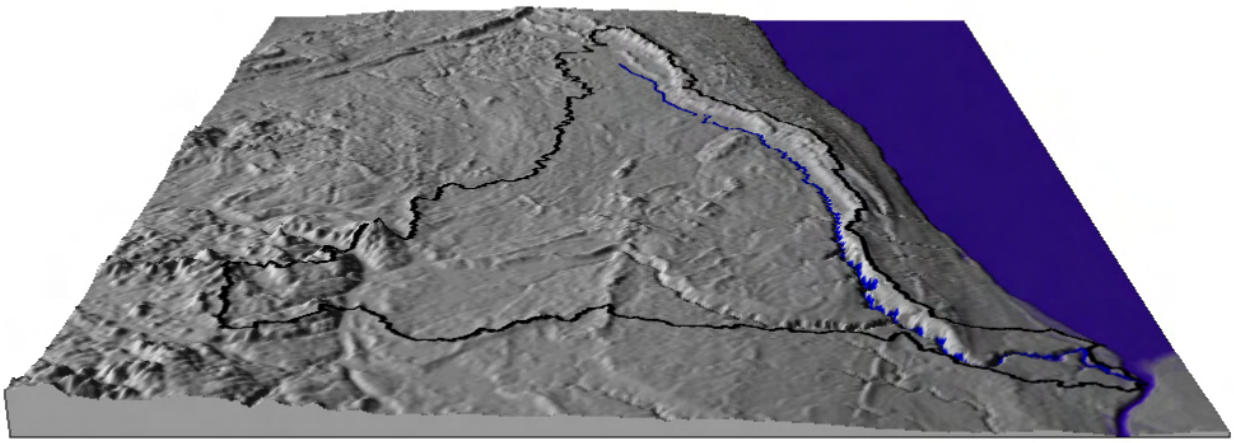


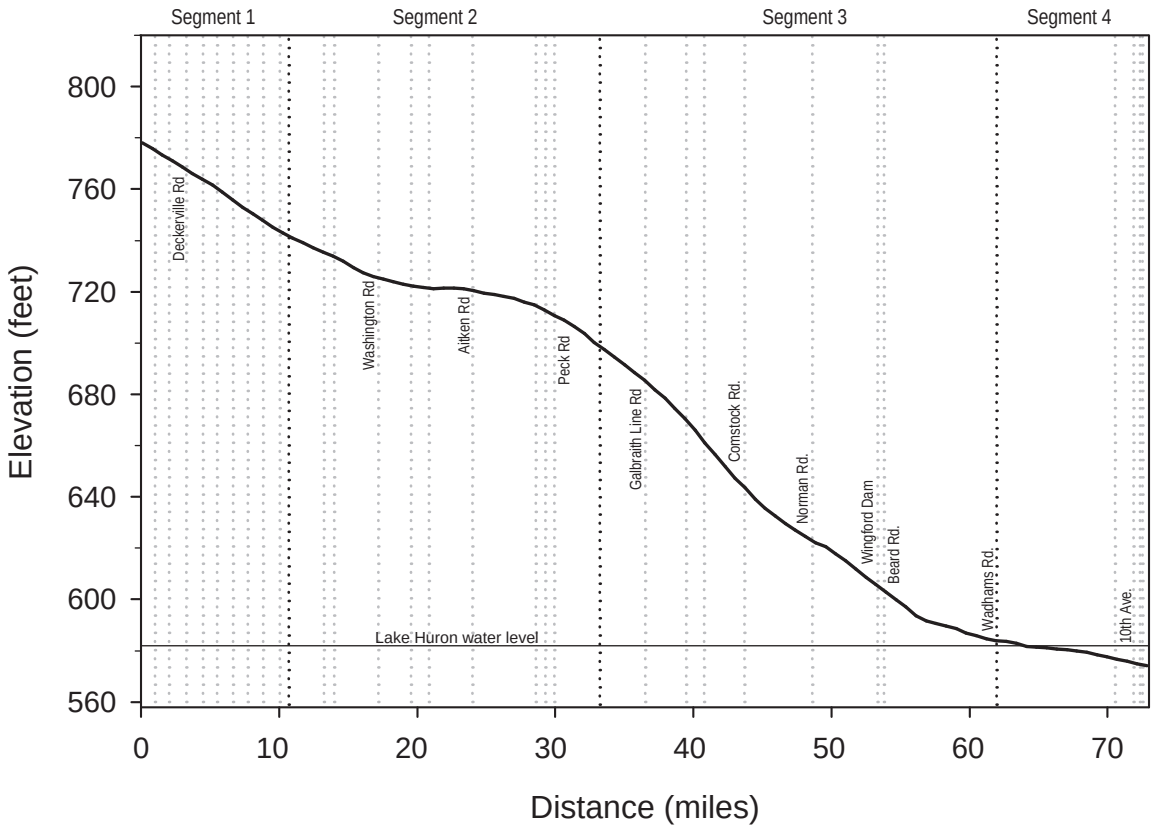


Figure 19.– Surface map (upper figure) shows general land surface features of the Black River main stem. Dark line (smoothed) on graph (bottom figure) shows vertical profile of entire length of main stem with gradual and steeper portions clearly visible. Gray vertical lines on graph indicate locations of road crossings, segment boundaries, and Wingford Dam. Horizontal black line on graph shows current water level in Lake Huron.

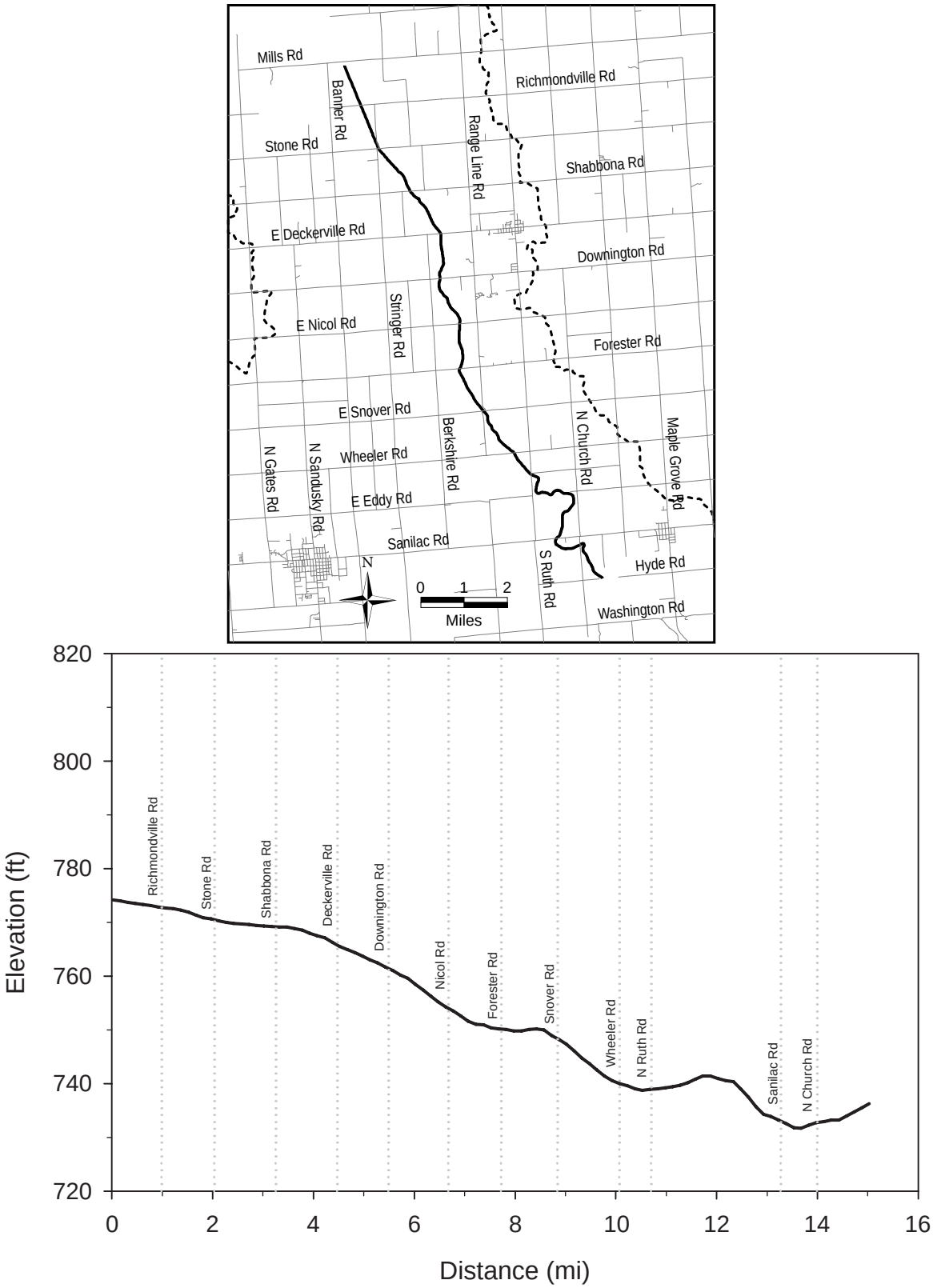


Figure 20.– Segment 1 (headwaters) of the Black River main stem (upper) with all road crossings for geographic reference. The outer rectangle covers 100,217 acres and the river segment is 15.0 miles long. River flow is southeast. Lower graph shows elevation change along this river segment. Smoothed line may indicate higher elevations downstream due to inherent errors in the source for digital elevation.

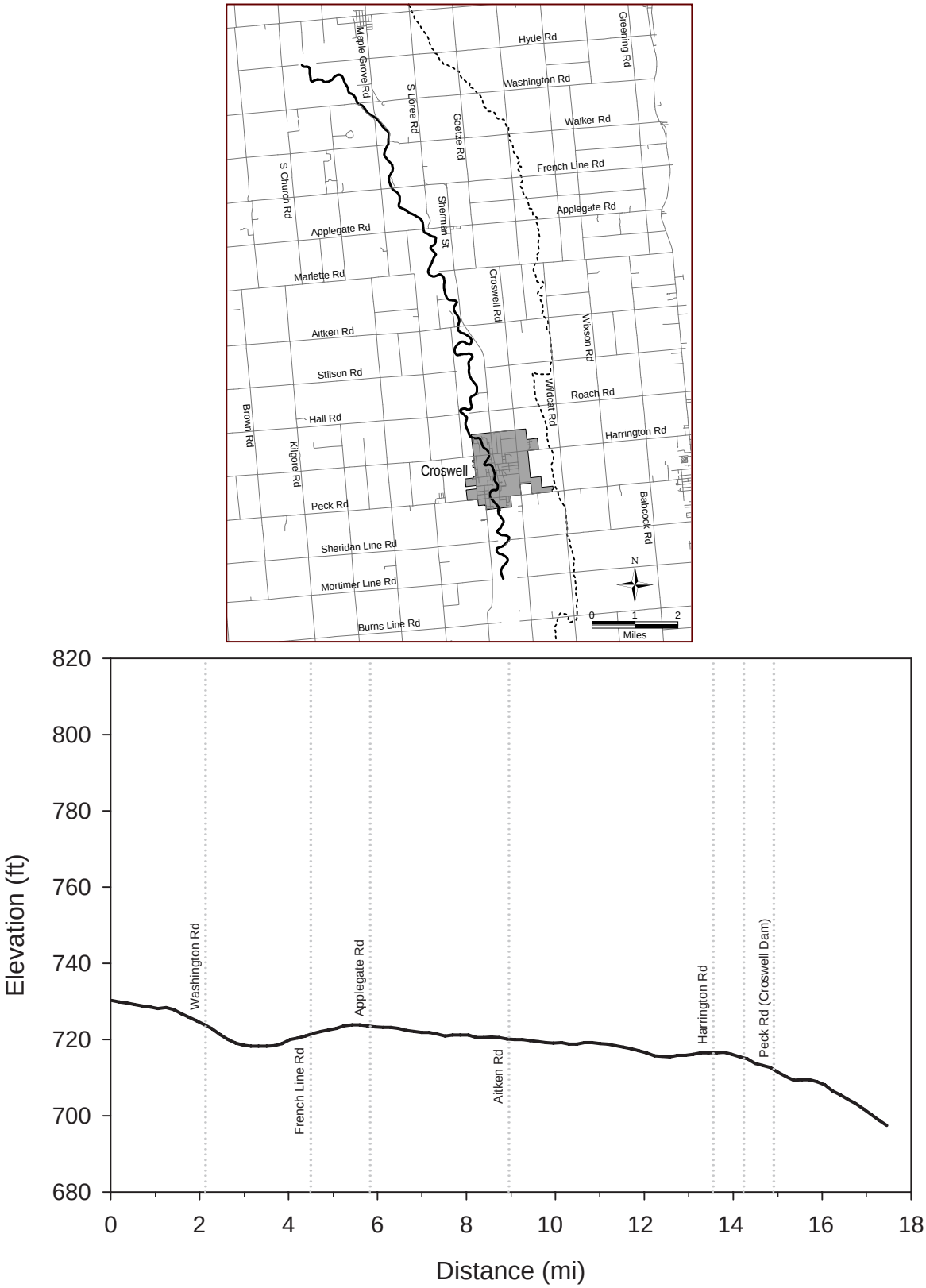


Figure 21.– Segment 2 of the Black River main stem (upper) with all road crossings for geographic reference. The outer rectangle covers 100,287 acres and the river segment is 17.5 miles. River flow is south. Lower graph shows elevation change along this river segment. Smoothed line may indicate higher elevations downstream due to inherent errors in the source for digital elevation.

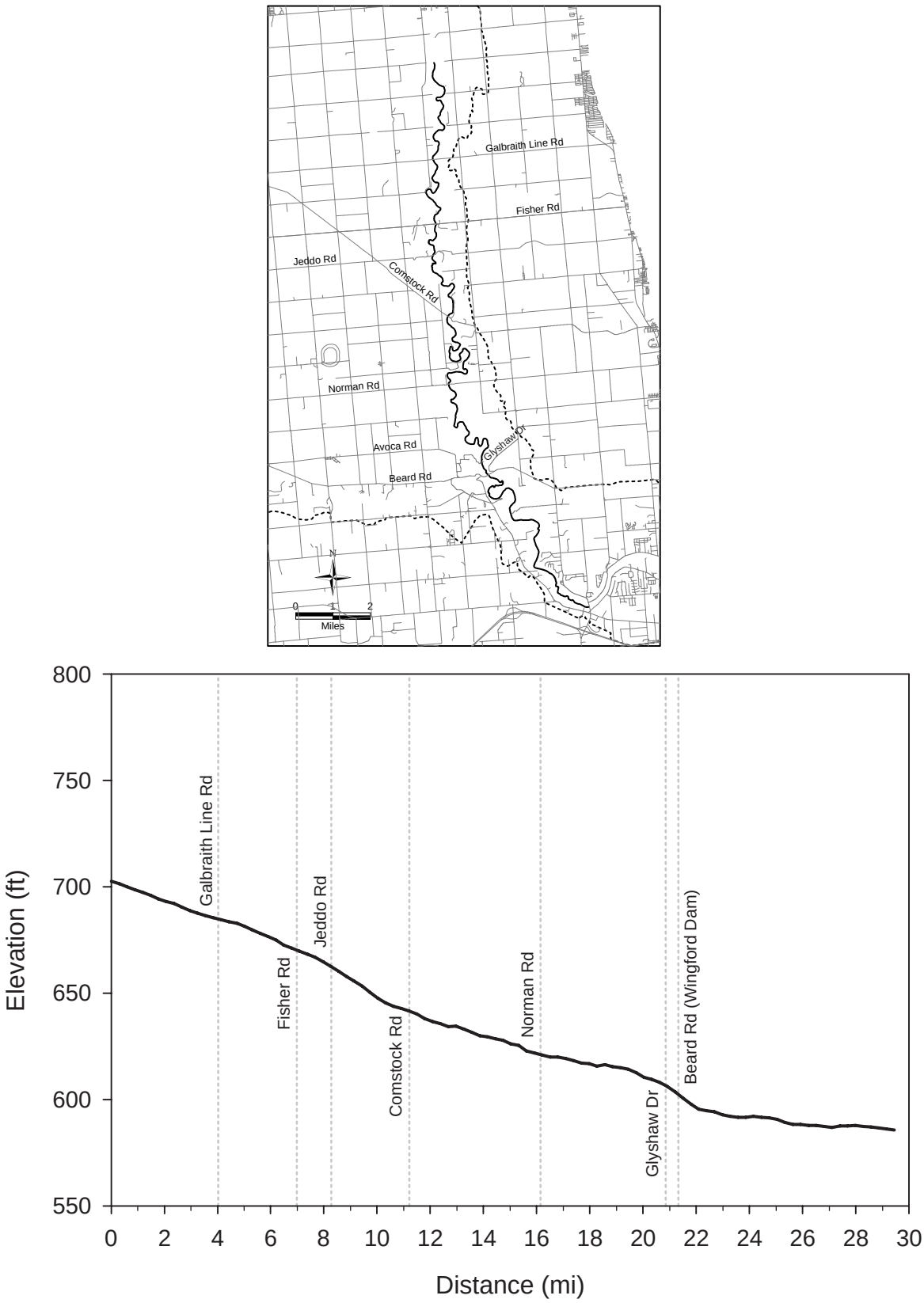


Figure 22.– Segment 3 of the Black River main stem (upper) with all road crossings for geographic reference. The outer rectangle covers 154,423 acres and the river segment is 29.5 miles. River flow is south. Lower graph shows elevation change along this river segment.

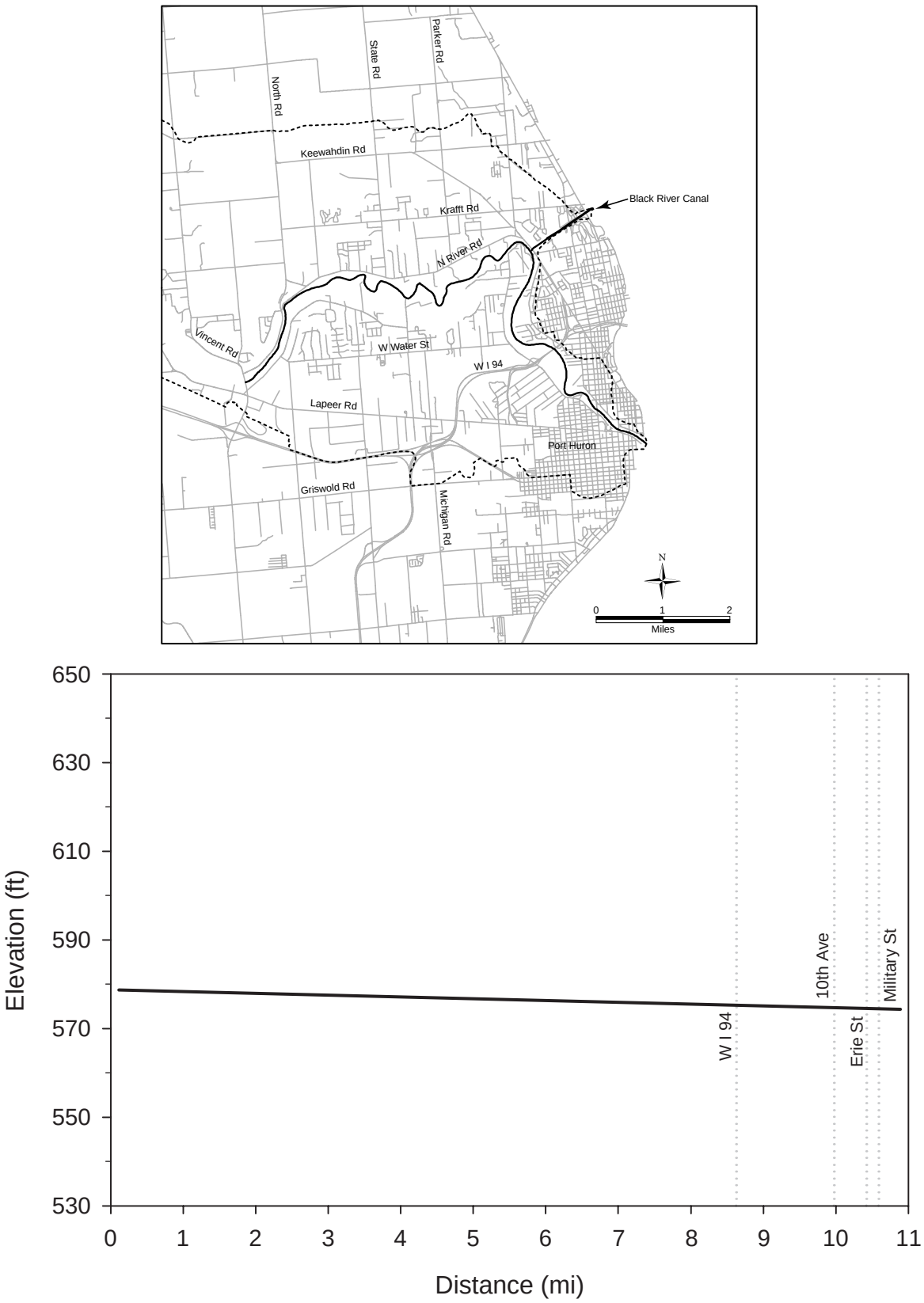
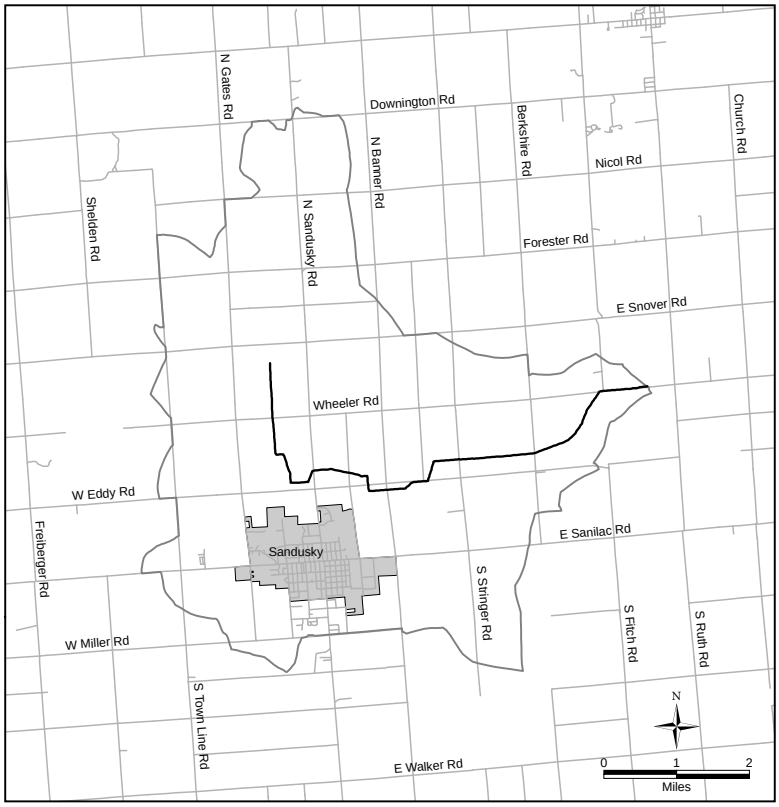


Figure 23.– Segment 4 of the Black River main stem (upper) with all road crossings for geographic reference. The outer rectangle covers 55,196 acres and the river segment is 10.9 miles. River flow is east. Lower graph shows elevation change along this river segment..



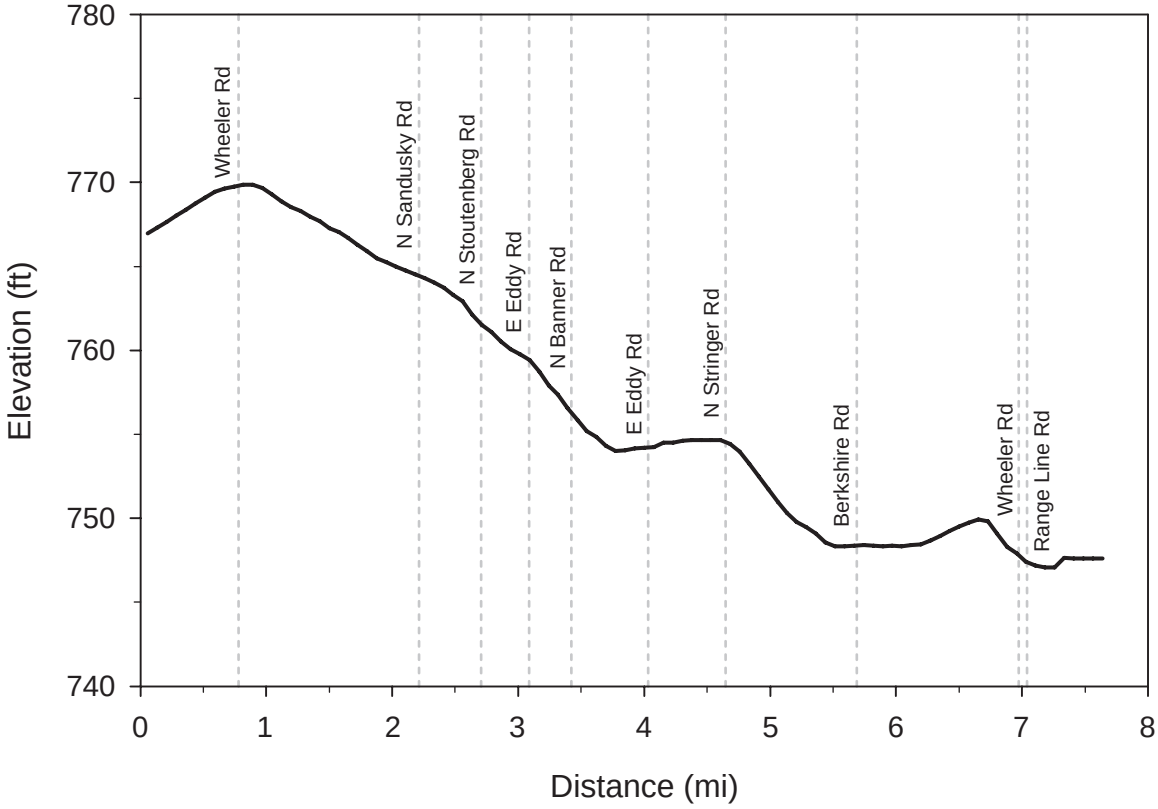
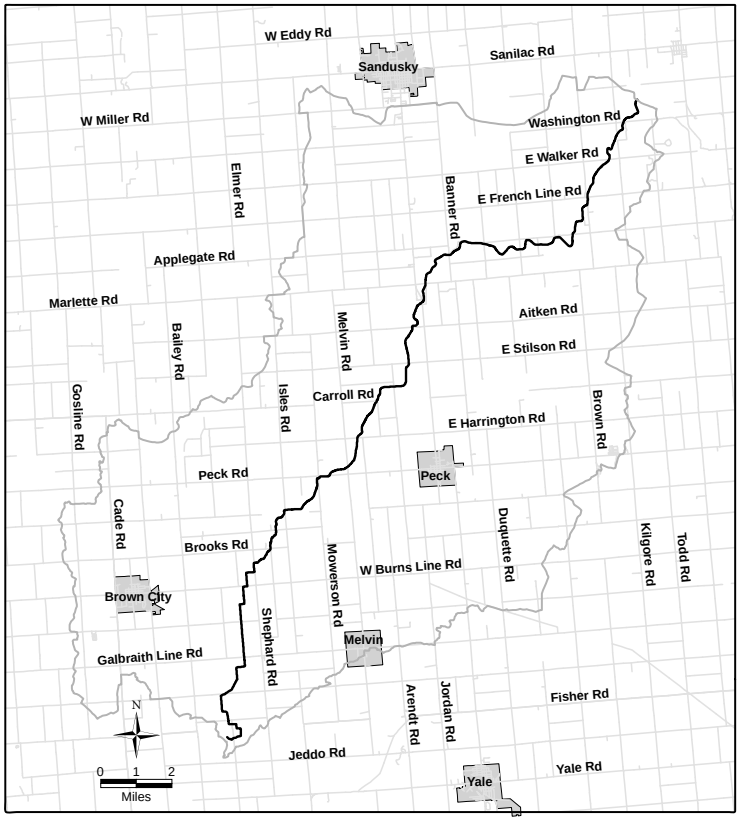


Figure 24.– Berry Drain subwatershed (upper) with all road crossings for geographic reference. The outer rectangle covers 74,018 acres and the river segment is 7.6 miles. River flow is east. Lower graph shows elevation change along this tributary.



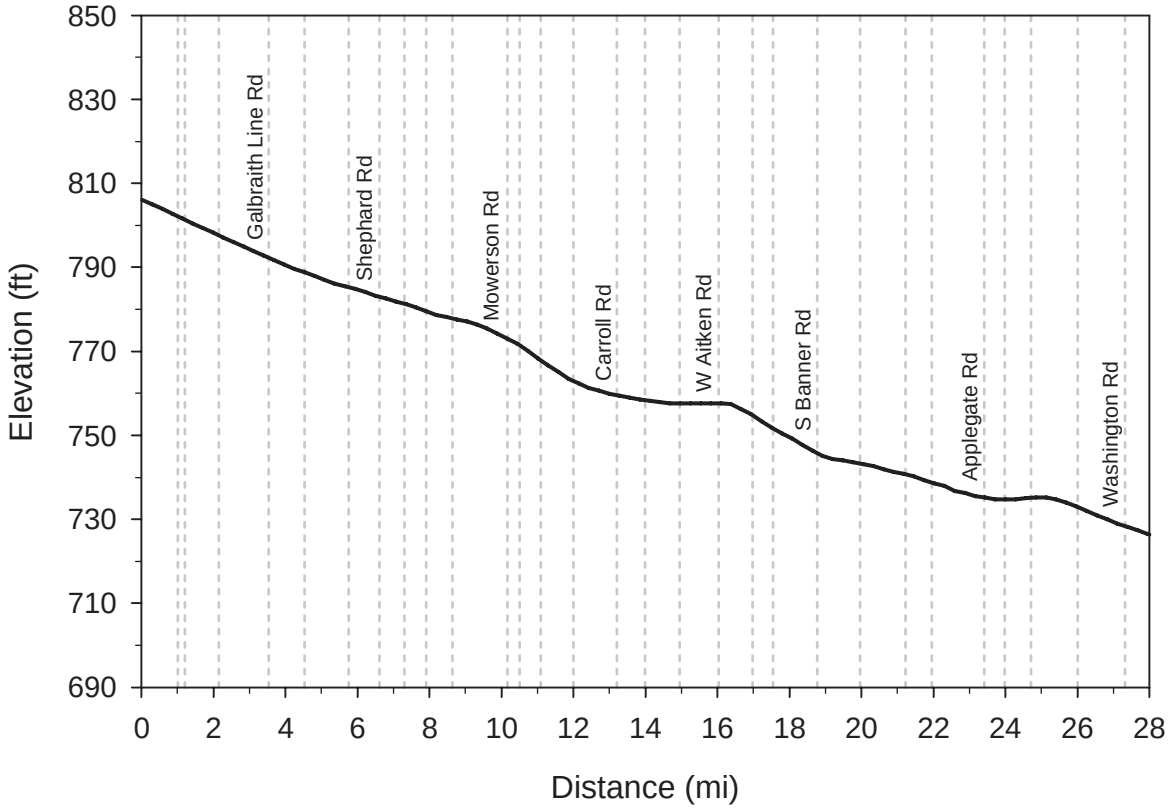


Figure 25.– Elk Creek subwatershed (upper, dotted boundary) with all road crossings for geographic reference. The outer rectangle covers 297,713 acres and the river segment is 28.3 miles. River flow is northeast. Lower graph shows elevation change along this tributary.

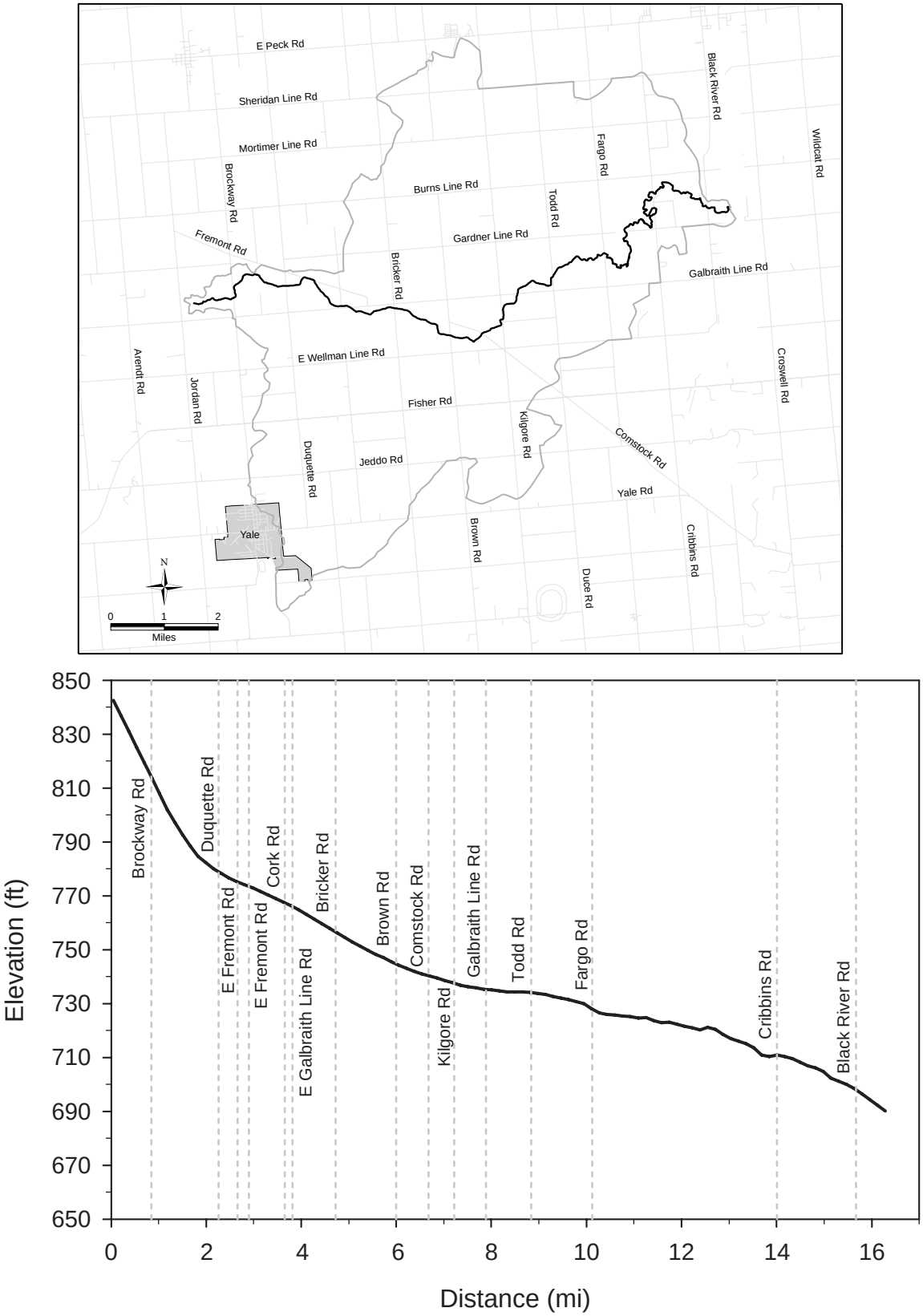


Figure 26.– Black Creek subwatershed (upper, dotted boundary) with all road crossings for geographic reference. The outer rectangle covers 110,439 acres and the river segment is 16.3 miles. River flow is east. Lower graph shows elevation change along this tributary.

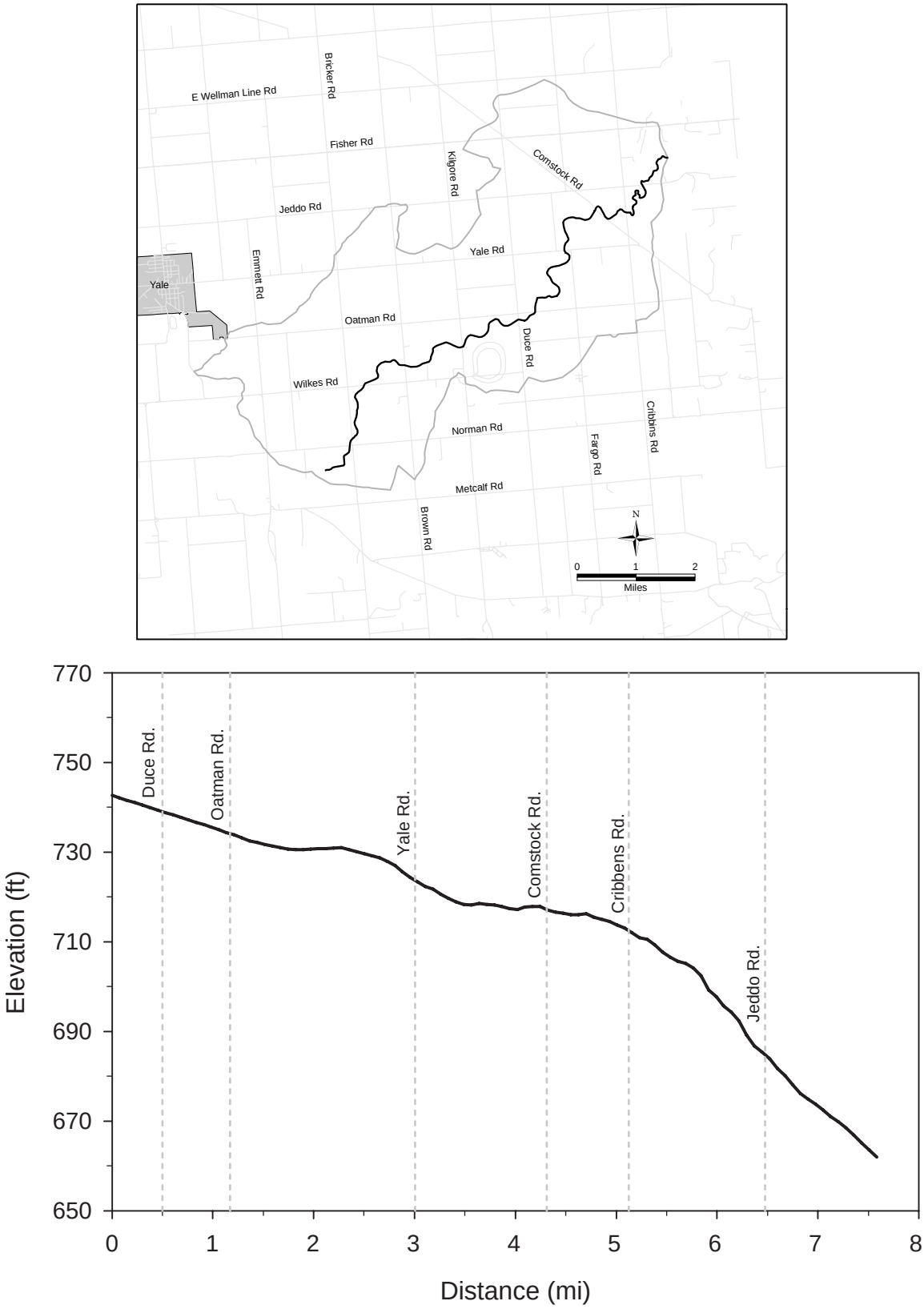


Figure 27.– Silver Creek subwatershed (upper, dotted boundary) with all road crossings for geographic reference. The outer rectangle covers 77,011 acres and the river segment is 11.5 miles. River flow is east. Lower graph shows elevation change along this tributary.

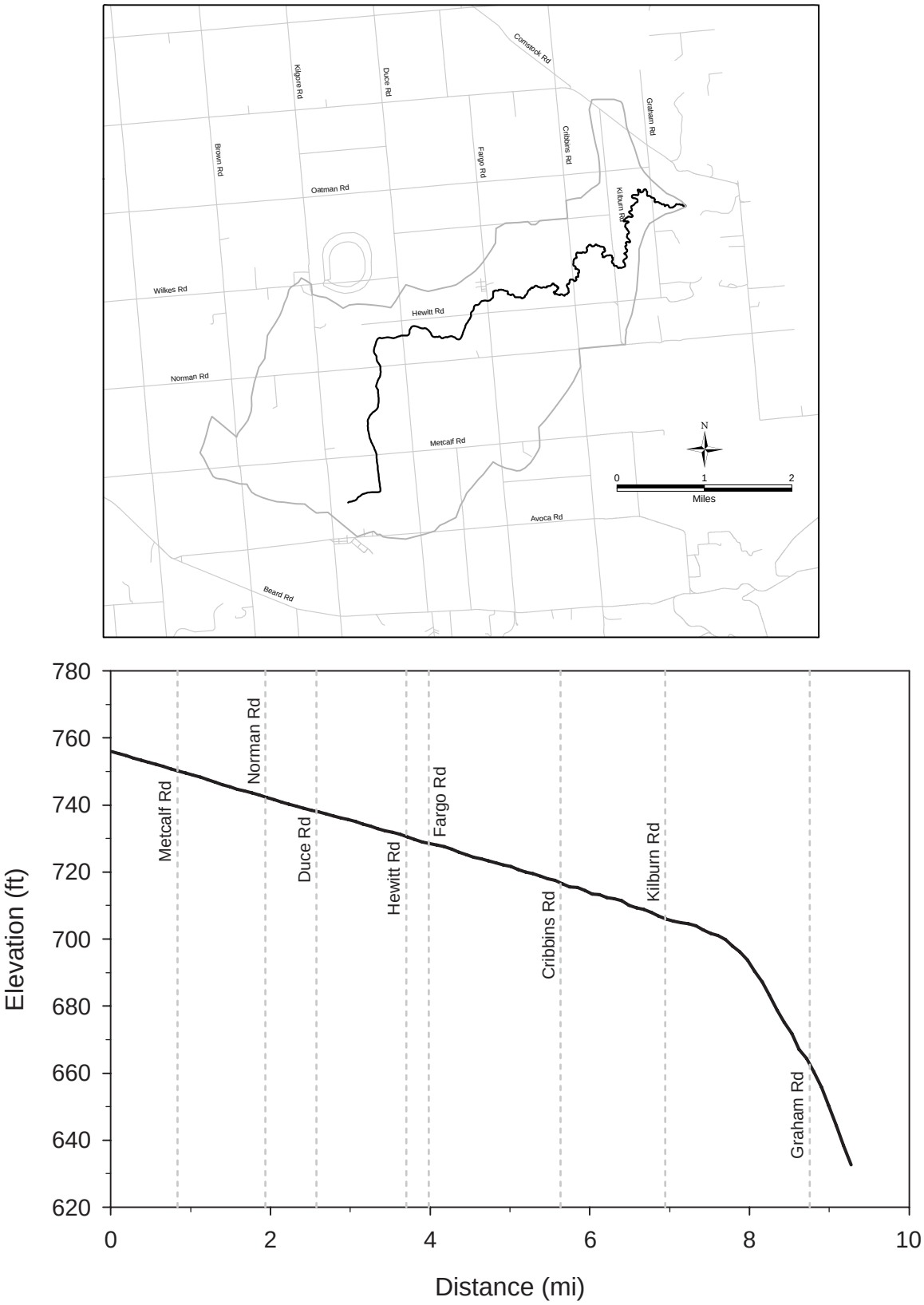
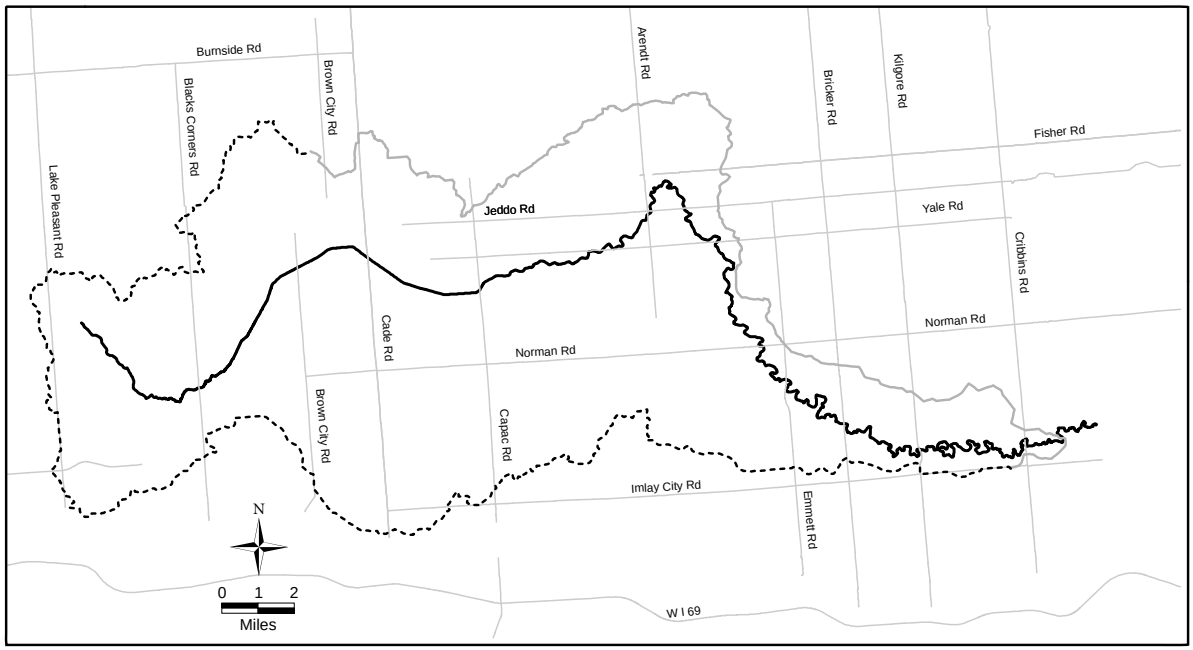


Figure 28.– Plum Creek subwatershed (upper, dotted boundary) with all road crossings for geographic reference. The outer rectangle covers 38,064 acres and the river segment is 9.3 miles. River flow is northeast. Lower graph shows elevation change along this tributary.



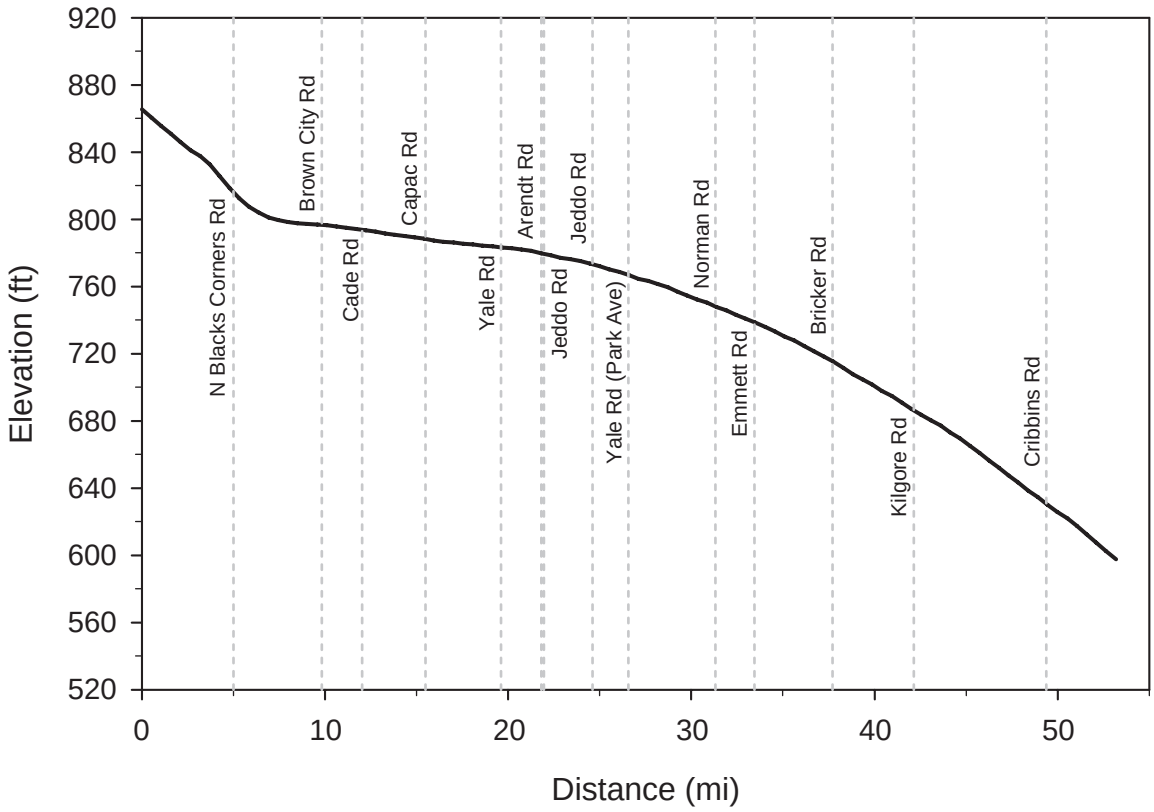


Figure 29. Mill Creek subwatershed (upper, dotted boundary) with all road crossings for geographic reference. The outer rectangle covers 377,950 acres and the river segment is 53.2 miles. River flow is northeast to southeast. Lower graph shows elevation change along tributary.–

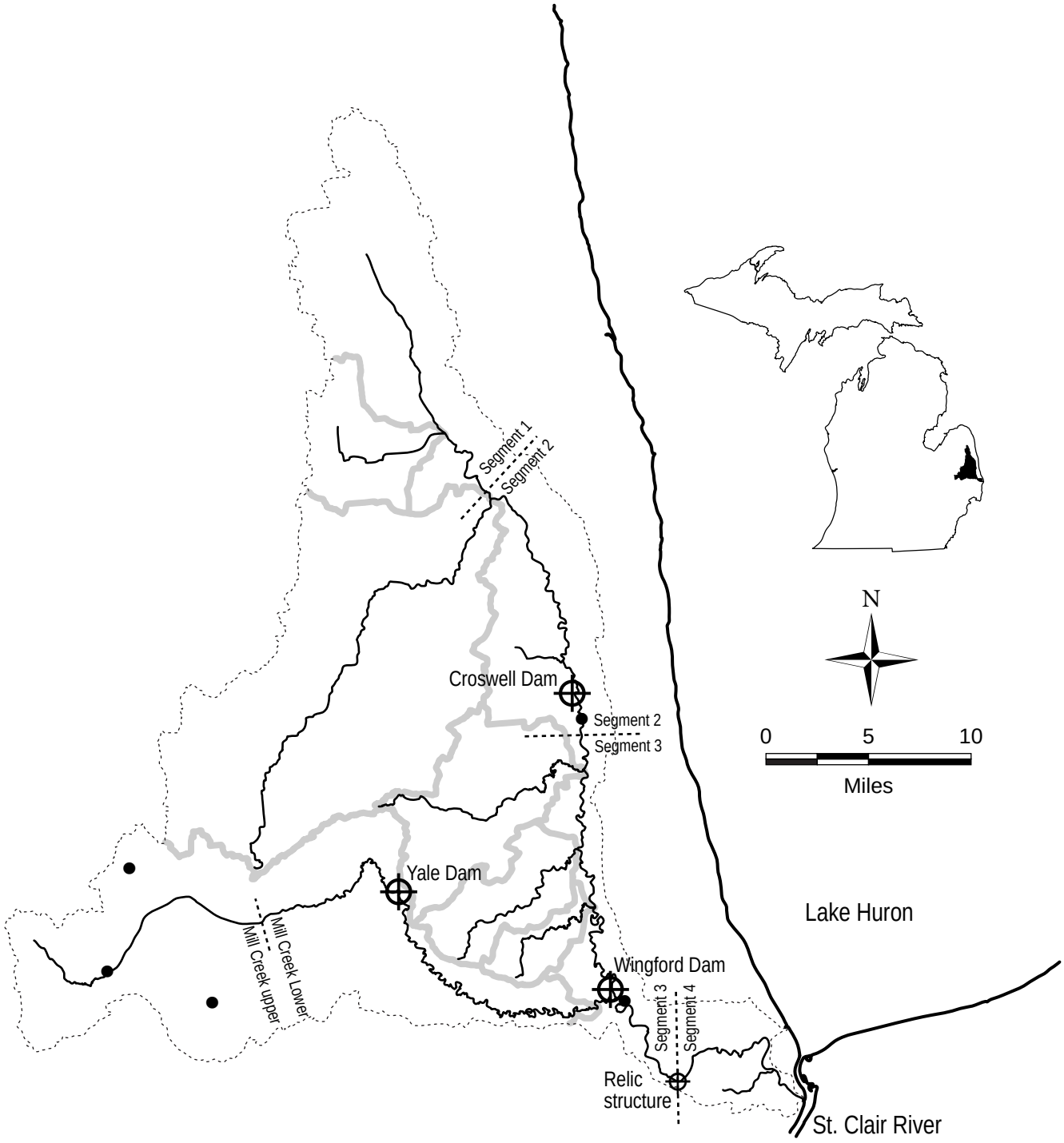


Figure 30.–Locations for three significant dams, two on the Black River main stem and one on Mill Creek indicated by large crosshair symbols. The smaller crosshair symbol shows location of a relic dam structure. Small, black dots show locations of small, mostly private dams listed in the Michigan Department of Environmental Quality dams database. Gray lines show boundaries of subwatersheds, solid black lines show the Black River and major tributaries. Dotted black lines delineate river segments.

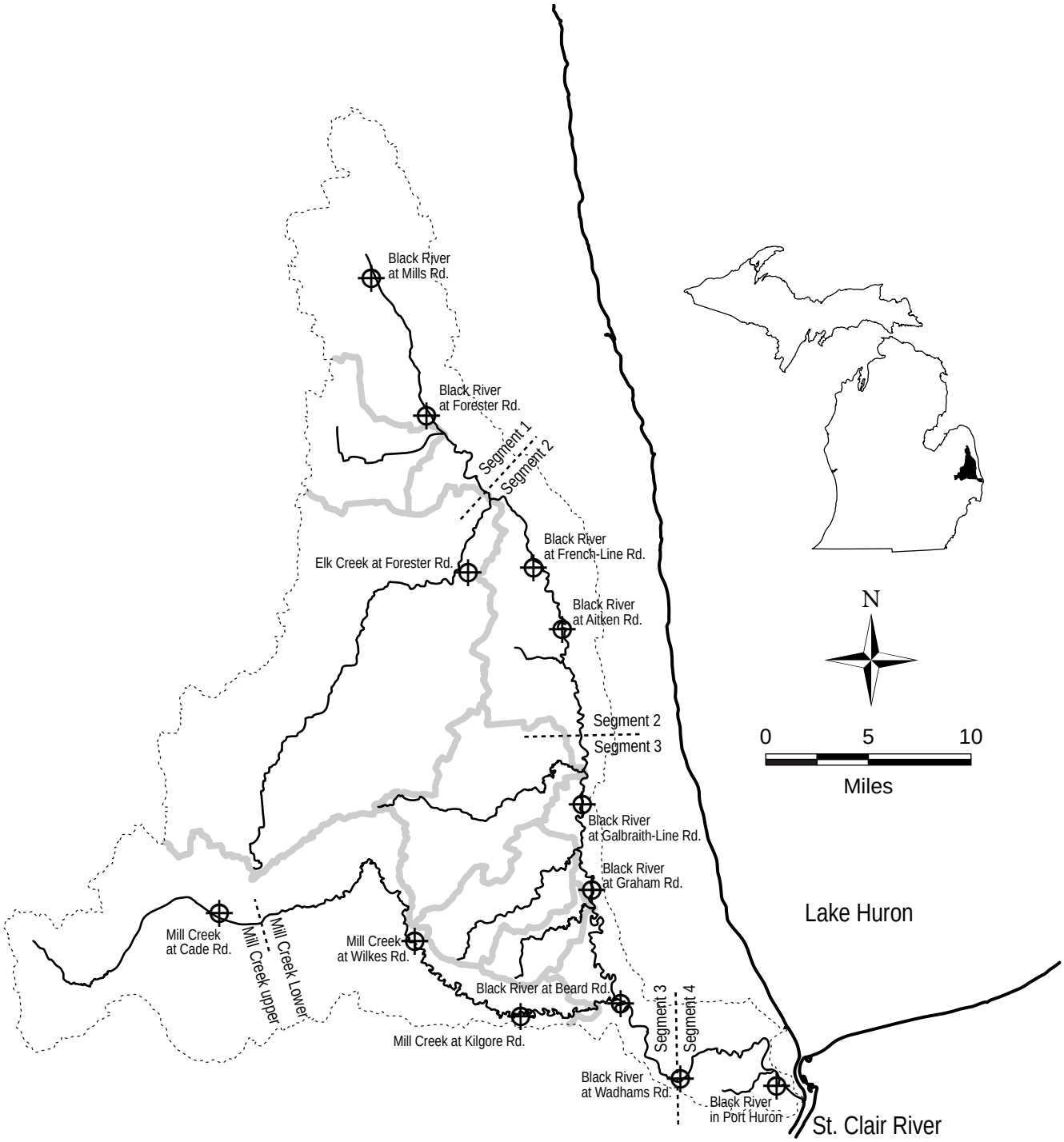


Figure 31.– Geographic locations (usually near road crossing) for Michigan Department of Natural Resources water temperature sensors deployed in the Black River watershed. Dotted lines divide major analysis segments of the Black River main stem and Mill Creek.

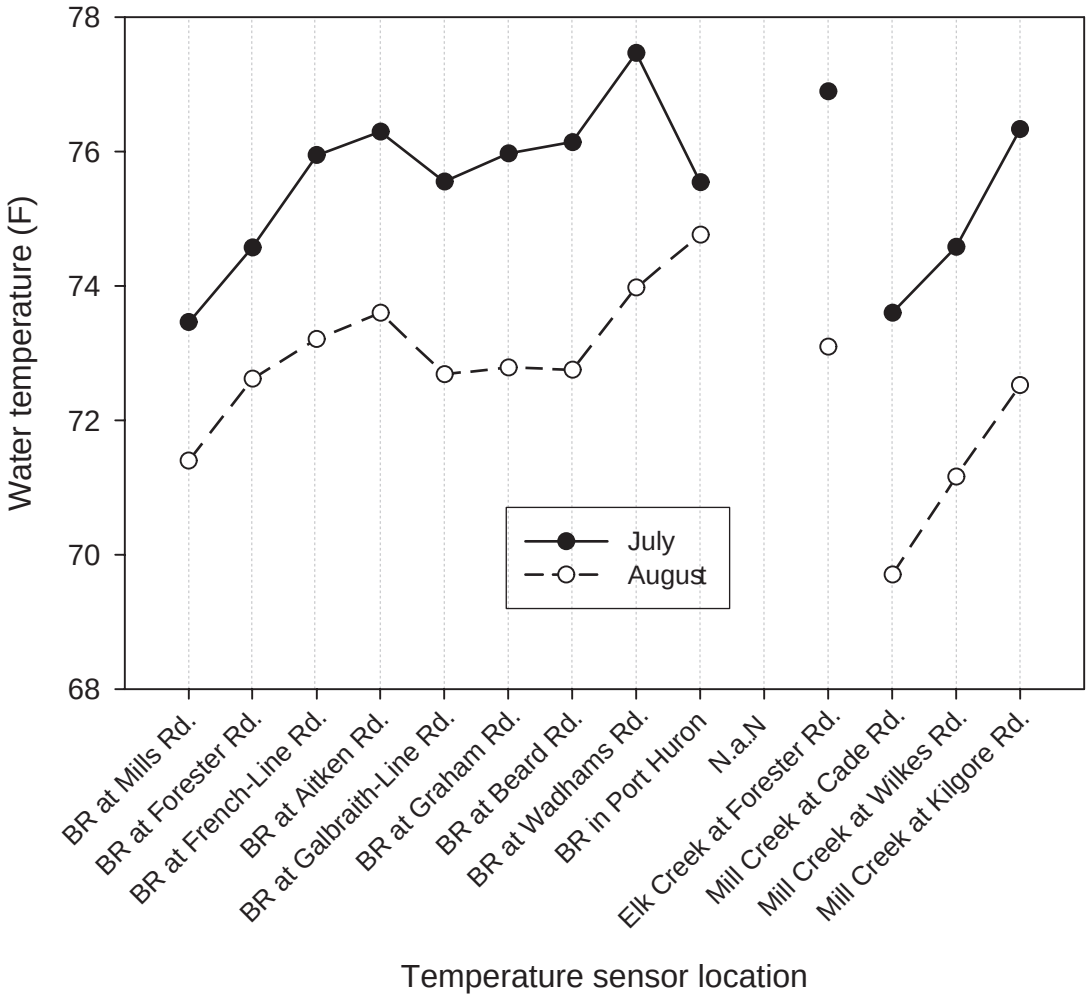


Figure 32.– Average water temperature during July and August at nine stations located near road crossings in the Black River (BR) main stem, one station in Elk Creek, and three stations in Mill Creek.

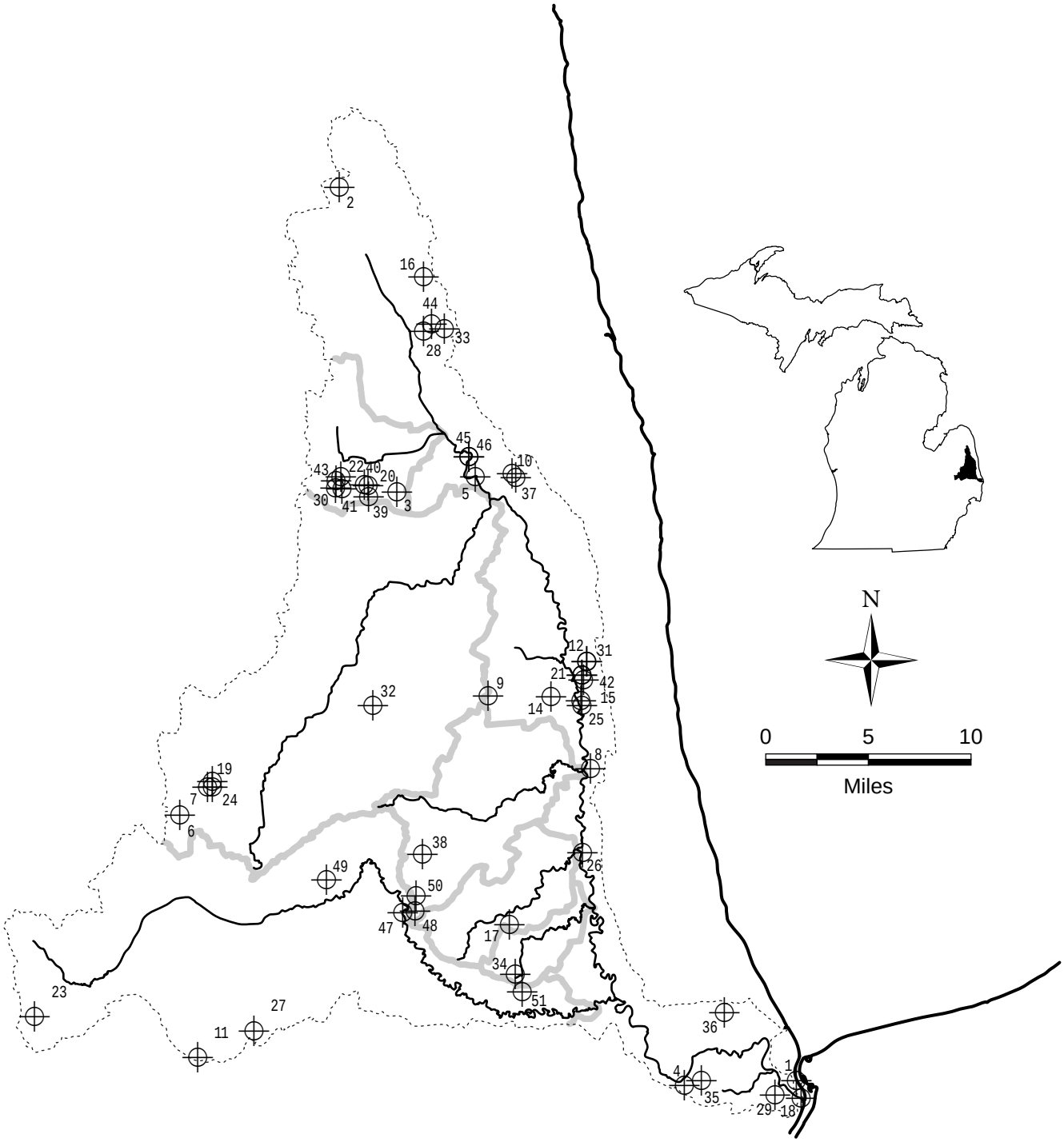


Figure 33.– Map of commercial and municipal entities that have National Pollutant Discharge Elimination System (NPDES) permits in the Black River watershed. Numbers identify the permitted activities listed in Table 6.

Figure 34.– Map of 996.6 miles of designated drains within the Black River watershed. Dark line shows the watershed boundary.

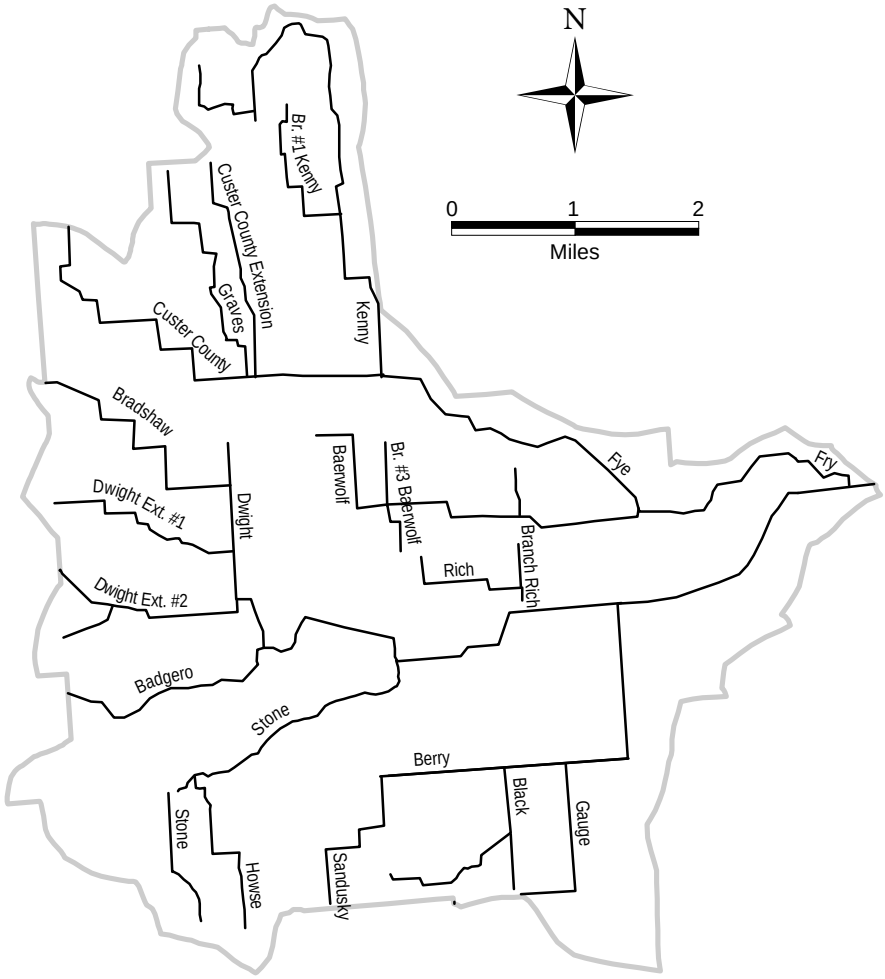


Figure 35.– Map of 56.1 miles of designated drains within the Berry Drain subwatershed. Dotted line shows the subwatershed boundary.

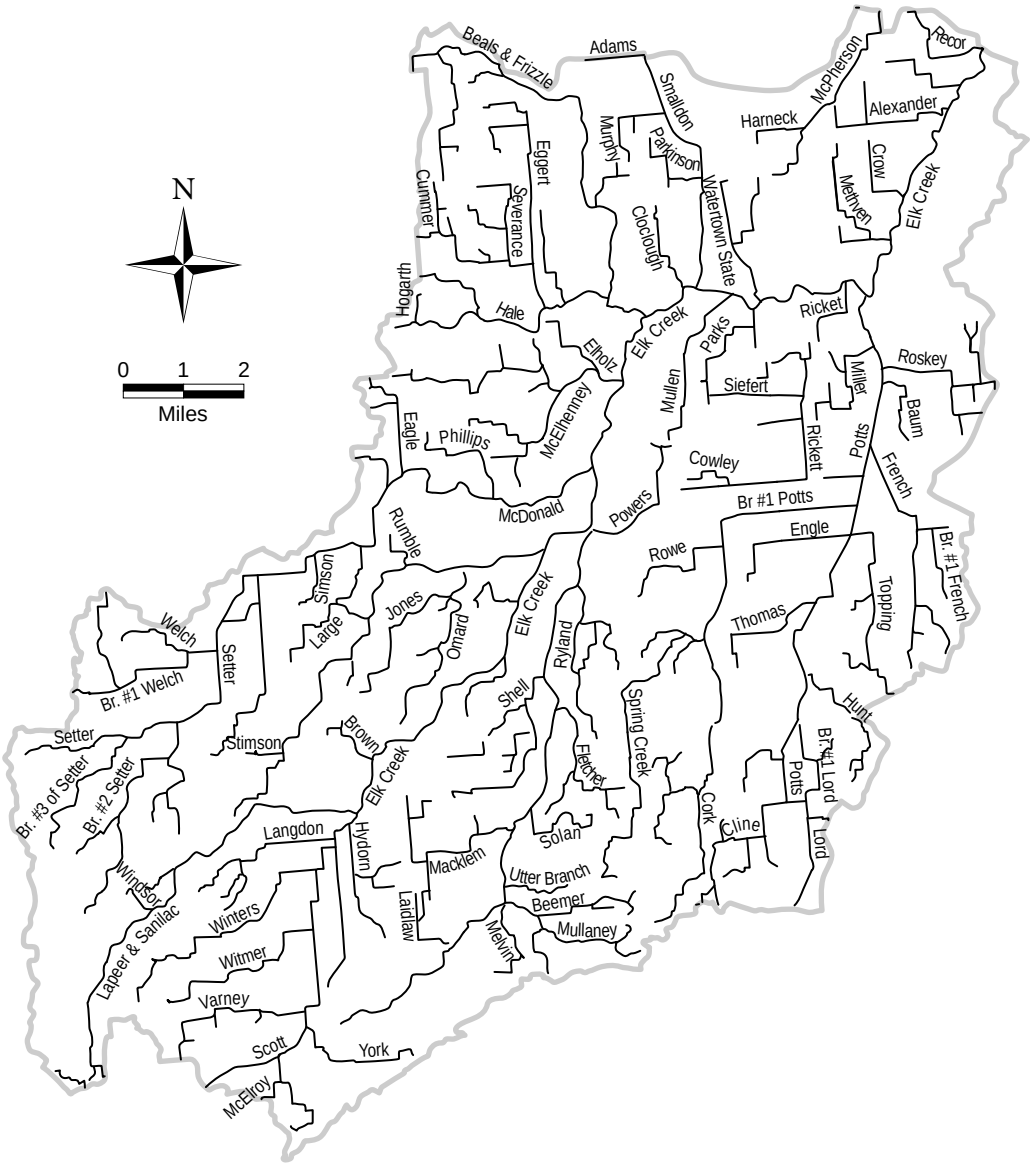


Figure 36.– Map of 347.2 miles of designated drains within the Elk Creek subwatershed. Dotted line shows the subwatershed boundary.

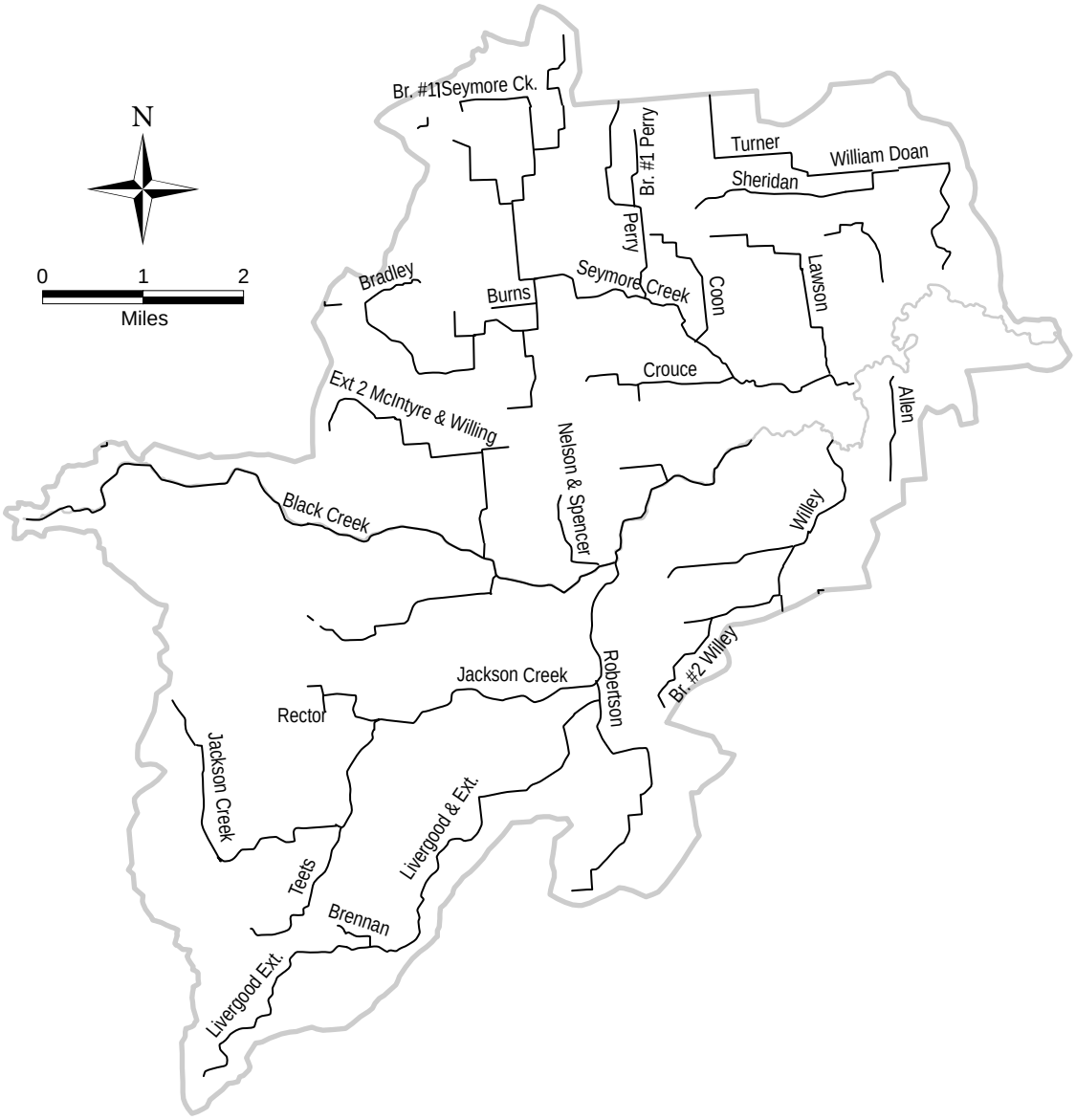


Figure 37.– Map of 75.3 miles of designated drains within the Black Creek subwatershed. Dotted line shows the subwatershed boundary and lighter gray line shows portion of Black Creek not having drain designation.

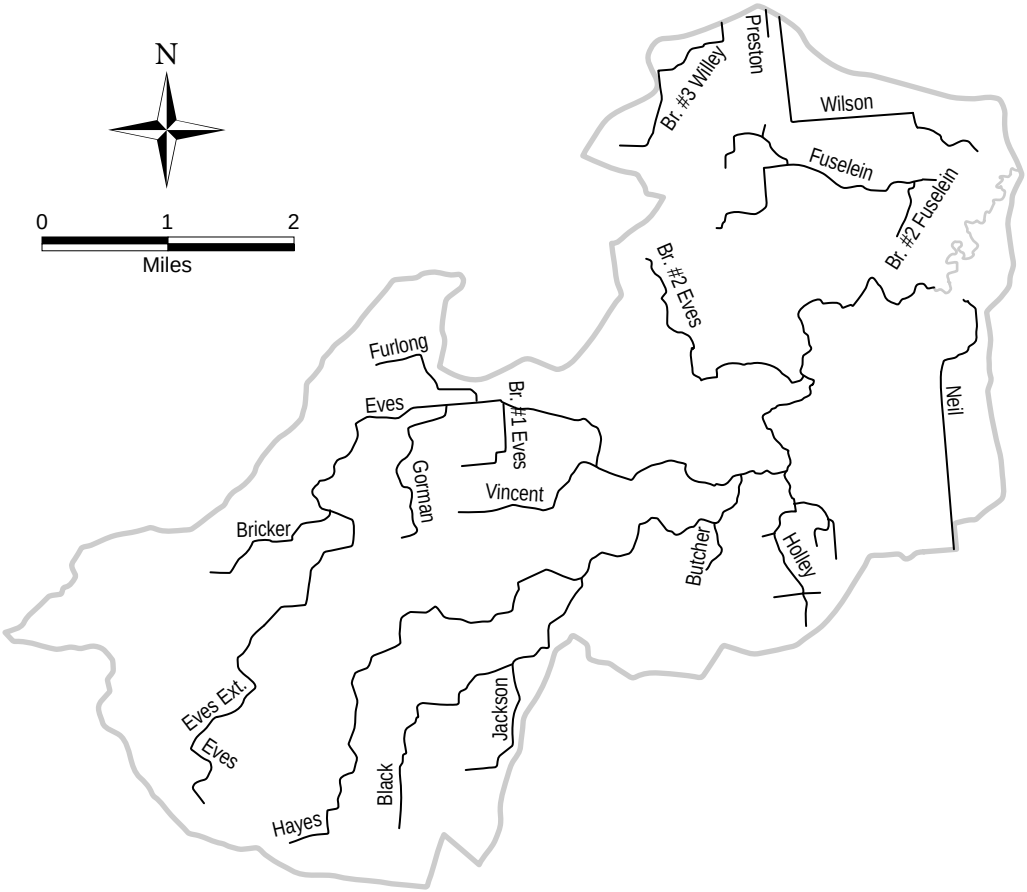


Figure 38.– Map of 43.9 miles of designated drains within the Silver Creek subwatershed. Dotted line shows the subwatershed boundary and lighter gray line shows portion of Silver Creek not having drain designation.

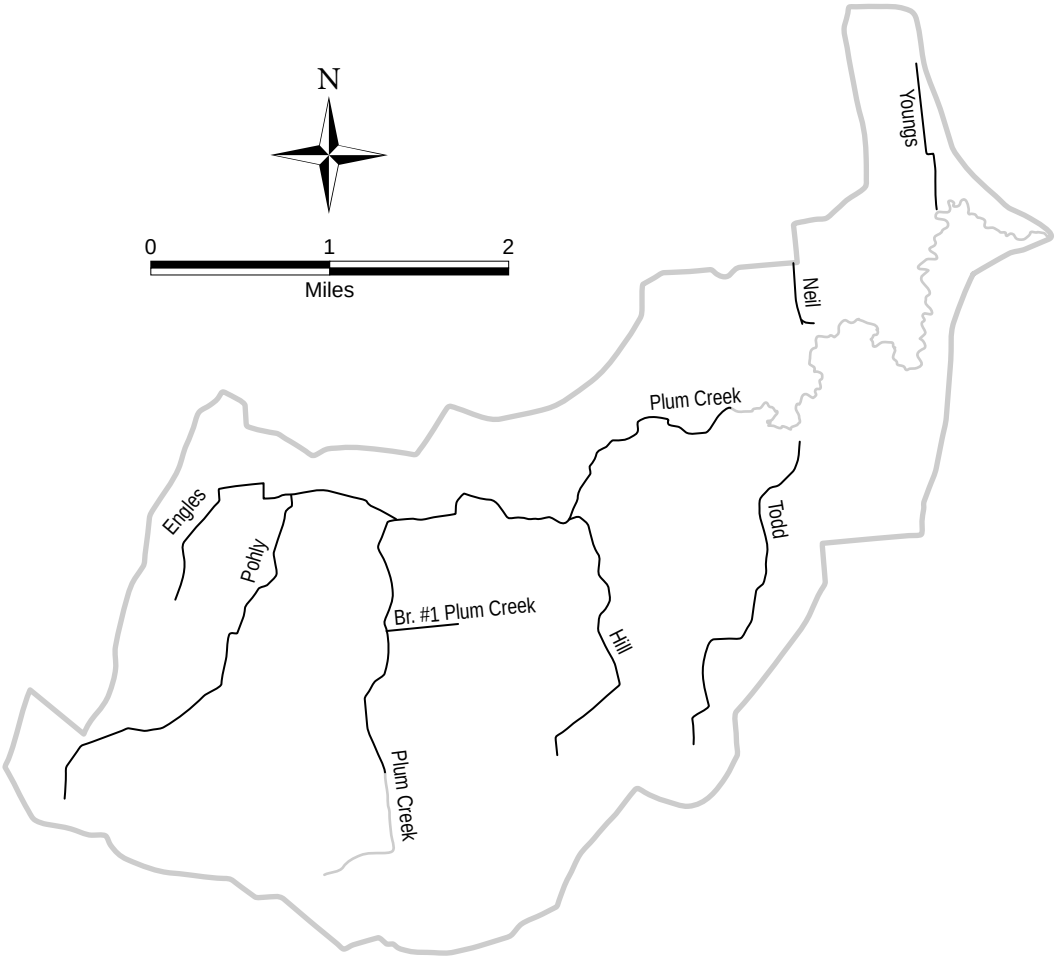


Figure 39.– Map of 13.0 miles of designated drains within the Plum Creek subwatershed. Dotted line shows the subwatershed boundary and lighter gray line shows portion of Plum Creek not having drain designation.

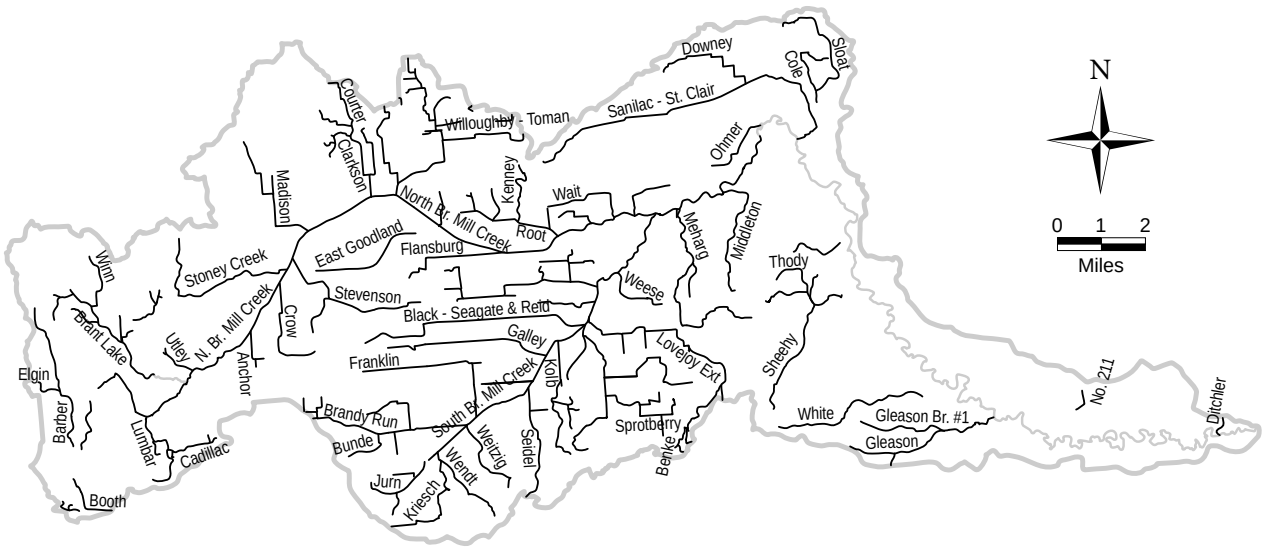


Figure 40.– Map of 166.2 miles of designated drains within the Mill Creek subwatershed. Dotted line shows the subwatershed boundary and lighter gray line shows portion of Mill Creek not having drain designation.

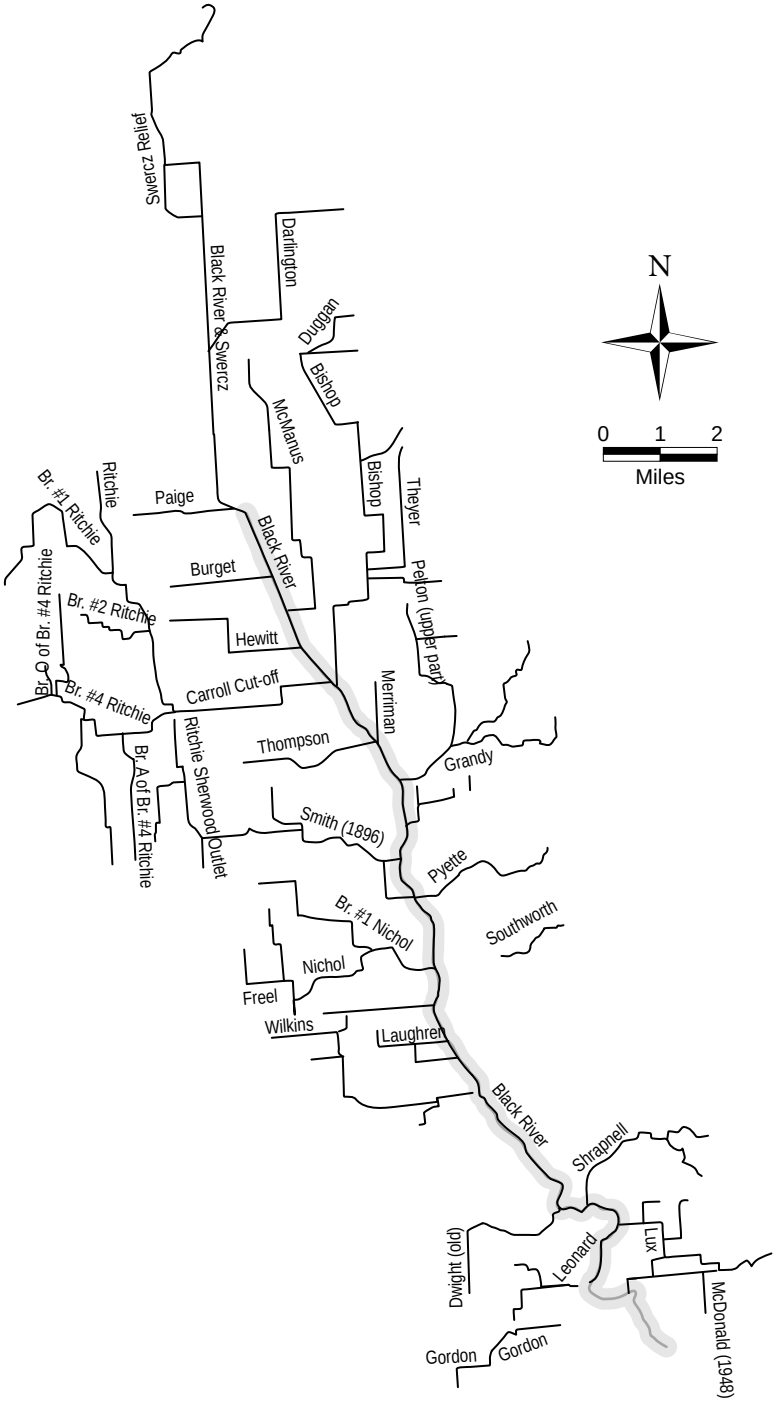


Figure 41.– Map of 124.8 miles of designated drains within Segment 1 of Black River watershed. Gray buffer shows actual stretch of river assigned to Segment 1.

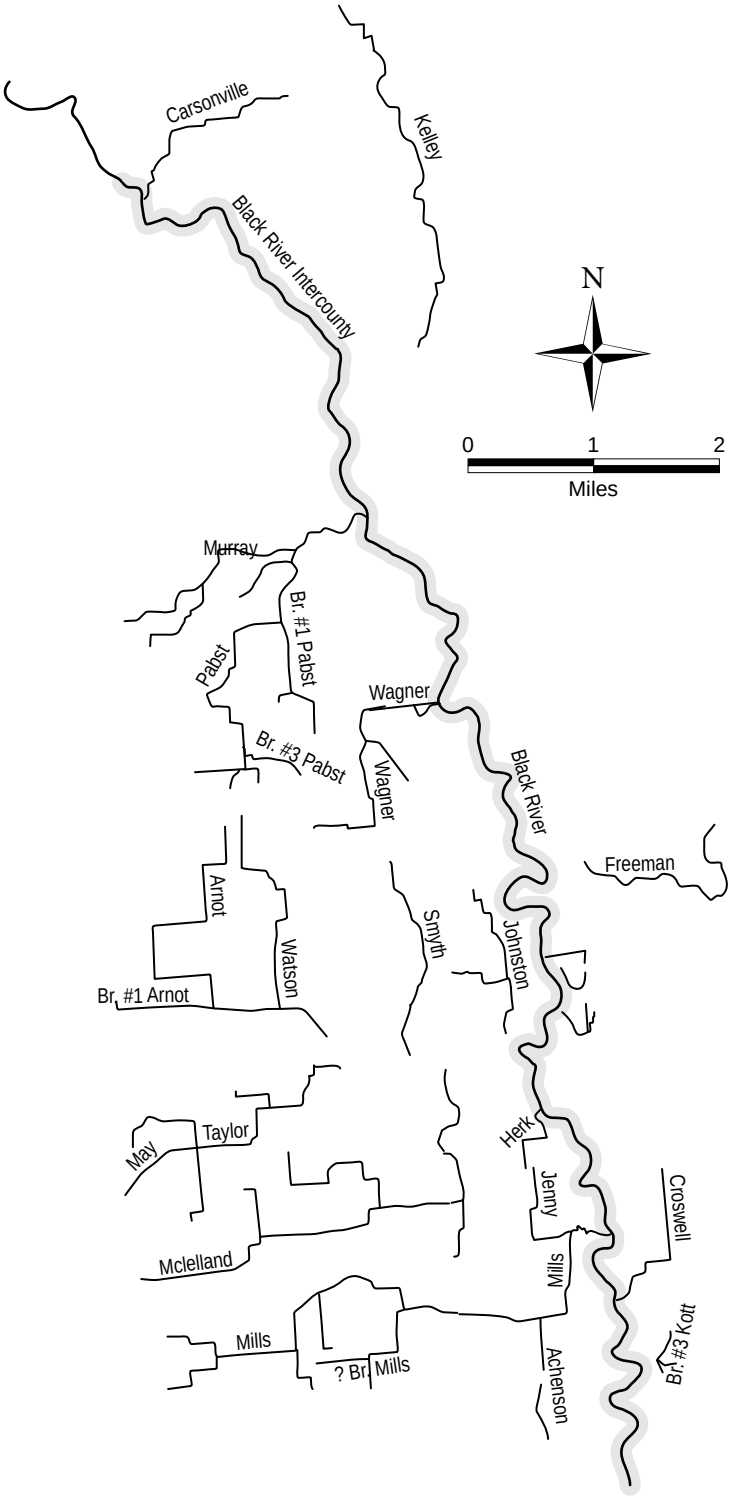


Figure 42.– Map of 72.5 miles of designated drains within Segment 2 of Black River watershed which includes the upper portion of the main stem. Gray buffer shows actual stretch of Black River main stem assigned to Segment 2.

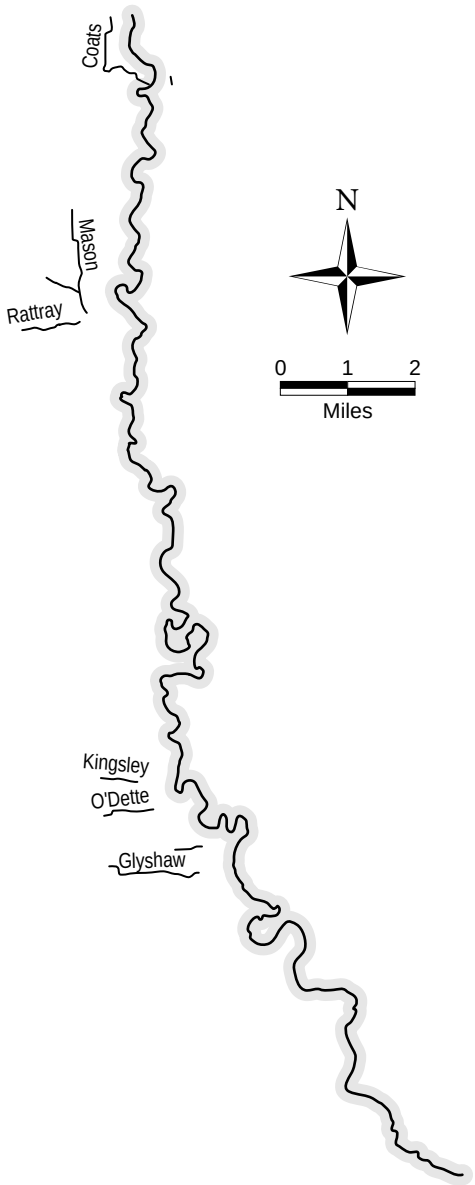


Figure 43.– Map of 8.0 miles of designated drains within Segment 3 of Black River watershed. Gray buffer shows actual stretch of Black River main stem assigned to Segment 3. None of the Black River main stem is designated a drain in this segment.

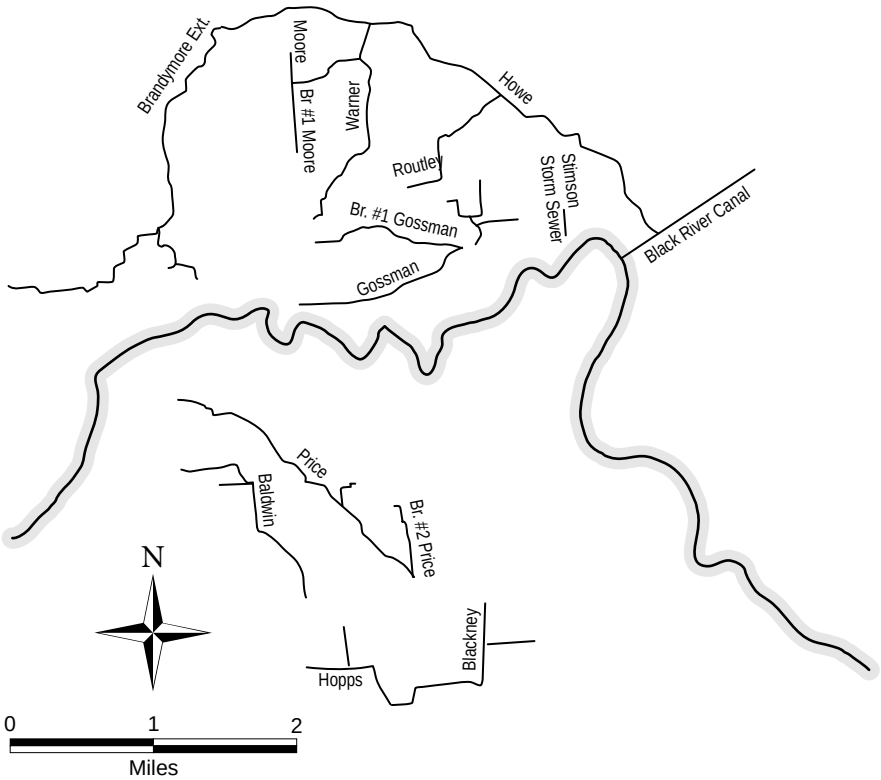


Figure 44.– Map of 23.9 miles of designated drains within Segment 4 of Black River watershed. Gray buffer shows actual stretch of Black River main stem assigned to Segment 4. None of the Black River main stem is designated a drain in this segment.

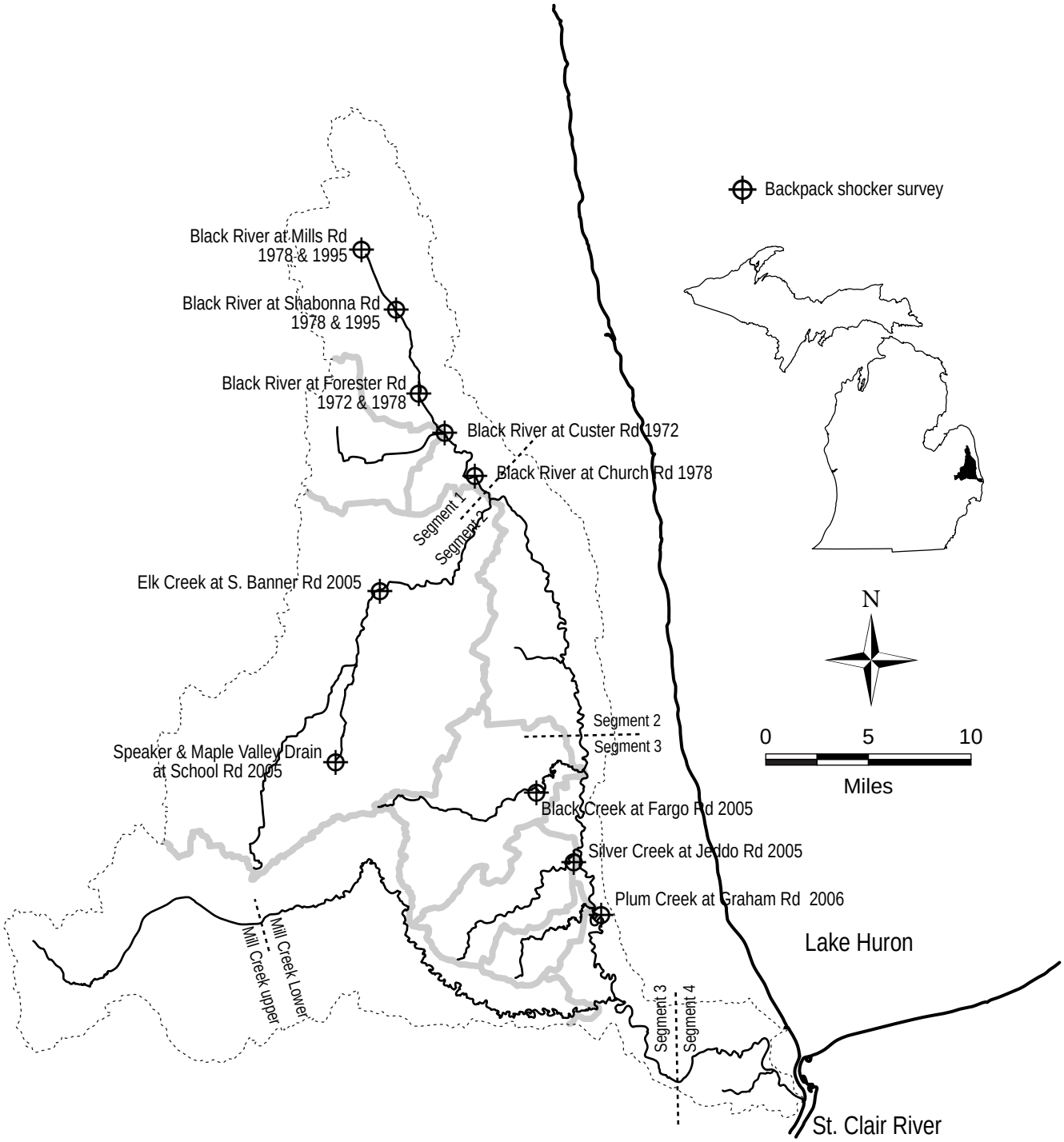


Figure 45.–Geographic locations (usually near road crossing) and year surveyed for Michigan Department of Natural Resources fish sampled with a backpack shocker in the Black River watershed. Dotted lines divide major analysis segments of the Black River main stem and Mill Creek.

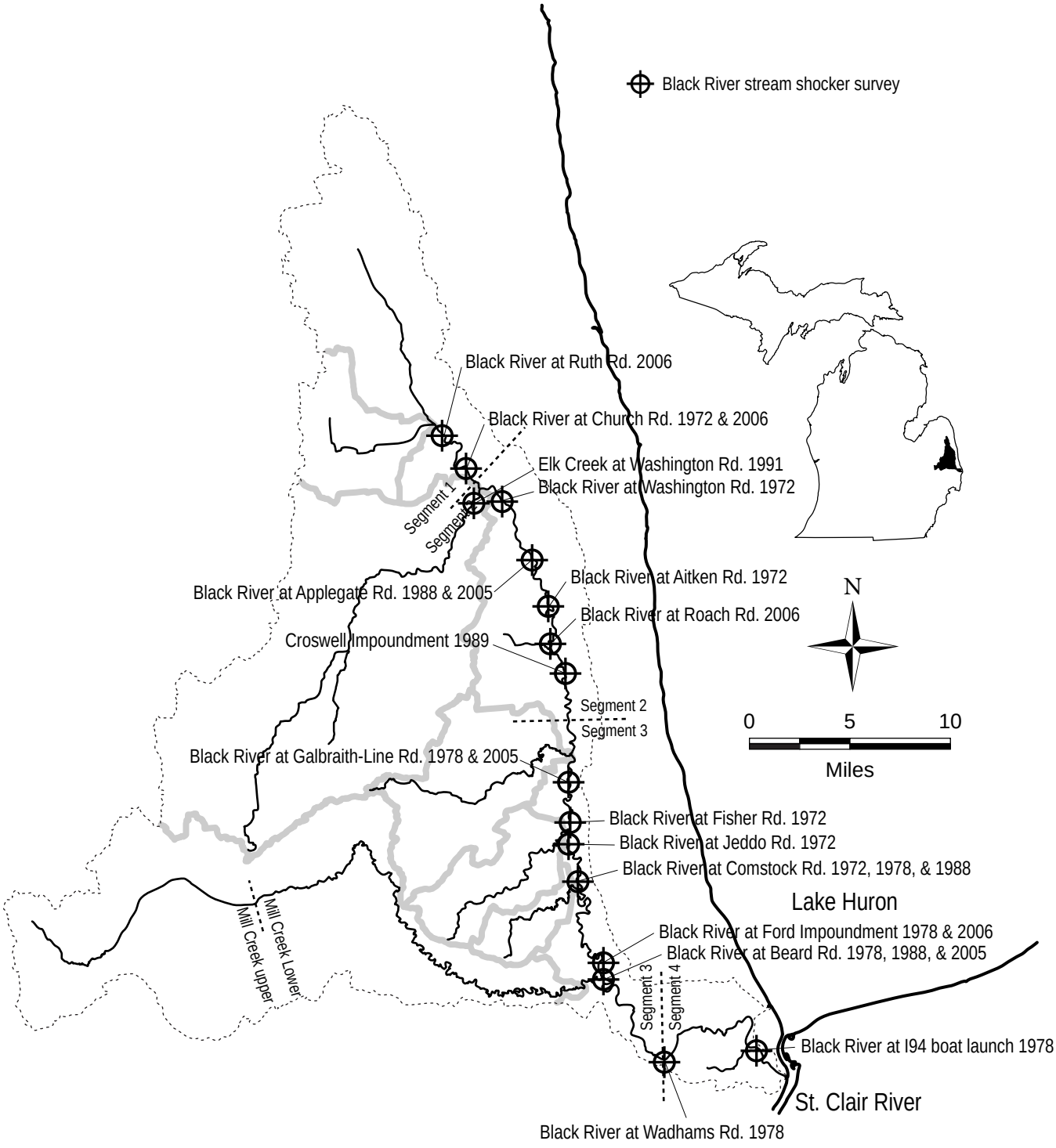


Figure 46.–Geographic locations (usually near road crossing) and year surveyed for Michigan Department of Natural Resources fish sampled with a stream shocker in the main stem of the Black River. Dotted lines divide major analysis segments of the Black River main stem.

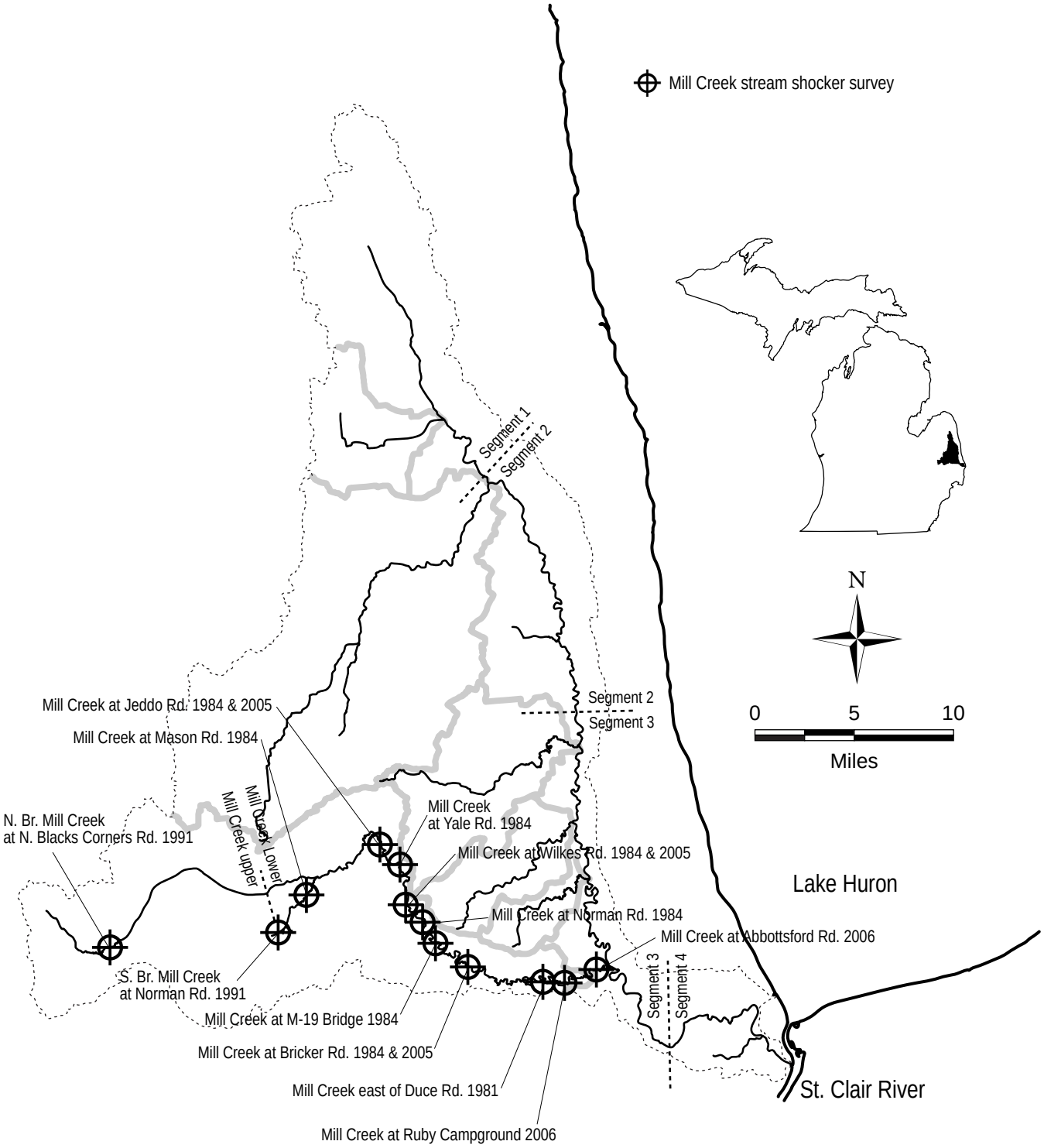


Figure 47.–Geographic locations (usually near road crossing) and year surveyed for Michigan Department of Natural Resources fish sampled with a stream shocker in Mill Creek which is a major tributary of the Black River. Dotted lines divide major analysis segments of the Black River main stem and Mill Creek.

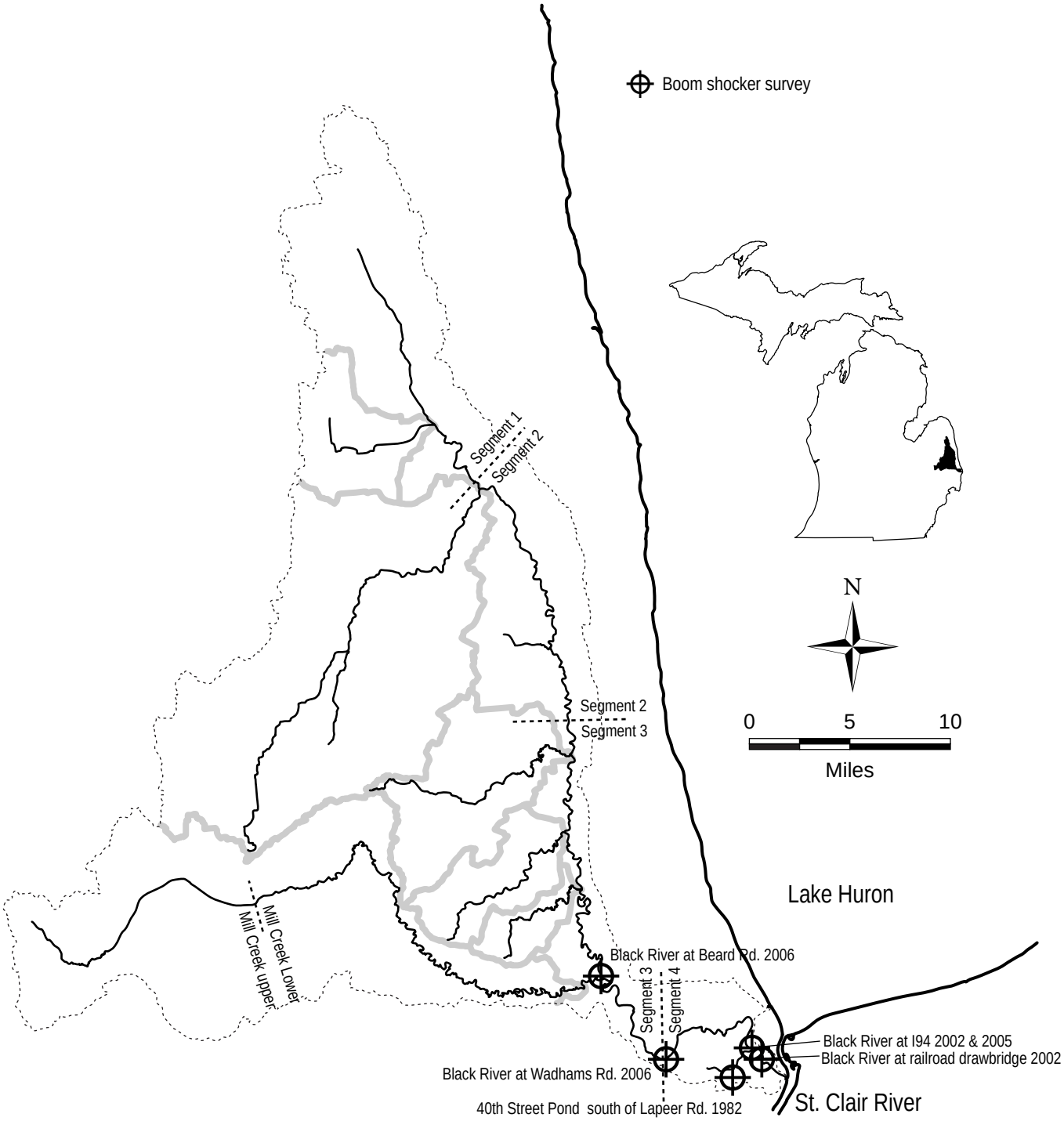


Figure 48.–Geographic locations (usually near road crossing) and year surveyed for Michigan Department of Natural Resources fish sampled with a boom shocker in the main stem of the Black River. Dotted lines divide major analysis segments of the Black River main stem.

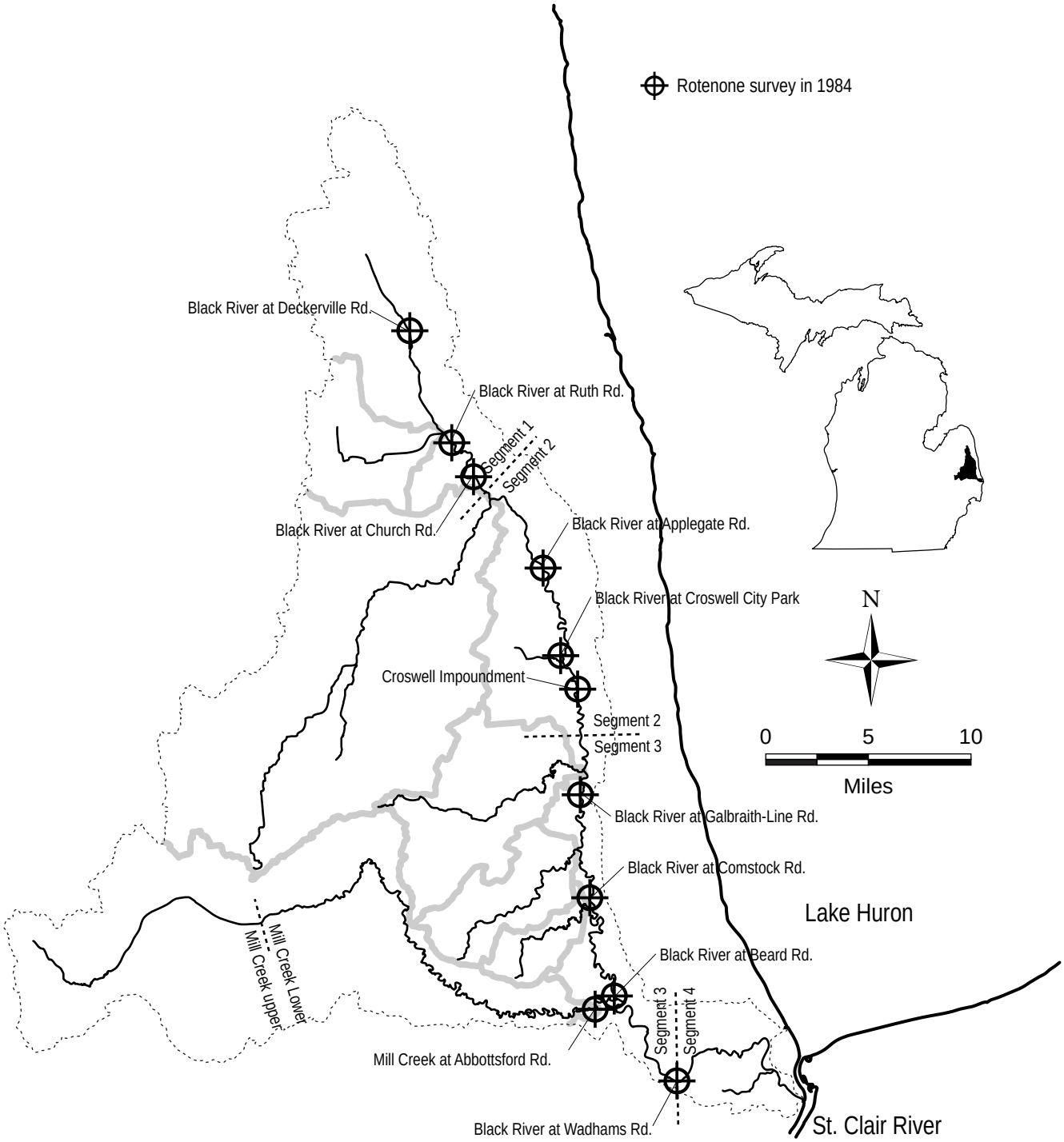


Figure 49.–Geographic locations (usually near road crossing) and year surveyed for Michigan Department of Natural Resources fish sampled with rotenone in the main stem of the Black River and lower Mill Creek. Dotted lines divide major analysis segments of the Black River main stem and Mill Creek.

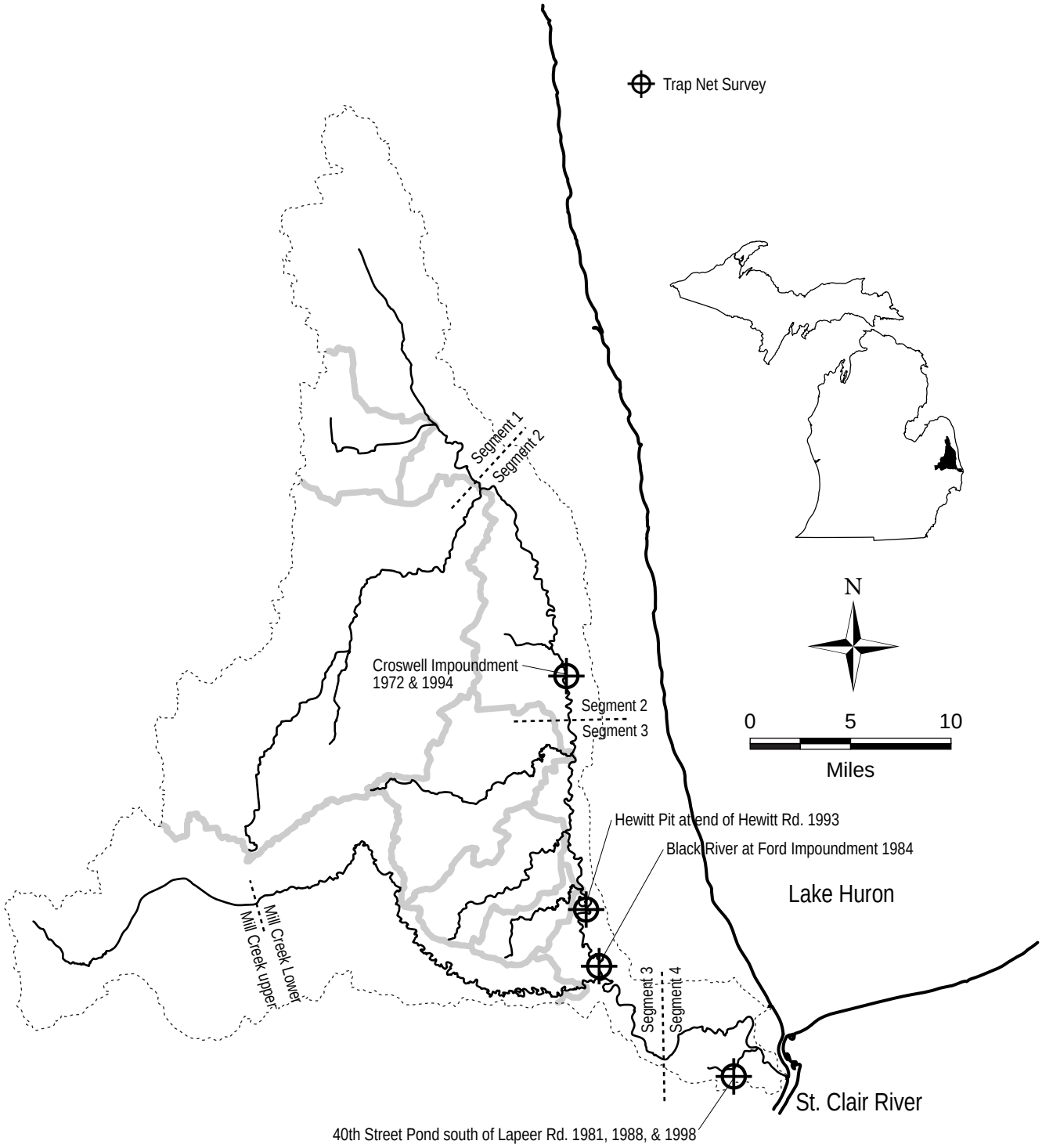


Figure 50.–Geographic locations (usually near road crossing) and year surveyed for Michigan Department of Natural Resources fish sampled with trap nets in backwater areas above dams on the main stem of the Black River and in two human-made ponds located close to the river. Dotted lines divide major analysis segments of the Black River main stem and Mill Creek.

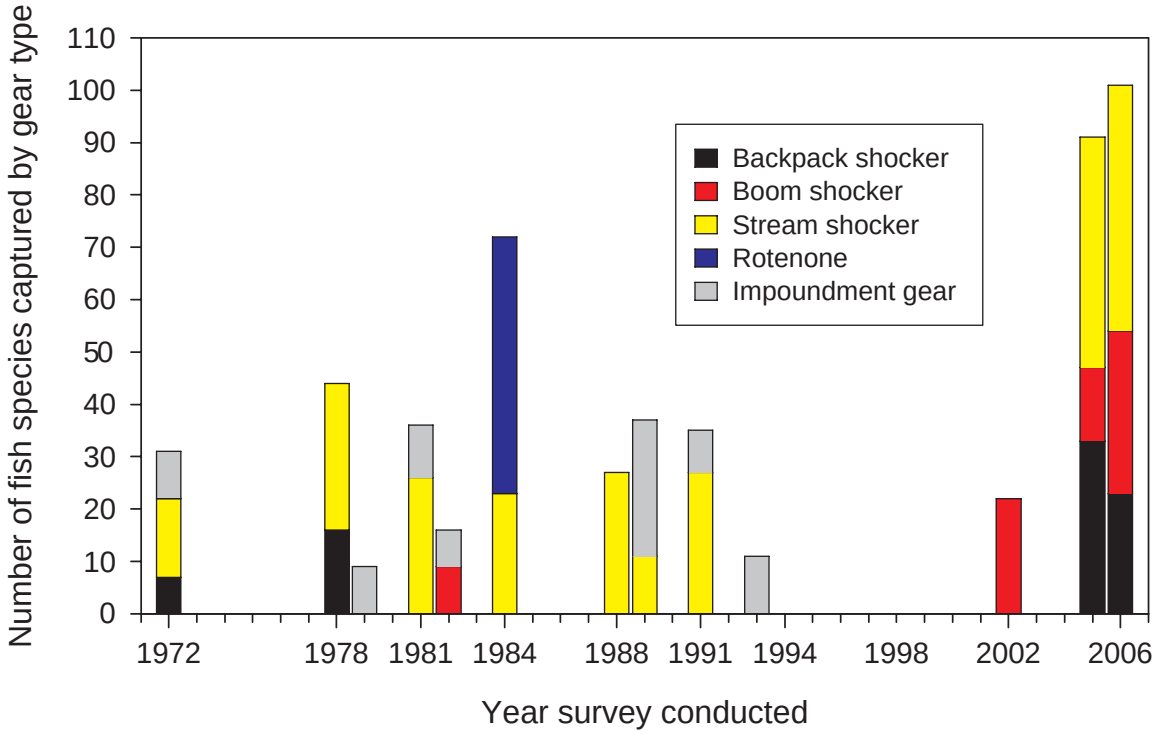


Figure 51.–Number of fish species captured in Michigan Department of Natural Resources surveys by year for each of five sampling techniques. Surveys were conducted in 14 of 35 years between 1972 and 2006.

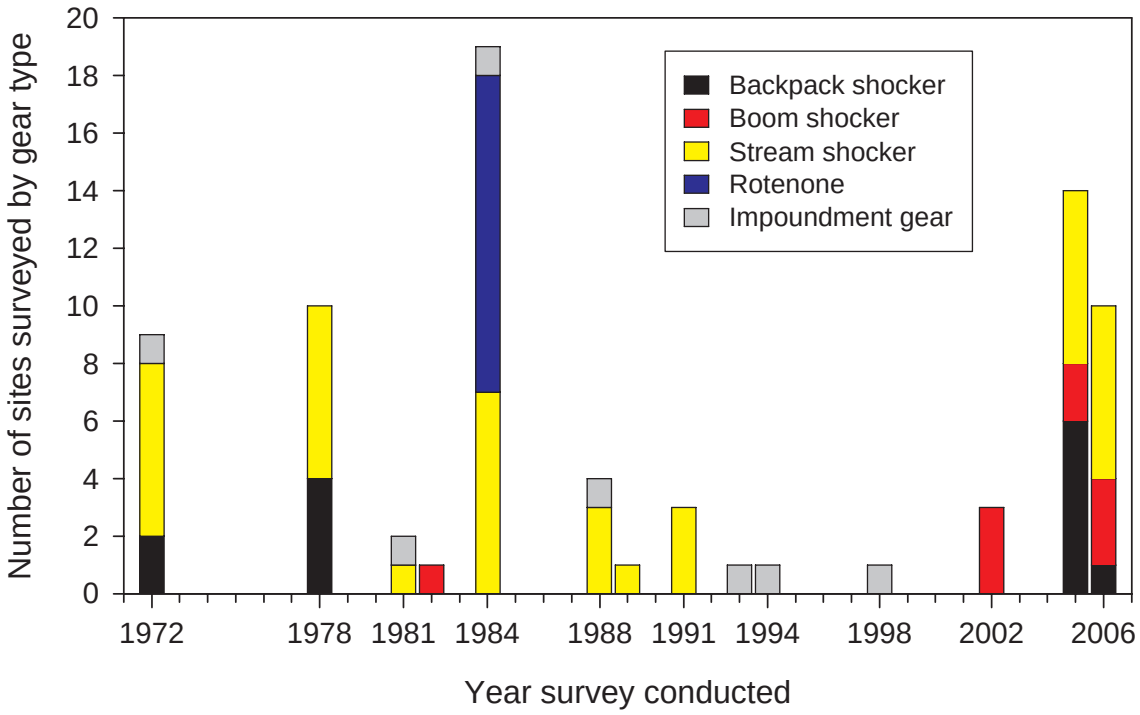


Figure 52.–Number of sites that fish populations were surveyed in the Black River watershed by Michigan Department of Natural Resources by year and each of five sampling techniques. A site was considered to be the contiguous area sampled at a single geographic location, usually at or near a road crossing. Surveys were conducted in 14 of 35 years between 1972 and 2006.

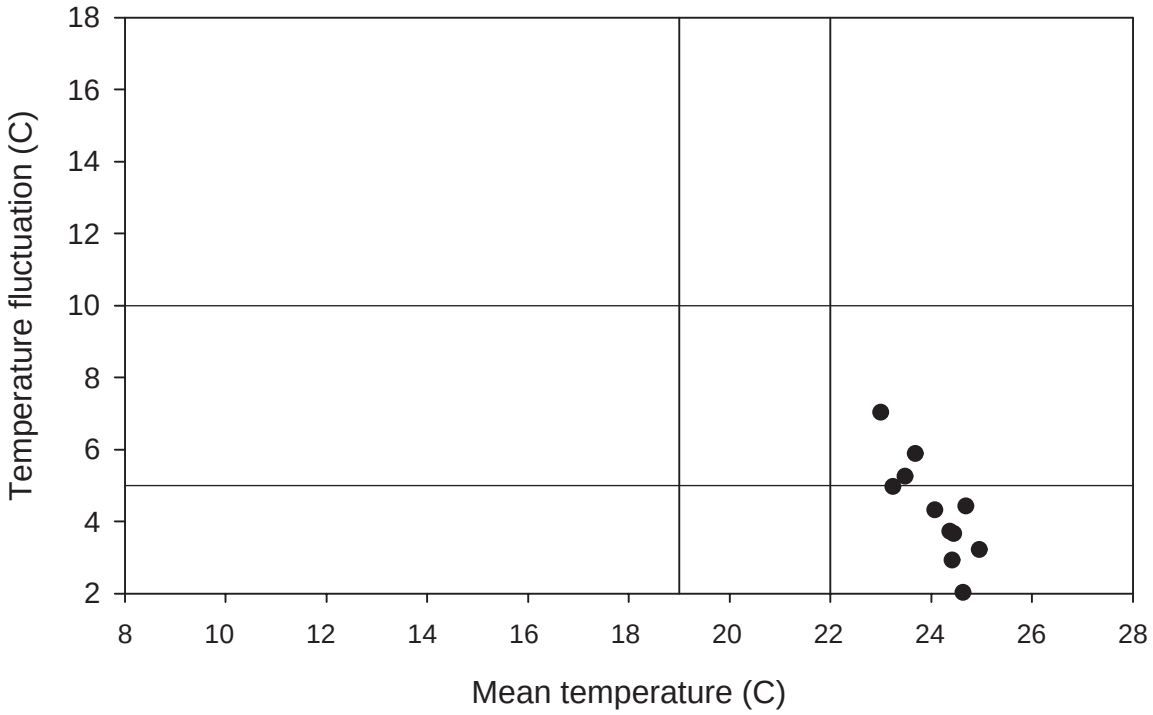


Figure 53.–July water temperature at 11 sites in the Black River plotted on axes designed to separate meaningful fish habitat thermal regimes (Wehrly et al. 2003). Thermal category boundaries for each axis are defined as: cold (<19 0C), cool (19 to <22 0C), and warm (≥22 0C) mean temperatures; and stable (<5 0C), moderate (5 to <10 0C), and extreme (≥10 0C) temperature fluctuations.

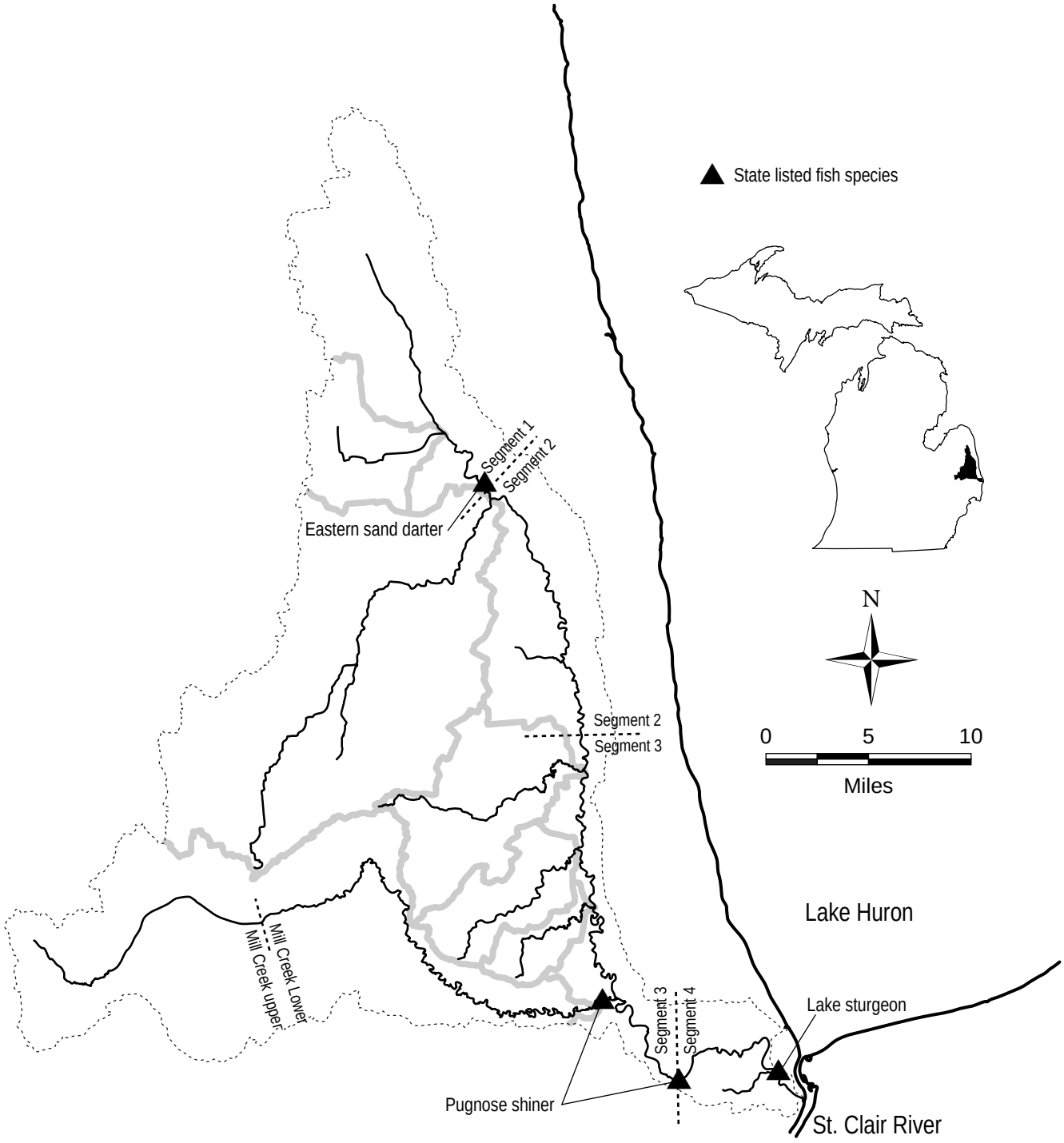


Figure 54.–Geographic locations within the Black River watershed for fish records in the Michigan Fish Atlas database that have status on the state list of species of special concern. Eastern sand darter (Ammocrypta pellucida) and lake sturgeon (Acipenser fulvescens) are state threatened species and pugnose shiner (Notropis anogenus) is a species of special concern.

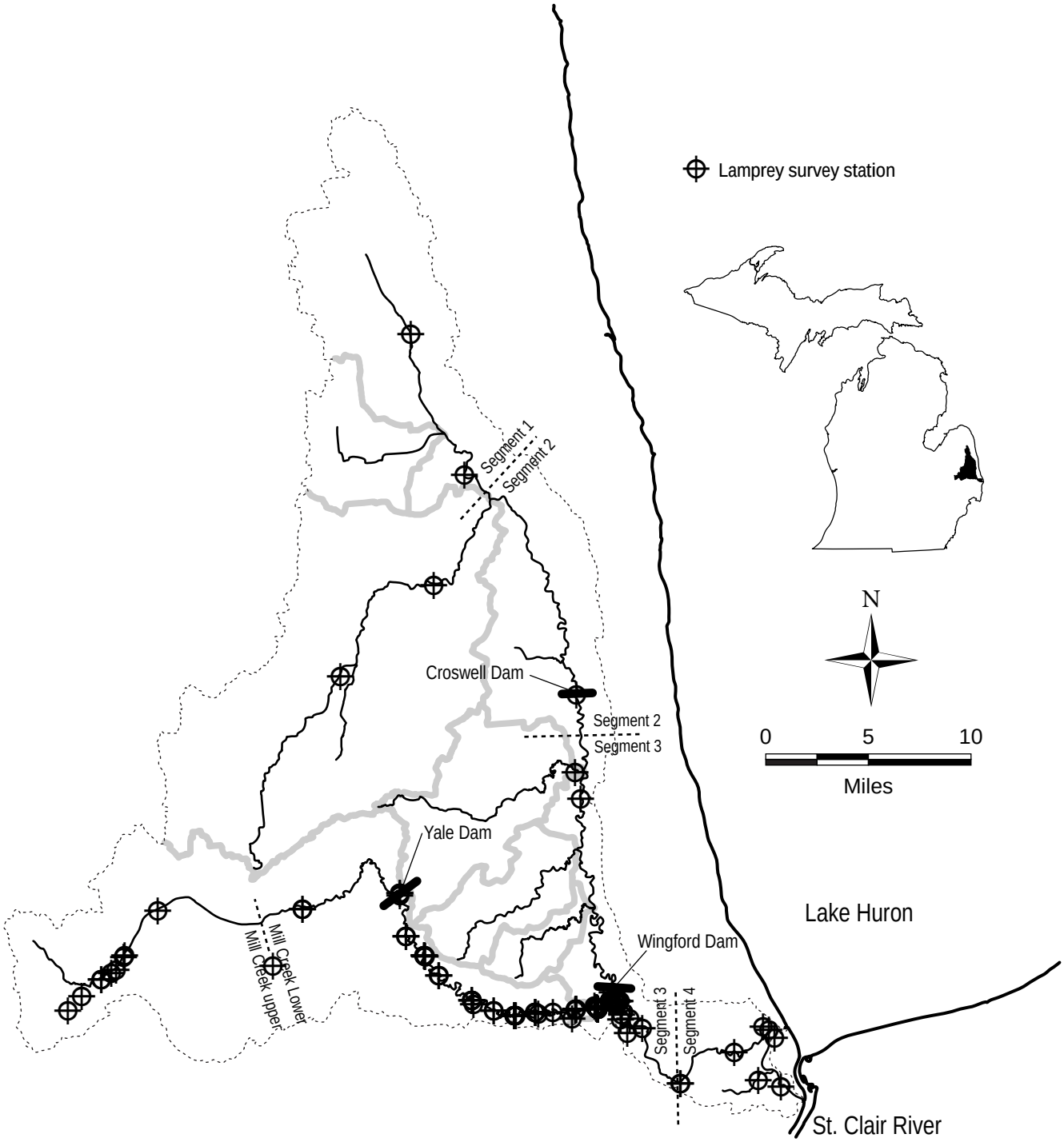


Figure 55.–Geographic locations (usually near road crossing) for all United States Fish and Wildlife Service sea lamprey survey activities in the Black River watershed. Heavy lines show dams that are significant barriers to upstream fish migration. Ford's Dam is now known as Wingford Dam.

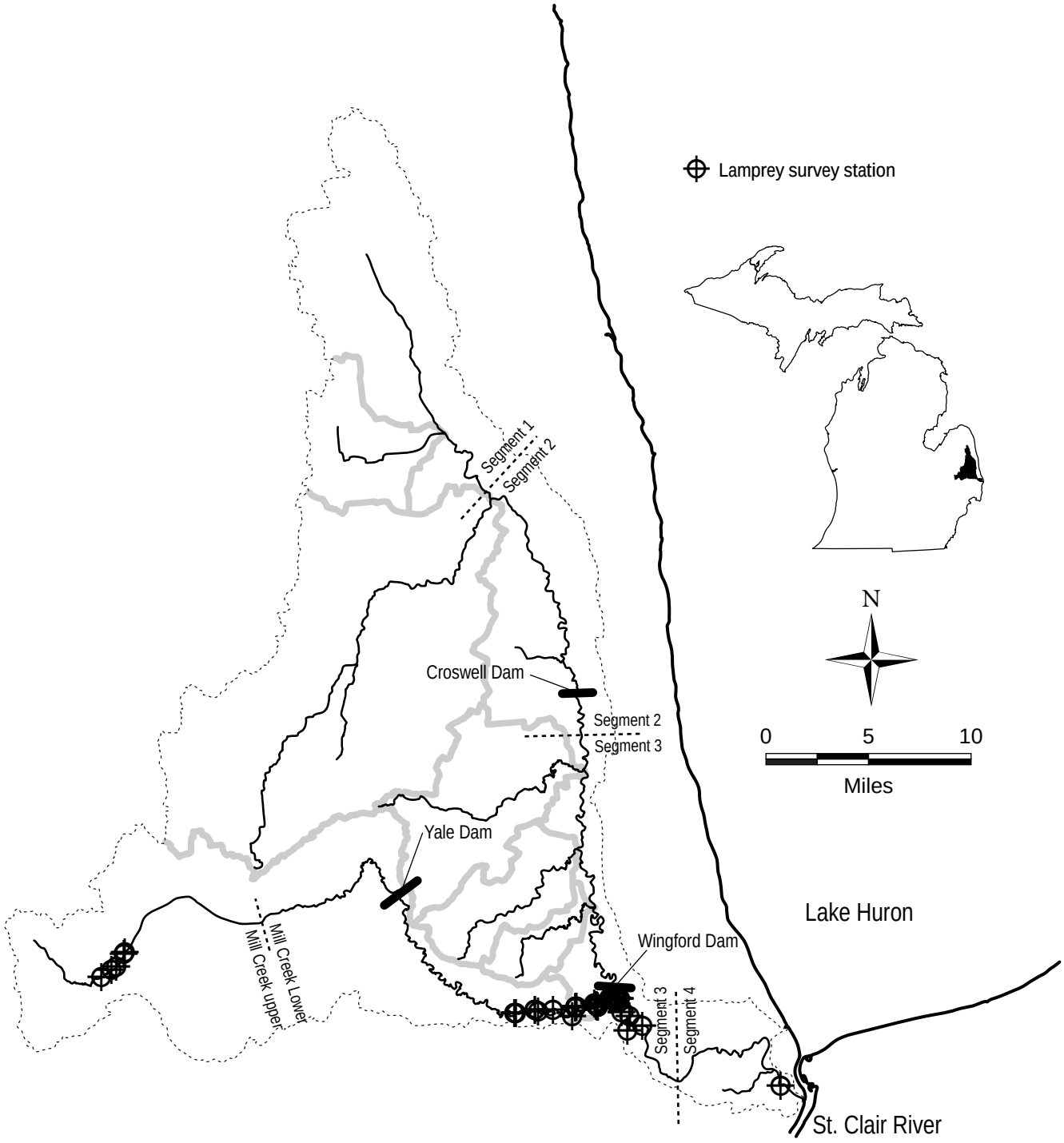


Figure 56.–Lamprey ammocete *Ichthyomyzon* spp. capture locations during United States Fish and Wildlife Service survey activities in the Black River watershed. These ammocetes are not readily identified to species in the field. Heavy lines show dams that are significant barriers to upstream fish migration. Ford's Dam is now known as Wingford Dam.

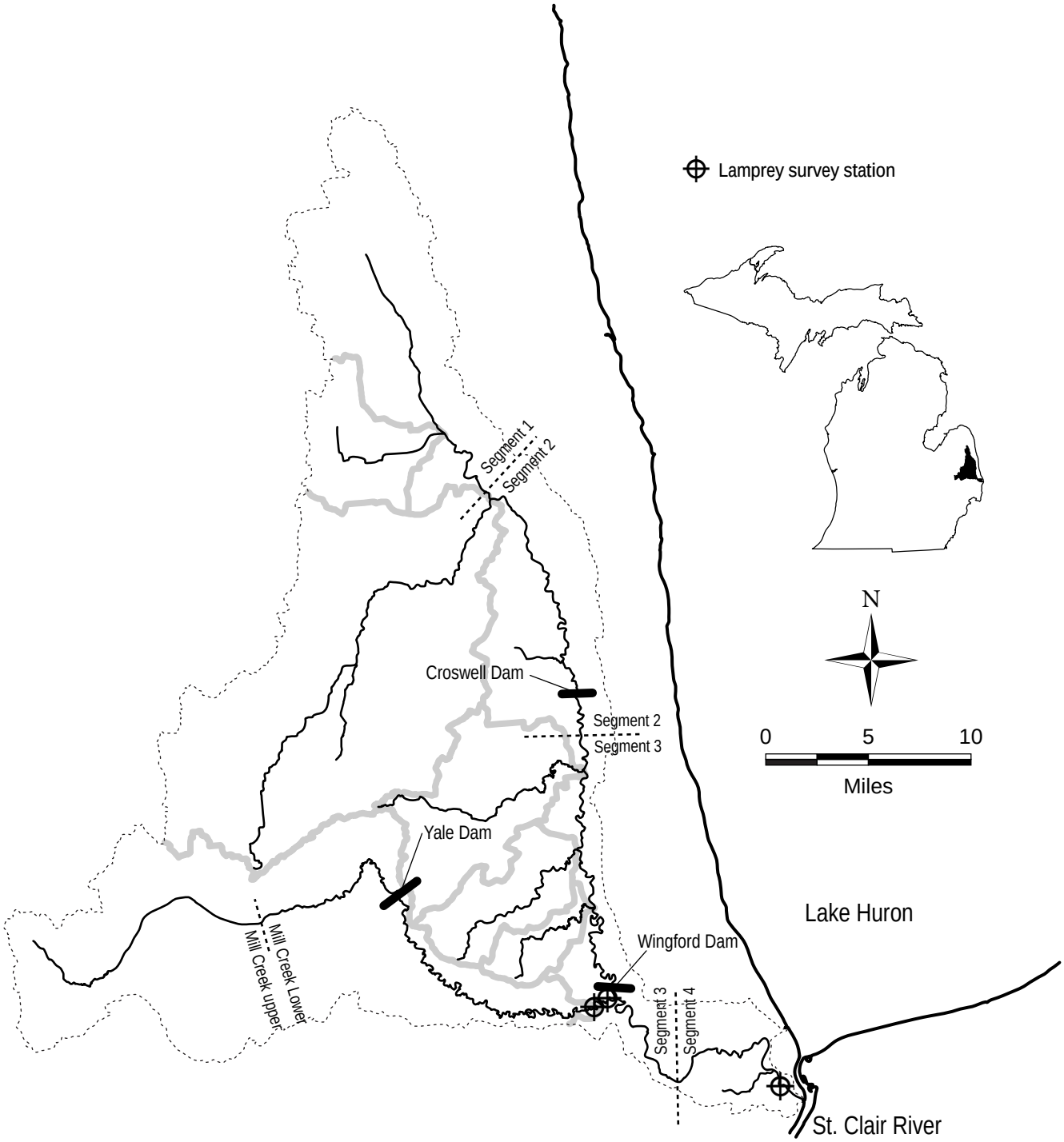


Figure 57.–American brook lamprey *Lampetra appendix* capture locations during United States Fish and Wildlife Service survey activities in the Black River watershed. Heavy lines show dams that are significant barriers to upstream fish migration. Ford's Dam is now known as Wingford Dam.

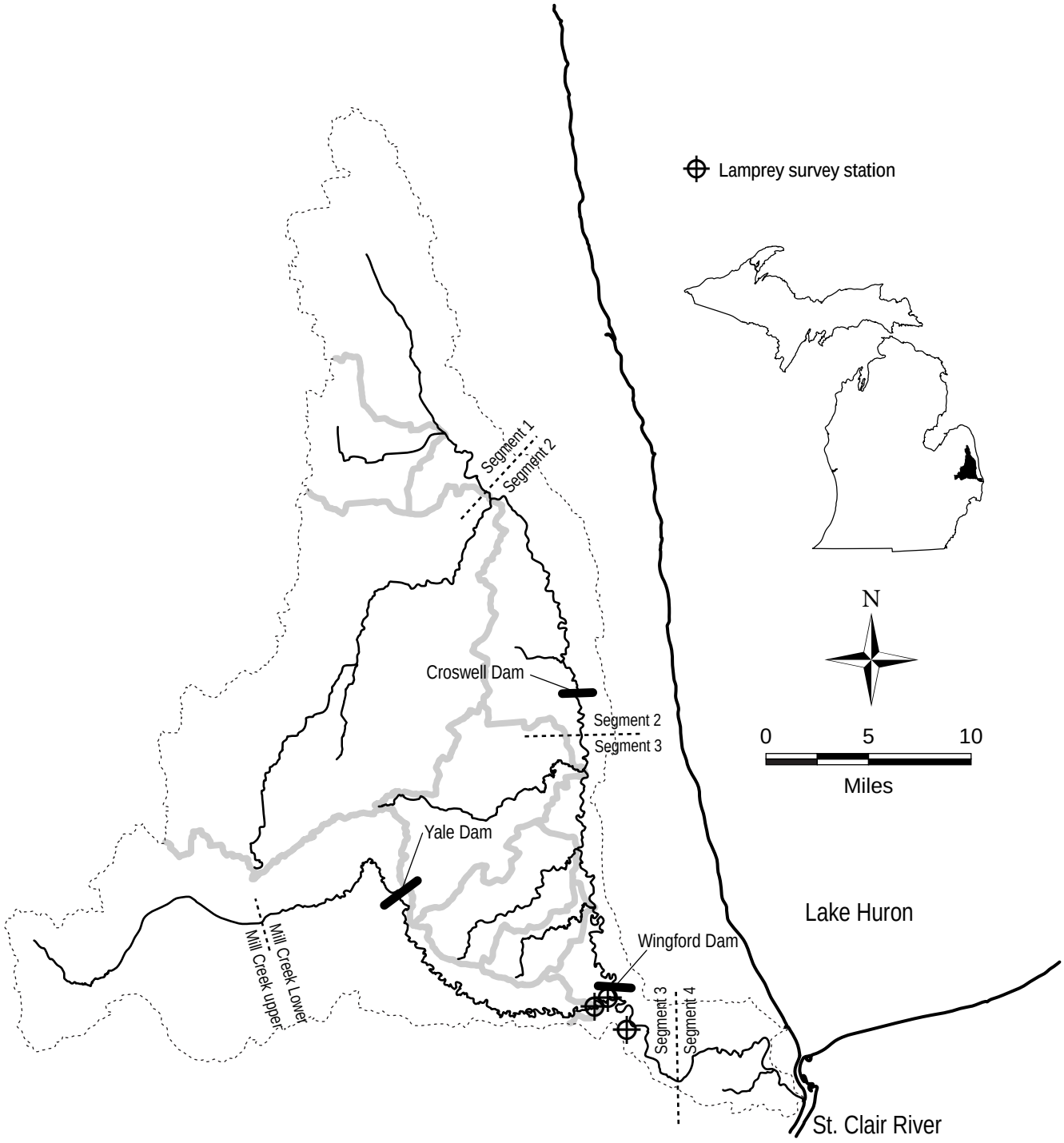


Figure 58.–Northern brook lamprey *Ichthyomyzon castaneus* capture locations during United States Fish and Wildlife Service survey activities in the Black River watershed. Heavy lines show dams that are significant barriers to upstream fish migration. Ford's Dam is now known as Wingford Dam.

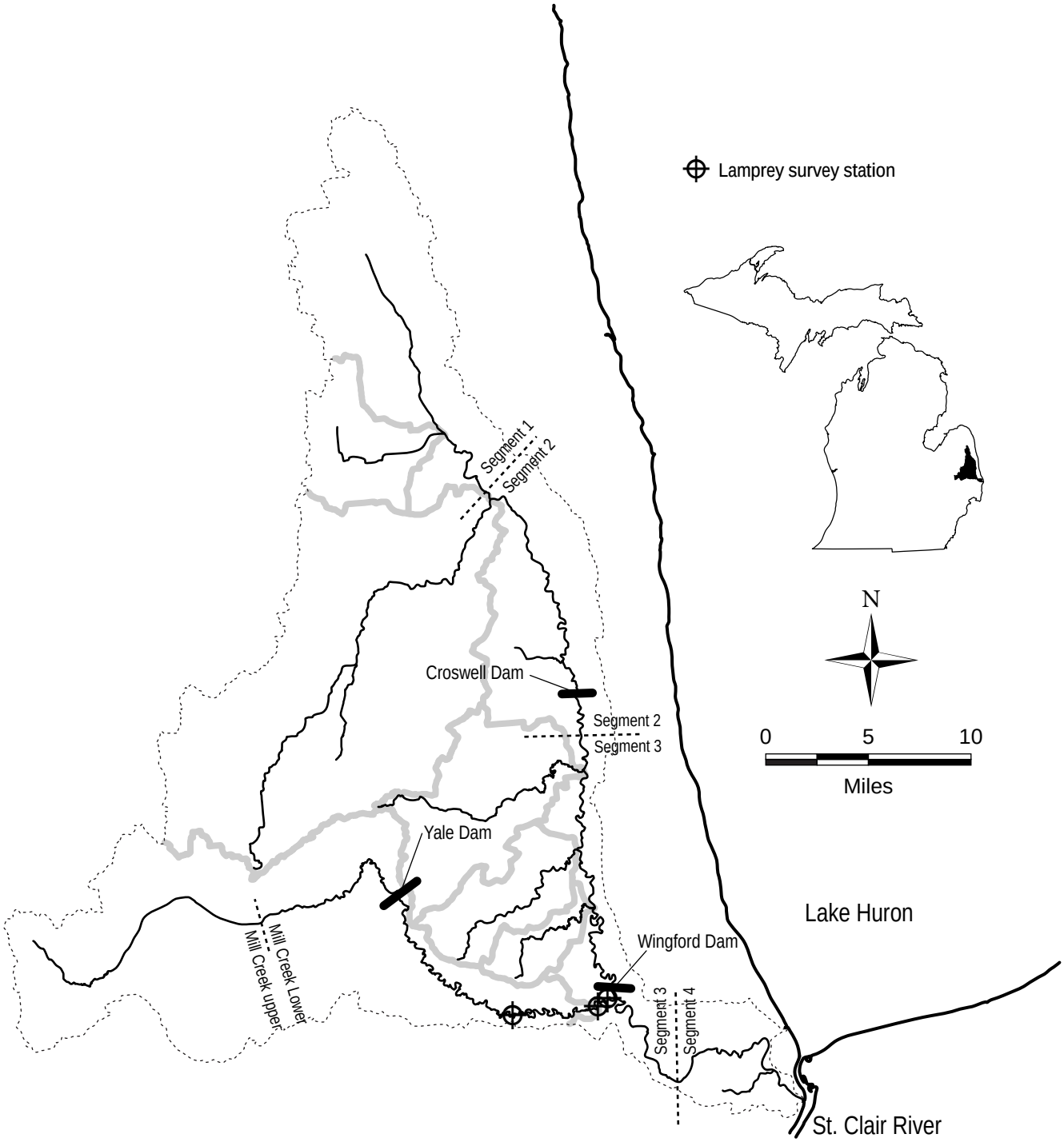


Figure 59.–Silver lamprey *Ichthyomyzon unicuspis* capture locations during United States Fish and Wildlife Service survey activities in the Black River watershed. Heavy lines show dams that are significant barriers to upstream fish migration. Ford's Dam is now known as Wingford Dam.

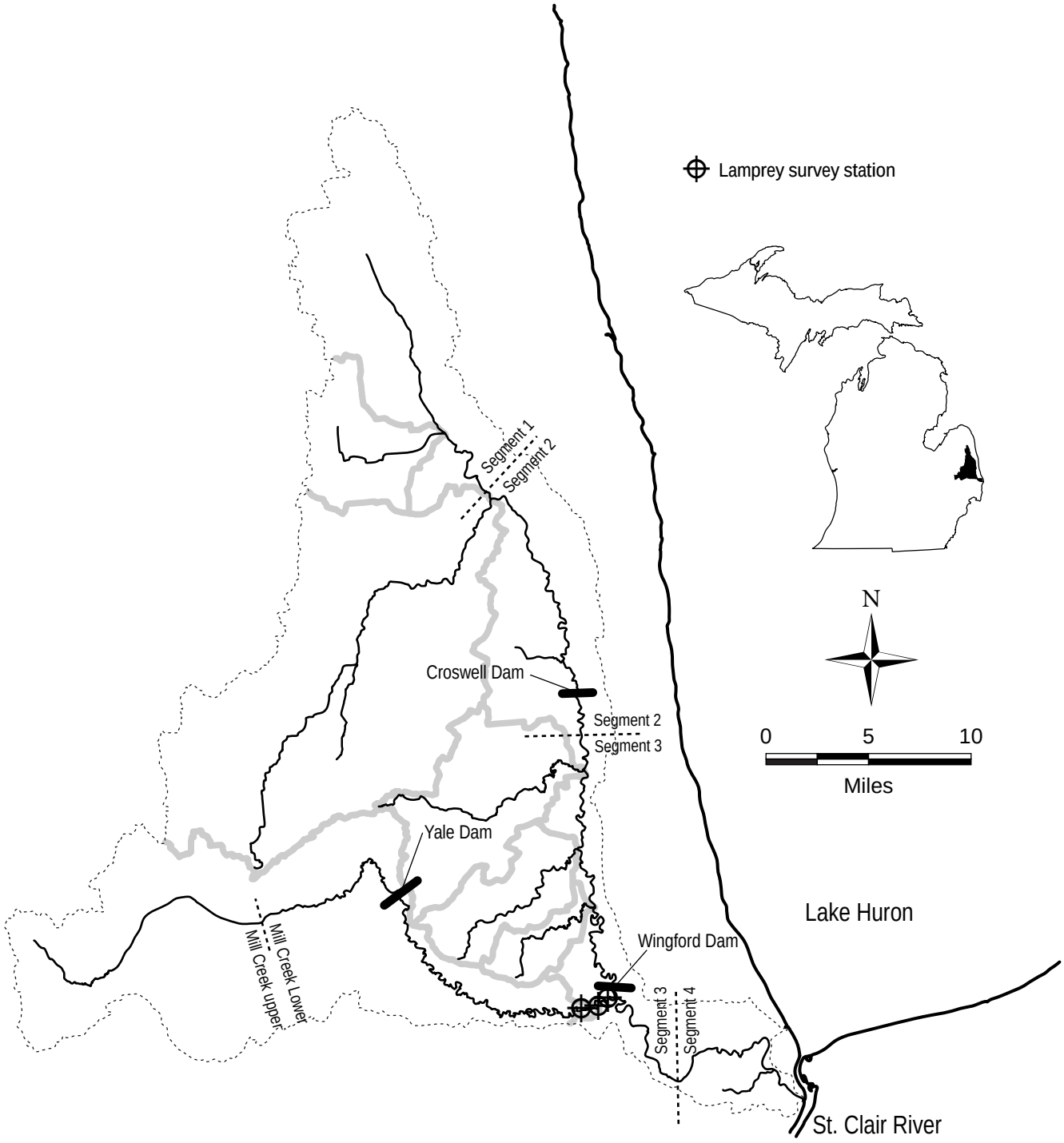


Figure 60.–Sea lamprey *Petromyzon marinus* capture locations during United States Fish and Wildlife Service survey activities in the Black River watershed. Heavy lines show dams that are significant barriers to upstream fish migration. Ford's Dam is now known as Wingford Dam.

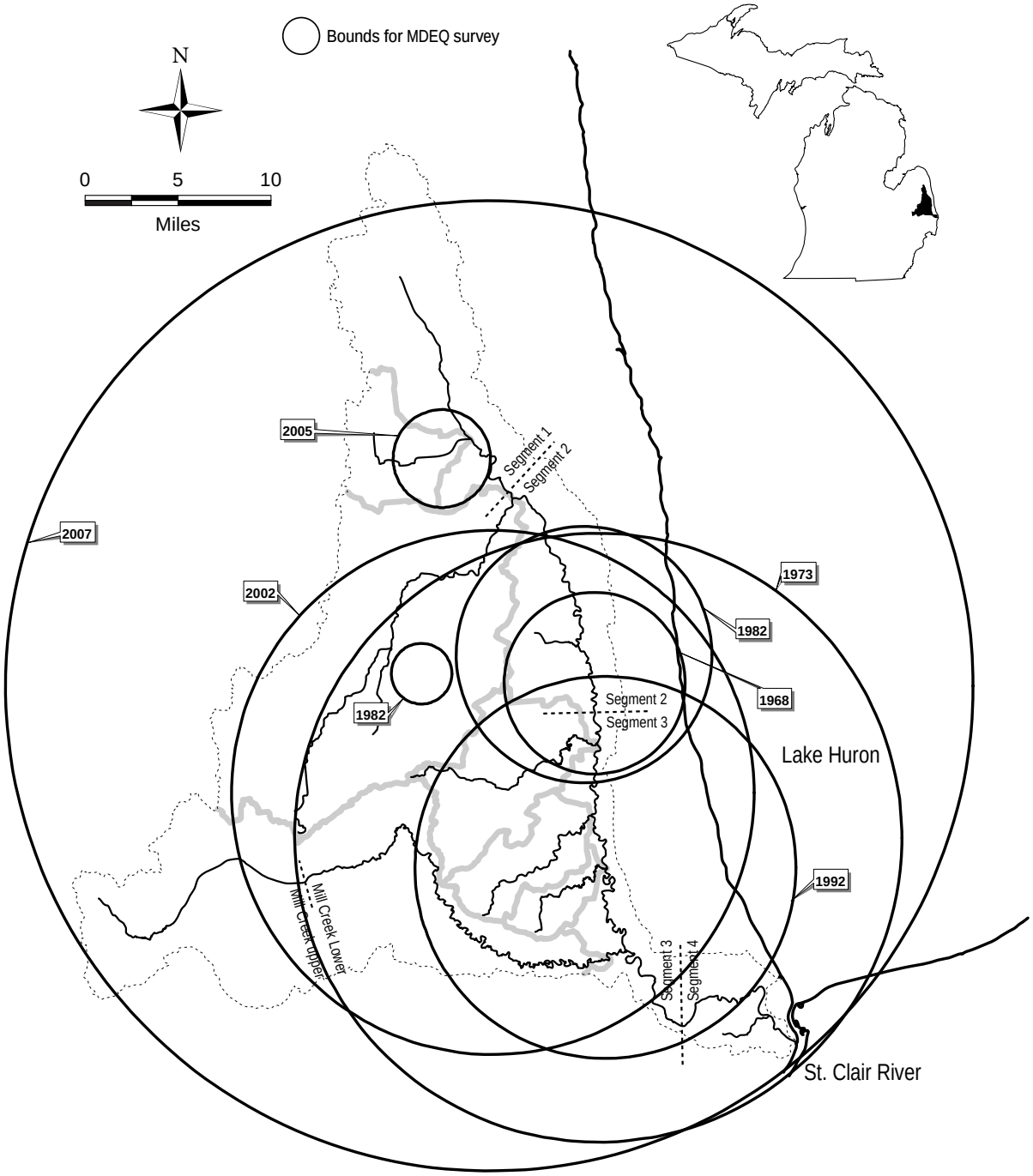


Figure 61.–Map of eight Michigan Water Resources Commission (now Michigan Department of Environmental Quality) biological surveys in the Black River watershed. Circles cover stretches of river that had sample stations each year that a survey was conducted.

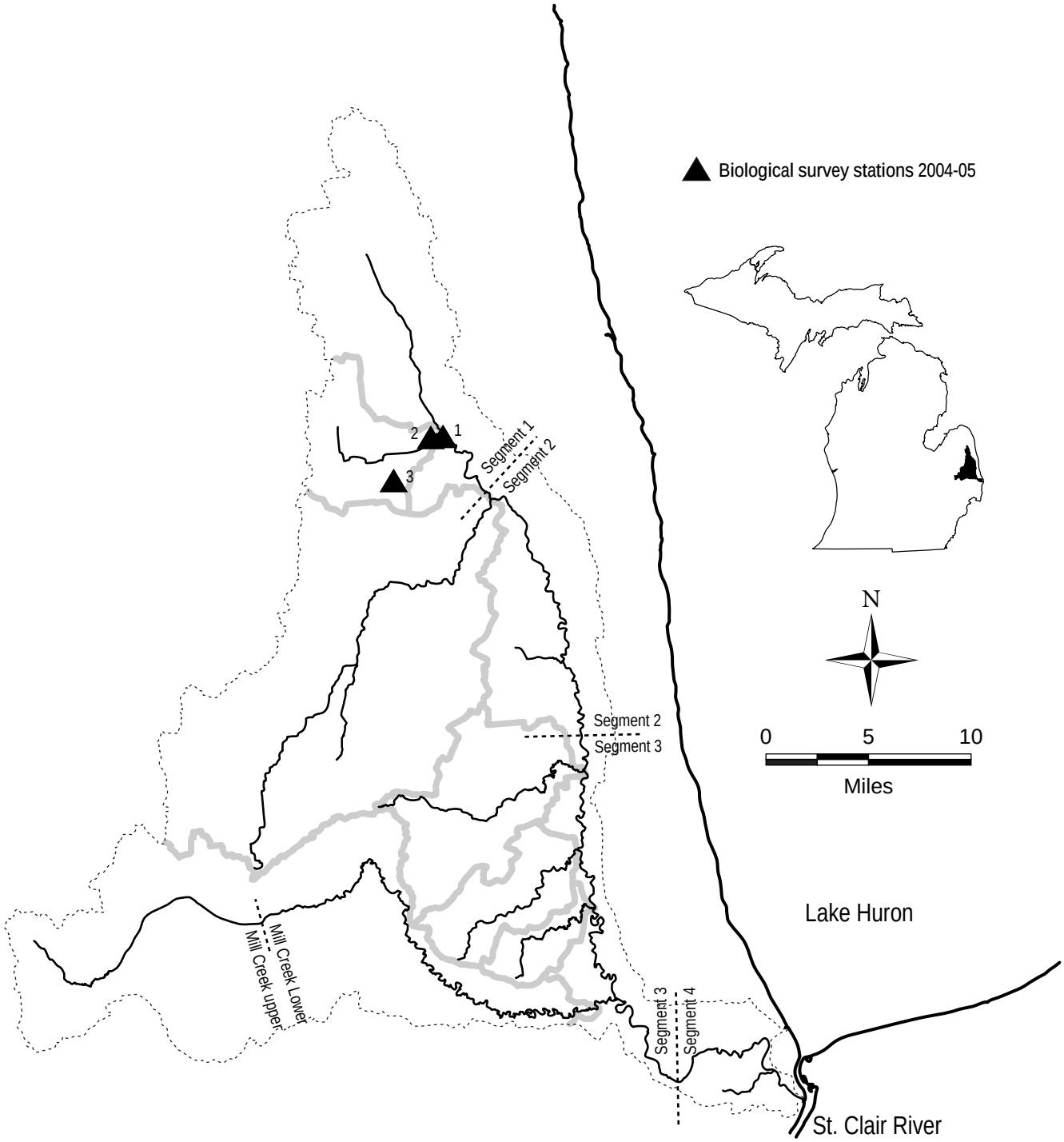


Figure 62.–Geographic locations (usually near road crossing) for Michigan Department of Environmental Quality Water Bureau 2004-05 biological survey stations (3) in Berry Drain, the major tributary to the Black River in Segment 1.

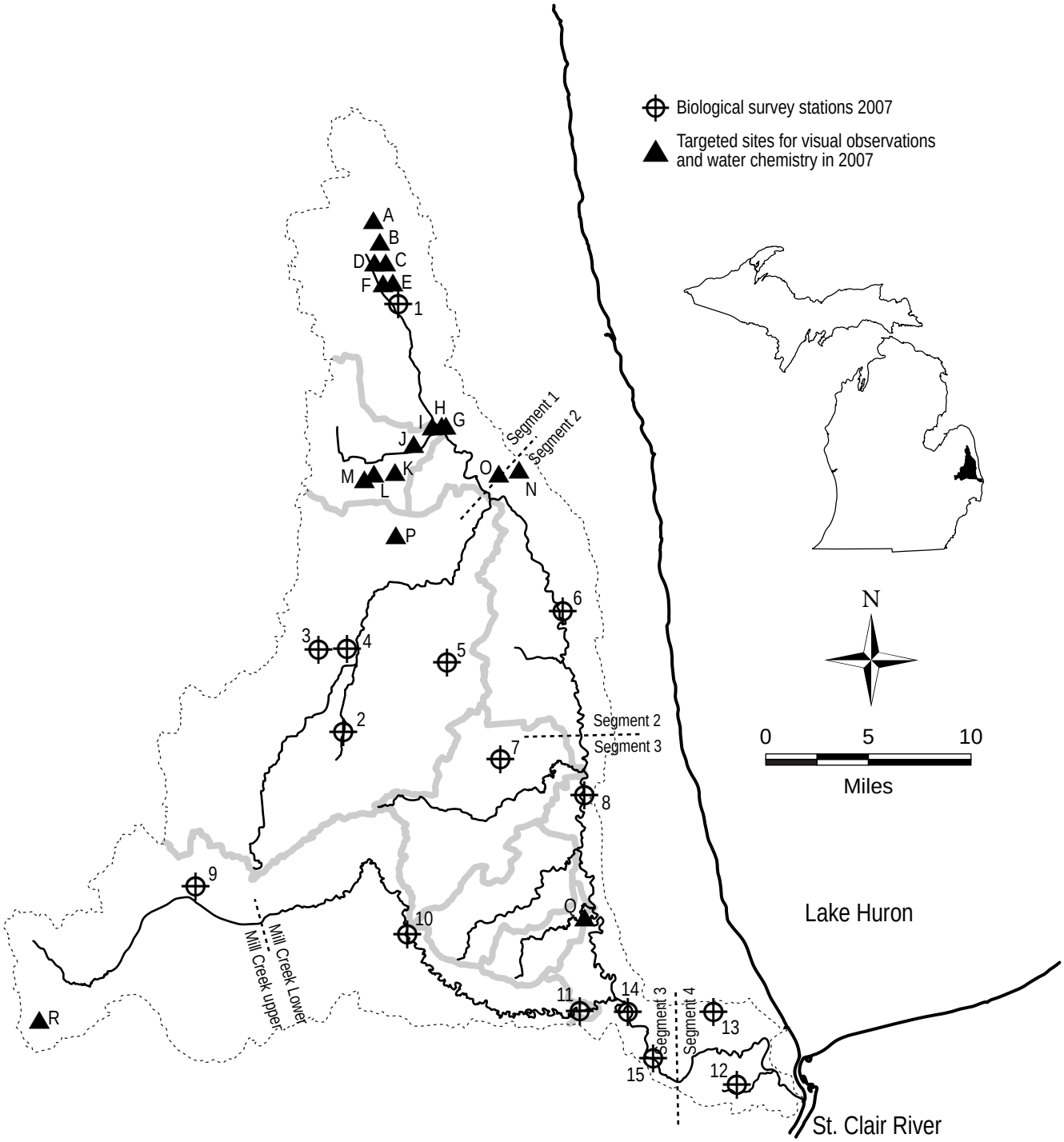


Figure 63.–Geographic locations (usually near road crossing) for Michigan Department of Environmental Quality Water Bureau during 2007 at 15 random biological survey stations (numbered) and 18 fixed targeted stations (lettered) for visual observations and water chemistry in the Black River and major tributaries (Schmitt 2008).

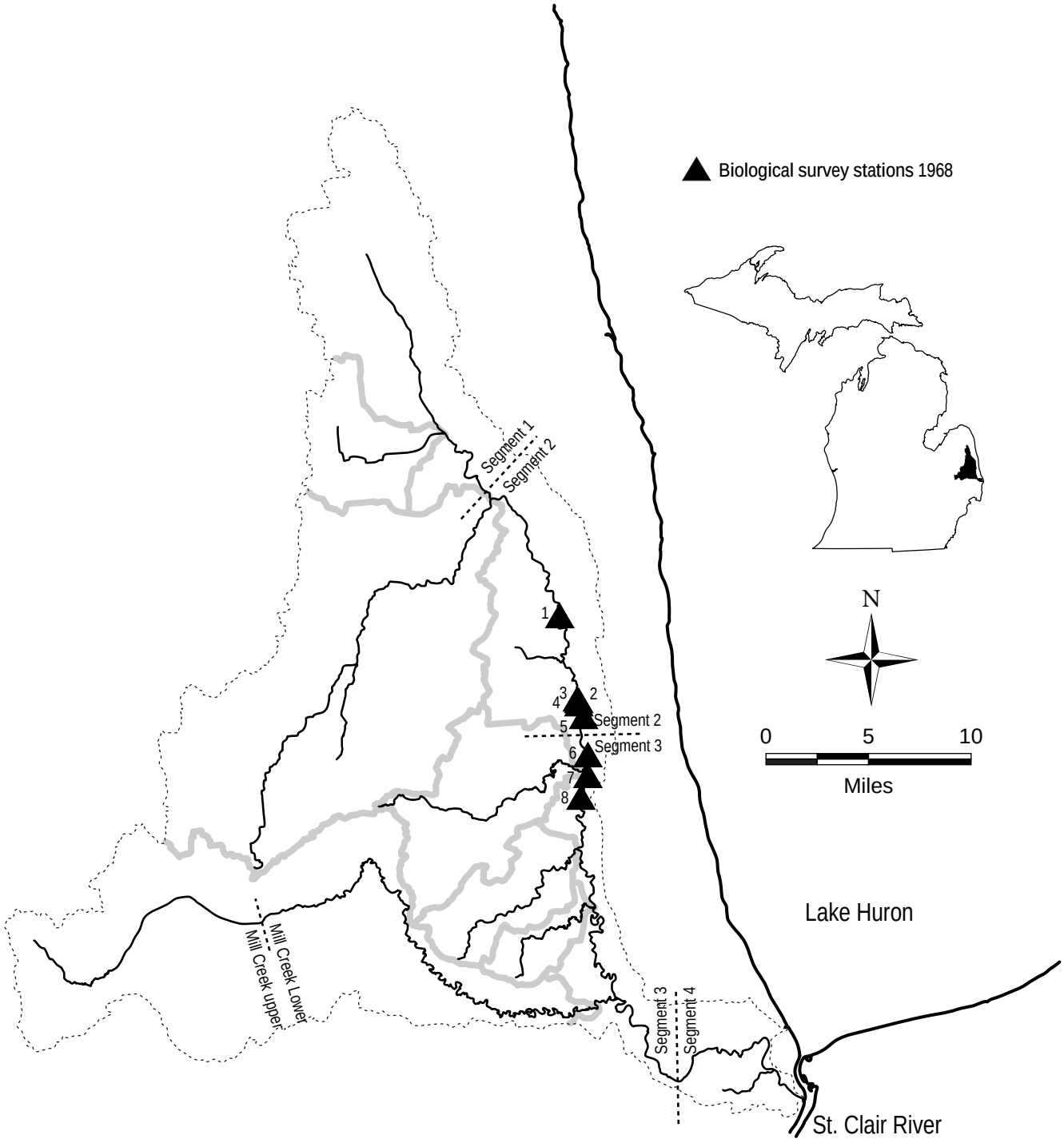


Figure 64.–Geographic locations (usually near road crossing) for Michigan Water Resources Commission (now Michigan Department of Environmental Quality) 1968 biological survey stations (8) in the vicinity of Michigan Sugar Company (segments 2 and 3 of the Black River).

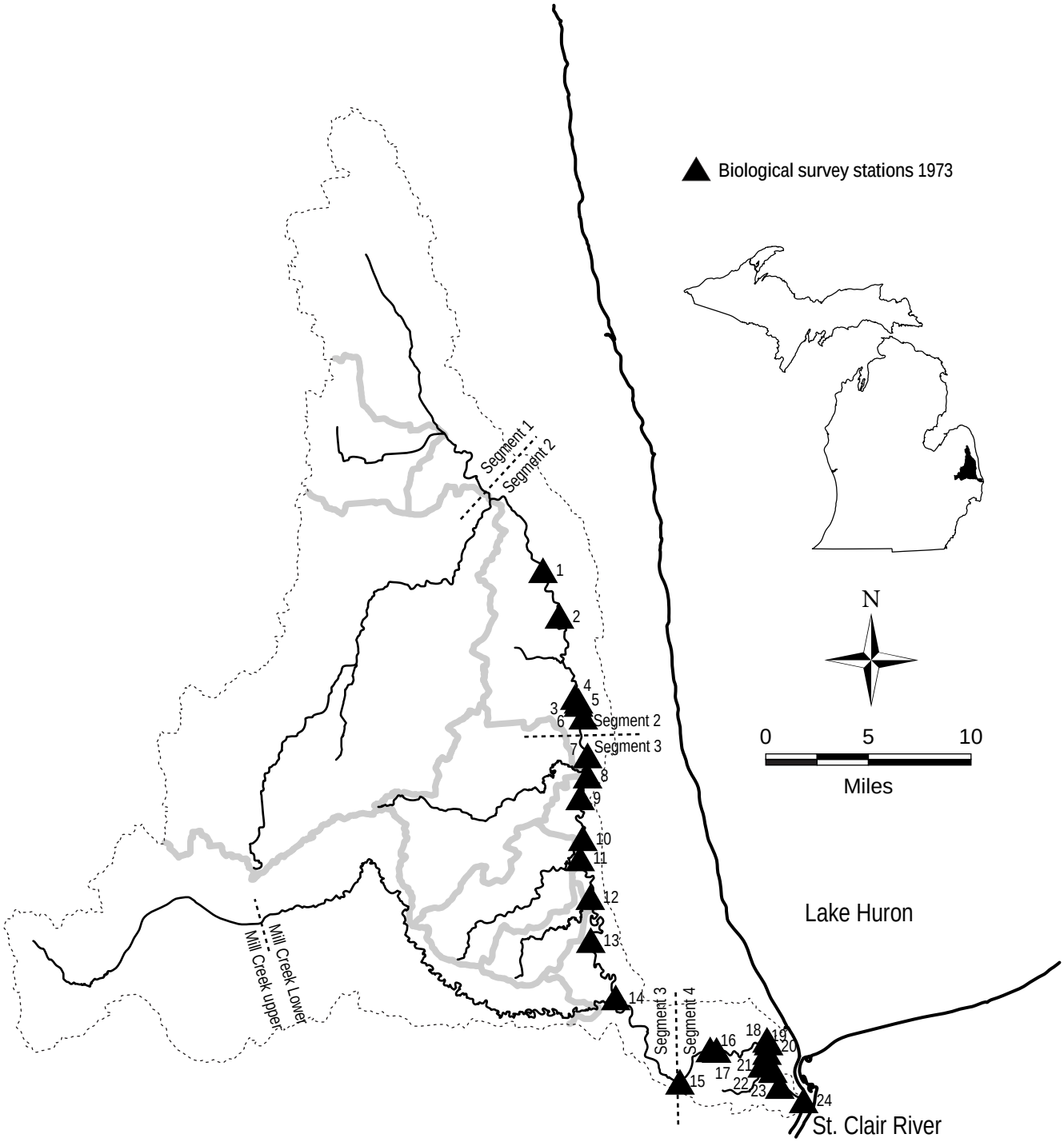


Figure 65.–Geographic locations (usually near road crossing) for Michigan Water Resources Commission (now Michigan Department of Environmental Quality) 1973 biological survey stations (24) in the Black River (segments 2, 3, and 4).

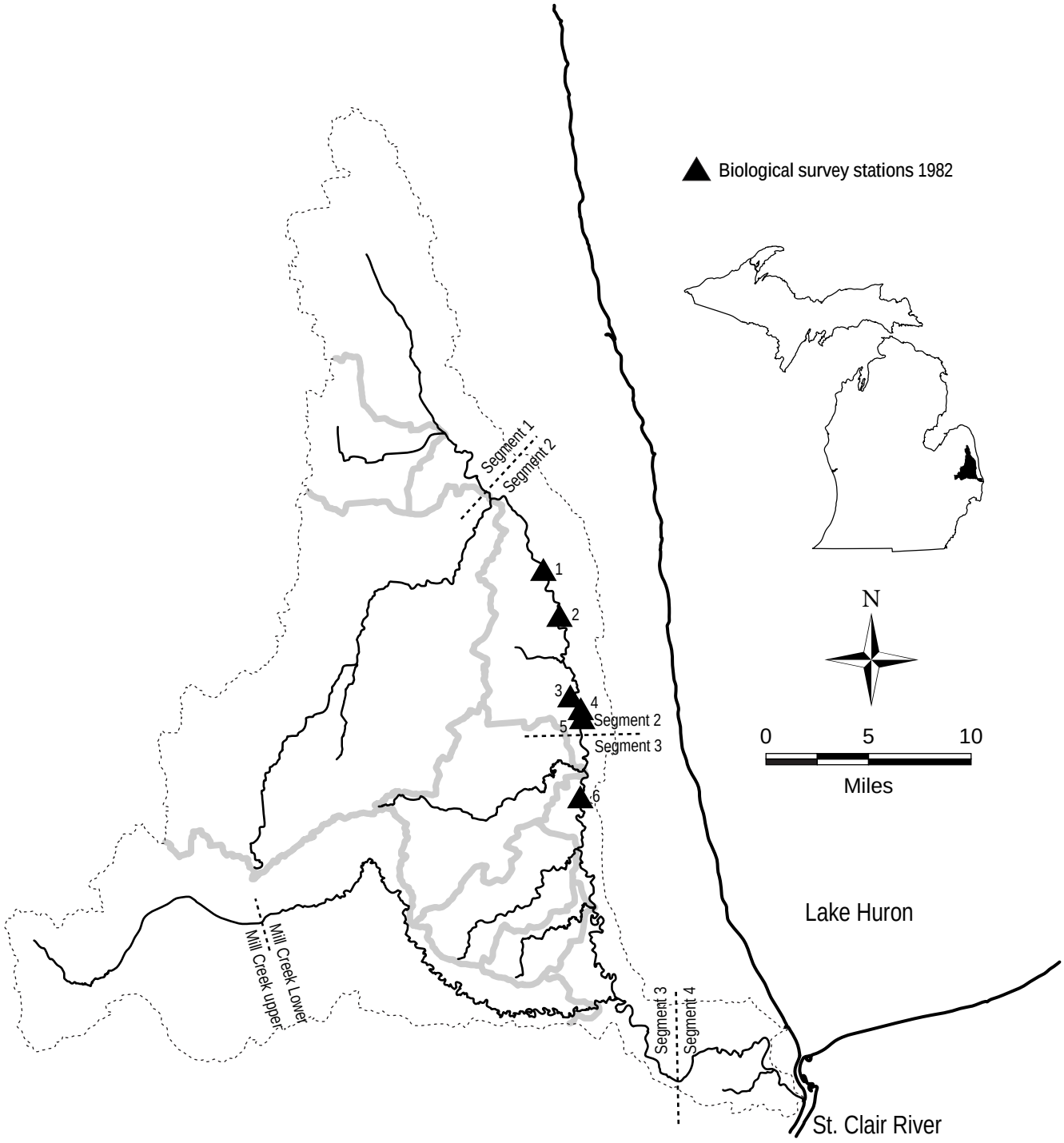


Figure 66.–Geographic locations (usually near road crossing) for Michigan Department of Natural Resources Surface Water Quality Division (now in Michigan Department of Environmental Quality) 1982 biological survey stations (6) in the Black River near Croswell (segments 2 and 3).

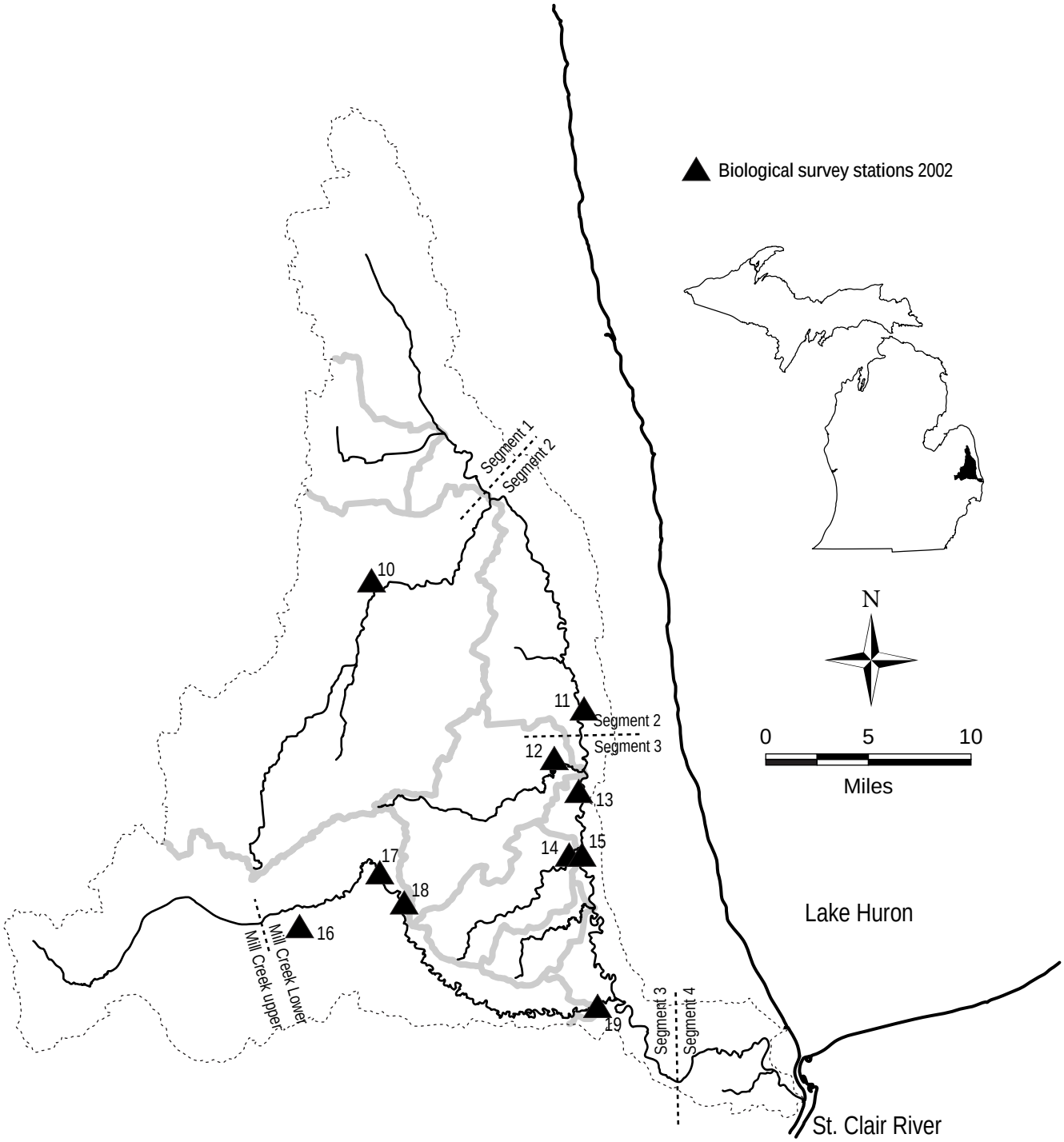


Figure 67.–Geographic locations (usually near road crossing) for Michigan Department of Environmental Quality Water Bureau 1992 biological survey stations (20) in the Black River (segments 2 and 3), lower segment of Mill Creek (16-19), Elk Creek (10), Black Creek (12), and Silver Creek (14).

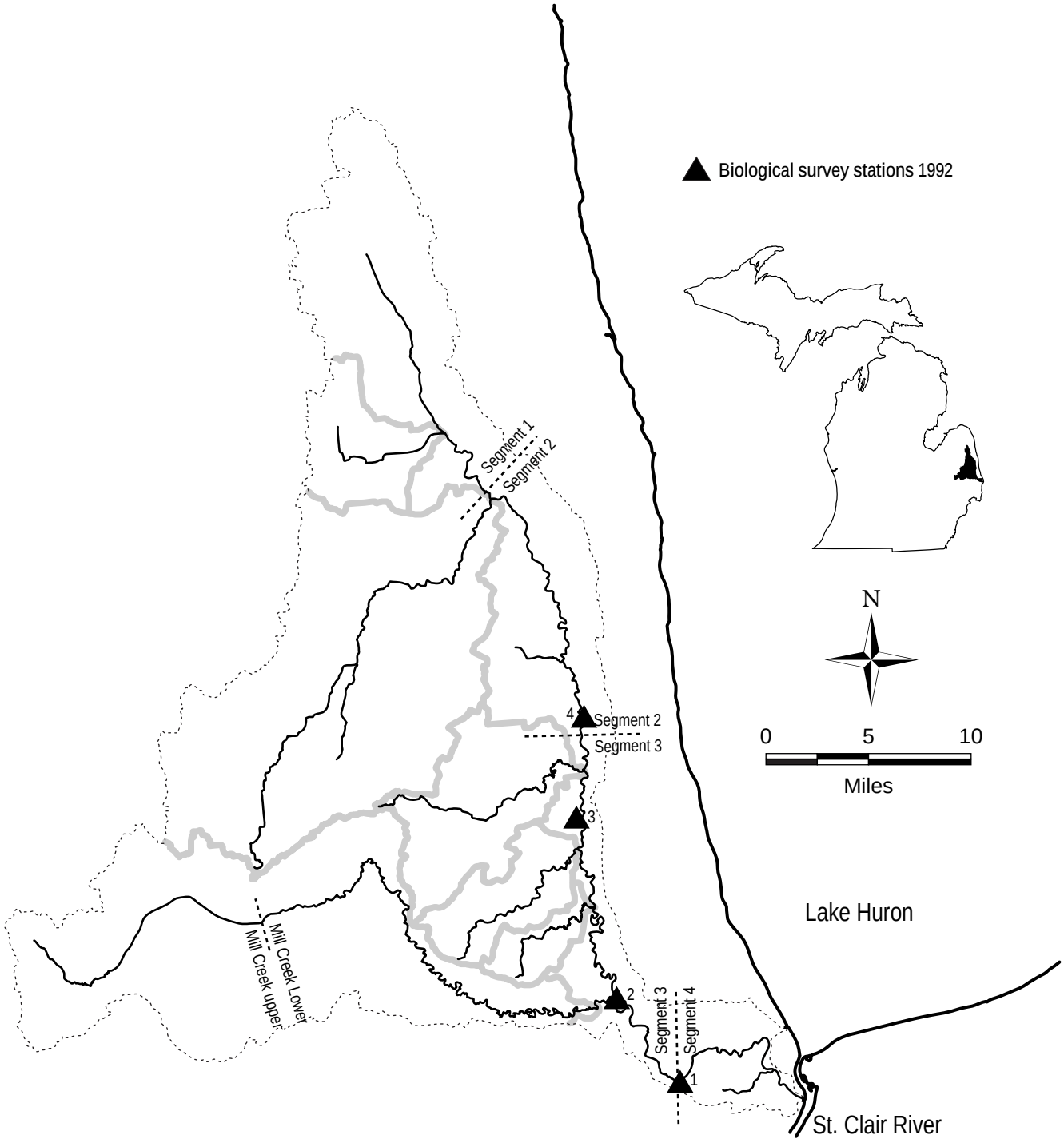


Figure 68.–Geographic locations (usually near road crossing) for Michigan Department of Natural Resources Surface Water Quality Division (now in Michigan Department of Environmental Quality) 1992 biological survey stations (4) in the Black River (segments 2, 3, and 4).

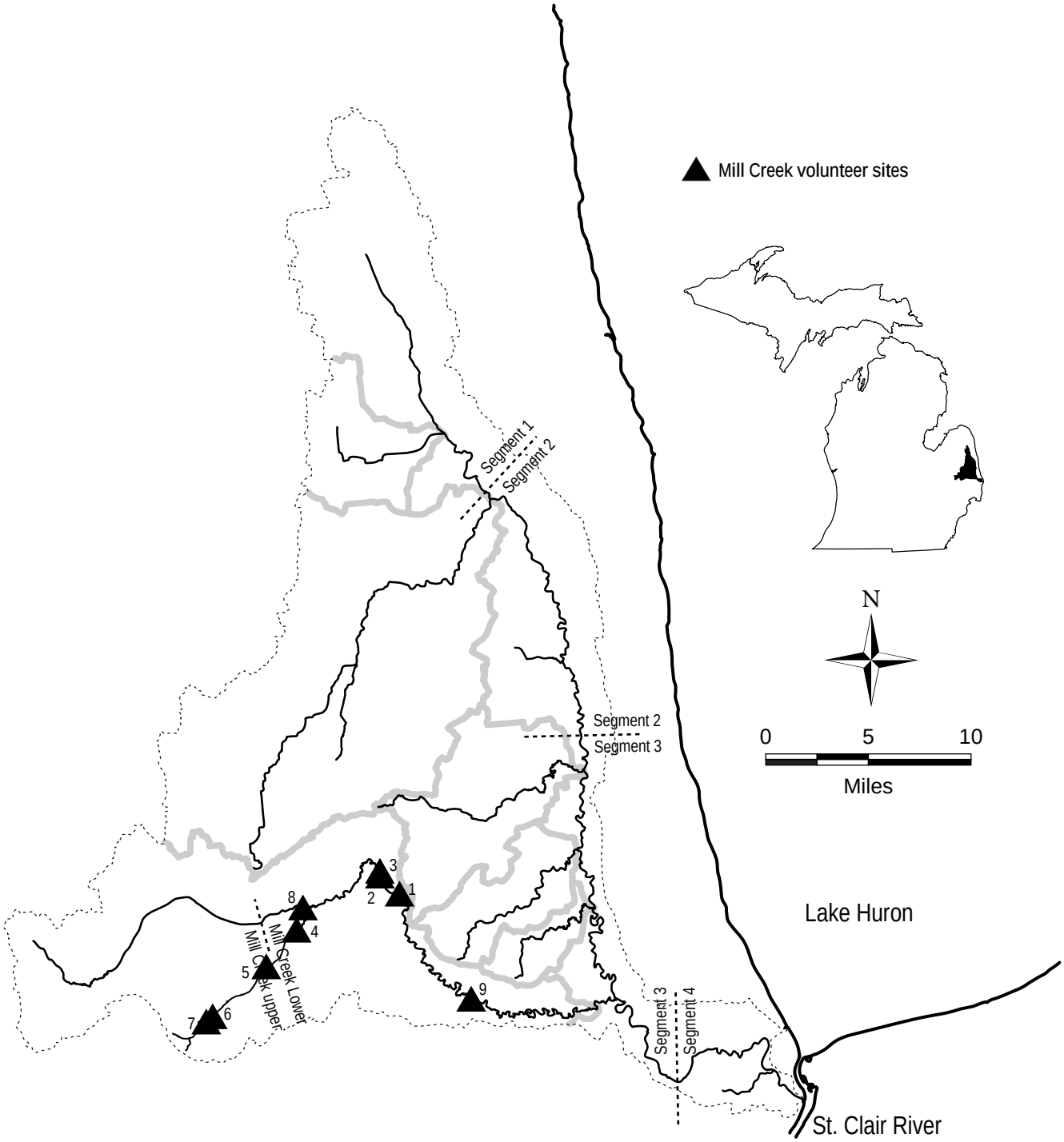


Figure 69.–Geographic locations for nine survey sites used since 2003 by participants in the Mill Creek Volunteer Monitoring Project, in cooperation with Michigan Department of Environmental Quality, to assess the quality of aquatic habitats and biota in Mill Creek. Station numbers are those used by project personnel.

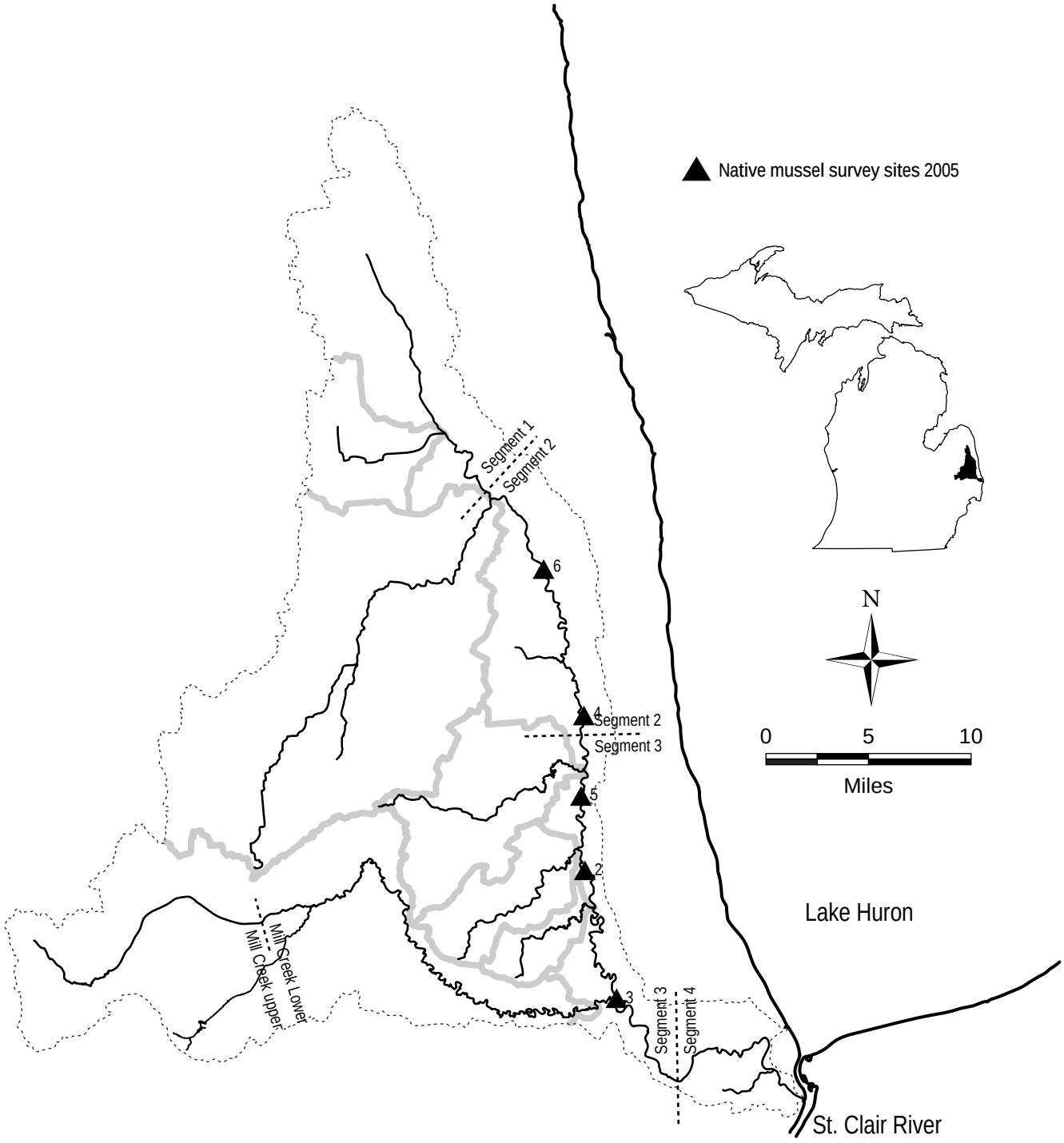


Figure 70.–Geographic locations for five native mussel survey sites used in 2005 by Douglas Sweet for the Michigan Natural Heritage Program (Sweet 2005). Station numbers are those used by the author.

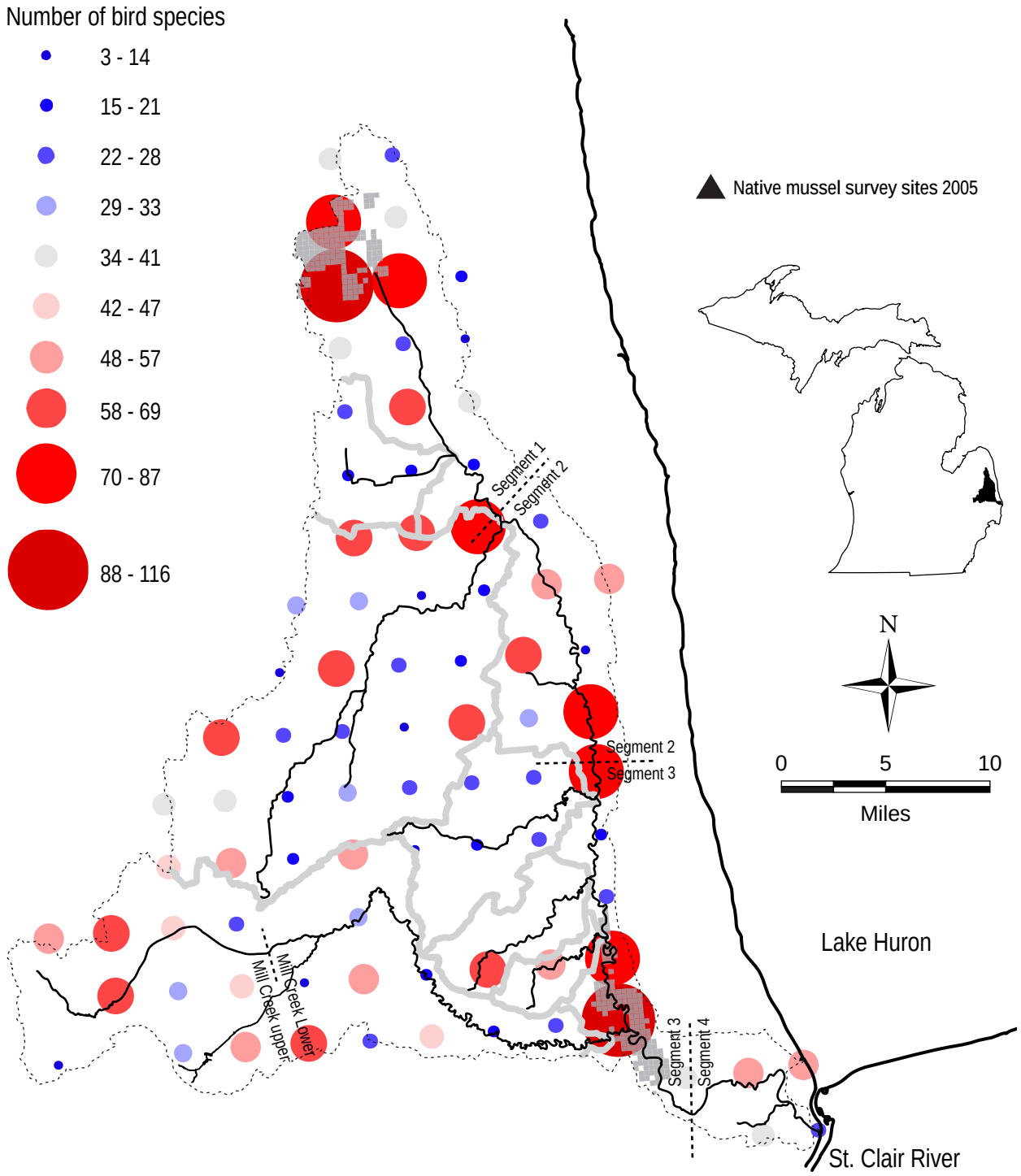


Figure 71.–Map of the number of bird species observed during breeding activities within the Black River watershed. Data, obtained from Breeding Bird Atlas Explorer (2008), were summarized by 9.5 mi2 blocks and plotted at the block center as circles sized to represent the number of species. Gray blocks show Michigan Department of Natural Resources state game areas.

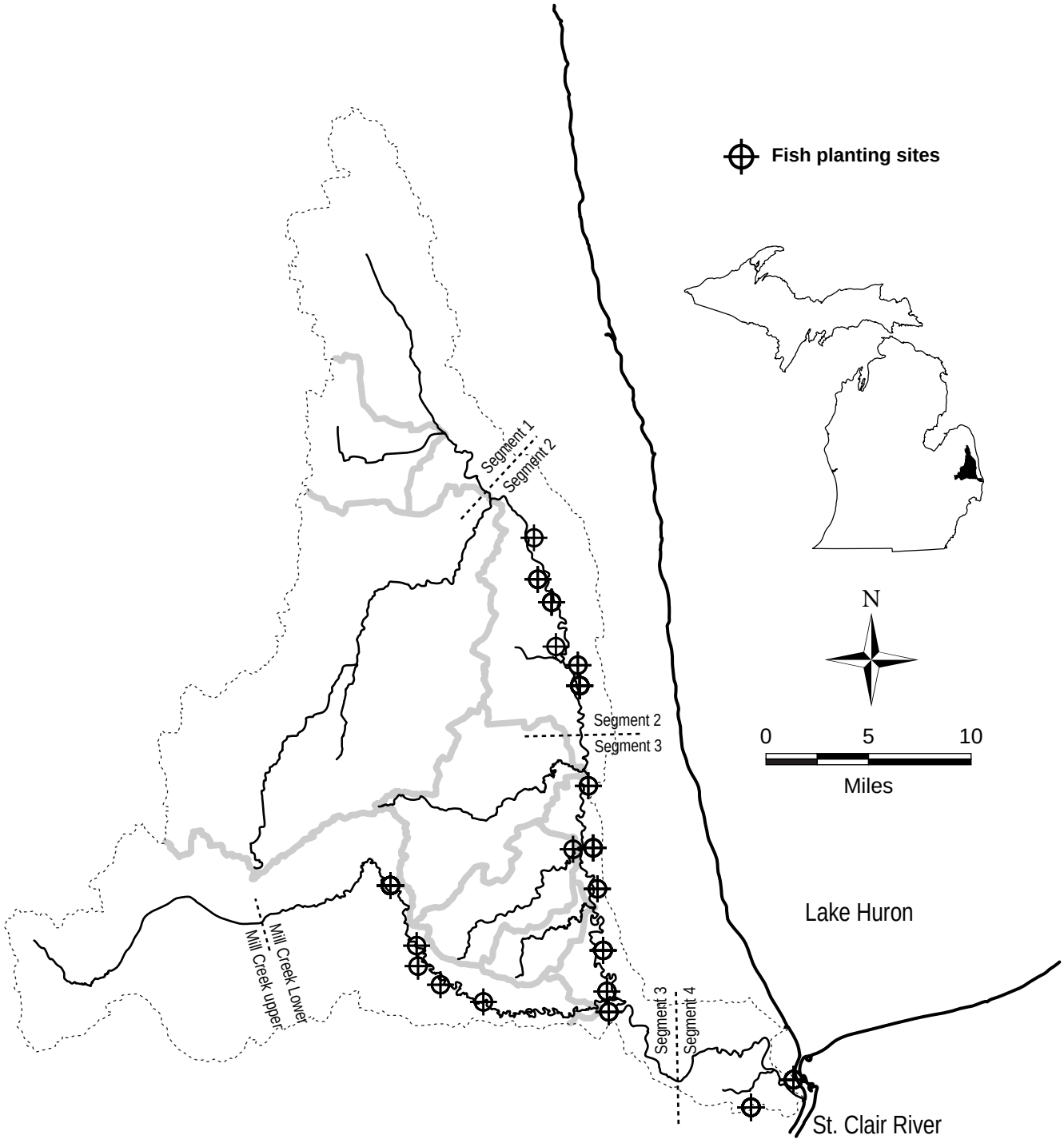


Figure 72.–Geographic locations (usually near road crossing) for Michigan Department of Natural Resources fish stocked in the main stem of the Black River (segments 2 and 3) and lower Mill Creek. Dotted lines divide major analysis sections of the Black River main stem and Mill Creek.

Figure 73.–Map of Michigan Department of Natural Resources lands (MDNR) (shaded squares) within both the Black River watershed and the Minden City State Game area. There are 5,875 acres of land open to public access with five public parking areas maintained by Wildlife Division of MDNR. These parking lots provide excellent access to the land and river for hunting, fishing (very small streams), and many other outdoor activities.

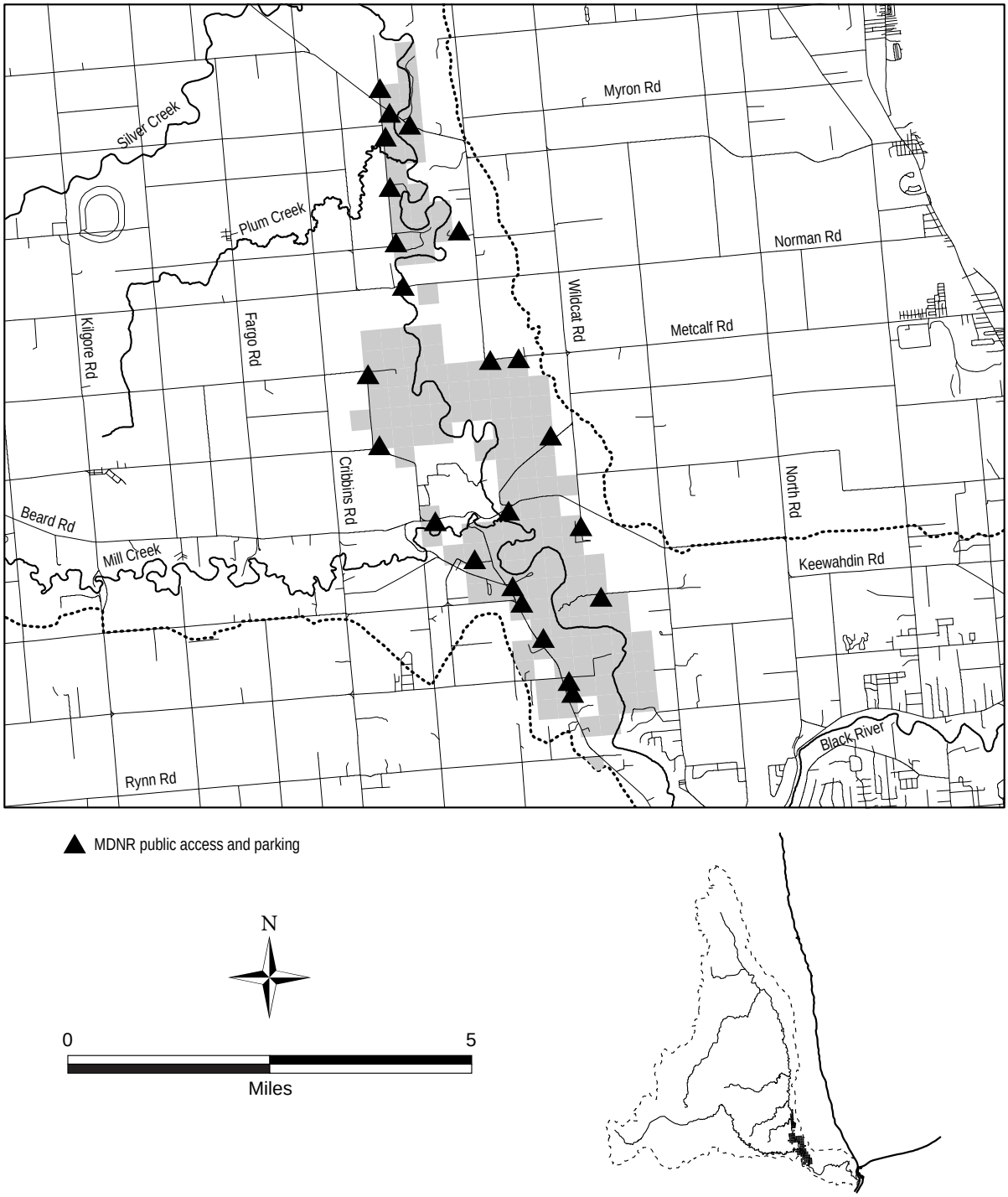


Figure 74.–Map of Michigan Department of Natural Resources (MDNR) lands (shaded squares) within both the Black River watershed and the Port Huron State Game area. There are 5,732 acres of land open to public access with 24 public parking areas maintained by Wildlife Division of MDNR. These parking lots provide excellent access to the land and river for hunting, fishing, bird watching, and many other outdoor activities.