The mission of the Bad River Watershed Association (BRWA) is to promote a healthy relationship between the people and natural communities of the Bad River watershed by involving all citizens in assessing, maintaining and improving watershed integrity for future generations. A key piece of implementing this mission is BRWA’s Volunteer Water Quality Monitoring Program, initiated in 2002. The program involves local citizens in collecting water chemistry, macroinvertebrate, and E. coli data from streams throughout the Bad River watershed. The goal of the program is to establish at least a four-year baseline of water quality data from sites in the watershed. The data will be used for determining the overall health of the watershed, to track changes over time, and to make informed decisions about protecting the health of the watershed. This report establishes baseline water quality conditions at BRWA’s sites in the Marengo River Basin on the Marengo River at Altamont and Riemer Road (Rd.) and the Brunsweiler River at Highway (Hwy.) C using the first four years of data collected from these sites.

**Marengo River, Altamont Rd.**
- **Trout Stream Classification**: Class III
- **Water Classification**: Outstanding Resource Water
- **Volunteer Monitors**: The Rekemeyer family, Roland Wolff

**Marengo River, Riemer Rd.**
- **Trout Stream Classification**: Class III
- **Water Classification**: Outstanding Resource Water
- **Volunteer Monitors**: Keith & Laura Carlson, Matt & Sara Hudson, Thomas Wyse and Andrea Haugo, Darienne McNamara, Suzanne Sanders

**Brunsweiler River, Hwy. C**
- **Trout Stream Classification**: Class III
- **Water Classification**: Outstanding Resource Water
- **Volunteer Monitors**: Lawrence Wiland, Keith & Laura Carlson, Melissa & Jason Fischbach family, Tracey Ledder, Nancy Larson & John Spangberg, Roland Wolff, Bob & Reba Rice, Stefania Strzalkowska

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**Trout Stream Classification (State of Wisconsin)**

- **Class I**: Highest quality trout waters. No stocking needed to maintain populations.
- **Class II**: Some natural reproduction, but stocking is needed to maintain a desirable sport fishery.
- **Class III**: No natural reproduction. Populations maintained by stocking.

**Water Classification**

Wisconsin’s highest quality surface waters are classified as:

- **Outstanding Resource Waters (ORW)**: Highest quality waters, typically no human point sources of pollution exist, no changes in baseline water quality allowed.
- **Exceptional Resource Waters (ERW)**: Similar to ORW but some human point sources of pollution exist. No changes in baseline water quality allowed.
Water Chemistry

BRWA volunteers collect water chemistry data from their sites on the first Saturday of each month using LaMotte Surface Water Monitoring Kits. In addition to the training they receive with chemistry kits, annual quality control sessions ensure volunteers collect reliable data. Baseline conditions are established using the first four years of data collected at each site. Data are summarized as overall averages and by season (spring (Sp) March–May, summer (S) June–August, fall (F) September–November, and winter (W) December–February). Error bars indicate one standard deviation. (Note: Data beyond the first four years were used to summarize baseline conditions at Altamont Rd. due to limited data availability at this site. Contact BRWA at 715-682-2003 for additional details on methods.)

**pH**

**Information:** A measurement of water acidity. A pH of 7.0 is neutral. pH affects what organisms can live in a stream.

**Water Quality Criteria:** State of Wisconsin criteria indicate natural waters must maintain a pH between 6.0 and 9.0, with no change greater than 0.5 units outside the estimated natural seasonal maximum and minimum.

**Results:** pH at all sites did not vary across seasons and consistently met Wisconsin criteria, indicating good water quality (Graph 1). Continued monitoring will determine if pH at these sites changes more than 0.5 units from this baseline.

**Dissolved Oxygen**

**Information:** Dissolved oxygen (DO), which is critical for sustaining aquatic life, is a gas found in water. DO concentration is especially important to the success of trout spawning, because trout eggs need well oxygenated water to survive.

**Water Quality Criteria:** State of Wisconsin criteria indicate trout waters must maintain a minimum of 6.0 mg/L and 7.0 mg/L during trout spawning season (fall).

**Results:** Average DO concentrations met Wisconsin criteria at all sites. In general, these results indicate favorable conditions for trout & trout spawning (Graph 2). DO was consistently lowest at Altamont Rd, possibly a result of its location near the outflow of Marengo Lake.

**Chloride and Turbidity**

**Information:** Chloride is a measure of salt in water. It occurs naturally but can also indicate human influences from things such as failing septic systems, road salt use, and agricultural runoff. Turbidity is a measure of sediment suspended in water, indicating areas where erosion may be a problem.

**Water Quality Criteria:** Wisconsin’s chronic toxicity criterion for chloride is 395 mg/L. There is currently no criterion for turbidity. BRWA monitoring will establish baselines for both parameters from which future data can be compared.

**Results:** Chloride concentrations were highly variable, but far below Wisconsin's chronic toxicity criterion (Graph 3). Turbidity was higher at Riemer Rd. during spring than other seasons (Graph 4). A similar peak was not observed at other sites. Rapid runoff of water from clay soils and open land (particularly during spring snowmelt) in this part of the Marengo Basin may be carrying sediment to the river. Additional monitoring during spring runoff upstream of Riemer Rd. may help determine sources of erosion and identify areas where BRWA could work with local agencies and landowners to implement best management practices.
**Nutrients**

**Information:** Phosphate and nitrate are nutrients critical for plant growth and occur naturally in water. Elevated nutrients may indicate pollution such as agricultural runoff, failing septic systems, and storm water runoff.

**Water Quality Criteria:** Until criteria for Wisconsin’s Lake Superior region are developed, BRWA compares its data to U.S. Geological Survey (USGS) surface water benchmarks for phosphate (0.1 mg/L) and nitrate (1.0 mg/L). These benchmarks are not regulatory criteria, but they provide an indication of where nutrients may be a problem. By looking at the percent of sample events where the benchmarks are exceeded, BRWA can determine where testing with more sensitive methods may be needed.

**Results:** At Altamont Rd., 8% of 38 samples exceeded the USGS benchmark for nitrate and 0% of 39 samples exceeded the phosphate benchmark. At Hwy. C, both nitrate and phosphate benchmarks were exceeded in 2% of 49 samples. Nutrients do not appear to be a problem at Altamont Rd. or Hwy. C. At Riemer Rd., 33% of 49 samples exceeded the nitrate benchmark and 20% of 49 samples exceeded the phosphate benchmark. These elevated results tended to occur during winter and spring months and were primarily during the first two years of testing. Like with the turbidity results, runoff events, particularly those associated with spring snow melt, may play an important role in water quality in this region of the Marengo River Basin. Testing with more sensitive methods and focusing testing during runoff events will provide a better idea if nutrients are of concern at this site.

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**Macroinvertebrates**

BRWA typically collects macroinvertebrates (different types of aquatic bugs) from sites in May (spring) and September (fall), with a goal of collecting at least 100 individuals per site. Macroinvertebrates are identified, given a tolerance score, and scores are used to calculate Hilsenhoff's Family Biotic Index (FBI).

**Information:** Macroinvertebrates provide important long term information about water quality in a stream because they typically spend a large part of their lives in the water and differ in their tolerance to pollution.

**Water Quality Criteria:** The lower the FBI score, the better the water quality at a site.

**Results:** FBI values for Marengo River Basin sites indicate “Excellent” to “Very Good” water quality (Graph 5). Additional fall sampling at Altamont Rd. is advised due to limited sample size.

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Graph 3. Seasonal and overall chloride averages at Marengo Basin sites.

Graph 4. Seasonal and overall turbidity averages at Marengo Basin sites.

Graph 5. Average spring & fall FBI values at Altamont Rd. (total spring samples = 3, fall = 2), Riemer Rd. (total spring samples = 3, fall = 3) & Hwy. C (total spring samples = 3, fall = 3).
Special Thanks to the Wisconsin Community Action Program, Trout Unlimited, and Wisconsin Department of Natural Resources for providing funding to support BRWA’s Volunteer Water Quality Monitoring Program. Contact BRWA at: (715) 682-2003 or visit www.badriverwatershed.org

**E. coli**

Beginning in 2006, *Escherichia coli* (*E. coli*) samples were collected monthly from May to October and during rain events from several sites in the Bad River watershed using the Coliscan Easygel method. Two samples are collected each time and incubated at 35 degrees Celsius (95 degrees Fahrenheit) for 24 to 48 hours. The resulting colonies are identified by color and counted. An average of the two samples is reported for each sample date.

**Information:** *E. coli* is a type of fecal coliform bacteria found in the intestines of all warm-blooded animals, including humans. The presence of *E. coli* in water may indicate contamination from sewage or animal waste. During rain events or snow melts, *E. coli* may be washed into streams.

**Water Quality Criteria:** BRWA compares its *E. coli* data to the United States Environmental Protection Agency (EPA) criterion of 235 CFU/100mL (colony forming units per 100 mL). Colony counts above this number may indicate water that is unsafe for drinking and swimming.

**Results:** One *E. coli* sample has been collected at Altamont Rd. (result: 140 CFU/100mL) and four at Hwy. C (Graph 6). These results were below the EPA criterion. At Riemer Rd., one sample exceeded and two were just below the EPA criterion out of eleven samples collected (Graph 7). Rain event samples tended to have higher bacteria counts. These results are of concern and additional sampling along this stretch of the Marengo River is underway to better characterize this potential problem.

**Connecting People Land and Water**

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**Summary**

BRWA volunteer monitoring on the Marengo River at Altamont and Riemer Rd., and the Brunsweiler River at Hwy. C indicates that, in general, these Marengo Basin sites currently have good water quality and are meeting standards for designation as trout waters. However, elevated turbidity during spring runoff, and occasional elevated *E. coli* counts and nutrients at Riemer Rd. are of concern and provide evidence that pollution sources may exist in this stretch of the Marengo River, particularly during runoff events. Additional testing is underway to further characterize these issues and BRWA will work with its partners to find solutions where needed. Altamont Rd. had limited samples for characterizing baseline, although no problems were noted. Future sampling could be targeted at this site, particularly during winter. Overall, baseline water quality conditions established here provide a reference to ensure these streams meet their designations as Outstanding Resource Waters by the State of Wisconsin. BRWA will use this information to work with local citizens, governments, and agencies to ensure we maintain a healthy relationship between the people and natural communities of the Bad River watershed for the enjoyment of future generations.

Special Thanks to the Wisconsin Community Action Program, Trout Unlimited, and Wisconsin Department of Natural Resources for providing funding to support BRWA’s Volunteer Water Quality Monitoring Program. Contact BRWA at: (715) 682-2003 or visit www.badriverwatershed.org

**Graph 6.** *E. coli* counts for sampling events at Hwy. C. The dashed line indicates EPA’s standard of 235 CFU/100mL.

**Graph 7.** *E. coli* counts for sampling events at Riemer Rd. The dashed line indicates EPA’s standard of 235 CFU/100mL.