Shawn Heiser
Joanna Christion
May 17, 2003

Calera Creek Study

Water Shed Analysis is a broad topic, which may encompass many different theories and methods. Some may be interested in studying the health of the water, soils, vegetation, aquatic and shoreline habitat, or the entire watershed ecosystem. Deciding on a watershed, discovering its potential problems and settling on the various techniques that may be used to study the creek can be a challenge.

Calera creek is a small creek found in Pacifica Ca. Calera creek is part of a larger watershed which drains from Montara Mountain. The reach that we studied was interesting because it runs right through a neighborhood called Valamar. There are houses and a road on either side of the stream. This is a fully urbanized stream, heavily impacted by the people that live all around it and have used it for decades. We expected to see the results of such close proximity to so many people.

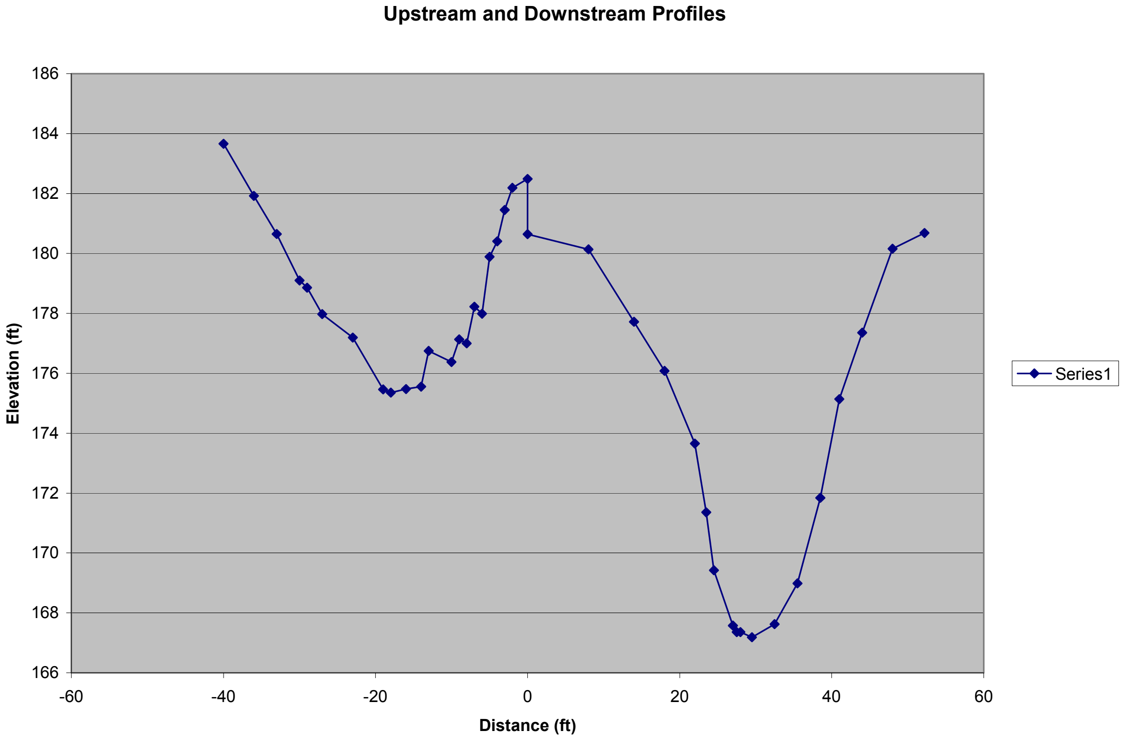
We decided to study this particular creek because of an interesting feature, a ten foot cement wall. This wall created a change in elevation between the upper and lower portions of our study area of about 10 feet. There were several morphological differences in the stream which the wall created on either side of it. We decided to study a six hundred foot reach of the stream, four hundred feet upstream, and two hundred feet downstream. Our objective was to create a baseline assessment of the area in order to provide data for future research.

We settled on gathering data for the purpose of creating a longitudinal profile above the cement wall and one below it. We also wanted to create cross-sectional profiles above and below the cement wall. We hoped to determine just how this stream was affected by this ten foot tall cement wall.

We were unable to officially determine the original reason for the placement of this cement wall; however we theorized that it was placed there in order to create a stock pond. Cattle ranching was at one time fairly common in this area and several artificially created stock ponds exist in the region. Of course the upstream and downstream portions surrounding the cement wall were at one time much closer together in elevation. The drastic differences in elevation became extremely exaggerated over the years due to seasonal heavy rains and thus heavy flows. 1982 was an exceptionally heavy flow year. The heavy rains and flows prompted a raise in the elevation of the dam from about four feet, to its current height of 10 feet. We theorized that this wall was creating fill on the upstream side and down-cutting on the down-stream side of the wall. This would account for the extreme differences in stream elevation.

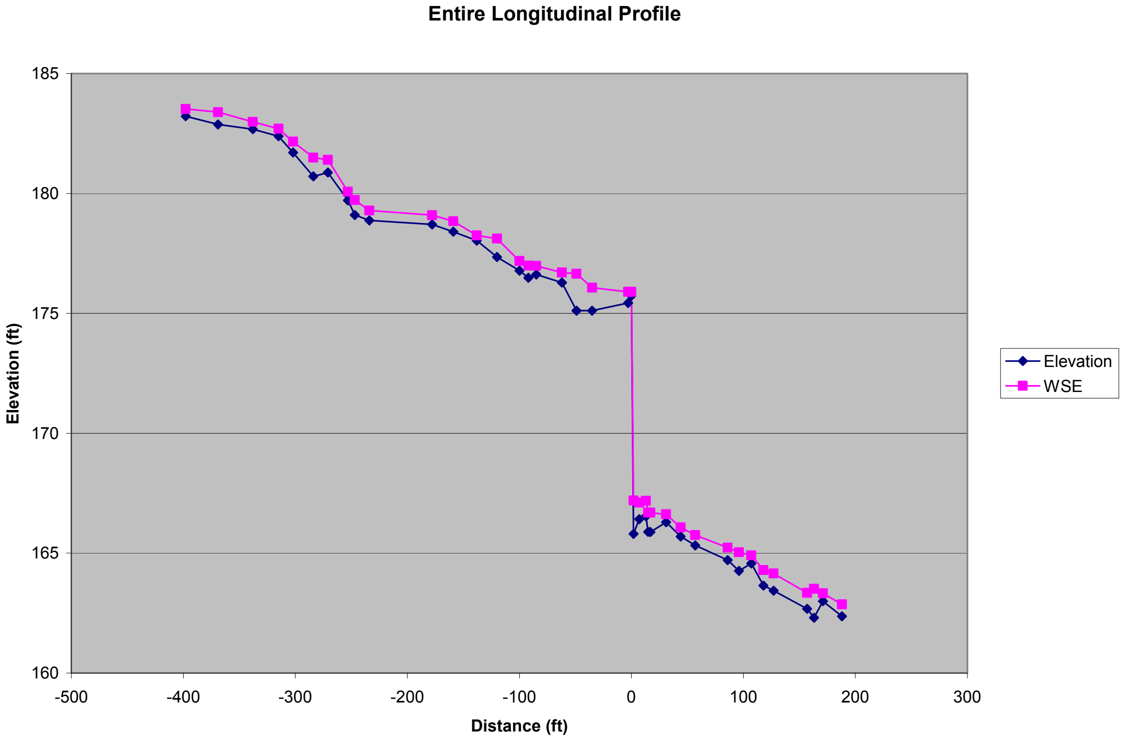
In order to measure our profiles we decided that Joanna would be the one to read the elevations through the transit device, record the readings and calculate all of the data (the brains). Shawn would be the one to lay the measuring tape, walk the creek with the stadia rod, and call out the station numbers, water depths, and substrate types while battling the aggressive nettle (the brawn). We decided that for accuracies sake we would do the same work type for the whole study rather then trading off jobs and risking confusion and inaccuracies.

Our first leg of the project was to determine the cross-sectional profile of the creek just downstream of the wall. To do this we first tied a stretch of measuring tape across the stream from the top of the left bank to the top of the right bank. This would serve to give us both a width measurement and station markers (feet measurements on the tape). We started at the very top of the wall in order to determine our bench mark elevation which was 175 feet according to our topographical map. Starting from the top of the left bank Joanna began to take intermittent readings as Shawn descended down the slope calling out station numbers and substrate type. Twice bank-full and bank-full stations were identified and recorded also for future calculations. When Shawn reached the stream itself he also called out the waters depth at the thalweg. Between each station a new elevation was calculated and recorded. The same was done for the upstream portion of the creek. Our results after entering the data in an excel program expressed the predictions that we had made. The left cross-section is upstream while the right cross-section is downstream.



The effects of the wall on these two sections of the stream, which were only about fifty feet apart, were quit dramatic. It shows that there most probably has been a lot of fill above the wall, which would account for its noticeably shallow profile. The entrenchment ratio for upstream was 1.7. According to the Rosgen classification system this makes the stream above the wall moderately entrenched. The width to depth ratio for this section is 7.7, meaning that the stream is seven times wider then it is deep at bank full. The downstream profile also reflects our predictions, only more dramatically then we expected. As the water flows toward the wall the much of the heavier sediment is stopped by the wall, the water flows over, drops several feet and lands below. The impact of the water as it hits the stream bed below, causes scouring and down-cutting to occur in the lower stream bed. You can see that over the years the scouring has been severe. This scouring has resulted in a downstream entrenchment ratio of 1.4. Again according to Rosgen, the stream would be classified as entrenched. The width to depth ratio in this section is 5.5, meaning the stream is five times as wide as it is deep. This is again a number that we would expect because of the scouring which has caused the stream bed and bank to be cut so narrowly.

Our next project was to look at the walls effect on the longitudinal profile of the stream. The first longitudinal profile that we did was the downstream section. Shawn laid out 200 feet of measuring tape along the thalweg of the stream. Again each foot marker indicated different stations along the stream. On the downstream longitudinal profile we were lucky. We could see all two hundred feet from one position. This meant that Joanna was able to sight the bench mark of 175 feet on the top of the wall, and all the intermittent stations along the two hundred foot stretch of stream. As Shawn walked along the stream bed calling out station numbers, he also called out the substrate type as well. We expected the substrate to be rockier downstream and to have more silts and sands upstream due to the dam. After we had gathered all our longitudinal data for the downstream section of the stream we started the upstream portion. The difference with this section was that we studied four hundred feet rather then the two hundred feet downstream. We did this because we predicted that the dam would influence the longitudinal profile too much within the first two hundred feet of the wall. Therefore, we went back an extra two hundred feet in order to show any flatting out of the stream as we got closer to the wall. We had to do several turning points to see the entire stretch of the upstream portion of our study. The turning points turned out to cause our statia rod reader some problems. At the first turning point Joanna read the wrong cross hairs and threw the elevations off by one foot (what a retard)! We had to go back out, re-due all the turning points, and then correct all the data. We were successful however and we got interesting, but predicted results.



The stream was not as steep above the wall due to the sediment fill and the downstream portion was a bit steeper due to all the scouring and down-cutting. As Shawn tromped through the creek he also noticed that the fill above the stream created a much muddier, softer stream bed, while the downstream portion had a more rockier, firm feel to it. This was as predicted. This graph also nicely illustrates the extreme difference in elevation between the two reaches. The slope upstream is .020, which is fairly steep. We derived the slope by dividing the change in water surface elevation (7.64ft) by the length of the stream studied (400 ft). The downstream slope was derived by dividing the change in water surface elevation (4.33 ft.), by the length of stream studied (200 ft), and we found a slope of .020. The slope of the valley is .03. We derived the slope by using the elevation change on the topographical map divided by the length of the valley. Using both the stream slope and the valley slope we derived our sinuosity for upstream to be .67, (.020/.03), and the sinuosity downstream to be .73 (.022/.03). These calculations put the upstream portion into the B classification and the downstream portion into the G classification according to Rosgen.

The effects of the wall on this stream are easy to see visually; however deciding what other effects there may be as a consequence to this wall is a little more difficult. For example what are the effects on migrating animals? Frogs and salamanders may be able to get around it. Fish and micro-invertebrates on the other hand would absolutely not be able to get upstream past that wall. So what is the possibility of removing this cement wall? That is hard to say. The ten foot difference in elevation between the upper and lower portions of the creek would be quite a challenge for removal. The fill in the upper portion would have to be dug out, and possibly put in the lower portion of the creek in order to lower the upper portion and raise the lower portion. In order to prevent mass loss of soil you would possibly have to divert the stream and add plenty of gravel, cobbles and boulders while you adjusted the elevations. This would be hard in this particular area though because of the entrenchment. Regardless of how the wall is removed, it would be a difficult and costly venture.