

Stressor Source Identification

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In order to limit the impact of stressors on critical characteristics of the watershed, the sources of the stressors should be examined and regulated. This section will attempt to identify specific watershed sources for the treatable concerns and stressors listed in the previous sections.

Elevated Levels of Nutrients – Nutrients can enter the waterway through interaction with runoff and direct discharge to the stream. Land application sources for nutrient loading include: agricultural fields adjacent to streams without filter strips, livestock farms (see Figures 10 and 12), dairy farms near Pigeon Lake, and horse farms along Wood Ditch. Lawn fertilizer applied by developments is also nutrient sources for algae blooms observed throughout the watershed.

Potential point discharges include treatment plant outlets, failing septic systems, and illicit sewer connections.

Elevated Levels of E. Coli – Sources for *E. Coli* and other bacteria in the watershed are similar to the nutrient sources. Land application sources include: agricultural fields adjacent to streams without filter strips, livestock farms (see Figures 10 and 12), dairy farms near Pigeon Lake, and horse farms along Wood Ditch. Potential point discharges include treatment plant outlets, failing septic systems, and illicit sewer connections.

Sedimentation – Sedimentation accumulates in lakes and channel bottoms as soil particles drop out of the flow regime during periods of low velocity flow. Sources of sediment degradation include: stream erosion at incised channel reaches downstream of Hogback Lake, along Golden Lake Road, at the entrance to Hogback Lake, between Long Lake and Little Bower Lake, and upstream of County Road 150 West; as well as upland erosion primarily from construction/development sites and agricultural fields upstream of Long Lake

Failing Septic Fields – Septic fields can fail do to age and lack of maintenance, and they can also be flooded during extreme rainfall events. Primary sources for septic affecting the watershed include: unsewered developments (especially along lakes) and farm houses adjacent to the streams and ditches.

Limited Maintenance – Maintenance performed by the Steuben County Surveyor’s Office is limited by local funding through the Ditch Tax, as well as applicable federal and state regulation of waterway construction activities. As noted in this last section, a referendum to increase the Ditch Tax for the Pigeon Creek Watershed was defeated by residents in a recent vote.

Inadequate Flood Conveyance / Storage – As previously discussed, flooding is caused when adequate capacity to convey flood flows is not provided in the waterway. For Pigeon Creek, this occurs due to several factors, including the lack of storage upstream of the lake chain, restrictions caused by the outlet to Hogback Lake, and limited channel

conveyance downstream of the lake chain due to the confined channel section with steep side slopes.

Several stressors can worsen flooding in the watershed. First, developments without proper detention facilities create additional runoff volume than under natural conditions. Although currently regulated by the City of Angola and Steuben County, developments constructed before the ordinances were enacted may not provide any detention volume for runoff control.

Another flood stressor is due to climactic changes, such as increases in rainfall over time. The 1992 Bulletin 71 “Rainfall Frequency Atlas of the Midwest” indicates a rainfall volume of 5.77 inches for the 100-year, 24-hour rainfall event in northeastern Indiana. This is an increase from the approximately 5.1 inches indicated by the 1961 Technical Paper 40 “Rainfall Frequency Atlas of the Eastern United States”. This increase is confirmed by the increasing flow trend for Pigeon Creek measured by the USGS gauging station (Figure 16). As experienced in the 1982 flood, snow melt is also a flood stressor. The quick melting of accumulated snowfall can create high flow rates in the local waterways, which can be blocked by snow, ice, or other debris.

A third stressor for increased flooding is the degradation of watershed conveyance capacity. In rural areas, this stressor occurs over time through the accumulation of debris and sedimentation in the waterways that restrict the amount of runoff conveyed downstream. Specifically, bridges, culverts, and other narrow passages have a high potential to clog with fallen tree limbs, trash, and other debris. The accumulation of sedimentation also restricts flow through the formation of sandbars and mounds that reduce the channel and lake outlet cross section. For urbanized areas, conveyance is based on the capacity of local roadside swales and storm sewers. As with the rural channels, urban swales, inlets, and sewers must be maintained to remove debris and sedimentation obstructions.

Federal / State Regulation – See “Limited Maintenance” in this section.

Shoreline and Upland Erosion – See “Sedimentation” in this section.