

Tahlequah Town Branch: Basin

NW SW NE section 4-16N-22E

Cherokee County

Latitude: N 35° 53' 49.1"

Longitude: W 94° 58' 13.4"

WBID: OK121700-03-0040G

Blue Thumb Volunteer Monitoring Data Review

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Description of Watershed and Monitoring Site:

Town Branch Creek is gravel dominated clear water stream located in the Ozark Highlands level III eco-region and drains approximately 9500 acres which ultimately flows into the scenic Illinois River. Its headwaters begin a couple miles north of the City of Tahlequah as well as from a perennial spring-fed headwater located at the Boys Methodist Home on the west side of Tahlequah. Town Branch Creek has significant ground water influence due to the multiple springs feeding into it. Land-use in the watershed is predominantly urban with significant agricultural uses in the headwaters. Town Branch Creek's monitoring site near Basin St. is located below most of the City's major outfalls, therefore exhibiting some of the classic problems of urban streams such as increased peak flows, accelerated bank erosion, down cutting, and increased sediment and pollutant loads.

Stream Condition & Habitat Overview:

Town Branch Creek at Basin Street is an extremely straight reach with little or no sinuosity. It has a relatively intact left riparian corridor with a significantly degraded corridor on the right. Bank stability, as with most urban streams, has been compromised by increased flow and velocities directly related to development and increased impervious surface area in the watershed. Given this, Town Branch Creek does not show the extreme impact that some urban streams experience. The effects of sedimentation on Town Branch Creek are surprisingly minimal leaving available habitat in the form of gravel/cobble riffles that offer a high quality home to bugs and certain species of fish. The occurrences of pools or deeper waters are moderate and thus offer some available habitat to pool dwelling fish species. Stream flow for the site can range

from seasonal base flows of 4-12 cubic feet per second (cfs) to extreme runoff events of 1000-2000 cfs. Ozarkian streams tend to be very flashy, meaning they rise really fast and drop really fast due to local geology, and in this case, the effects of urbanization. Canopy cover or shade on this reach of Town Branch Creek is high quality, offering plenty of shade in the hot summer months when high water temperatures can be problematic.

Biological Conditions

Fish

Fish assessments were done on 8/28/2002 and again on 7/16/2008 using seining as the method of collection. Total numbers of species from the collections were 12 and 9 respectively. This compared to 17 species for a reference or high quality stream in the same eco-region. The difference in species numbers is more than likely typical and to be expected in an urban stream. Increased peak flows and rates of erosion tend to create a very unstable substrate or creek bed, therefore degrading the quality and quantity of available habitat for fish. The numbers of intolerant fish species found in Town Branch Creek comprise nearly half of the total number of fish species collected in both sampling events. This is a good sign that the stream has not degraded to the point of being able to support nothing but tolerant species. Many urban streams are dominated by tolerant fish species due to the extreme physical and chemical conditions created by urban land-use. Town Branch Creek is without doubt affected by urban land-use, but in general seems to escape some of the major problems associated with urban streams. There are many variables that could play a role in maintaining the relatively good condition of Town Branch Creek, such as a relatively small urban population, confining geologic features, little or no industrial land use, and ground water influence (springs). Overall comparison to a regional reference stream shows that Town Branch fish communities are somewhere around 80% that of reference conditions.

Benthic Macroinvertebrates (bugs)

Macroinvertebrate communities have been sampled every winter and summer in Town Branch Creek since the summer of 2001. Taxa richness or total number of species for winter collections averaged about 16 species compared to 22 from a reference stream. Summer bug samples averaged 18 species compared to 20 in a reference stream. The total number of species tends to increase with increased water and habitat quality, and in general species diversity goes up as well. Diversity is a common measure of

ecological health reflecting well balanced communities, or ecosystems. The Shannon-Weaver Species Diversity Index measures the evenness of species distribution. It increases as more species are found in the sample and as individual species become less dominant. Town Branch bug data was plugged into this index and compared to data from a regional reference stream. In most collections, summer and winter, Town Branch bug communities showed to be more diverse than the reference stream. So, just because total species present was more in the reference stream doesn't mean that the bug community is as well-balanced. Town Branch Creek had a better distribution of different species than did the reference stream. Again, this shows Town Branch Creek to be a rather healthy stream even with the urban impact. Overall the bug communities are healthy, stable, and well-balanced and in some instances better than the reference condition.

Bacteria:

Bacteria samples were taken on five different occasions with the last one being taken on June 24, 2004. Of the 5 samples taken 3 of them were higher than the state standard for *E. coli* in a primary body contact waterbody. Town Branch Creek is currently on the state's 303d list. The 303d list is generated by state water quality agencies and is a list of streams that are not meeting water quality standards given a specific beneficial use such as primary body contact. Streams that do not meet the state standards generally have to develop Total Maximum Daily Loads (TMDL's), which are intensive studies that give discharge limits to different sources of pollutants, ultimately leading to compliance with the state standard. The potential source of *E. coli* is unknown and could be a combination of a number of sources. Urban streams are notorious for having high bacteria numbers, especially during a stormwater runoff event. Table 1 below shows the dates and the values of bacteria samples taken at Town Branch Creek: Basin.

Table 1. Bacteria sample dates and results for Town Branch Cr: Basin.

Date	E.coli cfu/100ml	State Standard
July 26, 2001	580	405
July 18, 2002	727	405
August 22,2002	167	405
Sept. 19, 2002	2419	405

June 24, 2004	280	405
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Water Chemistry

Water Chemistry data generated by Blue Thumb has been collected fairly routinely on Town Branch Creek since August of 2001. Parameters tested include: Dissolved Oxygen (DO), pH, Nitrogen, Orthophosphate Phosphorus, and Chloride. Oxygen saturation in aquatic systems is extremely important to the health of the fish and bugs that live in it. Oxygen levels too low or too high can be problematic leading to loss of sensitive species, diversity and even major fish kills. Town Branch Creek had an average percent oxygen saturation of 115%. This falls well within normal expected values for a stream in this eco-region. Another important water quality parameter is pH. pH is the measure of the acidity or alkalinity of an aqueous solution, in this case water. Most streams in this region have a pH ranging from 6 to 9. Town Branch had an average pH of 7.7 which also falls within the normal ranges of pH for a stream in the Ozark Highlands eco-region. Soluble nitrogen or biologically available nitrogen is nitrogen that can be taken up by living organisms, both plants and animals. Soluble nitrogen is essential for algae and plant growth, thus is an important parameter when looking at water quality. Town Branch Creek has an average of 2mg/L of soluble nitrogen. This number is rather high but probably to be expected given the urban and agricultural land-use in the watershed. Fertilizers, animal excrement, and raw sewage are all examples of possible sources of soluble nitrogen pollution. Perhaps one of the most important parameters with regards to having negative impacts on aquatic systems is phosphorus. Phosphorus is a major concern in the Illinois River Watershed and has brought much attention and remediation money into the area. Phosphorus tends to be the limiting nutrient, or in other words, the one nutrient that causes major algae and plant growth in its presence. Lake Tenkiller is the Impoundment or lake that receives all the water from Town Branch Creek and the Illinois River watershed. It is now considered a hyper-eutrophic lake, characterized by excessive nutrient concentrations such as nitrogen and phosphorous and therefore resulting in excessive productivity. Such waters often have significant algal blooms and periods of oxygen deficiency which are inhospitable to the organisms living in it and the humans who use it. It is amazing that one little chemical can have such a profound impact, economically, and environmentally. Phosphorus numbers in Town Branch Creek measured as orthophosphate phosphorus, averaged 0.067mg/L. This is a little high but again probably to be expected given the land-uses in the watershed. Finally, we have chloride. Chloride is a compound formed when chlorine picks up a negatively charged ion. It is the most common form of chlorine in the environment and is essential in the day to day function of generally all living things.

Common sources of chloride pollution are agricultural activities, industrial activities, oil and natural gas extraction, salting of streets, municipal tap water, and many more. Town Branch chloride numbers averaged about 15 mg/L. Public drinking water standards and state water quality standards require chloride levels to be below 250mg/L. Town Branch Creek is well within the tolerable ranges of Chloride.

Synopsis

Overall, Tahlequah Creek is a surprisingly healthy stream. It does show the negative effects of intense urban development on the physical habitat of the stream, but biologically speaking it is moderately healthy. Chemically it shows increases in the parameters that you would expect to see increases in, like nitrogen, phosphorus, and bacteria, but not to the extent of being toxic or detrimental to aquatic life. It is important for the future of the creek that conscious efforts be made to limit the impact of development and impervious surfaces on the physical and chemical aspects of the stream. New stormwater requirements around the country are a great first step towards managing our urban watersheds responsibly. Innovative new stormwater technologies and Low Impact Development (LID) are essential to maintaining the quality of Town Branch Creek in the future.