RIPARIAN BUFFER ASSESSMENT

A rapid vegetation assessment and physical survey of the Upper Granite Creek Watershed was undertaken to assess the current functionality of the watershed channels in terms of their ability to filter pollutants from runoff. This assessment was completed by Dr. Marc Baker of Southwest Botanical Research of Chino Valley, AZ. Properly functioning riparian areas should be able to slow down surface runoff and filter out both nutrients and *E. coli* bacteria, which are pollutants of concern in this watershed.

Survey Methods

Channel features affecting the effectiveness of the riparian area at intercepting and filtering surface runoff included percent cover of substrates, diversity of vegetation species and height classes, vegetative area width, roughness, and angle and length of bank slope.

Measurements were taken along 10 meter transects that ran perpendicular to stream reaches. Data was collected along the following creeks, within the City of Prescott, unincorporated Yavapai County, and Prescott National Forest: Aspen, Banning, Butte, Granite, North Fork Granite, Manzanita, and Miller.

Three hundred and sixty transects were completed along 39 creek miles in the upper watershed (**Fig. 12**). Transect location coordinates were selected based on the length in meters from the beginning point to the end point of each creek using a table of random numbers to determine the distance between transects.

A 10-meter transect length was selected. Literature indicates that the 10 meters of vegetation immediately bordering a waterway is desired *minimum* width of a buffer zone (Mayer, Reynolds, and Canfield, 2005). Wider riparian areas would be more effective, but not frequently observed in this watershed.

Creeks and their associated transects were categorized as either Urban (City of Prescott or unincorporated Yavapai County) or Forest (Prescott National Forest). At least 30 transects in each category were collected along each creek so that data analyses could determine the impact of urban development on riparian conditions.

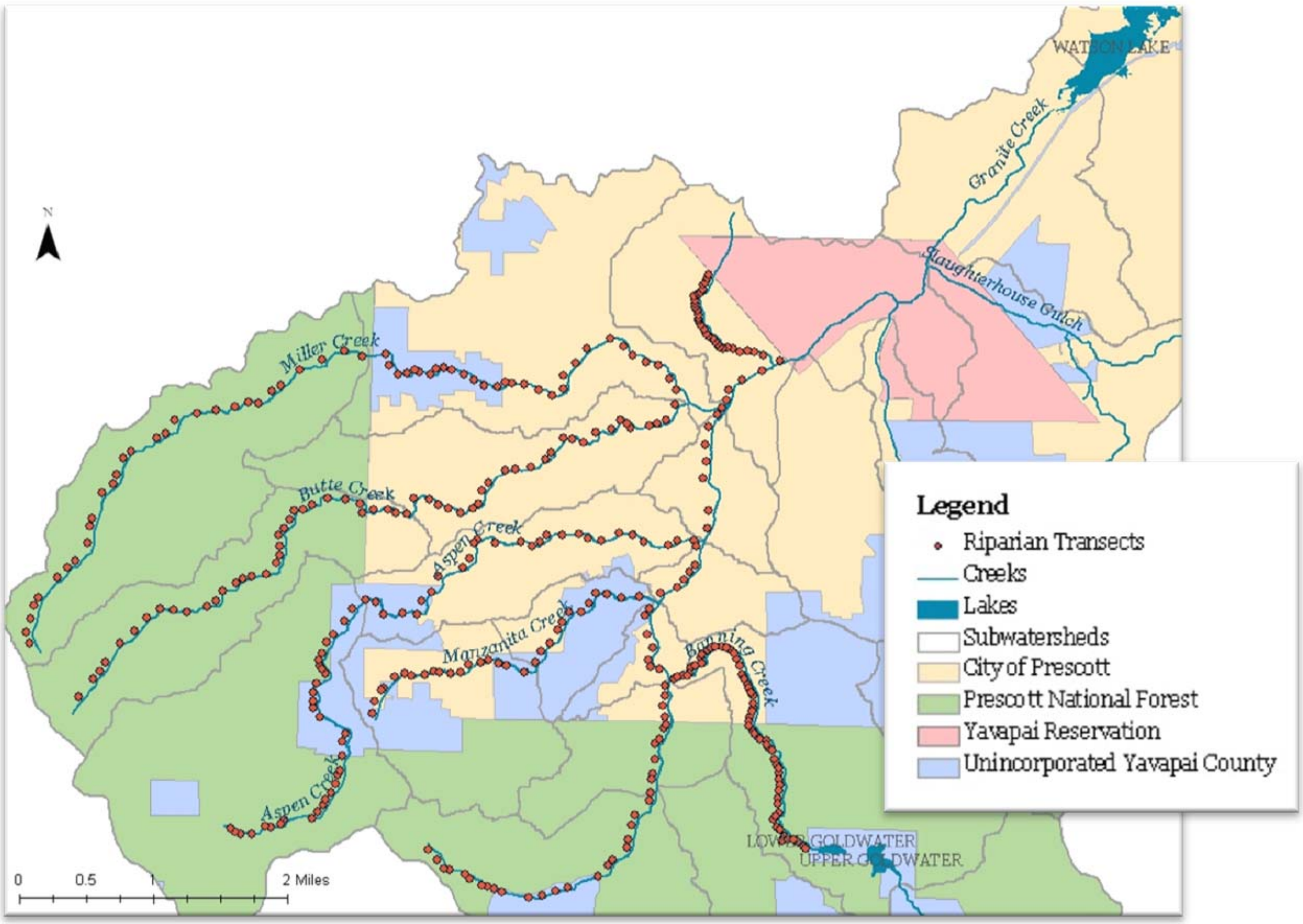

Figure 12: Riparian Buffer Transect Locations

Locations for the riparian buffer assessment transects were randomly selected with at least 30 transects in the urban area and forested area along each creek.

Riparian Transect Analysis Methods

The information gathered along each transect was used to develop two scores: a Riparian Score (**Fig. 13**) and a Bare Soil Score (**Fig. 16**).

The higher the Riparian Score, the more effective the riparian area along that transect should be at removing nutrients and bacteria. The riparian conditions could be compared at these transect locations along the creek, between streams, and between land uses (forest or urban). The highest

Riparian Scores indicate reference conditions – conditions that could be used as goals for future water quality improvement projects in this watershed.

The amount of bare soil along a transect (the Bare Soil Score) indicates potential for riparian enhancement or restoration projects to improve habitat conditions along the creek, and therefore, water quality in the creek. It is important to note that severe flooding occurred in January 2010, prior to the assessment. The percent of bare soil may have increased due to the scouring effect of the flood, but should be consistently higher across the watershed.

Riparian improvement projects and education would have the greatest potential for making a difference in water quality by targeting areas with transects that had both a low Riparian Score and a high Bare Soil Score.

Riparian Scores

Each transect was given a Riparian Score based on four categories:

- Percent vegetation (0 to 100)
- Potential nutrient and bacteria uptake based on vegetation classes (0 to 100)
- Surface roughness (0 to 100)
- Slope (0 to 90)

Riparian scores are shown in **Figure 13**. Those transects with higher riparian scores were more likely to have more vegetative cover, a greater diversity of vegetation species and height classes present, greater ground cover such as litter or duff, a lower slope, and a wider riparian area. Transects with lower riparian scores are likely to have little to no vegetation, occur in disturbed areas, or have limited width due to human activities or structures. Examples of transects with high and low riparian scores are shown in **Figures 14** and **15**.

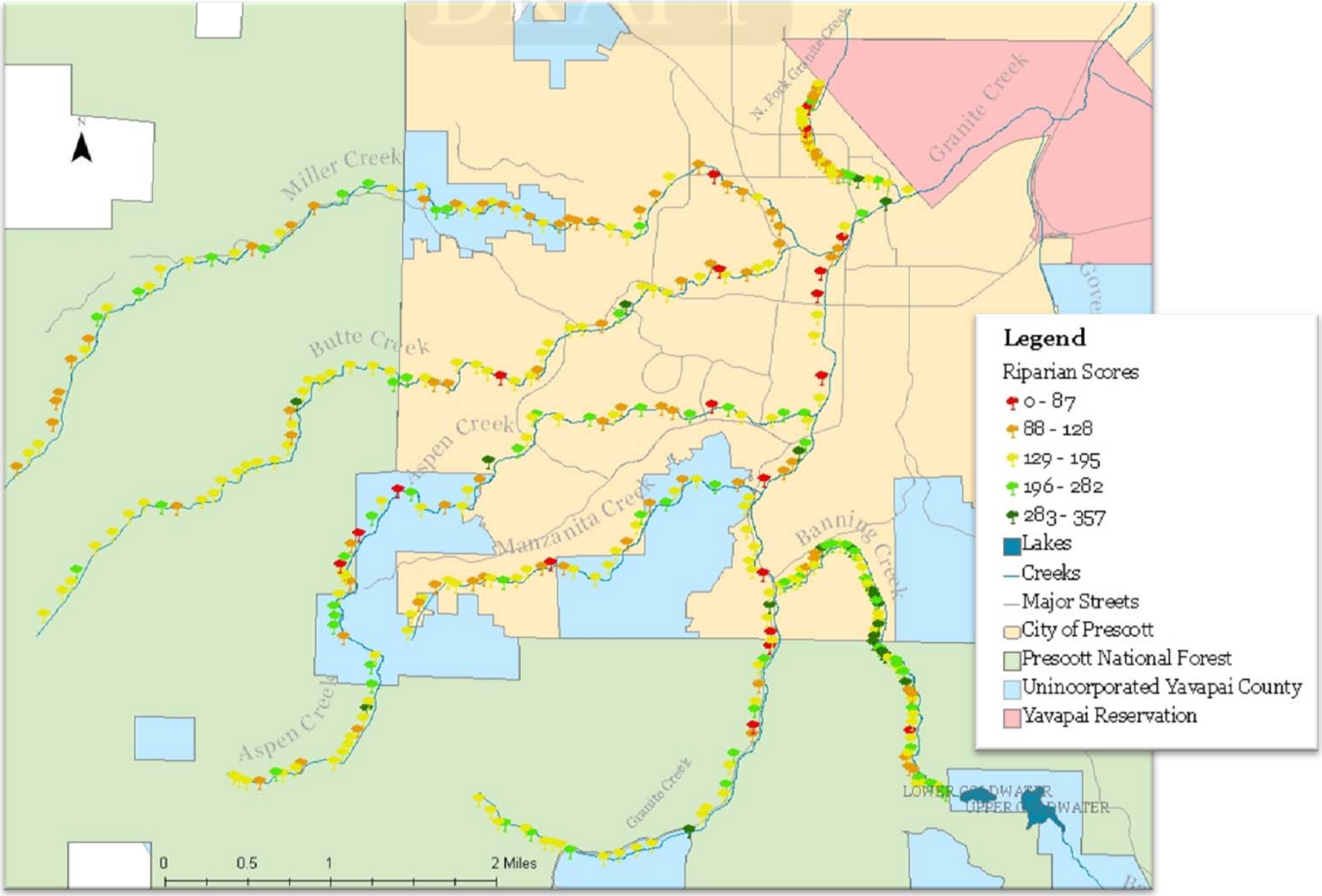

Figure 13: Riparian Scores Map

Each transect was assigned a “riparian score” based on the percent vegetation along the transect, vegetation classes, surface roughness and slope. Transects receiving the highest and lowest riparian scores are scattered across the watershed, appearing in both the urban and forested areas. Riparian impacts are not isolated to only a couple of streams.

Figure 14: High Riparian Scores

Transects along Granite Creek (left) and Banning Creek (right) received some of the *highest riparian scores*. Higher riparian scores reflect greater vegetation cover and surface roughness along the transect as well as low bare soil.

Figure 15: Low Riparian Scores

Transects along Granite Creek downtown (left) and Manzanita Creek (right) received some of the *lowest riparian scores*. Contrasted with the photos depicting high riparian scores above, these photos demonstrate that areas with less vegetation, more bare soil, and structures—like rock walls and paths—were likely to receive low riparian scores.

Bare Soil Scores

a) 1 if soil
b) 0 if any other category

Bare soil scores are shown on **Figure 16**. The amount of bare soil encountered along a transect may indicate opportunity for re-vegetation or other methods to improve riparian conditions. Transects crossing structures (roads, paths, buildings) may have a very low riparian score, but these structures are too costly to remove, therefore limiting the opportunity for riparian improvement at that site. In general, the Bare Soil Scores indicate potential “opportunities” for improving riparian conditions. Examples of high and low bare soil scoring transects are shown in **Figures 17** and **18**.

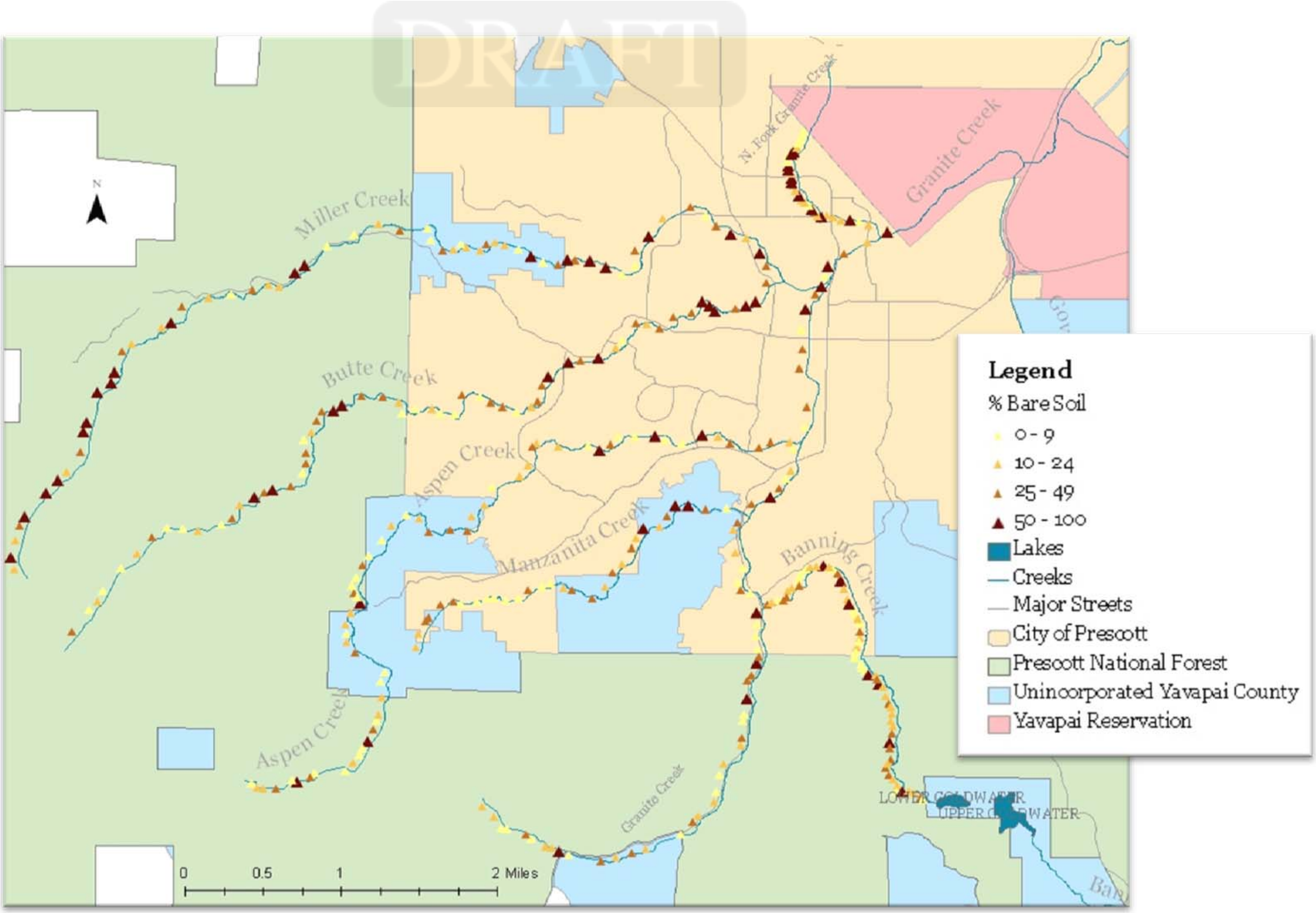

Figure 16: Bare Soil Map

Each transect was assigned a bare soil score based on the percent of bare soil encountered along the transect. High bare soil scores are correlated with low riparian scores, generally indicating a lack of vegetation. In some cases, a high bare soil score indicates opportunity for improvement through riparian restoration.

Figure 17: Low Bare Soil Scores

Transects along Manzanita Creek (left) and Granite Creek (right) received some of the *lowest bare soil scores*. These photos portray transects where ground cover—vegetation, litter, or duff—was prominent.

Figure 18: High Bare Soil Scores

Transects along Banning Creek (left) and Granite Creek (right) received some of the *highest bare soil scores*. Contrasted with the photos above, these photos show less ground cover and more exposed soil and rock.

<u>Conclusions</u>

Transects receiving the highest and lowest riparian scores are scattered across the watershed, appearing in both the urban and forested areas. The highest and lowest scoring transects are *not* segregated by land use even though the upper portion of the watershed (the forest) should be less affected by human activities. Riparian impacts are not isolated to only a couple of streams. Poor riparian conditions can appear adjacent to the best riparian conditions.

Transects in the highest bare soil category (50-100%) occur across the watershed. Transects in the 50-100% bare soil category frequently occur in clusters along Miller, North Fork of Granite, and Butte creeks. The lowest bare soil category (0-9%) occurs in clusters along Manzanita, Granite, and Butte creeks. Banning Creek, which had the highest riparian scores, also has a mixture of bare soil scores.

Another comparison of stream segments looked at the number of transects in the highest and lowest categories and the average riparian scores along each creek segment (**Table 6**). The highest average scores occur on Banning Creek in both the urban and forested segments. Urban Banning Creek has the greatest number of transects in the highest-scoring category. Only Miller Creek and urban Manzanita Creek did not have any transects in the highest riparian score category. Miller Creek had the greatest number of transects in the lowest riparian score category with at least 25% bare soil – in both urban and forested areas. Transects with the lowest riparian scores with at least 25% bare soil occurred in both urban and forest areas.

Table 6: Transect Comparisons by Creek Segment

Urban and forest creek segments were compared by the number of transects falling into the highest and lowest riparian score categories. Banning Urban and Banning Forest had the most transects in the highest riparian score category while Miller Urban and Miller Forest had the most transects in the lowest riparian score category.

Creek Segments	Riparian Score Category		Average Riparian Score
	Highest	Lowest With High Bare Soil Score	
Aspen Urban	1	5	168
Aspen Forest	1	4	171
Banning Urban	7	0	217
Banning Forest	4	3	201
Butte Urban	1	6	151
Butte Forest	1	0	162
Granite Urban	3	5	151
Granite Forest	1	2	175
Manzanita Urban	0	3	149
Miller Urban	0	13	146
Miller Forest	0	7	151
N. Fork Granite Urban	1	3	149

Further details on the methods and findings of the riparian buffer assessment can be found in the document “Analyses of a vegetation and physical survey of the upper Granite Creek Watershed, Prescott, Arizona in 2010: an assessment of riparian function.”