Walnut Creek: Purcell

NE1/4 NE1/4 NW1/4
Section 13-6N-2W
McClain County, OK
Latitude N 34° 59' 56.94"
Longitude W 97° 21' 44.7"
WBID#: OK520610-03-0010E

Blue Thumb Volunteer Monitoring Data Review – 1 December 2007
Written by: Jack C. McNeely

Description of Watershed and Monitoring Site

Walnut Creek is a multi-forked stream, draining a watershed basin of approximately 200 square miles in the Central Great Plains ecoregion of central Oklahoma. Land use in the basin is diverse; agriculture row crops, unimproved ranchland, urban runoff. For most of the year the stream is fed by various springs in the basin and rarely runs dry. However, spring runoff can result in severe downstream flooding and scouring of the 40 to 50 yard wide stream channel.

The monitoring site is located in the city of Purcell, approximately 1 mile upstream from where Walnut Creek empties into the South Canadian River. The site was selected due to its ease of access and lack of human disturbance. Access to the privately owned site was granted by a local sand and gravel/cement company located 400 yards upstream.

Stream Condition & Habitat Overview

During the time of monitoring, the stream channel was of sandy composition and lined with streamside cover consisting of many small (6-12ft.) willow and cottonwood trees. A habitat assessment carried out during the summer of 2006 (8/8/2006) resulted in an overall score of 51.5. The average of high quality streams within the Central Great Plains ecoregion resulted in a habitat score of 77.6. This assessment on Walnut Creek showed good bank stability and streamside cover, but only moderate instream cover, canopy cover shading and bank vegetation stability. The sandy creek bottom is very unstable for fish spawning as well as for benthic macroinvertebrate habitat. The presence of new point bars shows how prone Walnut Creek is to altering its flow within its sandy creek bed. Rocky riffles would be highly beneficial for the biological community but there is no presence of riffles. There were one or two small areas that were knee to waist deep but the majority of the creek at this time was ankle deep, insufficient habitat for medium and large fish. Walnut Creek from the monitoring point down to the river is rather straight with very few and gradual curves. Stream flow was rated poor, but was measured at the lowest flow because of drought that the stream had shown in two years of monitoring.

Biological Conditions

Fish

Collection of fish species present in the monitoring site area was accomplished by seining 400 meters downstream of the sampling site. Out of 2,417 total fish captured, fourteen species of fish were identified, of which twelve were tolerant species and two were intermediate insectivores. Species included red shiners, sand shiners (intermediate tolerance), bullhead minnow, river carpsucker, black bullhead catfish, channel catfish, plains killifish, mosquito fish (predominant), brook silverside (intermediate tolerance), green sunfish, warmouth sunfish, bluegill sunfish, longear sunfish and largemouth bass. Of the entire collection 87% was tolerant to pollution. No intolerant species nor sensitive benthic species (darters, madtoms, sculpins) were found. The minnow population from this fish collection was very low. However, it was very good to find five species of sunfish. When compared to the average of high quality sites in the Central Great Plains ecoregion, Walnut Creek scored a D+ (58%).

Note: Due to the abnormal drought conditions when the one fish sample was taken (8/8/2006), many of the fish observed in the stream were under stress conditions due to low water levels and higher than normal water temperature (37°C or 99°F). Future samples, taken under normal stream conditions, will most certainly show different results.

Benthic Macroinvertebrates

Benthic macroinvertebrates were collected from streamside vegetation just upstream of the monitoring site. Two samples were taken over a period of six months, one in winter (1/23/2006) and one in summer (7/17/2006). The winter sampling collected 14 various taxa (Oligochaeta, Amphipoda, Coleoptera, Diptera, Ephemeroptera, Odonata and Basommatophora) having a modified Hilsenhoff biotic index of 6.81, a modified North Carolina biotic index of 5.97 and a Shannon-Weaver diversity index of 2.64. The modified Hilsenhoff biotic index is a measure of the invertebrate community's tolerance to organic pollution. It ranges between 0 and 10, with 0 being the most pollution sensitive. The Shannon-Weaver diversity index measures the evenness of the species distribution. It increases as more and more taxa are found in the collection and as individual taxa become less dominant. This metric increases with increasing biotic quality.

The summer sampling collected 12 various taxa (Haplotaxida, Amphipoda, Coleoptera, Diptera, Ephemeroptera, Odonata and Basommatophora) having a modified Hilsenhoff biotic index of 6.88, a modified North Carolina biotic index of 6.97 and a Shannon-Weaver diversity index of 2.94.

For comparison, the Shannon-Weaver diversity average for high quality streams in the Central Great Plains ecoregion are 1.12 for winter and 2.12 for summer. These high quality sites averaged 10 various taxa for winter and 16 various taxa for summer. Walnut Creek has received excellent scores but is lacking in EPT taxa (Ephemeroptera,

Plecoptera and Trichoptera) which are the mayflies, stoneflies and caddis flies respectively. These insects are more sensitive to pollution. This rated Walnut Creek a "B" (80%) for winter and an "A" (92%) for summer benthic macroinvertbrate conditions.

Bacteria Testing

Bacterial counts of *Escherichia coli* and fecal coliforms were taken during the summer months of July, August and September in 2006. *Escherichia coli* counts were 100, 400 and 400 CFU/100 ml respectively. Fecal coliforms were 13,600 CFU/100 ml, 23,600 CFU/100ml and "too numerous to count" respectively. Clearly, the number of *Escherichia coli* and fecal coliforms increased as the summer progressed. This bacterial increase can be attributed to a nearby rancher's introduction of cattle into the streambed area for water, and their subsequent deposition of animal waste into the stream during the sampling period. In addition, the increase in the water temperature during this time would facilitate bacterial growth.

Chemical Testing

The following chemical data were collected monthly between 8/27/2005 and 1/28/2007.

Dissolved Oxygen (DO):
Dissolved oxygen saturation shows when there are problems with the amount of oxygen available in the water for aquatic life. Too little or too much are indicators of problems. Chemical data show that the DO saturation levels at the sampling site ranged from a low of 82% in the winter months to a high of over 150% during the summer. Photosynthetic activity and high water temperatures are the primary causes of the high DO saturation levels in the stream during the summer months. The mean DO saturation level at the sampling site was 122%. This is within the normal range of 80% to 130%.

pH (Hydrogen ion concentration):
Hydrogen ion concentration levels at the sampling site varied from 7.7 to 9.0, with a mean pH of 8.0. The stream water is slightly basic (7.0 being neutral), but is well within pH limits for normal biological activity.

Nitrogen:
An estimate of soluble nitrogen is made by adding the amounts of ammonia-nitrogen and nitrate/nitrite-nitrogen found in the water. Levels of soluble nitrogen were normally in the 0 to 1 mg/L range with a mean level of 0.68 mg/L. Nitrogen level spikes of up to 4.30 mg/L were detected during the months of July and August 2006. This was attributed to runoff from a fertilizer application on a newly cultivated field alongside the stream, one mile upstream of the sample site. Nitrogen levels declined through September to pre-fertilizer application "below detectable limit" levels.

Orthophosphate Phosphorous:
Phosphorous amounts in the stream were determined by detecting the level of orthophosphate. Normal ranges between 0.00 mg/L P and 0.05 mg/L P. The levels of orthophosphate at the sampling site ranged between 0.00 mg/L P and 1.06 mg/L P, with the mean level at 0.105 mg/L P. Correlations to the higher readings could have included increased activity at the cement plant upstream. Runoff from the materials used at the plant could have possibly been the cause for the elevated readings in the stream. The lowest readings were taken during the months of November thru March. The cement plant does not make, pour and/or clean out much concrete from their trucks during these months. Increased stream temperatures could also have affected the readings.

Chloride:
Chloride levels measured in the stream ranged between 10 mg/L Cl and 120 mg/L Cl, with a mean level of 35 mg/L Cl. The highest reading came during the same month (July, 2006) as the major fertilizer application located one mile upstream on a newly cultivated field next to Walnut Creek. As with the nitrogen levels, the chloride levels quickly declined through September to pre-fertilizer application levels of 35 mg/L Cl.

Surprisingly, the chemical condition of Walnut Creek appeared to be in much better condition than was anticipated, considering that the monitoring site is at the bottom end of the drainage basin. Also, the stream was very resilient in its ability to deal with large one-time amounts of various man-made materials introduced into its ecosystem.

Synopsis

Overall, the condition of Walnut Creek during the sampling period of 8/27/2005 to 1/28/2007 ranged from poor to good. The chemical condition of the water was within normal limits except during a severe drought that brought the level of the stream to its lowest level in 35 years (according to landowners living along the stream). This led to abnormally high water temperatures and subsequently high percent oxygen saturation readings. Unfortunately, this was when the physical habitat and fish assessment was carried out. Biologically, Walnut Creek showed good to excellent benthic macroinvertebrate activity. It also showed good bank stability and streamside cover. Instream cover, canopy cover shading and bank vegetation stability was fair. However, due to Walnut Creek's constantly shifting sandy bottom, intolerant fish and benthic macroinvertebrate species have little to no instream protection or permanent habitat. In addition, poor pool variability, constant channel alteration and poor stream sinuosity, as well as the lack of rocky runs or riffles resulted in a habitat assessment score of 51.5 out of a possible 180 for this ecoregion. Walnut Creek's physical habitat could be one of the major limiting factors for these intolerant biologic species.

Unfortunately, during June of 2007, several heavy rains (10+ inches) over the Walnut Creek drainage basin resulted in stream flood levels of 30 feet above normal levels, with stream widths up to ¼ mile wide throughout the sampling area. All instream vegetation was scoured from the stream channel, and stream banks were eroded to the point where much of the canopy cover shading (provided by large trees such as cottonwood and willow trees) was washed away. Pools provided by beaver dams at several locations along the stream were also destroyed. The once picturesque stream now looks like a war zone, with piles of broken branches and debris alongside a radically changed stream channel. Although the stream is flowing strongly, it will take some time for Walnut Creek and its inhabitants to return to normal conditions. Future samplings may indicate similar water quality, as the geochemistry of the area has not changed. However, biological conditions will more than likely be drastically different from the samples given in this report.