Appendix H:
Discussion of Importance of Riparian Habitat to Aquatic Communities and the Topeka Shiner

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The specific characteristics of a riparian zone that are optimal for aquatic communities are expected to vary with developmental stage, the use of the reach adjacent to the riparian zone, and the hydrology of the watershed. Criteria developed by Fleming et al. (2001) have been used to assess the health of riparian zones and their ability to support habitat for aquatic communities. These criteria, which include the width of vegetated area (i.e. distance from cropped area to water), structural diversity of vegetation, and canopy shading, are summarized in Table H-1.

Table H-1. Criteria for Assessing the Health of Riparian Areas to Support Aquatic Habitats (adapted from Fleming et al. 2001)

	Quality			
Criteria	Excellent	Good	Fair	Poor
Buffer width	>18m	12 - 18m	6 - 12m	<6m
Vegetation diversity	>20 species	15 - 20 species	5 - 14 species	<5 species
Structural diversity	3 height classes grass/shrub/tree	2 height classes	1 height class	sparse vegetation
Canopy shading	mixed sun/shade	sparse shade	90% sun	no shade

To maintain at least “good” water quality for aquatic habitats in general, riparian areas should contain at least a 12 m (~40 feet) wide vegetated area, 15 plant species, vegetation of at least two height classes, and provide at least sparse shade (>10% shade). In general, higher quality riparian zones (wider vegetated areas with greater plant diversity) are expected to have a lower probability of being significantly affected by atrazine than poor quality riparian areas (narrower areas with less vegetation and little diversity).

The following three attributes of riparian vegetation habitat quality were evaluated for this assessment: stream bank stability, sedimentation, and thermal stability. Each of these attributes and their relative importance with respect to the Topeka shiner is discussed briefly below.

Stream and river bank stabilization: Riparian vegetation typically consists of three distinct height classes of plants, which include a groundcover of grasses and forbs, an understory of shrubs and young trees, and an overstory of mature trees. These plants serve as structural components for streams, with the root systems helping to maintain stream stability, and the large woody debris from the mature trees providing instream cover. Riparian vegetation has been shown to be essential to maintenance of a stable stream (Rosgen, 1996). Destabilization of the stream can have a severe impact on aquatic habitat quality. In fact, geomorphically stable stream and river channels and banks are identified as PCEs for designated critical habitat. Any action that would significantly alter channel morphology or geometry to a degree that would appreciably reduce the value of the critical habitat for both the long-term survival and recovery of the species is considered as part of the critical habitat impact analysis in Section 5.3 of the risk assessment.

Following a disturbance in the watershed bank, the stream may widen, releasing sediment from the stream banks and scouring the stream bed. Changes in depth and or the width/depth ratio via physical modification to the stability of stream and river banks may also affect light penetration and the flow regime of the Topeka shiner's habitat. Destabilization of the stream can have severe effects on aquatic habitat quality by increasing sedimentation within the watershed. The effects of sedimentation are summarized below.

<u>Sedimentation:</u> Sedimentation refers to the deposition of particles of inorganic and organic matter from the water column. Increased sedimentation is caused primarily by disturbances to river bottoms and streambeds and by soil erosion. Riparian vegetation is important in moderating the amount of sediment loading from upland sources. The roots and stems of riparian vegetation can intercept eroding upland soil (USDA NRCS, 2000), and riparian plant foliage can reduce erosion from within the riparian zone by covering the soil and reducing the impact energy of raindrops onto soil (Bennett, 1939).

Increased siltation could alter spawning habitat and affect other processes such as feeding efficiency.

Increased sedimentation may affect the spawning habitat of fish by settling on spawning gravel and reducing flow of water and dissolved oxygen to the eggs and fry (Everest et al., 1987). In addition, fine particles settling on the streambed can also disrupt the food chain by reducing habitat quality for aquatic invertebrates, and adversely affect groundwater-surface water interchange (Nelson et al., 1991). Increased turbidity from sediment loading may also reduce light transmission, potentially affecting aquatic plants (Cloern, 1987; Weissing and Huisman, 1994).

<u>Thermal stability</u>. Riparian habitat including mature woody trees provides stream shading resulting in thermal stability. However, sensitivity of the Topeka shiner to fluctuations in water temperature are unknown. The designated critical habitat final rule indicates that temperature should be between 1 and 30 degrees Centegrade.

Sensitivity of Forested Riparian Zones to Atrazine

As previously summarized in Table H-1, the parameters used to assess riparian quality include buffer width, vegetation diversity, vegetation cover, structural diversity, and canopy shading. Buffer width, vegetation cover, and/or canopy shading may be reduced if atrazine exposure impacts plants in the riparian zone or prevents new growth from emerging. Plant species diversity and structural diversity may also be affected if only sensitive plants are impacted (Jobin et al., 1997; Kleijn and Snoeijing, 1997), leaving non-sensitive plants in place. Atrazine may also affect the long term health of high quality riparian habitats by affecting seed germination. Thus, if atrazine exposure impacted these riparian parameters, water quality within the action area for the Topeka shiner could be affected.

Because the majority of woody plants (i.e., shrubs and trees) are not sensitive to environmentally-relevant atrazine concentrations (MRID 46870400-01), effects on shading, streambank stabilization, and structural diversity (in terms of height classes) of woody forested vegetation are not expected. Effects are expected to be limited to herbaceous (non-woody) plants (e.g., grasses), which are not generally associated with shading.

The riparian health criteria described in Fleming et al. (2001; Table H-1) and the characteristics associated with effective vegetative buffer strips suggest that healthier riparian zones would be less sensitive to the impacts of atrazine runoff than poorer riparian zones. Although riparian zones rich in species diversity and woody species may contain sensitive species, it is unlikely that they would consist of a high proportion of very sensitive plants. Wider buffers have more potential to reduce atrazine residues over a larger area, resulting in lower loading levels. According to Fleming et al. (2001), buffer distances of >18 m (approximately 60 feet) are characterized as “excellent” in supporting aquatic habitats. It should be noted that the label requirements for atrazine specify no use within 66 feet of intermittent and perennial streams. While this “buffer” area was established to decrease atrazine loading to waterbodies resulting from drift, if maintained with other good to excellect (Table H-1) riparian habitat attributes, it is likely to reduce atrazine runoff to adjacent waterbodies. In addition, trees and woody plants in a healthy riparian area act to filter spray drift (Koch et al., 2003) and push spray drift plumes over the riparian zone (Davis et al., 1994), thus reducing exposure to lower height classes of plants (i.e., grassy and non-woody vegetation), which tend to be more sensitive. Therefore, higher quality riparian zones are expected to be less sensitive to atrazine than riparian zones that are narrow, low in species diversity, and comprised of young herbaceous plants or unvegetated areas. The available data suggest that riparian zones comprised of herbaceous plants and grasses would likely be most sensitive to atrazine effects. Bare ground riparian areas and areas with sparse vegetation could also be adversely affected by prevention of new growth of grass, which can be an important component of riparian vegetation for maintaining water quality.

Based on the low sensitivity of forested areas containing woody shrubs and trees to atrazine, it is unlikely that atrazine will adversely affect these types of riparian vegetation adjacent to use sites and watersheds within the action area to an extent that a “take” would occur.

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