2 Methods

Pool 8 is one in a series of 26 pools in the UMR formed by the construction of low-head dams in the 1930s for navigation. Pool 8 is 37 km long and, at low-water conditions, has a water surface area of 8,874 ha and a mean depth of 1.85 m. The area of Pool 8 that is aquatic at low discharge is composed of various geomorphic types including main channel, side channels, contiguous backwaters, and isolated backwater lakes. The focus of this study was contiguous backwater areas, excluding the large impounded backwater in the lower pool. These areas cover 1,980 ha and range in size from less than 0.1 ha to 256 ha (Figure 1). The backwater areas are shallow (mean depth of 0.67 m) and typically have low current velocities (median of 0.04 m/sec during the summer).

A geographical information system (GIS) was used to generate maps of all existing contiguous backwaters in Pool 8 (Owens and Rusher 1996). Backwater regions were defined as areas beyond the banks of the main or secondary channels (Wilcox 1993). A total of 337 distinct backwater areas were identified using these criteria. The study area did not include either backwater areas that have completely filled with sediment since impoundment or the impounded area as previously described. Estimates of sedimentation in the impounded area can be better obtained from elevation map comparisons using terrestrial preimpoundment elevation data. Many of the backwaters in the middle and upper portions of the pool were aquatic at the time of the preimpoundment terrestrial surveys and, therefore, the map comparisons cannot be done.

Backwater size (i.e., surface area, perimeter maximum, and effective fetch) and channel connection parameters (i.e., the number of channel connections, distance between connections to channels, and the size of the connections to channels) were used as criteria to stratify backwater selection. From this information, three general strata of backwaters were delineated: large backwaters, small, low-connectivity backwaters, and small, high-connectivity backwaters (Figure 2). A subset of backwaters was randomly selected from each stratum for sediment core sampling (Table 1, Figure 1).

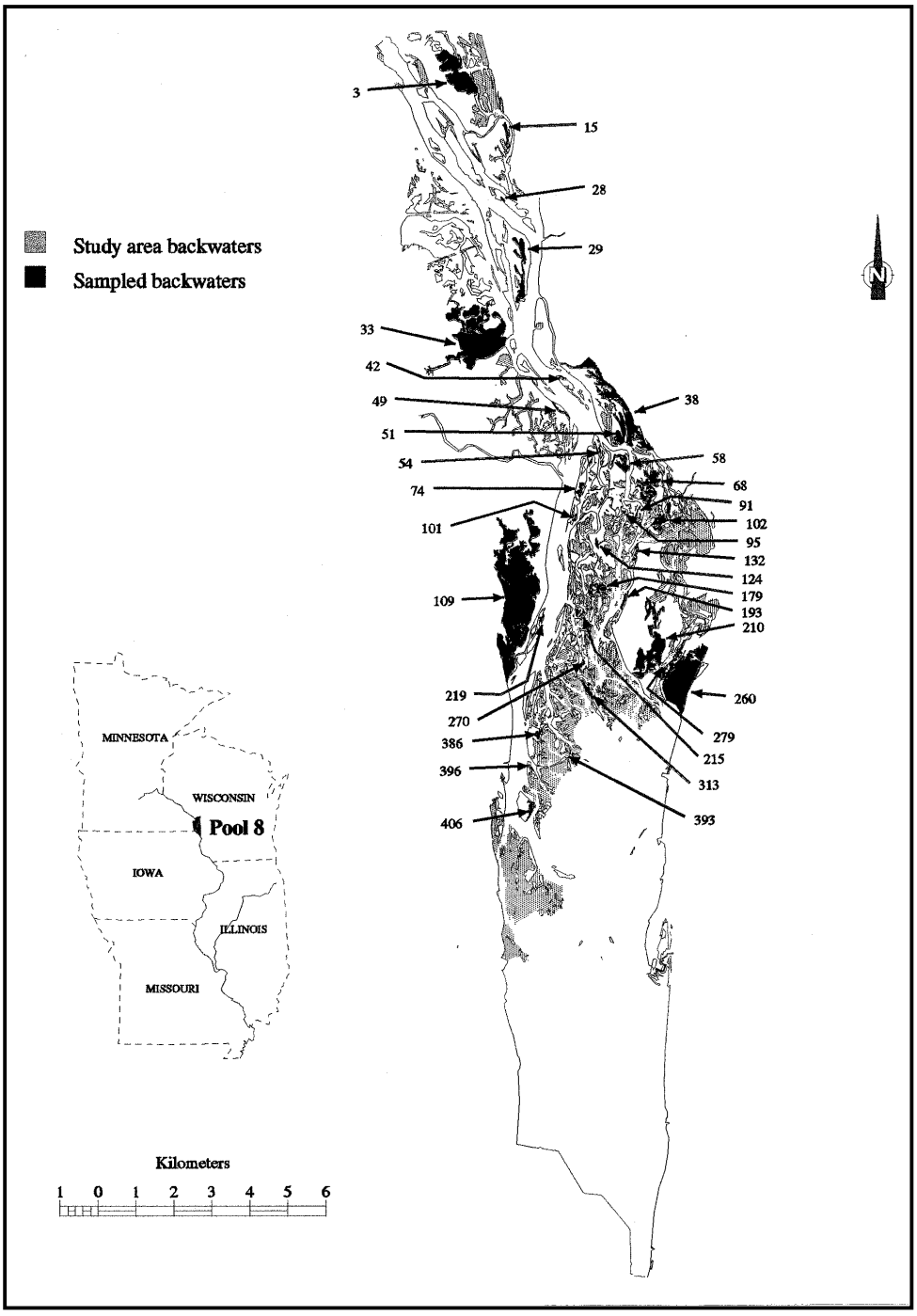
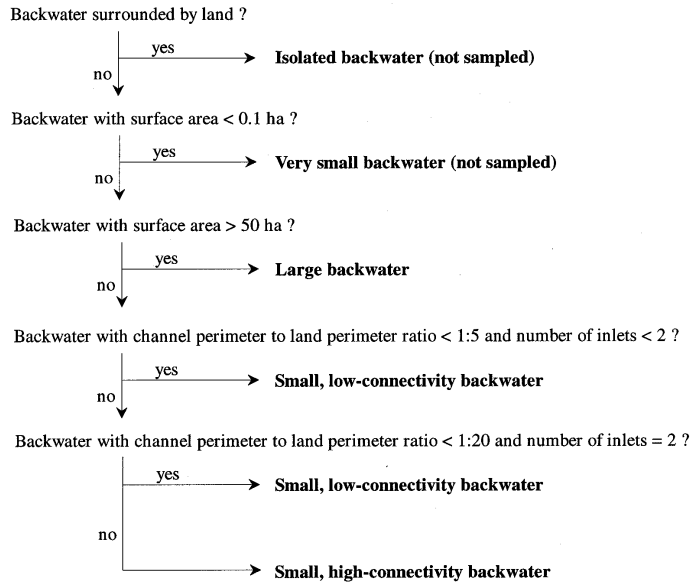


Figure 1. Map of the study area backwaters in Pool 8 and the location of the randomly selected backwaters selected for obtaining sediment cores

To select stations for sediment core collection, selected backwaters were further stratified by water depth, creating three depth strata to account for potential variance due to sediment focusing (Likens and Davis 1975, Håkanson 1977, Bellrose et al. 1983). Depth stratum 1 included depths less than the mean depth of the backwater (Figure 2). Depth stratum 2 included depths between the mean depth of the backwater and the mean depth plus 1 standard deviation (SD).



Depth class	Description
1	Depth less than the mean depth
2	Depth greater than the mean depth and less than the mean depth plus one standard deviation
3	Depth greater than the mean depth plus one standard deviation

Figure 2. Methods used to stratify sampling in Pool 8. (Flow chart illustrates criteria for classifying backwaters into three strata. Table shows the criteria for classifying depth ranges in each backwater based on mean depth and standard deviation of depth in each backwater)

Depth stratum 3 included depths greater than the mean depth plus 1 SD. In addition to randomly selected stations, sites along existing sediment range transects in Pool 8 were sampled to provide a comparison with rates of net sedimentation determined via changes in bed elevation since 1989 (Rogala and Boma 1996). These sites were not used in estimates of pool-wide fine sediment accumulation rates.

Sediment cores were obtained using a Wildco KB Sediment Core Sampler (Wildco Wildlife Supply) containing a plastic core liner (with an approximate 5-cm inside diameter and 50-cm length). The core was stored upright and transferred to the laboratory where it was sectioned at 10-cm intervals until preimpoundment material was encountered. Sections were weighed for moisture content determination and then dried to a constant weight at 105 ^{o}C (Håkanson 1977). Sediment density was estimated as dry mass of the section divided by its volume. Organic matter content in each core section was determined by loss on ignition at 550 ^{o}C (American Public Health Association 1992).

Table 1
Backwater Number, Area, Number of Sites Sampled with Coring Device, and Number of Sites Visited for Each Backwater Type. Total Number and Total Area of Each of the Four Backwater Types in Pool 8 are Shown in Parentheses

Backwater type (total no.) (total area)	Backwater number	Area (ha) of sampled backwater	Number of sites sampled	Number of sites visited
Large backwaters (10) (1065 ha)	3	54.65	15	15
	33	132.59	10	12
	38	60.42	10	10
	109	256.04	15	15
	210	53.19	14	15
	260	98.39	12	15
Total			76	82
Small, low-connectivity backwaters (89) (205 ha)	15	3.21	6	6
	28	0.49	2	2
	29	19.48	7	7
	42	0.71	3	3
	49	2.26	4	4
	51	12.67	9	9
	54	0.60	1	1
	58	7.67	6	6
	74	2.53	4	4
	91	0.55	3	3
	95	0.33	1	1
	101	0.61	1	1
	124	1.37	2	2
	219	0.90	1	1
	313	3.44	5	5
	396	0.16	1	1
Total			56	56
Small, high-connectivity backwaters (195) (706 ha)	68	21.63	8	9
	102	8.82	0	6
	132	2.18	0	4
	179	7.58	0	6
	193	2.89	0	6
	215	2.47	6	6
	270	0.18	1	3
	279	0.17	0	2
	386	1.83	0	3
	393	0.12	0	2
	406	4.33	0	6
Total			15	53
Very small backwaters (unsampled) (142) (4 ha)				
Total			147	191

Preimpoundment material was identified tactilely as an abrupt change in sediment density and/or texture. This determination was confirmed by examining differences in moisture content between the sections above and below the tactilely estimated preimpoundment interface, and by visual observations of differences in the composition of sediment. Other criteria were also used to arrive at a final estimate of the depth of preimpoundment material (see Figure 3).

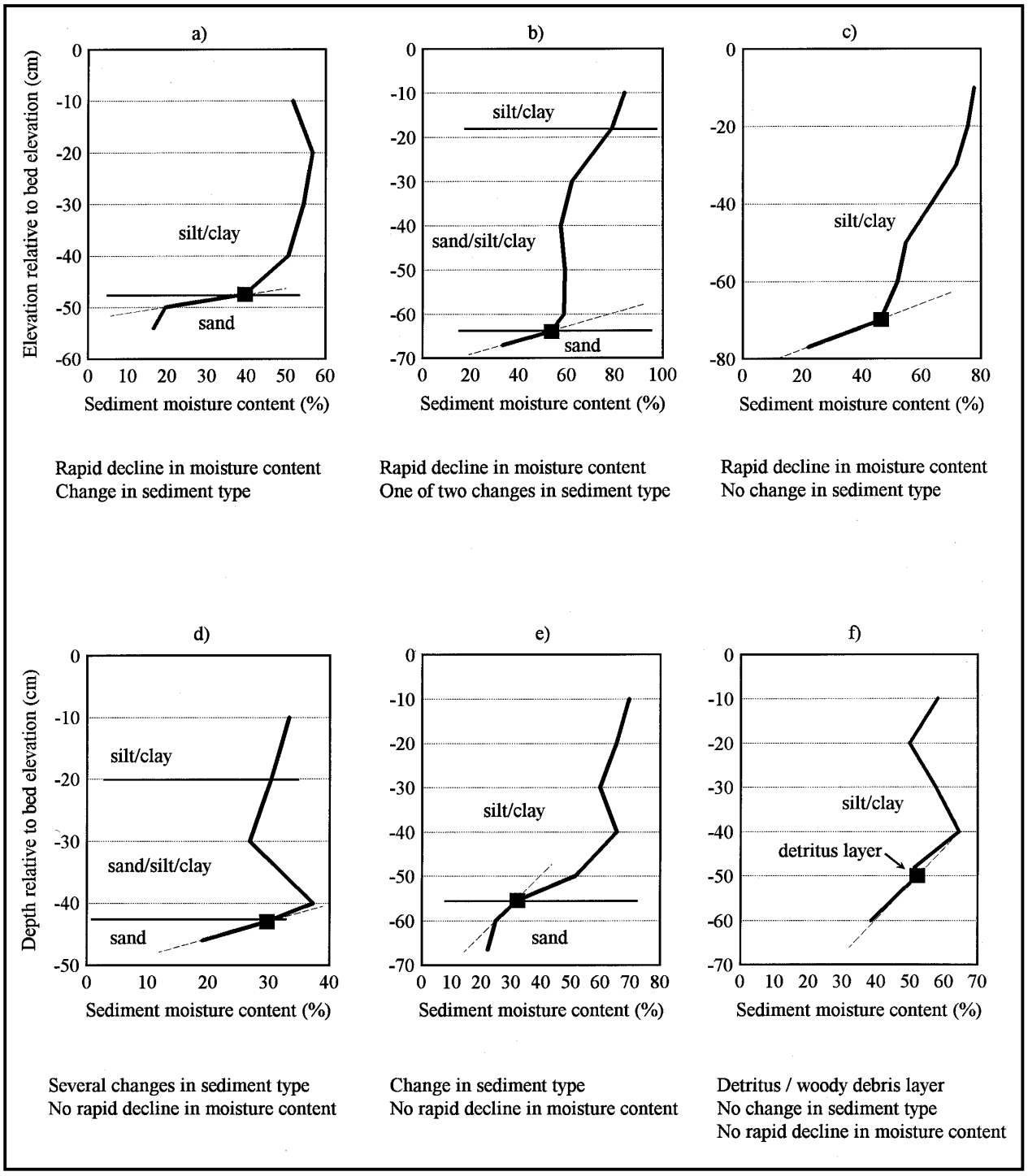


Figure 3. Examples of criteria used to identify preimpoundment sediment in the sediment cores. (Decline in moisture content is depicted by slope of dashed lime in each graph; more horizontal lines indicate a rapid decline in moisture content. Sediment types are labeled above and below the switch as marked with the solid horizontal lines)

Sediment cores were not collected at sample sites that were found to be channel-like, as determined by the presence of high-velocity and predominantly sand sediment during sampling. However, for the purposes of estimating fine sediment accumulation, these sites were considered to have no accumulation of fine sediment.

Rates of net fine sediment accumulation were calculated as the sediment depth above preimpoundment material divided by the time period since impoundment (58 years for Pool 8). Mean rates of net accumulation for each backwater were estimated by weighing rates within different depth strata by surface area. Similarly, rates of accumulation in the three backwater types were calculated based on surface area. Finally, a pool-wide mean (overall) net fine sediment accumulation rate for Pool 8 contiguous backwaters, excluding the impounded area, was estimated using the area-weighing approach. The Tukey's multicomparison test ($P = 0.05$) was used to test for significant differences.