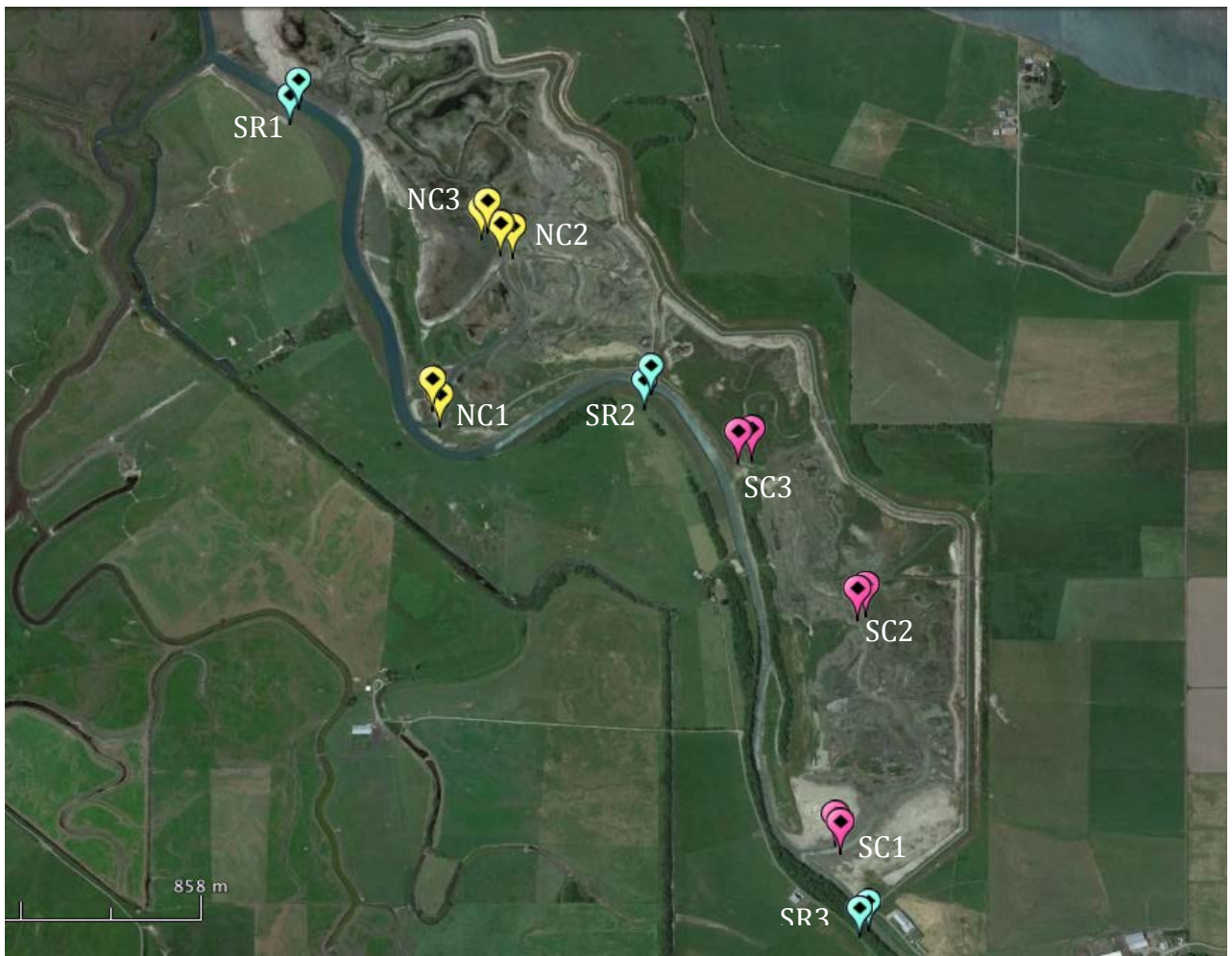


Figure 1: Location of the cross-section profiles for Salt River Ecosystem Restoration Survey Project, Fall 2014.
SR = Salt River cross-sections; NC= new North Channels cross-sections; SC= new South Channel cross-sections.

Methods and Results

Salt River Main Channel Cross-sections

Data for three cross-sectional profiles of the main Salt River channel were collected using a CTS/berger automatic level, tripod and stadia rod along the lower, middle and upper sections of the main Salt River channel (Figure 2). Permanent, rebar monuments were set on both sides of the main channel and geo-referenced to the Salt River Restoration Project's survey control points SR12, SR14 and SR11 (Figure 6B). The cross-sectional monuments were established on both sides of the channels using 4-foot lengths of ½"-rebar pounded into the substrate, leaving 3-inches exposed, and topped with labeled end caps (Figure 3). GPS (Garmin GPSMAP 62s) locations were recorded for each monument, along with photo documentation. Fluorescent orange flags were set adjacent to each monument for ease of relocation, however, it was observed at during subsequent surveys that these flags were degraded within several weeks and are unlikely to survive the entire year. All elevations are reported in feet using the NAVD88 vertical datum.



Figure 2: Auto level cross-section survey set up over Salt River SR2. (all photos by D. O'Shea)

Elevations and distances were collected at each major break in slope, vegetation edge (dotted line), waters edge, mid-channel, and at least 2 locations on either side of mid-channel. These are indicated by the tick marks (+) on the cross-section graphs. Flood plain measurements were collected approximately 200-feet on either side of the main channel. Cross-section profiles are viewed from the west or north with the zero-point on the left-side of the graph and extending 450 feet toward the south and east. The only exception was Salt River cross-section, SR3, where dense vegetation obscured visibility on the south side of the channel (Figure 5C).

A combination of circumstances made the surveying more challenging than expected. These included water levels about one-foot higher than predicted, early season rainfall, and diminishing daylight hours during lower-low tides (Figure 6A). When conditions made it impossible to survey using the standard approach of walking the stadia rod across the channel, it was necessary to use wetsuits, stand up paddleboard and a taut-rope stretched between each side of the channel. The surveyor then moved along the rope across the channel while at the same time steadying the stadia rod so the automatic level shot could be recorded (Figure 4).



Figure 3: Setting a rebar monument at Salt River cross-section SR1.



Figure 4: A paddleboard and taut-rope were used when water levels were too high to navigate on foot at the Salt River main channel site SR1 looking toward the southwest.

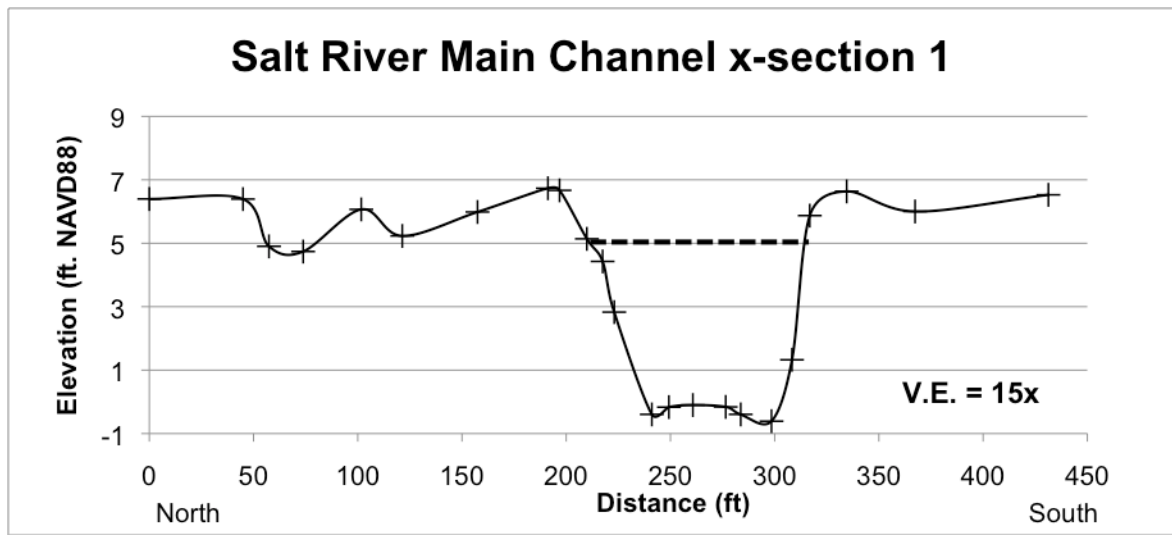


Figure 5A: Salt River Main Channel cross-section SR1. V.E. is the vertical exaggeration.

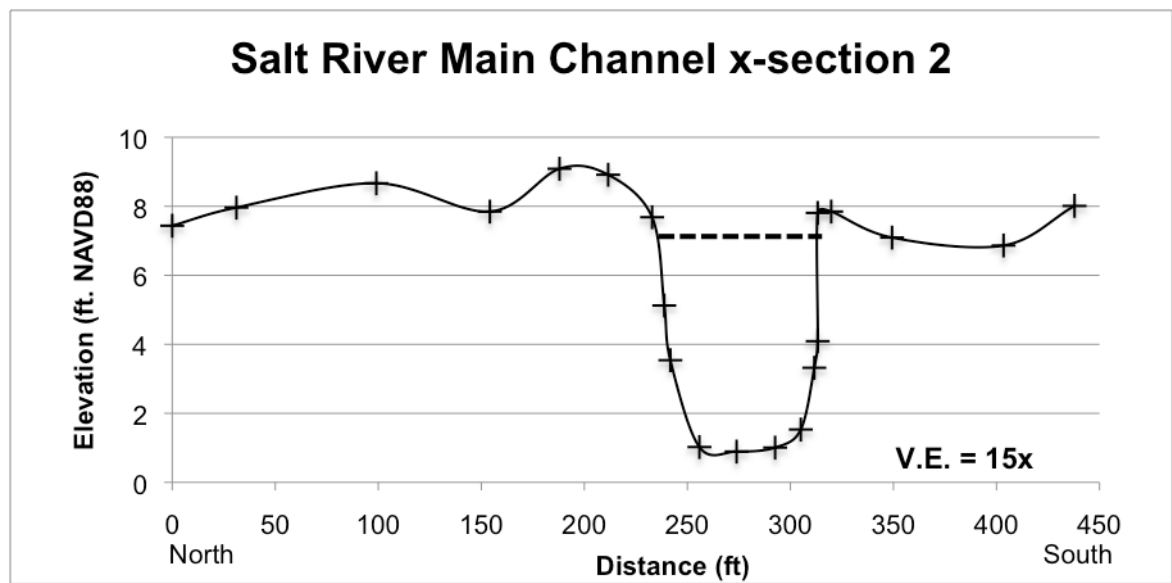


Figure 5B: Salt River Main Channel cross-section SR2.

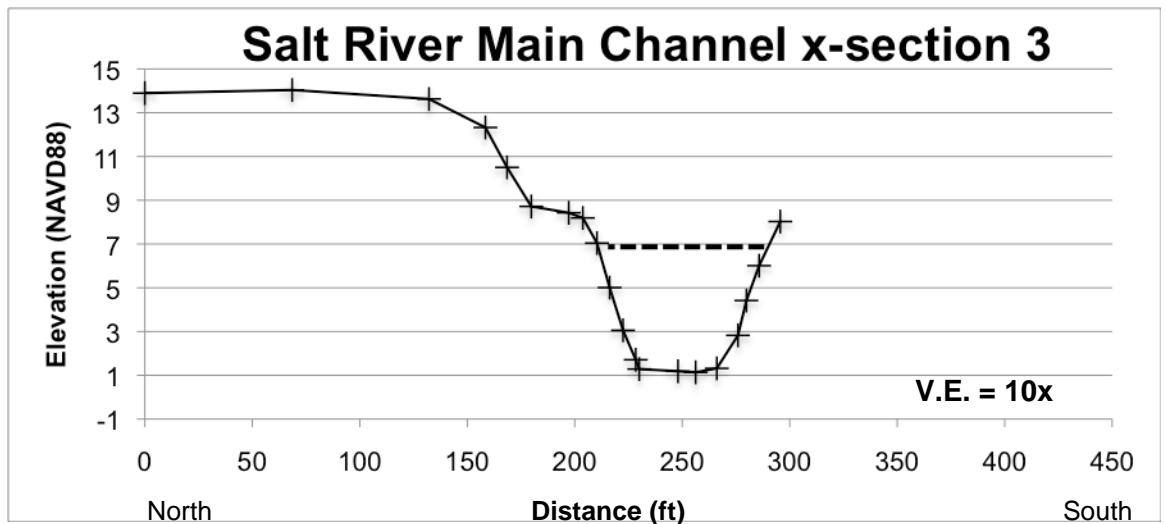


Figure 5C: Salt River Main Channel cross-section SR3.

New Slough Channel Cross- Sections

Three cross-sections were collected for each of the newly developed slough channels. The northern slough network drains into the main Salt River channel approximately 3,800 feet upstream from the confluence of the Salt River and Cutoff Slough, and the southern slough network drains into the main Salt River channel another 9,000 feet upstream of Cutoff Slough. The methods described for the Salt River cross-sections were repeated for these slough locations. All elevations are reported in feet using the NAVD88 vertical datum. All cross section profiles are viewed with the north (or west) side at the zero-point on the horizontal (distance) axis.

Elevations and distances were collected at each major break in slope, vegetation edge (dotted line), waters edge, mid-channel, and at least 2 locations on either side of mid-channel. These are indicated by the tick marks (+) on the cross-section graphs. Flood plain measurements were collected approximately 200-feet on either side of the main channel.



Figure 6A: New channel cross-section site NC1 approximately 3,800-feet upstream from Cutoff Slough looking toward the Northwest. Note surveyor, with stadia rod, chest deep in new slough channel.



Figure 6B: Auto level set up at the Salt River Restoration Project survey control point SR12 used to geo-reference the cross-section and longitudinal profiles.

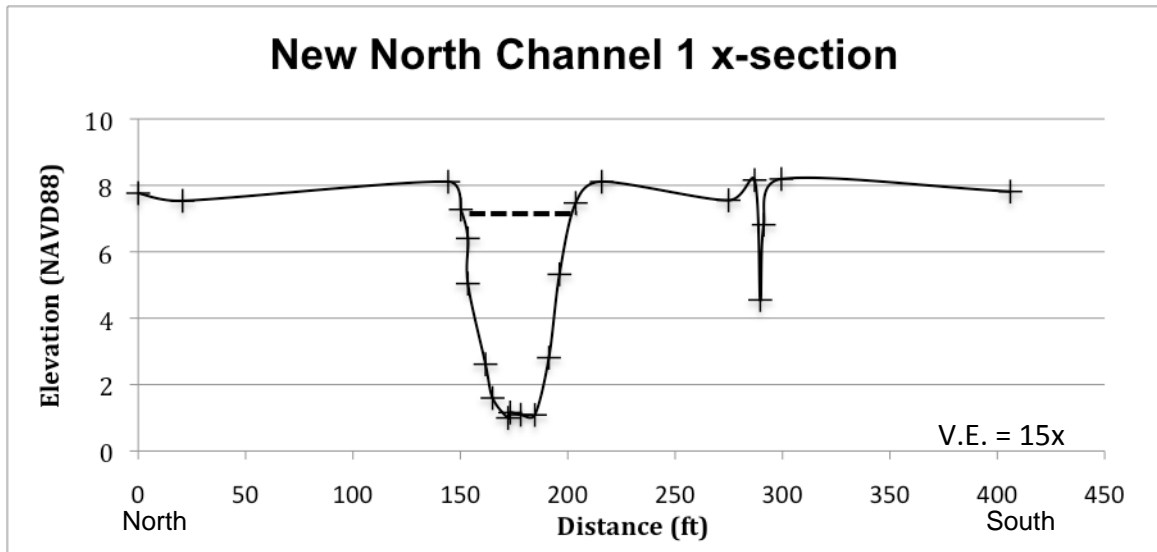


Figure 7A: New North Channel cross-section NC1

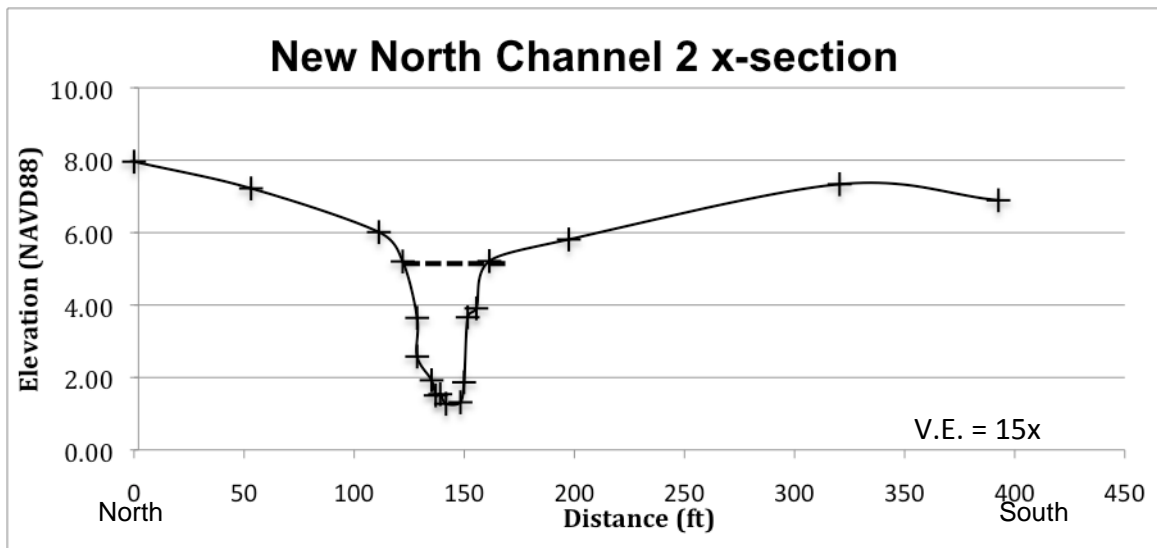


Figure 7B: New North Channel cross-section NC2

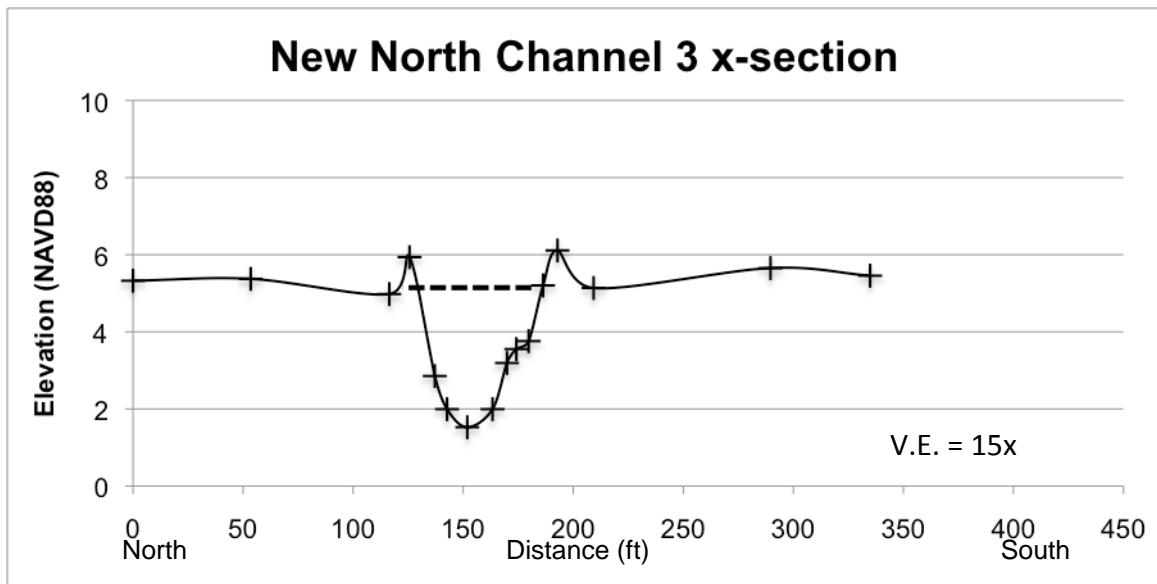


Figure 7C: New North Channel cross-section NC3

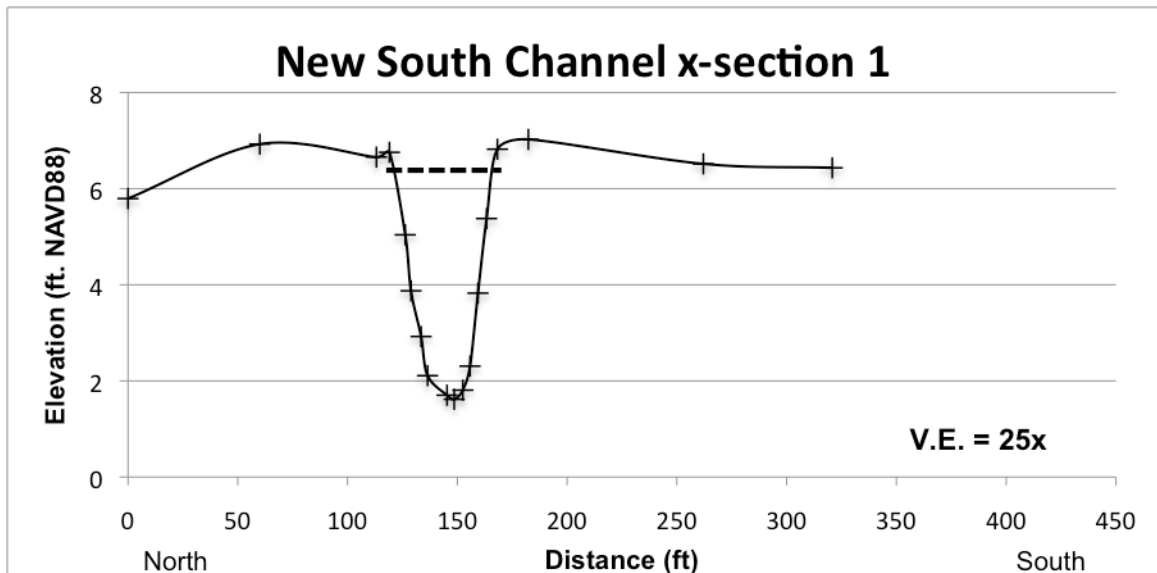


Figure 8A: New South Channel cross-section SC1

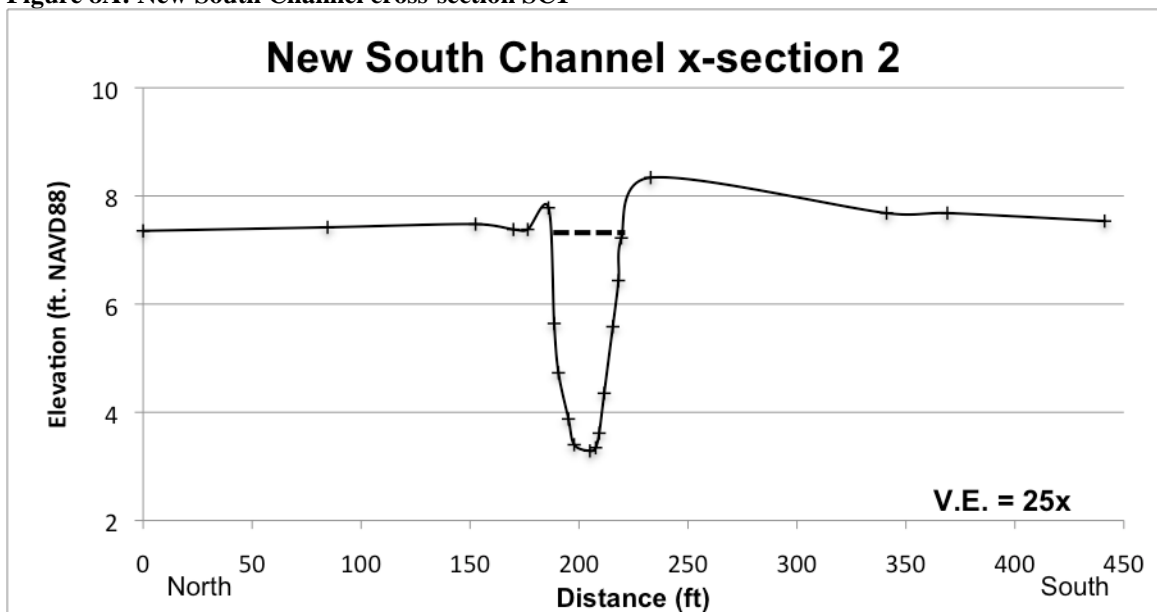


Figure 8B: New South Channel cross-section SC2

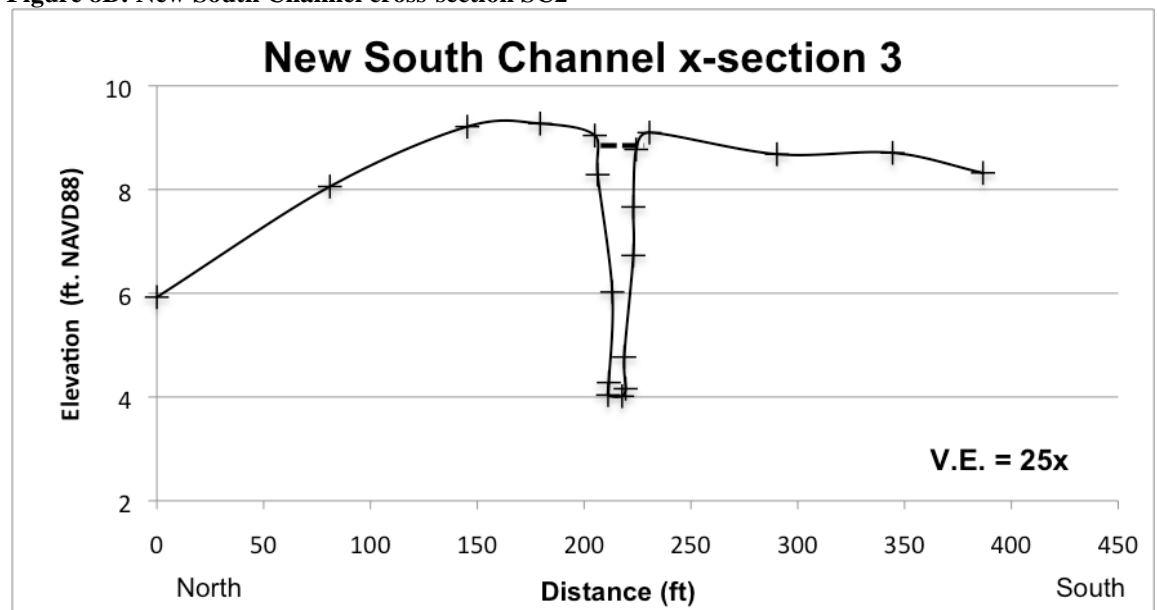


Figure 8C: New South Channel cross-section SC3

Salt River Longitudinal Survey

The longitudinal profile survey of the main Salt River channel from Cutoff Slough to the Riverside Ranch barn was collected using a Nikon DTM-352 Total Station laser theodolite, tripod, stadia rod, prism pole and single prism. Due to the aforementioned adverse surveying conditions, wetsuits and a standup paddleboard were used to locate the thalweg during the 2-day survey. The prism pole was secured to the stadia rod at a height of 10.28 feet to account for the deep-water conditions at the time of the survey. The prism pole was placed in the thalweg approximately every 200-feet with the total station located at one of four locations along the north bank of the main Salt River channel and geo-referenced to the Salt River Restoration Project's survey control points SR11, SR 14 and SR 12. A total of 48 measurements were taken along the Salt River. All elevations are reported in feet using the NAVD88 vertical datum.



Figure 9: Total station set up at SR3 (near the River Ranch barn) used for the longitudinal profile.

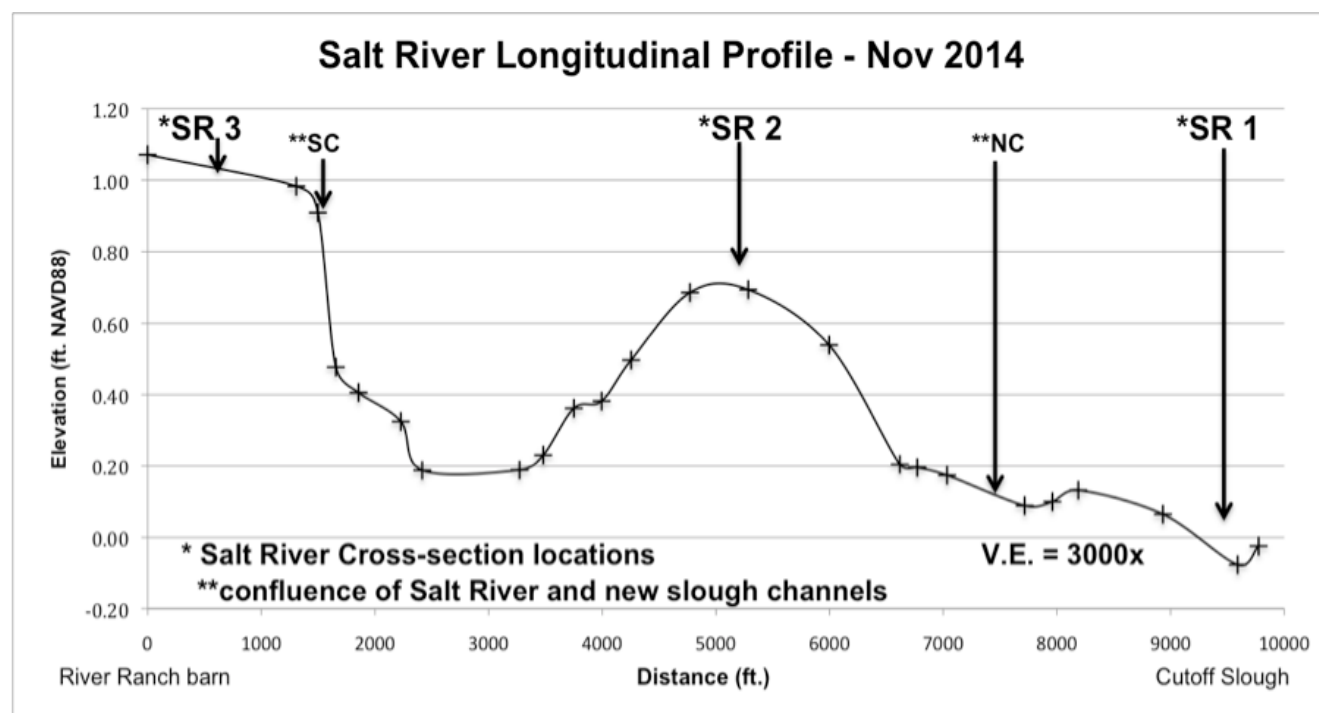


Figure 10: Longitudinal profile of the main channel of the Salt River – November 2014 from River Ranch barn to Cutoff Slough. The locations of Salt River main channel cross sections, and the confluence with the new South Channel (SC) and North Channel (NC) are indicated.

Discussion

The total relief on the 9775-foot section of the lower, main Salt River channel surveyed, from River Ranch barn to the confluence with Cutoff Slough, is 1.1 feet. Longitudinal profiles of the new North and South slough channels were not collected, however, based on the cross-section data for the sections surveyed, the relief on the new North Channel slough is 0.9 feet, the relief on the new South Channel slough is 2.4 feet. Poor visibility, high water levels and very soft sediment in the Salt River, and two newly excavated slough channels, made locating the thalweg challenging, particularly while completing the longitudinal profile. These conditions, combined with lack of sufficiently low tides during daylight hours, necessitated creative methods for collecting data, making it impossible to survey the longitudinal profiles for the two new slough channels within the time constraints of this project. Future surveys should be initiated earlier in the summer to maximize efficiency.

Appendix I:
Salt River Main Channel Cross-section Data.

SR1	
Distance (feet)	Elevation (feet NAVD88)
0.0	6.63
44.9	6.62
57.4	5.13
73.8	4.97
101.7	6.30
121.4	5.46
157.4	6.22
191.2	6.96
196.8	6.90
209.9	5.37
217.5	4.66
223.0	3.06
241.1	-0.17
249.3	0.06
260.8	0.13
276.5	0.07
283.7	-0.17
308.3	1.56
316.8	6.10
334.6	6.87
367.4	6.23
431.3	6.76

SR2	
Distance (feet)	Elevation (feet NAVD88)
0.0	7.44
31.2	7.96
99.1	8.67
154.2	7.85
187.9	9.09
211.6	8.91
232.9	7.68
238.8	5.12
241.7	3.54
255.8	1.02
273.9	0.89
292.6	1.01
305.0	1.53
311.6	3.32
313.2	4.09
313.2	7.81
319.8	7.85
349.3	7.09
403.4	6.86
437.9	8.01

SR3	
Distance (feet)	Elevation (feet NAVD88)
0.0	13.90
68.5	14.04
132.2	13.63
158.4	12.33
168.5	10.50
179.8	8.72
197.2	8.43
203.8	8.19
210.3	7.04
216.2	5.01
222.5	3.06
228.4	1.71
230.0	1.29
248.0	1.19
256.2	1.14
266.1	1.32
275.9	2.83
279.9	4.42
285.8	6.01
295.6	8.03

Appendix II:

Salt River new North Slough Channel Cross-section Data.

NC 1	
Distance (feet)	Elevation (feet NAVD88)
0	7.77
21	7.54
144	8.11
150	7.27
154	6.40
154	5.04
162	2.61
165	1.60
173	1.16
178	1.09
191	2.81
196	5.32
204	7.47
216	8.11
275	7.55
287	8.16
290	4.55
291	6.81
299	8.19
406	7.81

NC2	
Distance (feet)	Elevation (feet NAVD88)
0	4.91
53	5.65
111	6.85
122	6.45
129	4.89
129	3.82
135	2.17
137	0.74
142	0.97
148	1.56
150	3.11
152	4.91
155	5.15
161	6.46
197	7.24
320	5.35
393	5.79

NC3	
Distance (feet)	Elevation (feet NAVD88)
0	5.32
53	5.37
116	4.98
126	5.94
137	2.85
143	1.99
152	1.53
163	1.99
170	3.19
174	3.55
180	3.76
186	5.20
193	6.11
209	5.14
290	5.65
335	5.46

Appendix III:

Salt River new South Slough Channel Cross-section Data.

SC1	
Distance (feet)	Elevation (feet NAVD88)
0.0	5.79
60.0	6.93
113.2	6.66
119.1	6.75
126.3	5.04
128.9	3.87
133.5	2.92
136.4	2.11
145.3	1.70
148.6	1.62
152.5	1.81
155.8	2.31
159.4	3.83
163.3	5.38
168.3	6.82
182.4	7.02
262.1	6.52
320.8	6.43

SC2	
Distance (feet)	Elevation (feet NAVD88)
0	7.35
85	7.42
153	7.48
170	7.38
176	7.38
186	7.78
189	5.64
191	4.73
195	3.88
198	3.40
205	3.29
208	3.35
209	3.61
212	4.35
215	5.58
218	6.44
219	7.22
233	8.34
341	7.68
369	7.68
441	7.53

SC3	
Distance (feet)	Elevation (feet NAVD88)
0	5.93
81	8.06
145	9.21
179	9.27
205	9.04
206	8.29
213	6.02
212	4.28
211	4.04
218	4.02
219	4.16
219	4.77
223	6.73
223	7.66
224	8.77
231	9.10
290	8.68
344	8.71
387	8.32

Appendix IV:

Salt River Main Channel longitudinal profile data.

Distance (feet)	Elevation (feet NAVD88)
0	1.071
1308	0.983
1498	0.909
1656	0.477
1856	0.406
2228	0.325
2416	0.188
3273	0.189
3481	0.231
3750	0.362
3994	0.382
4254	0.497
4772	0.686
5284	0.694
5995	0.539
6618	0.205
6771	0.196
7034	0.174
7716	0.089
7960	0.100
8188	0.132
8933	0.065
9590	-0.076
9774	-0.024

Appendix V: Photographs of Salt River and new slough channel cross-sections:



Salt River Channel Cross section 1 –SR1. View is looking south.



Salt River Channel Cross section 2 –SR2. View is looking south.



Salt River Channel Cross section 3 –SR3. View is looking south.



New North Channel Cross section 1 -NC1. View is looking west.



New North Channel Cross section 2 -NC2. View is looking west.



New North Channel Cross section 3 -NC3. View is looking north.



New South Channel Cross section 1 –SC1. View is looking west.



New South Channel Cross section 2 –SC2. View is looking south.



New South Channel Cross section 3 –SC3. View is looking south.