"higher" water quality, 63 percent were "middle" quality, and 14 percent were considered "lower" quality. The sites that were added in 2004 tended to be of poorer quality, and in particular more AMD streams were added. A site-to-site comparison indicated that 67 percent of the sites had the same water quality site condition category in 2004 as in 1995, 18 percent improved, and 15 percent degraded.

Table 6 shows a comparison of the total number of sites to exceed levels of concern for the sites that were sampled in both 1995 and 2004. Total nitrogen had a similar number of exceeding values, while nitrate-n exceedences increased in 2004. The range of nitrogen values differed from 1995 to 2004, with a high of 6.31 mg/l in 1995 and 11.64 mg/l in 2004. More sites exceeded orthophosphate and phosphorus levels of concern in 1995 than in 2004, which could be a consequence of upgrades in wastewater treatment plants and best management practices (BMPs) to prevent soil erosion. Streams that did not exceed the aluminum level of concern in 1995 exceeded this level in 2004. The largest difference in parameters from 1995 to 2004 was in temperature. Flow was lower at most of the sites sampled in 1995, and a majority of the sampling was conducted in July and August.

Although the habitat assessment form has changed from 1995 to 2004 and the assessments are subjective measures completed by different people, the process of assigning a comparative condition category using a reference site remained the same. A much higher percentage of stream sites was rated excellent in 2004. Forty-one percent of the habitat condition ratings remained the same, 52 percent improved from 1995 to 2004, and seven percent degraded from 1995 to 2004.

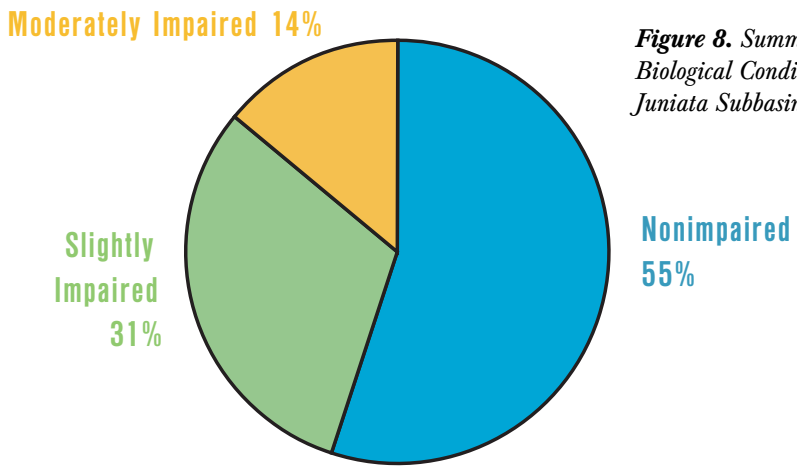

Figure 8. *Summary of the Biological Conditions in the Juniata Subbasin in 1995*

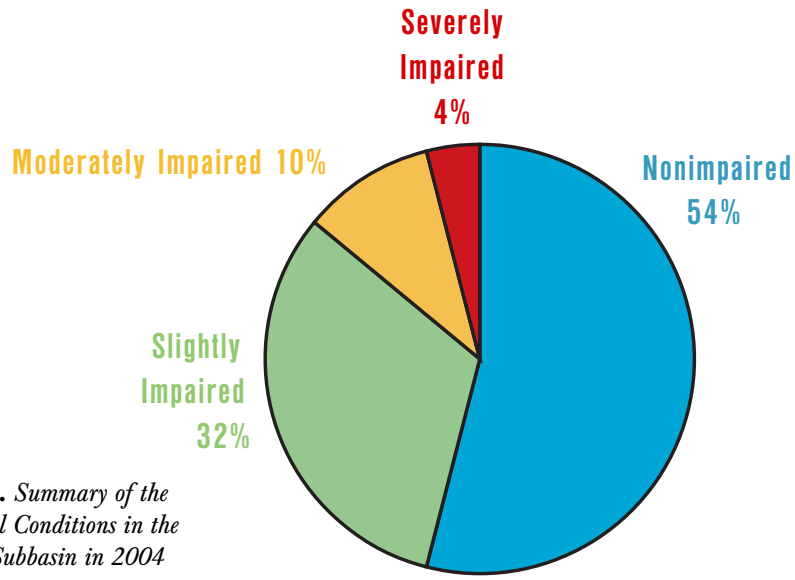

Figure 9. *Summary of the Biological Conditions in the Juniata Subbasin in 2004*

Conclusions

Overall, streams in this subbasin had very good water quality, macroinvertebrates, and habitat in 2004. Approximately half of the sites sampled in this subbasin had nonimpaired macroinvertebrate conditions. The largest source of impairment appeared to be from agricultural activities, although many streams exhibited only slight increases over background levels. Areas of AMD pollution were concentrated mostly in the area west of Altoona and in the area from Hopewell to Saxton, Pa. Urban pollution was not detected often in this survey, with the most urban influence found in the Altoona area.

Some of the highest quality watersheds within this subbasin were Aughwick Creek, Tuscarora Creek, Jacks Creek,

Table 6. *Number of Water Quality Values Exceeding Levels of Concern for the same sites in 2004 and 1995*

Year	Nitrite-N T	Nitrate-N T	Nitrogen T	Orthophosphate T	Phosphorus T	Sodium T	T Susp Solid	Acidity	Alkalinity	Aluminum T	Iron T	Temperature
1995	1	31	39	12	11	4	1	1	2	2	1	13
2004	0	38	40	8	3	1	0	0	2	5	0	0

Shobers Run, Great Trough Creek, Buffalo Run, Brush Creek, and Standing Stone Creek. Aughwick Creek Watershed had the most sites with the best possible site conditions in each category. Some of the most degraded watersheds were Burgoon Run, Beaverdam Branch, Shoups Run, Sixmile Run, and the Morrison Cove area. The Frankstown Branch was the section with the most impairment overall, with AMD, agriculture, and urban influences. The Raystown Branch had isolated sections of impairment (Ecoregion 69 and Morrison Cove), contributing AMD and agricultural pollution near the start of the impoundment of water from the dam. Unfortunately, numerous stations could not be sampled for macroinvertebrates due to high flow conditions, which reduced the information available in 2004 for many streams.

Efforts should be made to restore the most degraded watersheds within this subbasin and to protect the higher quality ones. Agriculture BMPs can be used to limit the impacts associated with farming operations. Information on these practices and other conservation methods can be gathered from the County Conservation District Offices (Table 1). Grant opportunities to cleanup AMD and more information on remediation technologies also are available in County Conservation District Offices and from the Western PA Coalition for Abandoned Mine Reclamation (Table 1). Urban stormwater problems can be minimized with low impact development and by allowing for groundwater recharge areas. More information on urban pollution remediation can be obtained from the Center for Watershed Protection in Ellicott City Md., through its Urban Subwatershed Restoration Manual Series (http://www.cwp.org/).

Further study and research would be needed to identify the source and cause of the higher aluminum values found in this survey. It appears that the higher aluminum concentrations were not adversely impacting macroinvertebrate communities. Aluminum is not toxic to aquatic life, such as fish, unless the pH of the stream is lower than approximately 5.2, when the aluminum is present in dissolved form (Gagen and Sharpe, 1987; Baker and Schofield, 1982).

A second year of more intensive sampling began in the Morrison Cove area in Spring 2005. The streams sampled in this Year-2 survey include Yellow, Beaver, Hickory Bottom, Potter, Three Springs, Halter, Cabbage, Plum, Clover, and Piney Creeks. The streams in the Yellow Creek Watershed (Beaver, Hickory Bottom, Potter, and Three Springs Creeks) have been impaired for agricultural pollution, and Halter Creek was impaired due to urban and industrial runoff and storm sewer problems (Table 5). Furthermore, the Morrison Cove area has been identified as a potentially stressed groundwater area. Quarterly water sampling of streams, springs, and seeps is being conducted to gather information on groundwater influence on stream quality. Macroinvertebrates were collected in spring 2005 in order to assess the biological health of these streams. More information on this project is available from SRBC.

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For raw data from this survey or more information concerning SRBC, visit our website: www.srbc.net.