Channel Profile Report: Salt River Ecosystem Restoration Project

Phase Two- Year 2020

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2 INTRODUCTION

Restoration of Phase two of the Salt River Ecosystem Restoration Project (SRERP) began in 2014 and is currently being implemented in stages. The phase two project area includes the Salt River corridor upstream of Riverside Ranch, as well as three tributaries that drain from the Wildcat Range into the main stem of the Salt River (Williams Creek, Francis Creek, and Reas Creek). One of the primary objectives of the larger SRERP is to re-establish a defined channel and riparian corridor to restore historic processes and functions in the Salt River watershed (GEC 2011). Over 750,000 cubic yards of sediment will ultimately be removed from the basin and a new, anabranching river system is being engineered along the original channel to increase sediment conveyance and facilitate fluvial interactions with the floodplain (Harvey & Associates 2012). In compliance with the SRERP Adaptive Management Plan, cross-sectional surveys and a longitudinal profile survey are conducted in the phase two project area to describe areas of erosion or deposition, deviations from restorations designs, and changes in channel planform over time.

3 METHODS

Figure 1: Locations of cross-section and longitudinal profile for phase two of the Salt River Ecosystem Restoration Project, 2019.

Elevation surveys in the Phase two project area for the 2020 monitoring year consisted of four cross-sections and a longitudinal profile (fig.1). The longitudinal profile spans a distance 3.5

kilometers from the confluence of Reas Creek to just upstream of cross-section ten. Cross-sections one, five, and seven were established in 2015 (Medel 2017) and cross-section ten was established in 2019. Each cross-section was reoccupied.

Data collected in 2020 were measured using a Trimble R10 RTK GPS unit. Upon completion of surveys, data were entered into Civil 3D which was used to create a surface and plot the cross sectional and longitudinal profiles. For survey years 2015 through 2019, a Nikon DTM-352 Total Station laser theodolite, tripod, prism pole and single prism were used. Elevations are geo-referenced, in feet, to the 1988 North American Vertical Datum (NAVD88). Horizontal locations were determined using GPS North American Datum 1983 (NAD83) in decimal degrees.

Data for cross-sectional surveys were collected across the floodplain, channel slope, water's edge, thalweg and across the bottom of the channel. The length of each cross-section varied due to private property or thick riparian vegetation that impeded access on either side of the floodplain. Measurements were taken at a minimum of 2 meter intervals across the floodplain, and at higher resolutions across areas with greater morphological complexity, though coarser resolutions were taken due to adverse environmental conditions (i.e. thick vegetation or high water levels). In previous surveys, elevation points for the longitudinal profile were collected at 60 meter intervals where possible, and coarser resolutions where made when channel height and/or vegetation prevented sighting of the prism. The 2020 longitudinal surveys data points were collected in shorter intervals when possible.

Cross-sectional profiles are presented looking downstream in the westerly direction and start on the south side of the channel (left bank) and extend to the north (right bank). The longitudinal begins (distance equals zero) at the confluence of Reas Creek and extends upstream to just upstream of cross-section 10.

Cross-section and longitudinal profiles are presented in a graph format. Selected years are presented for ease of discerning between years. The selected years will always include the first survey year and the most previous survey year.

4 RESULTS

4.1 CROSS-SECTION PROFILES

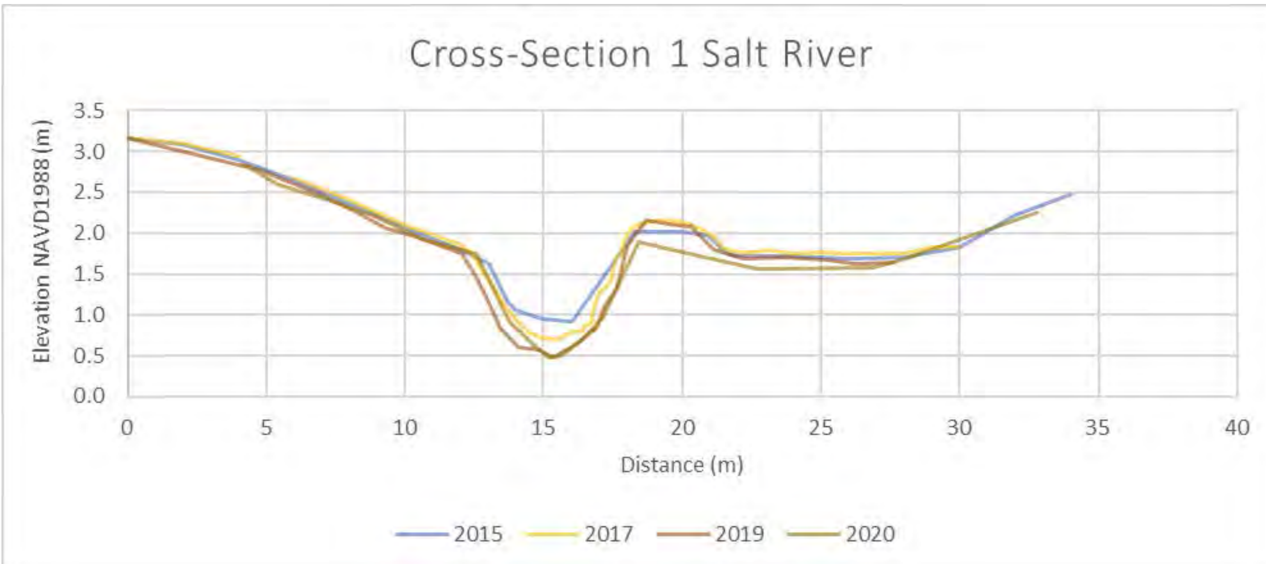

Figure 2: Cross-section one profile for years 2015 to 2020.

The profile for cross-section one (fig. 2) indicates some possible deposition on the left side of the channel since 2019, however is consistent with surveyed channel morphology in previous years. Channel bottom elevation is consistent with the 2019 survey. Since the original survey in 2015, the channel elevation has dropped by 0.42 meters. The coarse resolution on the active channel berm, above the right side of the channel, does not capture the relief of the feature. Possible minor scour and elevational lowering of 0.14 meters occurred on the floodplain compared to previous years.

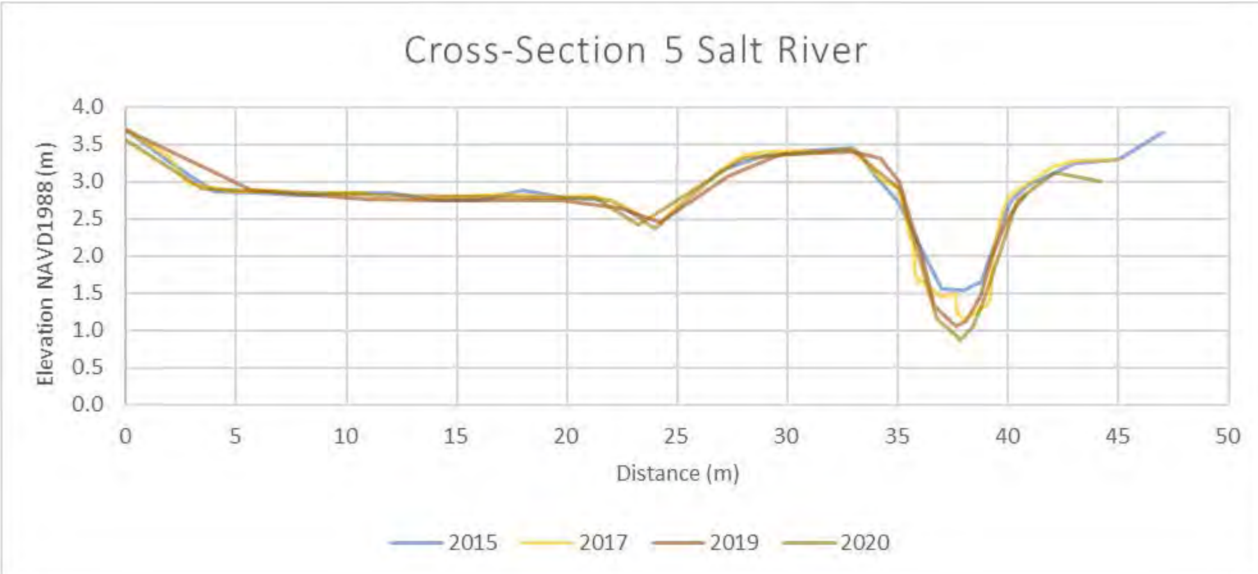

Figure 3: Cross-section five year 2018-2019.

Cross-section five closely maintained a similar configuration with 2019's survey, with a decrease in thalweg elevation of 0.19 m from the previous year (fig.3). Overall, the channel bottom has decreased by 0.57 meters since 2015. The cross-sectional profile shows floodplain elevations consistent with previous survey years.

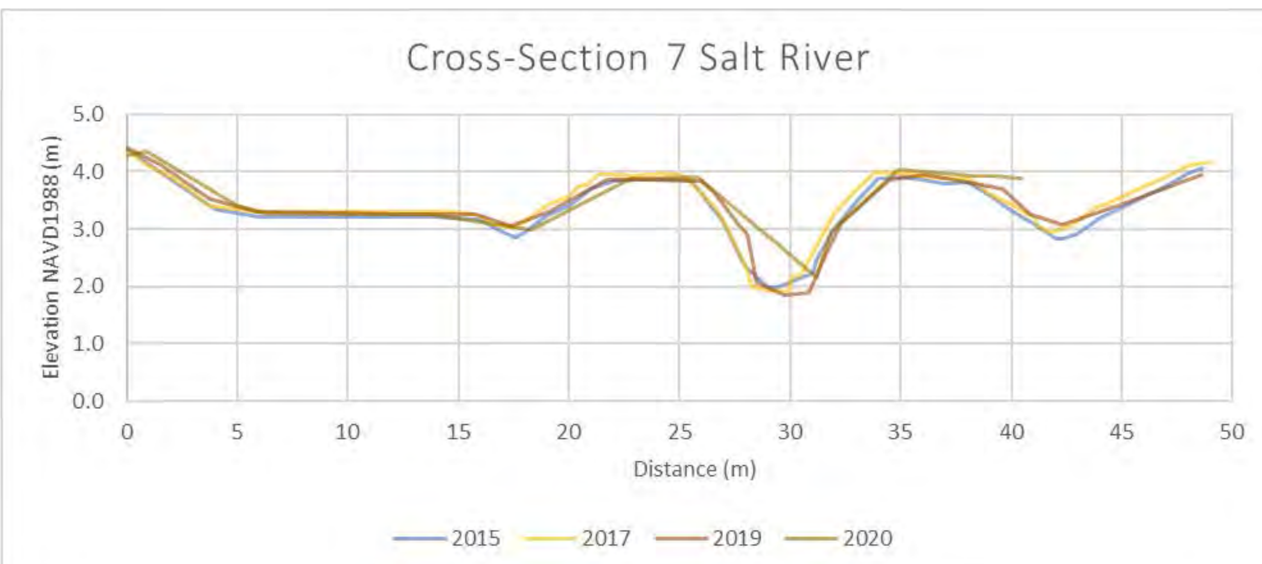

Figure 4: Cross-section seven years 2015-2019.

Current and previous surveys show consistent floodplain and active berm elevations for cross-section seven. However, the collection of the 2020 active channel data points are far too coarse to compare them to previous surveys. This may have been due to high water levels in the channel (photo 1). Some deposition appears to have occurred in 2019 on the left side of the channel and scour on the right channel bottom and side, resulting in slight widening and decrease in thalweg elevation of 0.26 m compared to 2018 (fig.4). Channel geometry remains relatively stable with potential for more lateral migration based on visual observation in the field of slumping on the right bank.

Photo 1: Phase 2 main Salt River active channel near cross-section 7

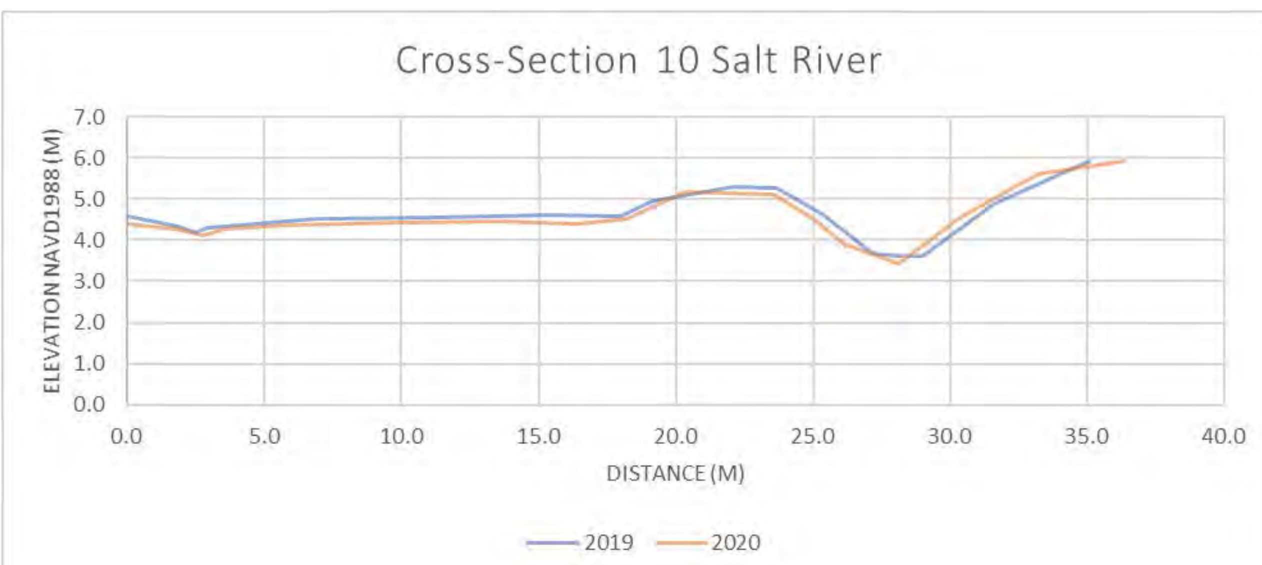

Figure 5: Cross-section ten years 2019 and 2020

Cross-section ten was established in 2019 on a reach of the restored Salt River that was constructed in 2018. The Salt River constructed upstream of cross-section ten is not connected to perennial water source as of 2021. Therefore, water entering the system upstream of cross-section ten is surface runoff during winter rain events. The deviations of surveyed points between years maybe due to typical surveying error, though some scour may have occurred in the channel bottom (0.19 meters). Deposition is unlikely.

Channel degradation is the dominant trend across transects; particularly in cross-sections one and five, which have decreased in thalweg elevation by approximately half a meter since 2015. The dynamic processes that cross-section one and five have experienced is likely due to the two sites being in an older constructed reach (constructed in 2014) compared to cross-section seven (constructed in 2015). Cross-section one and five are also influenced by daily tidal cycles, where cross-section seven and ten are not. Cross-section seven shows a trend toward erosion in the channel but of less overall magnitude than the other cross-sections.

4.2 LONGITUDINAL PROFILE

The longitudinal profile spans a distance of 3,700 meters and is presented between years 2016 and 2020. Cross-section sites are provided to show approximate locations. The sediment management area (SMA) on Francis Creek, at the confluence of the Salt River, is also shown. Data resolution is coarser in portions of the reach due to dense vegetation and excessive water depth.

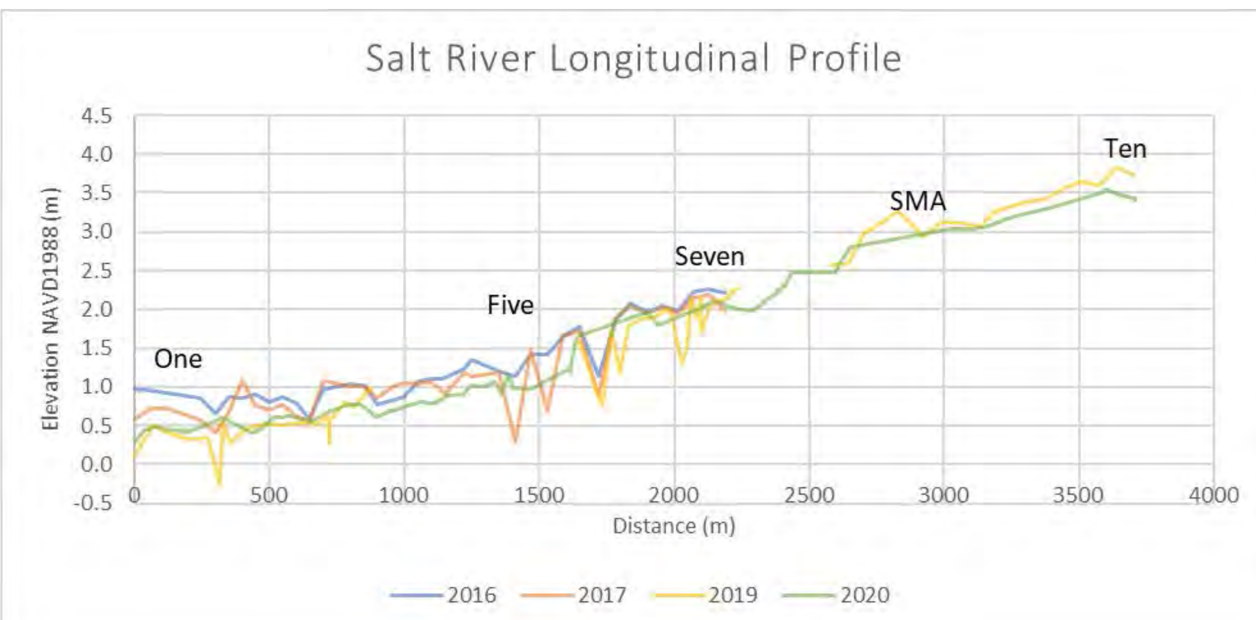

Figure 6: Phase 2 longitudinal profile of the main active channel of the Salt River.

In agreement with cross-sectional surveys, the longitudinal profile shows a dominant trend of scouring as illustrated by reductions in elevation throughout majority of the channel. However, the 2020 survey did not capture the scour holes between 400 meters to 2,200 meters. This may be due to the increased water level heights during the time of the survey. Notably, the 2019 deposition immediately downstream of the SMA was not captured in the 2020 profile due to lack of data points taken in that reach. In-channel vegetation in that reach was thick and in late 2020 vegetation was removed in a 150-foot reach in that area. Overall, the 2020 profile was consistent with the recent 2019 survey (fig. 6).

5 Discussion

In total, the data shows trends of decreased channel bottom elevations and potential net sediment transport out of the project area, which is consistent with past survey years. Channel degradation is most prominent in the downstream portions of the river as indicated by mean bed lowering in the longitudinal profile and lower thalweg elevations in cross-sectional profiles compared to previous years. In previous years' surveys, the downstream section had relatively uniform bed lowering, whereas the upstream portion had more variable sour patterns leading to incipient pool formation and greater morphological complexity.

Cross-sectional profiles indicate more lateral erosion in the lowest cross-section one site compared to the upstream sites. This could partially be due to several factors; vegetation was anecdotally observed to have propagated more rapidly in the upstream portion, these reaches are also dominated by a freshwater hydrology regime towards Francis Creek and are less tidally influenced in the middle portions compared to the lower reach near Reas Creek. Increased exposure to fluvial processes, compounded by a lack of root stabilization (as lower bank vegetation is limited in these areas) could be contributing to the higher rates of lateral erosion in the downstream portion. Conversely, riparian vegetation in the upper portions may lead to greater bank stability and less lateral erosion. Additionally, dense in-channel vegetation in the upper portions was observed, potentially causing water velocity to slow and let entrained particles settling out- thus leading to less overall change in channel geometries.

Future geomorphic surveys are required. It is recommended that surveys occur in the late fall when water levels are at their lowest in order to collect sufficient points for high resolution depiction of the active channel and when tree leaf vegetation is sparse to not interfere with equipment collecting data.

Literature Cited

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APPENDIX

5.1 CROSS SECTION ONE

Figure 7: Salt River main channel looking east in the upstream direction from cross-section one (2019).

Figure 8: Endpin marking the start of cross-section one (2019).

Figure 9: Channel (top, 2019) and aerial view (bottom, 2018) of bank slumps approximately 240 meters upstream of cross-section one. In additional to lateral erosion, vertical scour has occurred throughout survey years as shown by consistent deepening of a pool in the area (fig. 6).

5.2 Cross-section five

Figure 11: Cross-section five looking west in the downstream direction (2019).

Figure 12: Bank failure downstream of cross-section five (2019).


Figure 13: Endpin marking the start of cross-section five (2019).

5.3 Cross-section seven


Figure 14: Cross-section seven looking north across the channel transect, note dense riparian and in-channel vegetation (2019).

Figure 15: Endpin marking the start of cross-section seven (2019).

5.4 Cross-section ten

Figure 16: Cross-section ten looking upstream (2019).

Figure 17: Endpin marking start of cross-section ten (2019).

Figure 18: Cross-section ten endpin looking downstream (2020).

5.5 CROSS-SECTION LOCATIONS

Cross-section	Start		End	
	Latitude	Longitude	Latitude	Longitude
One	40.596153	-124.291790	40.596359	-124.291925
Five	40.596655	-124.277574	40.596968	-124.277332
Seven	40.594798	-124.271193	40.595225	-124.271380
Ten	40.596419	-124.256006	40.596605	-124.255673