WATER QUALITY AND USE

Beneficial Use Attainment

Fifty-five reaches of stream in the basin are designated for fish, wildlife and livestock watering, and aquatic life protection (Table 1) (MDNR 1994). In addition, all of the Moreau River, 50.0 miles of the North Moreau, 29.5 miles of the South Moreau, 10.5 miles of Smith Creek, 12.0 miles of Straight Fork and 3.0 miles of Willow Fork are also satisfactory for whole body contact. Boating and canoeing are designated uses on the Moreau, South and North Moreau rivers. No streams are designated for irrigation or drinking water uses.

Water Quality

State water quality standards were not met for two streams in the basin. A portion of North Moreau Creek and Straight Fork are identified as EPA CWA Section 303(d) impaired waterbodies (Figure wq). They exceeded standards for non-filterable residue (suspended solids). The two problem areas identified included the California S. Waste Water Treatment Plant (WWTP) and Versailles lagoon (EPA 1998). The California S. WWTP is in the process of upgrading its lagoons.

One reach of stream on Burris Fork is designated a "reference reach" for study in the Missouri Resource Assessment Monitoring Project (Fischer 2002, *personal communication*). This is a project aimed at identifying the health of Missouri streams on a statewide basis through random sampling of stream sites. Biomonitoring will be conducted on fish populations, aquatic habitat, water quality and aquatic invertebrates every 6 years.

Fish Kills

Only one fish kill was documented in basin streams since 1995 (MDC 2002b). This kill occurred in October 1997 on Straight Fork, a tributary to North Moreau Creek, at 43N 18W 36NE, just downstream from the Versailles waste water treatment plant. Insufficiently treated plant effluent caused the death of approximately 3,512 fish. Three quarters of a mile of stream were affected.

Water Use

Surface waters are not used for human consumption and crop irrigation is uncommon in this part of the state (DuCharme and Miller 1996). However, surface water is an important necessity for the livestock industry. For the counties in this basin, the estimated water consumption by livestock ranges from 101-225 million gallons per year per county (DuCharme and Miller 1996).

Point Source Pollution

In 2000, 61 municipal, industrial, and agricultural sites requiring National Pollution Discharge Elimination System (NPDES) outfall permits were identified as potential point-sources of pollution. Despite the number of permits, serious point source pollution problems in the basin are relatively few in number. They relate mostly to impaired municipal waste water treatment facilities and illegal spillage of hog manure into waterways. The California S. WWTP and Versailles WWTP have had the most serious problems with pollution. One incident at the Versailles WWTP involved a fish kill and excessive nutrient enrichment was associated with the California plant (MDC 2002b).

The spillage of hog manure into waterways has been documented (three times) periodically since 1995, however, no fish kills have resulted from these spills. Excessively high BOD and ammonia levels resulted from one hog manure spill on Beard Creek, a tributary to South Moreau Creek, in 1996 (MDC 2002b). This type of acute problem is associated with confined, high density livestock operations. In 2002, there were 19 confined swine, 16 poultry and 1 active dairy facility permits issued by the state of Missouri for containing animal wastes (MDNR 2002; Figure ps). High concentrations of operations occurred in the watersheds of Willow Fork, Burris Fork, Wilkes Creek and Blythes Creek.

Non-point Source Pollution

Soil erosion rates from cropland in the basin have declined steadily from 10.868 to 5.619 tons of soil lost per acre per year from 1982 to 1997, respectively (Barney 2002, *personal communication*). Erosion rates for pastureland have followed a similar but less dramatic trend, declining from 1.948 in 1982 to 1.322 tons per acre per year in 1997. Soil entering streams degrades aquatic habitat by increasing turbidity, water temperatures, and depositing excessive amounts of unconsolidated sand, silt and clay on the stream bottom to decrease diversity and destabilize in-stream aquatic habitats.

In addition to sediment laden runoff from fields, the clearing of riparian corridors and the trampling of streambanks by livestock also contribute to problems with sedimentation. The clearing of riparian areas diminishes the filtering function of the corridor and allows increased amounts of sediment to enter streams. This same vegetation also serves to strengthen streambanks. When trees are removed, the streambanks, particularly along outside bends, become weak and are prone to bank caving. This instability is particularly striking on aerial photos.

Nutrient-loaded runoff from pastures, feedlots, septic drainage fields, and direct contamination to streams by free livestock contributes to increasing in-stream biological oxygen demand (BOD), suspended solids, fecal coliform counts, and algae growth. Depletion of oxygen in the water for aquatic life is most serious during periods of low stream flow when water temperatures are elevated and the biological oxygen demand from organic rich nutrients is high.

Littering along streams at access points, bridges, and public areas is a problem throughout this basin (as well as throughout the state).

Community Involvement

Activity of local citizens in the Missouri STREAM TEAM program, a citizen network sponsored by the Conservation Federation of Missouri, the Missouri Department of Conservation, and

Missouri Department of Natural Resources for individuals interested in stream conservation and protection, is one gauge of community involvement in local stream issues. As of March, 2002, there are eight STREAM TEAMS in the watershed. Five teams adopted portions of the Moreau River, and other individual groups adopted Roark Creek, Honey Creek and Logan Creek. Examples of activities which these teams have participated in include: water quality and invertebrate monitoring projects, litter pick-ups, forestkeeper monitoring, or attendance at crayfish or water quality monitoring workshops. For 2001, seven of the eight teams reported no activity. This suggests community involvement in these streams is low.

Table 1. Beneficial use classifications for streams in the Moreau River Watershed (MDNR 1994).

Stream	Miles	From (Township, Range, Section)	To (Township, Range, Section)	County	Beneficial Use*
Bear Branch	2.0	Mouth	44N 15W 19	Moniteau	LWW, AQL
Blythes Creek	6.5	Mouth	Bus Hwy 54	Moniteau	LWW, AQL
Brush Creek	5.5	Mouth	42N 14W 16	Cole	LWW, AQL
Trib. to Brush Creek	1.0	Mouth	43N 14W 34	Cole	LWW, AQL
Burris Fork	8.0	43N 16W 10	43N 17W 25	Moniteau	LWW, AQL
Trib.to Burris Fork	0.5	Mouth	43N 16W 3	Moniteau	LWW, AQL
Trib. to Burris Fork	0.5	Mouth	44N 16W 34	Moniteau	LWW, AQL
Clark Fork	7.0	Mouth	43N 13W 34	Cole	LWW, AQL
Cliffty Branch	2.0	Mouth	44N 15W 36	Moniteau	LWW, AQL
Dry Fork	3.0	Mouth	45N 16W 28	Moniteau	LWW, AQL
Gracey Creek	2.0	Mouth	42N 16W 5	Morgan	LWW, AQL
Honey Creek	4.0	Mouth	43N 12W 29	Cole	LWW, AQL
Jones Creek	4.0	Mouth	42N 16W 4	Morgan	LWW, AQL
Kelley Branch	0.5	Mouth	44N 17W 1	Moniteau	LWW, AQL
Logan Creek	3.0	Mouth	44N 13W 19	Cole	LWW, AQL
Marney Branch	5.0	Mouth	43N 15W 3	Moniteau	LWW, AQL
Medlen Creek	1.0	Mouth	43N 15W 6	Moniteau	LWW, AQL
Mineral Branch	2.0	Mouth	44N 15W 17	Moniteau	LWW, AQL
Morgan Branch	1.5	Mouth	43N 14W 17	Cole	LWW, AQL

Table 1 continued

Stream	Miles	From (Township, Range, Section)	To (Township, Range, Section)	County	Beneficial Use*
Moreau River	33.0	Mouth	43N 14W 1	Cole	LWW,AQL, WBC,BTG
Trib. to Moreau River	0.5	Mouth	43N 12W 6	Cole	LWW, AQL
North Moreau Creek	50.0	43N 13W 1	44N 16W 4	Cole	LWW,AQL, WBC,BTG
Trib. to N. Moreau Creek	0.5	Mouth	44N 13W 23	Cole	LWW, AQL
Trib. To N. Moureau Creek	1.0	Mouth	44N 14W 9	Moniteau	LWW, AQL
Trib. to N. Moreau Creek	0.5	Mouth	44N 13W 9	Cole	LWW, AQL
Trib. to N. Moreau Creek	2.0	Mouth	45N 15W 33	Moniteau	LWW, AQL
Trib. to N. Moreau Creek	2.0	Mouth	44N 15W 18	Moniteau	LWW, AQL
Trib. to N. Moreau Creek	2.0	Mouth	44N 16W 12	Moniteau	LWW, AQL
Trib. to N. Moreau Creek	2.0	Mouth	44N 16W 2	Moniteau	LWW, AQL
Trib. to N. Moreau Creek	0.5	Mouth	44N 15W 4	Moniteau	LWW, AQL
Pilot Branch	1.0	Mouth	44N 16W 10	Moniteau	LWW, AQL
Roark Branch	1.0	Mouth	43N 14W 23	Cole	LWW, AQL
Rock Enon Creek	4.0	Mouth	43N 15W 14	Moniteau	LWW, AQL
Rocky Branch	2.0	Mouth	43N 16W 16	Moniteau	LWW, AQL
South Moreau Creek	20.5	43N 13W 1	43N 14W 29	Cole	LWW,AQL, WBC,BTG
South Moreau Creek	9.0	43N 14W 29	42N 15W 7	Moniteau	LWW, AQL,WBC, BTG
South Moreau Creek	6.5	42N 15W 7	42N 15W 31	Miller	LWW, AQL
Trib. to S. Moreau Creek	0.5	Mouth	43N 14W 25	Cole	LWW, AQL

Table 1 continued

Stream	Miles	From (Township, Range, Section)	To (Township, Range, Section)	County	Beneficial Use*
Trib. to S. Moreau Creek	0.5	Mouth	43N 13W 19	Cole	LWW, AQL
Trib. to S. Moreau Creek	1.5	Mouth	43N 15W 28	Moniteau	LWW, AQL
Trib. to S. Moreau Creek	1.0	Mouth	43N 15W 31	Moniteau	LWW, AQL
Trib. to S. Moreau Creek	1.0	43N 15W 31	43N 16W 25	Moniteau	LWW, AQL
Trib. to S. Moreau Creek	1.5	Mouth	42N 15W 29	Miller	LWW, AQL
Trib. to S. Moreau Creek	1.0	Mouth	43N 15W 30	Moniteau	LWW, AQL
Scott Branch	0.5	Mouth	44N 15W 5	Moniteau	LWW, AQL
Smith Creek	10.5	Mouth	43N 17W 2	Moniteau	LWW, AQL, WBC
Straight Fork	12.0	44N 16W 4	43N 17W 6	Moniteau	LWW, AQL, WBC
Straight Fork	6.0	43N 17W 6	43N 18W 36	Morgan	LWW, AQL
Strobel Branch (1)	2.0	Mouth	44N 14W 24	Cole	LWW, AQL
Strobel Branch (2)	2.5	Mouth	45N 14W 35	Cole	LWW, AQL
Trib. to Strobel Branch (2)	0.5	Mouth	45N 14W 36**	Cole	LWW, AQL
Trib. to Strobel Branch (2)	0.5	Mouth	44N 14W 1	Cole	LWW, AQL
Willow Fork	3.0	44N 16W 4	45N 17W 36	Moniteau	LWW, AQL, WBC
Willow Fork	6.5	45N 17W 36	45N 17W 29	Moniteau	LWW, AQL
Trib. to Willow Fork	0.5	Mouth	45N 17W 27	Moniteau	LWW, AQL

*Beneficial use= LWW=livestock and wildlife watering, AQL=protection of warmwater aquatic life and human health fish consumption, WBC=whole body contact, BTG=boating and canoeing.

**Trib. to Strobel Br. is reported as from Mouth to T45N, R13W, S36 in MDNR 1992 source, however, R13W, appears incorrect; R14W makes more sense.

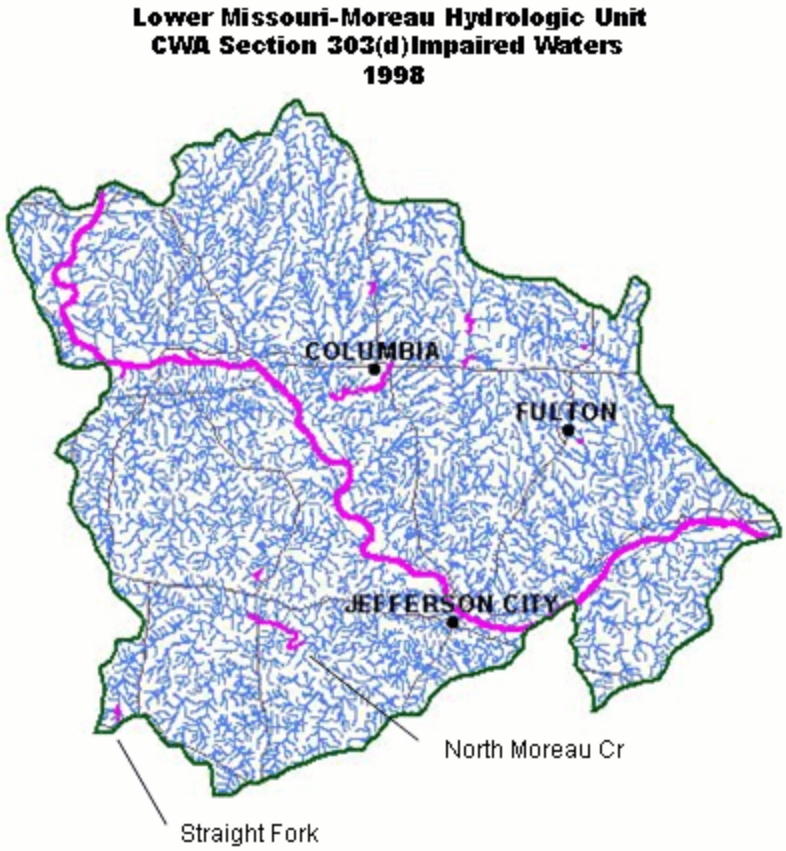

Figure wq. CWA Section 303(d) impaired waterways identified by the EPA which are associated with the California and Versailles, MO waster treatment facilities.

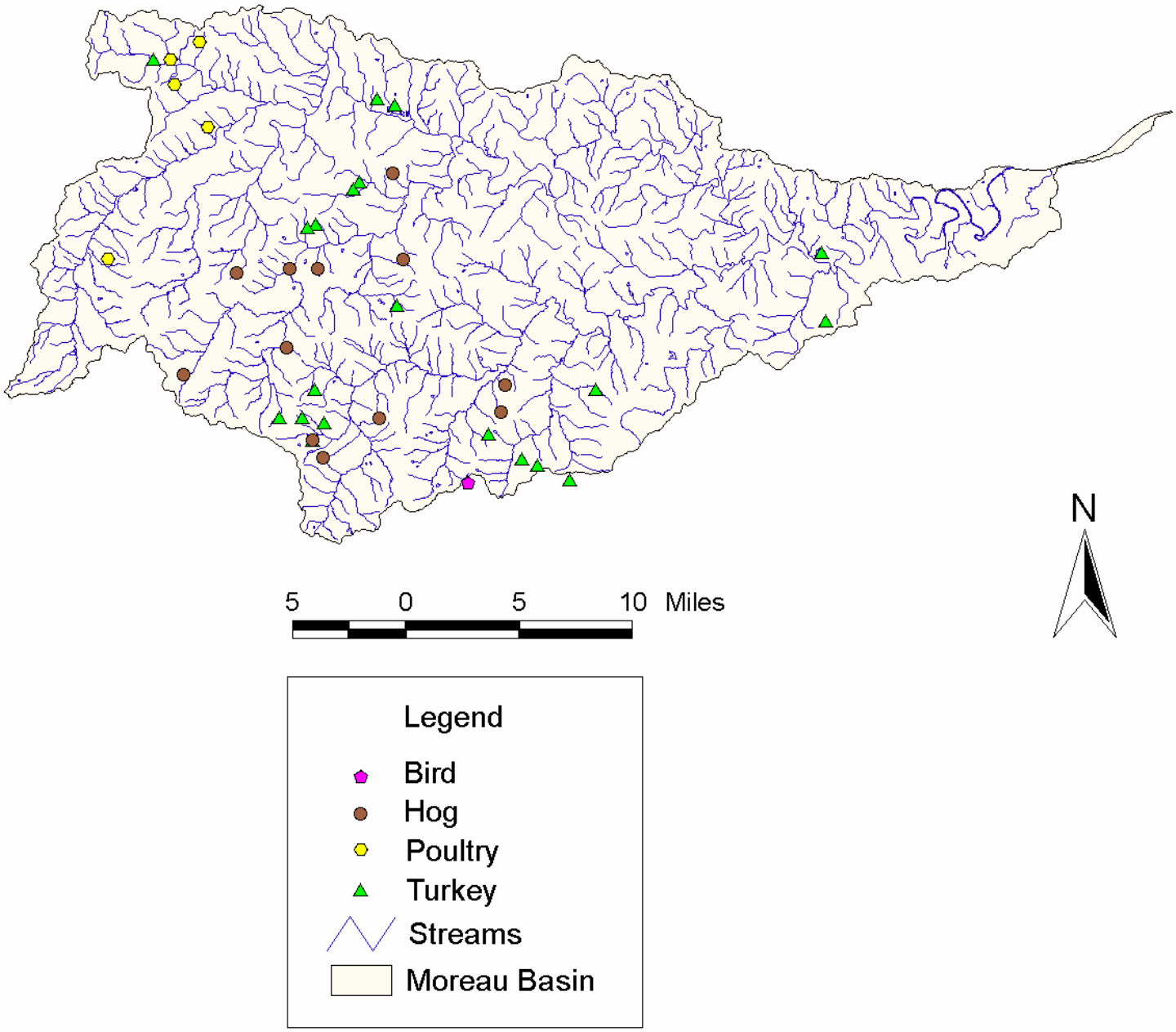

Figure ps. CAFO point source discharge locations within the Moreau River Watershed.