Sopers Branch Tributary Assessment

During the month of May 2014, CPJ field staff performed Rosgen Level I-III stream assessment and geomorphic data collection. This work included measurement of two permanent cross sections, relative measurement of approximately 300 linear feet of stream longitudinal profile, two pebble counts and evaluation of bank erosion and near bank shear stress. The two cross sections (XS) were installed at riffle facets. Cross sectional data included locating the following bank and bed features: top of bank, bottom of bank, left and right edges of water, bankfull elevation and thalweg (deepest part of channel). Bankfull channel dimensions (width, mean depth, max depth, cross sectional area, etc.) were calculated after determining the bankfull elevation from the cross section survey. These channel dimensions are used as input variables in several estimation methods to determine bankfull discharge and velocity. "Bankfull" is defined as the elevation associated with the channel-forming discharge which is typically between the one and two-year storm events in the urbanized Piedmont.

Bed material size distribution was determined from Wolman pebble count analysis at the cross sections. The particle analysis provides roughness characteristics useful in determining bankfull discharge and velocity. The water surface measurements are utilized in determining the average water surface slope. The water surface slope and roughness characteristics defined by the D84 particle size are additional parameters used in the estimation methods to determine the bankfull discharge and velocity.

The Soper Branch stream is divided into four reaches based on variations in physical characteristics including channel geometry and hydrology.

Reach 1 begins at the outfall at Frederick Road and transitions from a riprap lined channel to a narrow channel with extremely low banks. Vegetation is present up to the edge of water resulting in small debris jams along the drainage path. Runoff from Frederick Road and surface flow from the surrounding wetland enters the stream at several locations along the right bank. Bank heights are extrememly low and average from approximately 0.5 to 0.75 feet. Bed materials are dominated by very fine to fine silt/sand. Although no cross section was measured within Reach 1, a visual assessment and approximate measurements show that Reach 1 has a low slope, high width to depth ratio, and can be classified as a Rosgen type C channel. All stormflows in this Reach have to access the floodplain and support the adjacent wetland hydrology. An extremely high amount if invasive species and several small nick points, created by vegetation and small woody debris also characterize this reach. Reach 1 ends at the first of several significant headcuts, nearing 2-feet-deep, located at station 1+44.5.

Reach 2 begins at the headcut and continues downstream to station 1+81. Reach 2 includes approximately 33 linear feet of a tributary (referred to as Tributary 2) which has been created by the migration of another headcut. This tributary exhibits the same characteristics as the mainstem channel within Reach 2. Reach 2 is highly entrenched and all banks are steep. Bank heights average approximately 3-feet-tall and bed materials are slightly larger than in Reach 1 and range from very fine silt/sand to medium gravel. The channel slope and bank widths are also significantly higher than in Reach 1. One measured cross section was performed within Reach 2 at station 1+52. Reach 2 can be classified as a relatively unstable Rosgen B channel. BEHI scores are high, indicating that the channel is

continuing to degrade through active bank erosion. Reach 2 ends just below the confluence with Tributary 2 at Station 1+85 at the start of a lateral bench.

Reach 3 is 30 feet in length and extends from the start of the lateral bench downstream to station 2+11. The reach is characterized as a stable B channel with bank heights measuring approximately 3-feet-tall and the least vertical banks within the study area. The lateral bar along the right bank is well vegetated and bed materials range from sand to large cobble. Substantial tree roots from an undercut 34-inch-diameter tulip poplar currently stabilize the right bank. One cross section was measured with Reach 2 at station 2+34 across the lateral bar. BEHI scores indicate a moderate rating and support observations that this reach is the most stable and contributing the least amount of eroded bank materials to the downstream portion of Soper Branch. However, it should be noted that if active headcuts currently located downstream of this reach migrate upstream, the tulip poplar could be impacted and alter the stability of this reach.

Continuing downstream from the tulip poplar defining the end of Reach 3, channel conditions significantly worsen. Although this reach is outside of the study area, visual observations show that Reach 4 can be classified as a highly unstable Rosgen G channel. The stream profile was continued into this area by approximately 17 feet beyond the tulip poplar to end at the next riffle. Bank heights increase again to 3.5 and 5.7-feet-tall on the left and right banks, respectively, and are nearly vertical. Bank conditions and exposed tree roots suggest ongoing significant channel bed and bank erosion. BEHI scores for this short section are high.

Monitoring:

Due to the actively eroding existing conditions present at the Little Bennett Soper Branch tributary, several bank and bed pins were installed. The purpose of these pins is to monitor the rate of channel degradation and headcut migration, if any, upstream toward the Comus Road outfall. Results of the bed and bank pin monitoring will be helpful ensuring that applicable stormwater treatment(s) to protect the existing natural resources present within this portion of the Little Bennett Campground are installed. This will ensure that the natural features present are able to persist and will be appreciated by those utilizing the new trail.

A total of three rebar were installed at the upstream limit of each headcut present at the time of the field assessment. All rebar installed was 6-feet-long. One rebar was installed along the mainstem at station 1+44.5 and approximately 1.1’ of the rebar remained out of the ground (Image 1). The remaining two rebars were installed at headcuts that delineate the start of Tributary 2 and are approximately 0.5’ out of the ground.

In addition to the rebar installed to monitoring the potential migration of the existing headcuts, three bank pins were installed in the mainstem channel. Mainstem bank pins are located within the right bank at 1+48.22, upstream of the current location of the confluence with Tributary 2. The length of each rebar that remained out of the bank was recorded and will serve as the baseline data for comparison

with future measurements. Additional measurements detailing the spacing of the pins were also recorded. The baseline measurements were as follows, where Pin #1 is the closest to the channel bottom and the length of rebar exposed was measured at the bottom of the rebar (Image 2):

Pin #3 – 0.52 rebar exposed

Pin #2 – 0.55’ rebar exposed

Pin #1 – 0.52’ rebar exposed

Bullets:

- **Reach 1: Moderately stable C channel, low gradient, very low banks with access to flood plain, fine bed material**
- **Reach 2: Unstable B channel, several headcuts present, widened channel with steep banks, and fine to medium bed material, increased channel slope and increased entrenchment.**
- **Reach 3: Short, stable B channel with a well-established lateral bar, least steep bank slopes, and larger average size of bed material, stabilized by significant tulip poplar tree**
- **Reach 4: Highly unstable G channel, near vertical high banks, highest degree of actively eroding bed and banks, several headcuts present**

Image 1

Image 2