Although channelization and wetland drainage are not typically thought of as nonpoint source pollutants, these activities are included because options for helping to alleviate their effects are available through the nonpoint source program. Some of these options include restoring wetlands and creating vegetative shoreline buffers. The guidelines for using these management techniques are presented in Chapter 5.

The most pervasive and serious effects on the streams in the watershed include physical habitat loss which affects nearly all streams in the watershed. The habitat loss is caused in part by the deposition of eroded sediment on the streambeds and in part by stream channelization and drainage of riparian wetlands.

Sedimentation is a serious problem in most streams. Exceptions include the Mud Lake Outlet in the Cedarburg Subwatershed, the portion of Cedar Creek in the Little Cedar Lake Subwatershed and in portions of the North Branch of Cedar Creek. These streams are very well buffered by wetlands, which filter out much of the pollutant load before it can reach surface waters. Sediment deposition is also less of a problem in portions of Cedar Creek within the Upper Cedar Creek and Horn's Corners Subwatersheds. Sediment deposition in these portions of Cedar Creek is less of a problem because of the higher stream gradients which discourage sediment buildup.

Extensive habitat loss due to channelizing of streams has also occurred throughout the watershed. This has destroyed normal stream structure and led to increased water temperatures due to lack of overhanging vegetation. Notable exceptions include those portions of Cedar Creek in the Upper Cedar Creek, Horn's Corners and Cedarburg subwatersheds; the North Branch Cedar Creek; and Lehner Creek. Although Lehner Creek has not been channelized, loss of overhanging vegetation due to cropping practices is suspected to be causing increased water temperatures. Virtually all intermittent streams have been extensively channelized.

Drainage of riparian wetlands has accompanied much of this channelizing. This has decreased base flows in affected streams. The greatest impacts have occurred in Kressin Creek, Little Cedar Creek, Cedarburg Creek, Evergreen Creek and lower portions of the North Branch Cedar Creek.

In localized areas riparian habitat has been degraded through livestock overgrazing. This has caused a loss of overhanging vegetation. In some places, cattle have trampled the streambed.

Table 4-2 shows the results of bacteriological sampling conducted at 19 sites in the watershed during 1986. Of the five segments of Cedar Creek designated for full-body contact recreation, only the uppermost portions (above the Mayfield Pond) met the established recreational use water quality standards.

Table 4-2. Bacterial contamination of surface waters in the Cedar Creek Watershed[1]

Sample Location(2.)	Stream Name	Geometric Mean Count (MFFC/100 ml)	Range of Sample Counts (MMFC/100 ml)	Number Samples >400 MFFC/100 ml
1	Cedar Creek	161	60-2,300	1
2	Cedar Creek	82	1-400	0
3	Cedar Creek	285	20-20,000	2
4	Lehner Creek	563	10-38,000	3
5	Cedar Creek	1,204	180-50,000	2
6	Jackson Tributary	8,200	410-160,000	5
7	Cedar Creek	3,191	430-100,000	5
8	Cedar Creek	3,137	640-30,000	5
9	Frieden's Creek	4,898	650-20,000	5
10	Cedar Creek	4,239	750-29,000	5
11	Cedar Creek	2,874	1,100-30,000	5
12	N. Br. Cedar Creek	11,224	1,800-220,000	5
13	Un-Named Tributary	1,194	250-17,000	2
14	N. Br. Cedar Creek	2,617	220-100,000	4
15	Cedar Creek	1,864	240-30,000	4
16	Cedar Creek	2,072	150-50,000	3
17	Cedar Creek	1,316	140-50,000	3
18	Cedar Creek	1,346	160-27,000	2
19	Cedar Creek	412	70-4,600	2

1 Each site was sampled five times during the summer of 1986. Recreational use standards require that the geometric mean count not exceed 200 MFFC/100 ml. It also requires that counts exceeding 400 MFFC/100 ml not be exceeded in more than 10% of the samples.

Source: Wisconsin Department of Natural Resources

The remaining portions of the creek designated for full-body contact recreation including portions in the Jackson, Cedarburg Creek and Cedarburg subwatersheds exceeded the established recreational water quality criteria. Remaining sampling locations on Cedar Creek and its tributaries are all established in areas designated for partial-body contact recreation. All of these surface waters are seriously contaminated with bacteria greatly exceeding the recreational water quality standards.

Although nonpoint source pollution is probably depressing dissolved oxygen levels to some extent in watershed streams, aquatic macroinvertebrate populations indicate that dissolved oxygen levels are generally good throughout the watershed. The Hilsenhoff Biotic Index indicates that water quality, as indicated by dissolved oxygen impacts on these animals, is "good" in many streams. These include portions of Cedar Creek located in the Little Cedar Lake, Upper Cedar Creek, Mayfield and Cedarburg subwatersheds; Lehner Creek; Frieden's Creek; and Evergreen Creek. Localized areas of "fair" water quality are found in portions of Cedar Creek in the Mayfield and Cedarburg subwatersheds and in Evergreen Creek. One site of "very poor" water quality was identified in the extreme headwaters of Little Cedar Creek.

Although urban stormwater is known to contain a wide array of organic and inorganic pollutants, there has been no water quality monitoring conducted on Cedar Creek or its tributaries to determine the extent to which these pollutants have affected the quality of sediments, surface waters or biota.

Lake Potential

Nineteen of the 20 lakes and ponds in the Cedar Creek Watershed have the potential to support balanced warm water fish communities. Lehner Lake has the potential to a cold water fish community.

Existing Status of Lakes

Map 5 shows the extent to which these lakes are meeting their biological use potential. Lehner Lake is fully meeting its potential, and currently supports brook trout reproduction. Mud Lake and Long Lake are also fully meeting their biological potential, although indications are that winterkill limits these lakes to seasonal use.

The water quality in Big Cedar Lake and Gilbert Lake is considered to be good. Based on measurements of water clarity, chlorophyll and phosphorus levels Big Cedar Lake is considered to be moderately eutrophic (mesotrophic). Both lakes are considered to be only partially meeting their full potential, however. Limitations in Big Cedar Lake are primarily due to aquatic vegetation. The lake is considered to be threatened with continued degradation by nutrient, bacteria and sediment loads from nonpoint pollution sources. A videotape documentary of spring runoff shows that sediment plumes form in both Gilbert and Big Cedar Lakes due to influent stream contamination. The darkest and largest sediment plume was observed at the mouth of the un-named perennial stream entering Big Cedar Lake in the

northeast quarter of Section 5, Polk Township. Another significant plume was observed at the end of Gonering Drive, in the southeast quarter of Section 19, West Bend Township. A third significant plume of animal waste and sediment was observed coming from a culvert near Linden Point in the southeast quarter of Section 30, West Bend Township. Other observed problems included:

- an oil slick and accumulation of debris deposited in the lake from a storm sewer located in the Cedar Hills Subdivision (Section 5 of Polk Township),
- a smaller plume located along the shoreline at Fontana Drive in Section 5 of Polk Township,
- a smaller plume located at the mouth of an intermittent gully near the Linden Inn in the southwest quarter of Section 31, West Bend Township,
- manure deposited on the ice in Cedar Lake,
- a plume at the north end of Gilbert Lake, at the mouth of the stream located in Section 17 of West Bend Township,
- a plume along the southwest side of Gilbert Lake.

The water quality of Little Cedar Lake is also considered to be good. It is mesotrophic, based on measurements of water clarity, chlorophyll and phosphorus.

Nonpoint Sources

Rural Nonpoint Pollution Sources

Rural nonpoint pollution sources described for this watershed include barnyards, winterspread manure, unrestricted livestock access to streams, streambank erosion and upland erosion. These are the principal sources of sediment, bacteria and nutrients coming from agricultural land uses.

Barnyard Runoff

Table 4-3 shows the pollution potential of the 136 barnyards inventoried in the Cedar Creek Watershed. The estimated mass load of phosphorus from these barnyards during a 10-year, 24-hour rainfall is about 934 pounds of phosphorus. This probably represents 60 to 80 percent of the phosphorus pollution that occurs from animal waste management, with the remainder related to manure spreading.

Table 4-3. Pollution potential of barnyard runoff for subwatersheds in the Cedar Creek Priority Watershed

	RUNOFF DESTINATION											
	Surface Waters		Pocket Wetlands		Deep Soils		Shallow Soils		No Runoff		Subwatershed	
Subwatershed	*Number*	*Load**	*Number*	*Load**	*Number*	*Load**	*Number*	*Load**	*Number*	*Load**	*Number*	*Load**
Big Cedar L.	4	41	1	5	3	27			2	n.a.	10	73
Little Cedar L.	2	32							2	n.a.	4	32
Upper Cedar Cr.	3	13			1	7					4	20
Mayfield	11	93							3	n.a.	14	93
Internally Drained												
Lehner Cr.	1	7									1	7
Jackson	6	26	1	2	3	11	1	30			11	69
Up. Kressin Cr.	3	25			1	24					4	49
Lo. Kressin Cr.	5	103	1	1							6	104
Up. Little Cedar Cr.	4	19	2	5	1	30			1	n.a.	8	54
Mid. Little Cedar Cr.	3	24							1	n.a.	4	24
Lo. Little Cedar Cr.	1	1							2	n.a.	3	1
Cedarburg Cr.	5	24							1	n.a.	6	24
Frieden's Cr.	6	47							1	n.a.	7	47
Evergreen Cr.	3	36			1	15			2	n.a.	6	51
Horns Corners	15	109			1	2			3	n.a.	19	111
No. Branch Cedar Cr.	8	48	2	8	4	12					14	68
Trenton Township	3	7	1	10	1	8					5	25
Cedarburg Bog	2	33			1	9			1	n.a.	4	42
Cedarburg	3	28	1	11	1	1			1	n.a.	6	40
Watershed Total	**88**	**716**	**9**	**42**	**18**	**146**	**1**	**30**	**20**	**n.a.**	**136**	**934**

* The mass load of phosphorus (in pounds) discharged from barnyards during the 10-year, 24-hour rainfall event.
Source: Wisconsin Department of Natural Resources

Table 4-4. Summary of annual manure spreading information for the Cedar Creek Priority Watershed

County	Livestock Operations (No.)	Acres Needed[1]	Acres Available					Unsafe Acres Spread/Yr.
			Total	Safe		Unsafe[2]		
Ozaukee	32	480	800	630	79%	170	21%	90
Washington	87	2,010	4,300	3,320	77%	980	23%	360
Watershed	119	2,490	5,100	3,950	77%	1,150	23%	450

1 Acres needed for winter-spreading manure.
2 Acres that are over 6% in slope, in wetlands, or in floodplain.

Source: Wisconsin Department of Natural Resources

Eighty-eight of these barnyards, representing about 75 percent of the phosphorus potential, discharge to the stream network. Runoff from the remaining 48 barnyards does not affect the surface water of streams or lakes. This is either because the animals are confined to the barn (20 barnyards), the runoff is contained by pocket wetlands (9 barnyards), or the runoff totally infiltrates into the ground before it can reach a flowing surface channel (19 barnyards).

Winterspread Manure

Table 4-4 shows the pollution potential posed by livestock operators who may be spreading manure during the winter on environmentally sensitive lands. These lands are defined as those that have a high potential to contribute manure laden runoff to surface waters during the spring period of rainfall and snowmelt. For purposes of this analysis, it includes lands having slopes of at least 6 percent or that are located in the floodplain.

It is estimated that the 119 livestock operations need a total of 2,490 acres of environmentally safe land for winterspreading manure. Of the 5,100 acres of land available, it is estimated that 3,950 acres (77 percent) are environmentally safe for winterspreading while 1,150 acres (23 percent) are located on slopes over 6 percent or in the floodplain.

Although there are enough safe acres across the entire watershed to meet the need for winterspreading, these acres are not necessarily distributed according to the needs of individual livestock operators. It is estimated that a total of 450 acres of environmentally sensitive lands are spread with manure in the watershed each winter. Most of this (80 percent) is expected to occur in Washington County.

Streambank Degradation

Table 4-5 provides information concerning streambank degradation in the watershed. Overall, there are 41 stream reaches in the watershed that are bordered by degraded streambanks. Thirty of these are on Cedar Creek and its principal tributaries, while 11 are on secondary perennial and intermittent streams.

Generally speaking these sites are significant primarily where they are associated with unrestricted cattle access that results in bacterial contamination of the water and reduction in the quality of riparian habitat. Of the 19 sites evaluated for bacterial contamination, four were located immediately downstream of areas having unrestricted cattle access. These locations include site numbers 3 and 8 on Cedar Creek, site number 4 on Lehner Creek and site number 14 on the North Branch of Cedar Creek. Each of these four sites has high bacteria counts which may have been influenced by cattle. Paired Hilsenhoff Biotic Index sites in the Evergreen Creek Subwatershed showed a decrease in water quality associated with an area of unrestricted cattle access.

The significance of the degraded sites as a watershed sediment source is minimal, whether or not the erosion is induced by cattle access. Streambank derived sediment loads produce less than 1 percent of the sediment loading in the watershed, and produces only 1 percent of the sediment load in each of the two subwatersheds (Horn's Corners and Cedarburg) where it was found most often. All sites that were evaluated for sediment production produced less than 10 tons per site and most sites had very low rates of lateral recession indicating that streambanks are not actively cutting at significant rates.

Upland Erosion

Table 4-6 shows the distribution of land uses inventoried in the Cedar Creek Watershed. Agricultural land uses have been divided into five categories including cropland, grassland, pasture, woodland and wetland.

Agricultural land uses cover 84 percent of the watershed land area. Cropland dominates the rural land cover, making up about one-half of the watershed land cover. Cropland dominates all subwatersheds with the exception of the Cedarburg Bog Subwatershed, where wetlands dominate. Pasture lands cover only about 2 percent of the rural landscape. On a watershed basis, woodlands, wetlands and grasslands are similar in land area, each covering from 9 to 13 percent of the land area.

Estimated sediment loadings from all sources in the Cedar Creek Watershed are shown in Table 4-7 to illustrate the importance of agricultural areas as a source of sediment to Cedar Creek and its tributaries. Comparisons are made for the watershed as a whole, for individual subwatersheds and for three river points along Cedar Creek. Each river point reflects the cumulative contributions from all land uses located between it and the outlet to Little Cedar Lake.

Table 4-5. Streambank condition inventory results, Cedar Creek Priority Watershed

Subwatershed	Water Body	Number of Degraded Sites*	Frequency of Cause	
			Cattle Access	*Other*
Big Cedar L.	Lakeshore	0		
	Tributaries	0		
Little Cedar L.	Cedar Cr.	0		
	Lakeshore	0		
	Tributaries	0		
Upper Cedar Cr.	Cedar Cr.	2	2	
	Tributaries	0		
Mayfield	Cedar Cr.	1	1	
	Lakeshore	0		
	Tributaries	1	1	
Lehner Cr.	Lehner Cr.	2	2	
Jackson	Cedar Cr.	2	1	1
	Tributaries	1	1	
Up. Kressin Cr.	Up. Kressin Cr.	0		
Lo. Kressin Cr.	Lo. Kressin Cr.	0		
	Tributaries	0		
Up. Little Cedar Cr.	Up. Little Cedar Cr.	2	2	
	Tributaries	0		
Mid. Little Cedar Cr.	Mid. Little Cedar Cr.	1	0	1
	Tributaries	0		
Lo. Little Cedar Cr.	Lo. Little Cedar Cr.	0		
	Tributaries	1	0	1
Cedarburg Cr.	Cedarburg Cr.	1	1	
	Tributaries	0		
Frieden's Cr.	Frieden's Cr.	0		
	Tributaries	1	1	
Evergreen Cr.	Evergreen Cr.	2	1	1
	Tributaries	2	2	
Horns Corners	Cedar Cr.	8	2	6
	Tibutaries	3	2	1
No. Branch Cedar Cr.	No. Branch Cedar Cr.	0		
	Tributaries	0		
Trenton Township	No. Branch Cedar Cr	2	2	
	Tributaries	2	2	
Cedarburg Bog	Tributaries	0		
Cedarburg	Cedar Cr.	7	0	7
	Tributaries	0		
Watershed Total	**Principle Waters**	**30**	**14**	**16**
	Tributaries	**11**	**9**	**2**

* Less than 1% of the watershed streambanks are seriously eroding.
Of all subwatersheds, the Lehner Creek Subwatershed has the greatest amount (7% of its length) of streambank erosion.

Source: Wisconsin Department of Natural Resources.

Table 4-6. Inventoried land use (in acres) for subwatersheds in the Cedar Creek Priority Watershed

Subwatershed	Urban Study Area[1]		Scattered Urban[2]		Rural Cropland		Rural Grassland		Rural Pasture		Rural Woodland[3]		Rural Wetland		Watershed Total
Big Cedar L.			1,436	26%	2,343	42%	518	9%	52	1%	818	15%	367	7%	5,534
Little Cedar L.			529	33%	431	27%	159	10%	62	4%	270	17%	163	10%	1,614
Upper Cedar Cr.			202	9%	1,254	54%	181	8%	51	2%	448	19%	181	8%	2,317
Mayfield	198	4%	432	9%	3,291	71%	193	4%	83	2%	224	5%	226	5%	4,647
Internally Drained			439	28%	706	44%	109	7%	34	2%	290	18%	15	1%	1,593
Lehner Cr.			50	7%	409	61%	51	8%	31	5%	18	3%	111	17%	670
Jackson	235	5%	475	10%	2,848	60%	547	11%	22	0%	651	14%		0%	4,778
Up. Kressin Cr.			144	10%	958	66%	99	7%	27	2%	127	9%	88	6%	1,443
Lo. Kressin Cr.			221	7%	1,790	56%	460	14%	72	2%	177	6%	464	15%	3,184
Up. Little Cedar Cr.			1,143	21%	2,910	53%	546	10%	89	2%	380	7%	461	8%	5,529
Mid. Little Cedar Cr.			330	16%	1,327	65%	121	6%	41	2%	76	4%	148	7%	2,043
Lo. Little Cedar Cr.			184	9%	1,545	76%	110	5%	18	1%	186	9%		0%	2,043
Cedarburg Cr.	175	2%	464	6%	3,820	53%	1,013	14%	47	1%	1,271	18%	437	6%	7,227
Frieden's Cr.	21	1%	449	12%	2,191	58%	172	5%	40	1%	831	22%	83	2%	3,787
Evergreen Cr.			181	4%	2,760	65%	222	5%	29	1%	1,057	25%	20	0%	4,269
Horns Corners	225	3%	725	10%	3,864	54%	715	10%	183	3%	492	7%	1,005	14%	7,209
No. Branch Cedar Cr.			363	8%	1,804	38%	694	15%	60	1%	1,346	29%	434	9%	4,701
Trenton Township			310	11%	1,735	59%	414	14%	100	3%	371	13%		0%	2,930
Cedarburg Bog			37	1%	868	23%	346	9%	69	2%	262	7%	2,245	59%	3,827
Cedarburg	2,761	48%	33	1%	1,746	31%	649	11%	27	0%	200	4%	282	5%	5,698
Watershed Total	3,615	5%	8,147	11%	38,600	51%	7,319	10%	1,137	2%	9,495	13%	6,730	9%	75,043

1 Includes urban land uses in the Jackson and Cedarburg Study Areas, described in the text.
2 Includes primarily residential subdivisions and farmsteads located outside of urban study areas. Does not include roads, highways, railroads or other transportation land uses.
3 Includes wooded swamp.

Source: Wisconsin Department of Natural Resources

Consequently, River Point 1 receives sediment from three subwatersheds, River Point 2 receives sediment loading from 12 subwatersheds, and River Point 3 receives sediment from 17 subwatersheds. On a watershed basis, sediment from agricultural lands dominates the sediment loading to Cedar Creek. This dominance occurs at all three river points, ranging from 79 percent at River Point 3, to 90 percent at River Point 2. This dominance is also seen within individual subwatersheds. With the exception of the Cedarburg Subwatershed, agricultural erosion contributes from 76 to 100 percent of the total sediment load to surface waters.

Croplands are the dominant sediment source within the agricultural land use category. Croplands contribute 97 percent of the agricultural sediment on a watershed basis. On a subwatershed basis, this contribution of croplands ranges from 93 to 98 percent.

Urban Nonpoint Pollution Sources

Urban areas produce a wide array of pollutants which can impair water quality. Some such as sediment, nutrients, bacteria and pesticides are also produced by agriculture. Others such as heavy metals (zinc, copper, lead) and PAHs (polycyclic aromatic hydrocarbons) have been monitored primarily in runoff from urban areas. Urban areas not only contribute to increased pollutant loadings, but can disrupt stream hydrology. Increases in impervious area can result in changes to surface water hydrology as infiltration is reduced and runoff is increased. The result is "flashy" streams that have low base flows during dry periods and high stream velocities and peak discharges during storms. These streams lose stability in important habitat characteristics such as stream flow, temperature and bank structure.

Much has been learned about the pollutants carried in urban stormwater, and the urban source areas which generate them. This section is a brief introduction to stormwater quality in general, based on monitoring conducted from 1970 to the present in Wisconsin (primarily Madison and Milwaukee) and throughout the nation. The stormwater pollution basics summarized below are applied to the Cedar Creek Watershed later in this chapter.

Urban land uses vary in their significance as pollutant source areas. Automobile traffic density and industrial activity are prime determinants for many of the heavy metals (including lead, copper and zinc) and are also important sources of PAHs. The metals are generated by wear of tires and brake linings and are also present in oil, antifreeze, grease and gasoline. PAHs are generated by incomplete combustion of hydrocarbons, with cars and industrial emissions being important sources. Residential, commercial and industrial areas are important sources of fertilizers and pesticides. Industrial storage areas and atmospheric fallout are primary sources of PCBs (polychlorinated biphenyls). Wildlife and domestic pets are likely sources of bacteria, which is often found to be excessive in urban runoff.

The significance of an urban land use as a pollution source is judged in two regards. First, the land use is evaluated based on its capability to generate a mass of pollutants for transport to surface waters. Table 4-8 shows the relative importance of representative urban land uses as generators of several pollutants.

Table 4-7. Annual sediment delivery results for the Cedar Creek Watershed

Subwatershed	Urban Sediment Load (t/y)[1]		Historic Construction Sediment Load (t/y)[2]		Agricultural Upland Sediment Load (t/y)[3]		Scattered Urban Sediment Load (t/y)[4]		Streambank Sediment Load (t/y)		TOTAL SEDIMENT LOAD (T/Y)
Cedar Lake	0	0%	0	0%	538	79%	140	21%			678
Little Cedar Lake	0	0%	0	0%	222	85%	40	15%			262
Upper Cedar Creek	0	0%	0	0%	542	99%	7	1%			549
Mayfield	28	2%	270	19%	1,097	76%	49	3%			1,444
Lehner Creek	0	0%	0	0%	126	99%	1	1%			127
Point 1*	28	1%	270	13%	1,765	83%	57	3%			2,120
Jackson	32	3%	120	12%	816	83%	13	1%			981
Upper Kressin Creek	0	0%	0	0%	284	98%	7	2%			291
Lower Kressin Creek	0	0%	0	0%	705	99%	6	1%			711
Upper Little Cedar Creek	0	0%	0	0%	989	92%	84	8%			1,073
Middle Little Cedar Creek	0	0%	0	0%	373	92%	33	8%			406
Lower Little Cedar Creek	0	0%	0	0%	528	98%	12	2%			540
Cedarburg Creek	1	0%	210	16%	1,070	83%	10	1%			1,291
Frieden's Creek	0	0%	0	0%	784	97%	25	3%			809
Evergreen Creek	0	0%	0	0%	897	99%	5	1%			902
Point 2*	61	1%	600	7%	8,211	90%	252	3%	0		9,124
Horns Corners	9	1%	180	13%	1,141	84%	17	1%	9	1%	1,356
North Branch Cedar Creek	0	0%	0	0%	376	98%	6	2%			382
Trenton Township	0	0%	0	0%	545	98%	12	2%			557
Cedarburg Bog											0
Cedarburg	254	11%	1,530	64%	590	25%	0	0%	29	1%	2,403
Point 3*	324	2%	2,310	17%	10,863	79%	285	2%	38	0%	13,822
WATERSHED	324	2%	2,310	16%	11,623	79%	465	3%	38	0%	14,762

1 Based on SLAMM Model results for urban lands within the CEDARBURG and the JACKSON STUDY AREAS.
2 Based on estimated historic annual construction rate @ 30 t/a/y delivery rate.
3 Based on WIN Model results for rural land uses only.
4 Based on acres inventoried by county LCD and unit area loads based on SLAMM for grassed swale drainage.

* River Point 3 includes Points 1&2. Point 2 includes Point 1. None of the points include inputs to either Big Cedar or Little Cedar Lake.

Table 4-8. Unit area pollutant generation rates from urban land uses

Land Use	Sediment	Unit Load (lb/ac/yr) Phosphorus	Lead	Zinc	Other Pollutants of Concern
Freeways	880	0.9	5.5	2.1	volatile organics[1], PAHs [2]
Industrial	1,000	1.5	2.4	2.1	pesticides[3], PCBs[4], PAHs, esters[5], volatile organics, aliphates[6]
Commercial	1,000	1.5	2.7	2.1	volatile organics, PAHs
Shopping Centers	440	0.5	1.1	0.6	volatile organics, PAHs
High Density Residential	420	1.0	0.8	0.7	pesticides, esters, benzene[7]
Medium Density Residential	190	0.5	0.2	0.2	pesticides, esters, benzene
Low Density Residential	10	.04	.01	.04	pesticides, esters, benzene
Parks	3	.03	.005		pesticides, esters, benzene

1 Series of carbon compounds which have been shown to be harmful to human health and the environment.

2 Polynuclear aromatic hydrocarbons (PAHs) are composed of rings of benzene and other aliphates. Some PAHs are carcinogenic.

3 Pesticides are hazardous chemicals and may adversely affect aquatic and human health.

4 Polychlorinated biphenyls (PCBs) are very stable compounds which persist in the environment for long periods of time. They are passed through the food chain and are highly toxic.

5 A commonly encountered ester is acetyl acetate, frequently used as a solvent. The substance is toxic and considered a dangerous fire and explosive risk.

6 Any organic compound of hydrogen and carbon. An example of an aliphate of concern is methane gas.

7 Aromatic hydrocarbon. Clear, colorless water-soluble liquid. Recognized as a human carcinogen. Benzene is found in gasoline.

Source: Wisconsin Department of Natural Resources.

Ultimately, the importance of a given land use will be determined not only by the unit area loading capability of the land use, but also by the areal extent of the land use. Strategies to reduce mass loads are generally applied regionally or community wide.

Land uses are also evaluated based on the concentrations at which pollutants are discharged. Wisconsin has not established discharge standards for urban stormwater, but existing standards for municipal and industrial point sources can be used to help interpret stormwater concentrations. Runoff monitored from commercial and high density residential areas in Madison and Milwaukee during 1990 was found to exceed acute toxicity standards developed for point sources as defined in NR 105 and NR 106 Wis. Adm. Code. Event mean concentrations exceeded these standards 45 percent of the time for copper and zinc. Event mean concentrations of PCBs exceeded the human cancer criteria 100 percent of the time while PAH concentrations exceeded this criteria 60 percent of the time.

Table 4-9 presents more detailed information concerning the percent reduction needed in stormwater pollutant concentrations in order to meet effluent toxicity standards. The largest reductions in stormwater pollutant concentrations are needed for zinc and copper coming from commercial, industrial, high density residential and freeway land uses. Significant reductions in lead concentrations are also needed, primarily in runoff derived from commercial, industrial and freeway areas.

Table 4-9. Reductions in stormwater pollutant concentrations needed to meet acute toxicity standards for fish and aquatic life*

Land Use	Lead[1]		Zinc[2]		Copper[3]	
	Concentration (ug/l)	Reduction Needed (%)	Concentration (ug/l)	Reduction Needed (%)	Concentration (ug/l)	Reduction Needed (%)
Low Den. Res.	2	0%	<1	0%	2	0%
Medium Den. Res	13	0%	58	0%	9	0%
High Den. Res.	74	18%	223	70%	30	69%
Commercial	125	51%	338	81%	48	81%
Industrial	125	51%	338	81%	48	81%
Institutional	52	0%	205	68%	19	50%
Park, Open	1	0%	<1	0%	<1	0%
Freeway	200	70%	473	86%	50	82%

* Based on measured annual average event mean concentrations of recoverable metals from commercial and high density residential land uses in Madison and Milwaukee, 1990. Estimates for other land uses are extrapolated from these measurements.

1 The acute toxicity (LC-50) standard for lead is 61 ug/l at a stormwater hardness of 26 ppm.
2 The acute toxicity (LC-50) standard for zinc is 66 ug/l at a stormwater hardness of 26 ppm.
3 The acute toxicity (LC-50) standard for copper is 9.3 ug/l at a stormwater hardness of 26 ppm.

Source: Wisconsin Department of Natural Resources.

Institutional land uses pose a problem primarily due to concentrations of zinc and copper. In addition, stormwater runoff is known to frequently exceed phosphorus and suspended solids limits frequently imposed on municipal and industrial point source discharges. Ultimately, the degree to which end-of-pipe concentrations exceed acute toxicity standards or other guidelines will depend on the mix of contributing land uses draining to the pipe. Strategies to reduce concentrations are very site-specific, requiring analyses on smaller urban sub-basins.

Sweeping streets and using grassed swale drainage systems in place of curb and gutter drainage will moderate the availability and transport of pollutants carried in urban stormwater. Street sweeping will reduce the amount of pollutants available for transport and affect the mass load and concentration of pollutants discharged. Street sweeping, particularly during the spring and fall, will remove pollutants from streets and parking lots before they can be transported to storm sewers. Street sweeping is less effective for pollutants present in a more soluble state such as zinc, copper and phosphorus.

Properly constructed grassed swale drainage systems also reduce pollutant loads. These swales work primarily through stormwater infiltration and secondarily through pollutant filtration. These systems are most applicable to lower density development such as residential areas, institutional land uses and industrial park areas. If soil infiltration rates are poor, the slope of the swale is too steep, or the swale becomes clogged with fine sediments the grassed swale will not control pollutants.

Urban Stormwater Pollution in the Cedar Creek Watershed

Two urban study areas are being evaluated to determine the pollution potential of both existing and planned future development. The Jackson Study Area is 6 square miles, and includes portions of the towns of Jackson and Polk, as well as all lands within the village of Jackson. The Cedarburg Study Area, located in Ozaukee County, is 14 square miles and includes portions of the towns of Cedarburg and Grafton, and all portions of the incorporated municipalities (the cities of Cedarburg and Mequon and the village of Grafton) that are within the watershed.

Stormwater Runoff From Existing Urban Areas in the Study Areas

Table 4-10 shows the distribution of acreage amongst the major urban land use categories. About 12 percent of the Cedarburg Study Area is covered by commercial, industrial and multi-family residential land uses that have been shown to produce high unit area loadings and concentrations of pollutants. In the Jackson Study Area, these land uses cover about 30 percent of the area.

The following information concerning urban stormwater pollution from urban areas in the Cedar Creek Watershed is based on the presence of existing urban land uses, as measured from 1985 aerial photographs, and the anticipated future urban growth in the watershed.

Table 4-10. Area extent, in acres, of urban land uses for study areas in the Cedar Creek Watershed: 1985[1]

Study Area	Municipality	Residential Density			Commercial	Industrial	Institutional	Parks, Open space	Total
		Low	Medium	High					
Cedarburg	City of Cedarburg	123	692	107	76	83	166	253	1,500
	City of Mequon	27							27
	Village of Grafton	2	140	43	6	2	5	37	235
	Town of Cedarburg	941	12	1	48	13	29	213	1,257
	Town of Grafton	127						23	150
Study Area Subtotal:		1,220	844	151	130	98	200	526	3,169
Jackson	Village of Jackson	19	84	32	20	59	12	95	321
	Town of Jackson	31	1	1	5	2	2	26	68
	Town of Polk	42		3	3	6	1	3	58
Study Area Subtotal:		92	85	36	28	67	15	124	447
WATERSHED TOTAL		1,312	929	187	158	165	215	650	3,616

1 Land use definitions are contained in the plan appendices.

Source: Wisconsin Department of Natural Resources.

The concentrations and mass loadings of stormwater pollutants that come from these land uses are estimated based on data collected from other urban areas, since no site-specific urban pollutant monitoring has been conducted in the Cedar Creek Watershed.

The urban lakeshore developments on Big Cedar Lake and Little Cedar Lake were visited and visual inspections made of possible urban nonpoint pollution sources. In addition, a videotape made by the Big Cedar Lake Protection and Rehabilitation District. The videotape, with aerial as well as ground-based photography, shows the effects of spring snowmelt on runoff quality and quantity to Big Cedar Lake.Table 4-11 shows the extent grassed swale drainage and street sweeping are used in the city of Cedarburg and the villages of Jackson and Grafton. Grafton sweeps most frequently, while programs for Jackson and Cedarburg are minimal. Grassed swale drainage is not commonly used in any of these three municipalities.

Table 4-12 summarizes the total urban acreage and pollutant loading for municipalities within the Cedarburg and Jackson study areas. Lead and sediment are evaluated both as indicator pollutants. Both are found to cause water quality problems in the Milwaukee River, while sedimentation has been observed as a water quality problem in Cedar Creek. The Cedarburg Study Area accounts for 88 percent of the urban land use and about 80 percent of the urban pollutant loading in the watershed. Most of the pollutants within the study area are generated within the city of Cedarburg and the adjoining township. A smaller portion is generated within the village of Grafton.

Table 4-11. Street sweeping schedule and grass swale location by land use for municipalities in the Cedar Creek Watershed

Municipality	*Residential & Institutional*		*Commercial & Industrial*	
	Street Sweeping* (frequency)	Grass Swales (% area)	Street Sweeping* (frequency)	Grass Swales (% area)
C. of Cedarburg	twice/year	None	twice/year	None
V. of Grafton	once/month	None	twice/month	None
V. of Jackson	twice/year	None	twice/year	None

*Beginning 04/01/89 and ending 10/15/89

Table 4-12. Urban area and pollutant loads for municipalities in the Jackson and Cedarburg Study Areas of the Cedar Creek Watershed

Study Area	Municipality	Urban Area (acs)	Lead Load (lbs/year)	Sediment Load (tons/year)*
CEDARBURG	City of Cedarburg	1,500	732	195
	City of Mequon	27	<1	
	Village of Grafton	235	84	29
	Town of Cedarburg	1,257	185	39
	Town of Grafton	150	<1	1
	STUDY AREA SUBTOTAL	3,169	1,002	263
JACKSON	Village of Jackson	321	0.00	56
	Town of Jackson	68	19	3
	Town of Polk	58	27	5
	STUDY AREA SUBTOTAL	447	311	64
WATERSHED TOTAL:		3,616	1,313	327

* Does not include construction site erosion.

Source: Wisconsin Department of Natural Resources

Most of the urban areas within the city of Cedarburg and the village of Grafton discharge either directly to Cedar Creek via storm sewer or discharge to the creek via intermittent streams. The three significant exceptions occur within the city of Cedarburg. City Drainage District 14, which includes 379 acres, drains to a series of shallow ponds located off Evergreen Boulevard. This district contains primarily medium density residential areas and open land. City Drainage District 4, which contains 161 acres of land, drains to a quarry located off Lincoln Boulevard. This district contains a wide variety of land uses including commercial, industrial, open space and a range of residential densities. Drainage District 13, which includes 210 acres, drains to a pond located off Tamarack Drive. Land use in this district is exclusively medium and low density residential. These drainage districts encompass about 40 percent of the urban area for the city of Cedarburg and drain about 20 percent of its existing pollutant load. It is not known to what extent these areas reduce the pollutant loads prior to discharge to Cedar Creek.

The Jackson Study Area accounts for 12 percent of the urban land use and about 20 percent of the urban pollutant load in the watershed. Most of this pollutant load is generated within the village of Jackson and flows to Cedar Creek within the Jackson and Mayfield subwatersheds via storm sewers connected to open ditches and intermittent streams. There is a large dry detention area for stormwater located adjacent to the Green Valley Development that collects water from a 495 acre drainage area. This area is primarily agricultural land with about 15 acres of trailer park and about 5 acres of existing industrial development. This basin was designed for flood control purposes and probably provides little stormwater pollution control benefit.

Table 4-13 shows the contribution of these pollutants by land use, illustrating how management strategies can target large portions of the annual mass pollutant loading by focusing on a small portion of the urban area. In the Jackson Study Area the multi-family, commercial and industrial land uses contribute 85 to 96 percent of the urban pollutant load while encompassing only 33 percent of the existing urban land use. Most of these land uses occur in the village of Jackson, although some isolated tracts occur in the towns of Polk and Jackson. In the Cedarburg Study Area these same land uses contribute 55 to 75 percent of the urban pollutant load while encompassing 12 percent of the existing urban land use. Unlike the Jackson Study Area, the Cedarburg Area generates a large portion (20 to 35 percent) of its pollutant loading from medium density residential areas that encompass 27 percent of the Study Area.

The established urban area is the only significant source of heavy metals and PAHs. This area is not generally a significant source of sediment, however. These areas contribute only about 1-2 percent of the annual sediment load to Cedar Creek, with the remainder coming primarily from agricultural erosion and eroding construction sites.

Table 4-13. Land use contributions to the urban pollutant loading for study areas in the Cedar Creek Watershed: 1985

Study Area	Urban Area (ac.)	Land Use	% of Urban Study Area	*% of Study Area's Urban Pollutant Load*	
				Lead	Sediment
CEDARBURG	3,169	Low Density Residential	38%	1%	3%
		Medium Density Residential	27%	20%	34%
		Multi-Family Residential	5%	13%	14%
		Commercial	4%	34%	23%
		Industrial	3%	26%	18%
		Institutional	6%	5%	8%
		Parks, Open	17%	1%	0%
JACKSON	447	Low Density Residential	21%	0%	0%
		Medium Density Residential	19%	6%	14%
		Multi-Family Residential	8%	11%	14%
		Commercial	6%	24%	22%
		Industrial	15%	58%	50%
		Institutional	3%	1%	2%
		Parks, Open	28%	0%	0%

Source: Wisconsin Department of Natural Resources

Table 4-14. Reductions needed in stormwater pollutant concentrations in urban runoff discharged to Cedar Creek from the city of Cedarburg and the village of Grafton*

Municipality	Drainage District	Drainage Area	Storm Sewer Outfall Location	*Lead*[3]		*Zinc*[4]		*Copper*[5]	
				Conc. (ug/l)	Reduction Needed (%)	Conc. (ug/l)	Reduction Needed (%)	Conc. (ug/l)	Reduction Needed (%)
C. Cedarburg	#10	108[1]	Cedar Cr. @ Keup Rd.	26	0%	86	24%	12	22%
	#9(Part)	40[2]	Cedar Cr. @ Highland Dr.	35	0%	106	38%	15	39%
	#14(Part)	5[2]	Cedar Cr. @ West Elm St.	54	0%	160	59%	23	60%
	#14(Part)	80[2]	Cedar Cr. @ Bridge Rd.	25	0%	85	22%	12	20%
	#6(Part)	11[2]	Cedar Cr. @ Cleveland St.	76	19%	217	70%	32	71%
	#6(Part)	28[2]	Cedar Cr. @ Wis. Power Line	58	0%	171	61%	25	62%
	#6(Part)	6[2]	Cedar Cr. @ Turner St.	111	45%	307	79%	45	80%
	#6(Part)	160[2]	Tail race @ Mill St.	58	0%	171	61%	25	62%
	#3	123[1]	Cedar Cr. @ Green Bay Rd.	83	27%	242	73%	35	74%
	#7	112[1]	Cedar Cr. @ Spring St.	46	0%	142	53%	20	54%
V. Grafton		232[2]	Intermittent Stream	35	0%	111	41%	16	42%

* Based on calculated estimates of the expected average annual stormwater concentrations of heavy metals.

1 City estimate.
2 DNR estimate.
3 The acute toxicity(LC-50) standard for lead is 61 ug/l at a stormwater hardness of 26 ppm.
4 The acute toxicity(LC-50) standard for zinc is 66 ug/l at a stormwater hardness of 26 ppm.
5 The acute toxicity(LC-50) standard for copper is 9.3 ug/l at a stormwater hardness of 26 ppm.

Source: Wisconsin Department of Natural Resources

The hazard posed by concentrations of heavy metals and other toxic materials at stormwater outfalls is determined by the mix of land uses draining to each storm sewer pipe. In order to determine how much of a problem this might be, a preliminary assessment was made of calculated effluent concentrations for some selected storm sewer outfalls. Storm sewer pipes were selected based on the presence of commercial, industrial or multi-family land uses expected to produce pollutant concentrations exceeding acute toxicity standards for point source discharges. Estimates of stormwater pollutant concentrations are based on calculations and do not reflect monitoring at these storm sewer locations.

Table 4-14 shows the results of this preliminary assessment for the city of Cedarburg and the village of Grafton. The storm sewers identified in Table 4-14 collect runoff from about 66 percent of Cedarburg's commercial land uses and 50 percent of its industrial and multi-family residential areas. For Grafton, the storm sewers discharging to the intermittent stream listed capture runoff from all of the community's commercial, industrial and multi-family residential land in the watershed.

Based on the information in Table 4-14, storm sewer pipes in the city of Cedarburg and the village of Grafton can be expected to significantly exceed acute toxicity standards for effluent. Zinc and copper are anticipated to occur nearly anywhere that commercial, industrial and multi-family land uses are mixed in with the medium density residential areas. For some areas, average concentrations for zinc and copper may need to be reduced on the order of 40 percent to meet acute toxicity standards. In other drainages, 50 to 80 percent reductions for zinc and copper may be required. Lead toxicity is probably a more localized problem, requiring that a larger portion (over 40 percent) of the drainage area be made up of critical land uses. For these areas, lead concentrations may need to be reduced 25 to 50 percent to meet standards.

It is important to note that in all cases, these stormwater concentrations are projected to exceed standards in these communities because of contributions from relatively small areas of commercial, industrial, high density residential and institutional land uses. Consequently, selective treatment of these areas should result in acceptable reductions in stormwater pollutant concentrations as well as mass loadings.

The land use and storm sewer network configuration for the village of Jackson indicates that similar concerns over stormwater pollutant concentrations may exist for that community as well. Concentrations can be expected to experience some dilution however as the stormwater drains through open drainage ditches in undeveloped areas prior to discharge to Cedar Creek.

Stormwater Runoff From New Urban Development in the Study Areas

Planned urban development poses several additional pollution hazards including:

- potential construction site erosion,
- increases in the mass loading of urban stormwater pollutants,
- increases in the numbers of storm sewer outfalls that may discharge high concentrations of stormwater pollutants, and
- potential changes to small stream hydrology.

Table 4-15. Projected mix of planned urban land use for the Cedar Creek Watershed

Study Area	Residential		Commercial	Industrial	Institutional	Parks, Open areas	Total	Municipalities
	Low	Medium						
CEDARBURG	470	470	120	110	40	30	1,240	C. of Cedarburg C. of Mequon V. of Grafton Tn. of Grafton Tn. of Cedarburg
JACKSON	320	320	40	170	40	70	960	V. of Jackson Tn. of Jackson Tn. of Polk

Source: Wisconsin Department of Natural Resources

Table 4-15 shows the projected mix of planned urban land uses expected to occur in the Jackson and Cedarburg Study Areas. Not all of this development is anticipated to occur within the planning period, however. In the Cedarburg Study Area, 80 to 100 percent of this projected development is expected to occur by the year 2000, whereas in the Jackson Study Area about 50 percent of the development is anticipated within this time frame.

Table 4-16 reflects that portion of the development that is expected to occur by the year 2000, and how this development could change the current level of urban pollutant loading. Development in the Cedarburg Study Area is anticipated to increase the existing urban area by about 33 percent. This development will occur primarily in the Cedarburg Subwatershed in the city of Mequon and what is now Cedarburg Township. Small amounts of development are also anticipated within the current municipal boundaries for Grafton and Cedarburg. Unless stormwater controls are used, the current mass load of heavy metals from the study area is anticipated to rise by 73 percent due to increased runoff.

Development in the Jackson Study Area will increase the urban area by about 107 percent by the year 2000. Significant development will occur in the Jackson and Mayfield subwatersheds, with a lesser amount anticipated for the Frieden's Creek Subwatershed. Most of this development will occur within what is now the municipal boundary for the village of Jackson, although significant areas will also develop in the towns of Jackson and Polk. Unless stormwater controls are used, the current mass load of heavy metals from the study area is anticipated to increase by nearly 200 percent due to increased runoff. This will result in significant increases of these stormwater pollutants to Hasmer Lake, Tilly Lake, Frieden's Creek and Cedar Creek.

Anticipated future development rates are expected to significantly increase the potential for sedimentation from construction sites. On a unit area basis, construction sites can produce erosion at rates 10 to 100 times that occurring from agricultural land. Loads from construction sites in the Jackson Study Area could increase by 145 percent while those from the Cedarburg Study Area could increase by 11 percent. The historic contribution of construction erosion to the mass load of sediment in Cedar Creek has been 7 percent near Jackson and 17 percent near Cedarburg. Consequently, these potential increases will continue to keep construction site erosion as an important source to consider. Fortunately, much of the predicted construction will occur in municipalities having construction site erosion control ordinances.

Construction site erosion in the Jackson Study Area is regulated by the village of Jackson and Washington County. The village of Jackson has adopted the state model ordinance for control of construction site erosion. Consequently, a significant portion of the area where development is anticipated is covered by ordinance. The county regulates stormwater runoff and construction site erosion in unincorporated areas (Polk and Jackson townships) through its land subdivision ordinance. This ordinance applies only to subdivision activities (grading and utility installation) in developments of five or more lots. Consequently, the ordinance does not regulate construction erosion in several critical categories. These include construction site erosion from: individual home building sites in subdivision plats for five or more lots; grading, road and utility installation, and individual home building in areas where plats are for fewer than five lots; general road, bridge or utility construction and maintenance.

Table 4-16. Planned increased in urban development and associated loadings in the Jackson and Cedarburg Study Areas, 1985-2000*

Study Area	Land Use Increase		Total Lead Increase		Sediment Increase[1]		Sediment Increase[2]		Where Growth Expected
	acres	%	Pounds	%	Tons	%	Tons	%	
Cedarburg	1,060	33%	740	73%	170	63%	200	11%	Tn. Cedarburg, C. Cedarburg, C. Mequon, V. Grafton
Jackson	480	107%	650	197%	140	210%	570	145%	V. Jackson, Tn. Jackson, Tn. Polk
Watershed	1540	43%	1390	105%	310	92%	770	33%	

* Figures in this table reflect a portion of the planned urban development that is anticipated to occur by the year 2000. These estimates are 80 to 100 percent for the Cedarburg Study Area and 50% for the Jackson Study Area.

1 Increase in sediment from new impervious urban areas.

2 Increase in sediment production potential of eroding construction sites. Most municipalities have construction site erosion control programs that should greatly reduce the potential sediment delivery from these sites.

Source: Wisconsin Department of Natural Resources

The county ordinance coverage needs to be upgraded to provide adequate coverage of new construction in the towns of Polk and Jackson.

Construction site erosion in the Cedarburg Study Area is regulated by the city of Cedarburg, the city of Mequon, the village of Grafton and the town of Cedarburg. The cities of Cedarburg and Mequon, and the town of Cedarburg all have adopted the state model ordinance for control of construction site erosion. This provides coverage for most of the area within the watershed where future construction is anticipated .

There are some additional needs, however. The village of Grafton has limited erosion control coverage in its municipal code and will need to upgrade its ordinance. The town of Grafton has no ordinance coverage.

Urban Runoff Concerns In Other Areas

Several concerns have been raised about urban runoff impacts outside of the Jackson and Cedarburg study areas. Other areas of concern include Big Cedar Lake, Little Cedar Lake, Gilbert Lake and the Cedarburg Bog.

- Big and Little Cedar Lake: The urban development in these areas is principally lower density residential lakeshore development with grassed swale and open ditch drainage. The primary problem appears to be excessive stormwater volumes that are generated on agricultural lands upgradient of the lakeshore developments. These stormwater flows have no designed systems for conveyance to the lake, and consequently cause flooding in the residential areas. In some places, these concentrated stormwater flows are cutting small gullies. In other places these flows are picking up sediment and other pollutants from roads, parking lots and yards. This latter problem is most evident at Gonering Drive, although the oil slick and debris noted near the Cedar Lake Hills subdivision indicates this problem occurs elsewhere as well.

- Little Cedar Lake: Concerns raised by landowners on Little Cedar Lake include road salt use on state and county trunk highways, and potential stormwater runoff impacts from residential subdivision development.

- Gilbert Lake: Citizen concern has been expressed that the planned road construction along State Highway 33 between State Highway 144 and County Trunk Z could have water quality impacts on Gilbert Lake. Specifically, concern has been expressed over the potential for water quality impacts from the road project and associated increase in urban strip development which may follow. Both construction site erosion and post-development are concerns.

- Cedarburg Bog: Concern has also been expressed over the possible impact on the Cedarburg Bog complex from highway runoff along State Highway 33. Road salt and sediment are pollutants of concern.

Water Resources Objectives for the Cedar Creek Watershed

The overall water resources objectives for this project are to contribute to the full attainment of the designated recreational and biological uses for surface waters. It is recognized that full attainment of these objectives will require management actions outside the scope of this nonpoint source control project, as stated in the integrated resource management plan for this area (DNR, 1990).

Biological Use Objectives

The biological use objectives of this project are to contribute towards the full attainment of the potential biological uses shown in Map 4.
The biological uses will be protected in those surface waters shown in Map 5 to be fully meeting their potential. These surface waters should experience no measurable decrease in habitat, water quality or biological populations.

The biological uses will be enhanced in those surface waters shown in Map 5 to be partially meeting their potential. These surface waters should experience improvements in habitat. Existing biological communities should become healthier.

The biological uses will be improved in those surface waters shown in Map 5 to be not meeting their potential. These surface waters should experience significant improvements in habitat. In addition, existing biological populations should basically shift to new ones. The cold water aquatic community should extend its range into lower Lehner Creek, a warm water sport fish community should become established on Evergreen Creek, and a balanced warm water forage fish community should become established on the Jackson Tributary.

Recreational Use Objectives

The project objective is to significantly reduce the geometric mean bacteria count in watershed streams identified as exceeding recreational use standards.

Nonpoint Source Pollution Reduction Goals

Rural Pollution Reduction Goals

The following rural pollutant reduction goals must be achieved in order for the nonpoint source project to make a successful contribution towards attaining the water resources objectives identified above.

Sediment: Table 4-17 shows the reduction in agricultural sediment loading needed in each subwatershed. These subwatershed reductions are based on the need to reduce the sediment impacts on stream substrate in subwatershed streams as well as downstream surface waters. In most subwatersheds the reduction goal for sediment delivered from agricultural uplands ranges from 50 percent to 75 percent. Exceptions include the Lehner Creek Subwatershed where the reduction goal is 90 percent, and the Big and Little Cedar Lake Subwatersheds where the reduction goal is 30 percent. These sediment reduction goals will be applied primarily to eroding agricultural lands.

Nutrients: The goal is to reduce nutrient loading from nonpoint sources by at to Little Cedar and Big Cedar Lakes by about 30 percent. The goal is also to reduce the overall phosphorus loading to the watershed from nonpoint sources by 60 percent while achieving a high level (40 to 50 percent) of nutrient reduction in contributing subwatersheds.

The nutrient reduction goals will be applied primarily to barnyard runoff and winterspread manure. The sediment reduction goals identified for agricultural lands should adequately reduce nutrients attached to eroded sediment.

Bacteria: The goal is to significantly reduce the input of bacteria from livestock. The nutrient reduction goals for animal waste sources should provide a significant level of reduction. In addition, cattle access to streams in the watershed will be managed, either through partial restriction or total elimination.

Habitat Degradation: Cattle access to streams in the watershed will be properly managed, either through partial restriction or total elimination. Streambank erosion that poses a site-specific hazard to habitat will be managed.

Wetland restoration and the creation shoreland buffers will be encouraged to help increase wetland acres and provide additional habitat along channelized streams.

Urban Pollution Reduction Goals

The following urban pollutant reduction goals are established to help fully achieve the potential designated uses in Cedar Creek and the Milwaukee River to which this creek system is tributary. The goals, along with a brief justification are presented below.

Sediment: Developing urban areas have historically had the potential to contribute significant portions of the total annual sediment load delivered to Cedar Creek. This potential sedimentation from construction sites will increase over the planning period unless proper controls are in place.

Table 4-17. Sediment reduction goals for agriculture in the Cedar Creek Watershed

	SEDIMENT REDUCTION NEEDS FOR:			
	WATERS IN SUBWATERSHED		DOWNSTREAM WATER RESOURCES	
Subwatershed	% Reduction	Stream	% Reduction	Stream & Subwatershed
Big Cedar Lake	30%*	Big Cedar L.**		
Little Cedar Lake	30%*	Little Cedar L.*		
Upper Cedar C.	30%	Cedar C.	70%*	Cedar C., Mayfield
Lehner C.	90%*	Lehner C.		
Mayfield	75%*	Cedar C., Tribs.		
Upper Little Cedar C.	60%	Little Cedar C.	70%*	Little Cedar C., Lower Little Cedar C.
Middle Little Cedar C.	50%*	Little Cedar C.		
Lower Little Cedar C.	70%*	Little Cedar C.		
Upper Kressin C.			70%*	Little Cedar C., Lower Little Cedar C.
Lower Kressin C.			70%*	Little Cedar C., Lower Little Cedar C.
Jackson	60%*	Cedar C.		
Frieden's C.	70%*	Frieden's C.		
Evergreen C.	70%*	Evergreen C.		
Cedarburg C.			60%*	Cedar C., Cedarburg
North Branch Cedar C.	40%	No. Branch Cedar C.**	70%*	No. Br. Cedar C., Trenton Township
Trenton Township	75%*	No. Br. Cedar C.		
Horn's Corners	30%	Cedar C.	60%*	Cedar C., Cedarburg
Cedarburg	60%*	Cedar C.		

* Selected sediment reduction goals for sediment from agriculture in the subwatershed.
** The reduction goal for this waterbody is not based on "embeddedness" factors.

Consequently:

1. The goal is to achieve effective control of construction site erosion on all new development throughout the watershed.
2. Where sites of streambank erosion are found to meet the targeting criteria established for the rural areas, the goal will be to control these sites.
3. Where excessive stormwater from upland areas flows uncontrolled through lakeshore developments around Big and Little Cedar lakes, and where such flows contribute significantly to water pollution, the goal will be to reduce the erosive capacity of the stormwater. Detention and infiltration alternatives will be considered, in addition to conveyance alternatives.

Urban Toxic Materials: There are two characteristics of urban stormwater pollution that should be addressed. These are: the annual mass loading of urban stormwater pollutants and the concentrations at which these pollutants are discharged.

- Annual Mass Loading. Urban stormwater discharges fromthe Jackson and Cedarburg study areas contribute incrementally to the elevated concentrations of heavy metals (lead and cadmium) that have been monitored in the Milwaukee River mainstem as far upstream as Pioneer Road (CTH C) in Ozaukee County. Between 1970 and 1980, monitoring in the Milwaukee River at several points between the North Avenue Dam and Pioneer Road revealed that average metals concentrations are approximately 50 percent greater than the chronic toxicity standards for fish and aquatic life. The relative contribution of the Jackson and Cedarburg study areas to the total annual urban stormwater load of heavy metals is estimated to be 15 percent in the upper portion of the Milwaukee River and about 5 percent in the lower reaches. In order to contribute towards a 50 percent reduction in concentrations of metals in the Milwaukee River, contributing urban areas in the Cedar Creek Watershed are asked to reduce their annual mass loading of these materials by 50 percent over the course of the planning period.

  There is no monitoring or bio-assessment data for Cedar Creek to determine either the impacts of current mass loadings from urban areas or specific projected stream response to reducing these pollutant loads.

- Stormwater Pollutant Concentrations. Extensive monitoring of storm sewer pipes in Madison and Milwaukee indicates that several urban land uses are capable of producing pollutant concentrations exceeding acute toxicity standards for point source discharges. Monitoring of pollutant concentrations has not been conducted on stormwater from the Cedarburg or Jackson Study Areas. However, it is expected that stormwater pollutant concentrations are exceeding these standards at selected stormwater outfalls.

  The needed reduction in stormwater pollutant concentrations will vary depending upon the mix of contributing land uses. Based on preliminary screening of selected outfalls in the Cedarburg and Jackson Study Areas, it is expected that average annual event mean concentrations of zinc and copper will need to be reduced by 50 to 80 percent in those areas where commercial, industrial and high density residential land uses are present. Required reductions are expected to be less for lead, but will still be needed if the drainage areas have large portions of commercial, industrial or higher density land uses.

Reduction goals for specific storm sewer pipes will be verified as part of detailed engineering studies to be conducted during implementation of this watershed project. The inclusion of stormwater monitoring as a component of feasibility studies will be negotiated on a case-by-case basis.

It is important to note that there is no monitoring data from Cedar Creek or its tributaries with which to assess the impact of stormwater concentrations on sediment quality, water quality or biota. The assumption, however, is that stormwater concentrations should be reduced at least to the point where average event mean concentrations do not exceed acute toxicity standards for point sources.

Consequently:

1. The goal is to reduce the mass load of urban toxic materials, including heavy metals, by 50 percent in both the Jackson and Cedarburg Study Areas,
2. The goal is to reduce the incidence of stormwater pollutant concentrations that exceed acute toxicity standards for effluent. Based on average annual concentrations of copper, zinc, lead and PAHs expected to occur, a reduction of 50 to 80 percent in stormwater pollutant concentrations will probably be needed for most storm sewer pipes draining a mixture of urban land uses. Precise reduction goals must be developed for individual storm sewer pipes based on more detailed information.

Stream Flow: Research indicates that stream morphology is shaped in equilibrium with the mean annual flood, which occurs on the average of every 2.33 years (Krug and Goddard, 1986). As the peak flows for this recurrence interval flood increase, the stream begins to cut a new shape into the landscape, resulting in streambank erosion and alterations to the streambed.

Increases in peak stream flows may occur in localized areas of the Cedar Creek Watershed as urbanization increases. Where stream hydrology is altered significantly, streambank erosion and habitat degradation will occur. In some circumstances, it can also lead to significant reductions in stream base flows.

Consequently:

1. The goal is to maintain the hydrologic characteristics of surface waters so that base flows are not significantly reduced and so that stream discharge flows under the average annual flood are not significantly increased. In order to accomplish this, the goal for new development is to maintain runoff characteristics under the 2-year, 24-hour rainfall conditions at levels that are consistent with pre-development conditions.
2. Infiltration of stormwater runoff should be used to protect stream base flows where cost-effective and where groundwater will not be contaminated.

Other: Urban areas have the potential to produce many other pollutants ranging from bacteria and nutrients to oil, antifreeze, pesticides, etc.

Consequently:

1. The goal is to generally improve urban housekeeping practices to reduce the amount of contaminants reaching surface waters.

CHAPTER FIVE
Nonpoint Source Control Needs

Introduction

This chapter identifies recommended nonpoint source control actions for the Cedar Creek Watershed. These recommendations are based on water quality and land management inventories, and provide the levels of pollutant reduction needed to achieve the water quality objectives presented in Chapter 4. The first portion of this chapter presents the watershed's rural nonpoint source control needs. The second portion of the chapter presents the watershed's urban nonpoint source control needs.

As previously discussed, man-induced and natural factors beyond the scope of the priority watershed project affect water resources in this watershed. Management actions related to point source control, fisheries management, wildlife management and recreation are discussed in the integrated resource management plan prepared for this watershed (DNR, 1990).

Rural Nonpoint Source Control Needs

Nonpoint Source Management Categories

A management category is a statement of the relative need to control a specific source in order to meet water resources objectives. Management categories in turn determine eligibility of specific sources for financial and technical assistance under the priority watershed project. Sources are placed in management categories based on:

- Biological and recreational potential of streams being considered.
- Current or expected future impacts of nonpoint sources on those biological and recreational uses.
- Subwatershed pollutant load reductions needed to achieve desired water quality conditions in Cedar Creek and its tributary streams.

- Pollutant load reductions needed to help achieve water quality objectives in the Milwaukee River.

Management categories are established for each major type of nonpoint source. These major divisions include the following: barnyard runoff; manure spreading; eroding croplands and other uplands; streambank erosion or degradation. Each pollution source, such as an individual barnyard or a specific cropped field, is placed in a management category depending on criteria established for its major source type.

The basic management categories used in this project are described below. The implications that each management category has for funding eligibility under the watershed project are also summarized.

- **Management Category I:** Individual sources in this category contribute significantly towards water resource degradation. A reduction in pollutant loads or other impacts from sources in this management category is essential if the project's water quality objectives are to be met. Generally, this management category is defined in such a way as to encompass those sources that will collectively provide the pollutant control needed. In some cases, however, significant sources are not placed in this management category because control is less feasible.

  Nonpoint sources in this category are eligible for funding and/or technical assistance under the priority watershed project. As a condition of funding, control of all pollution sources in this category will be required as part of any individual cost-share agreement. For example, if a landowner has several pollution sources on his/her property -- barnyard, streambank erosion, cropland erosion -- which are in this category, then all of these sources need to be controlled to meet the conditions of the agreement.

- **Management Category II:** Sources are placed in this category for one of two reasons. First, individual sources that contribute moderately toward degradation of water resources are placed in this category. Designating these sources for control is important because it provides some buffering against failure to get 100 percent landowner participation in controlling sources in Category I. Second, individual sources that are highly significant but less practical to control are placed in this management category.

  Nonpoint sources in this category are also eligible for funding and/or technical assistance under the priority watershed project. Inclusion on cost-share agreements of sources in this category is optional, however. An example would be a landowner whose barnyard is in Management Category I but who also has areas of cropland erosion in Management Category II. The cost-share agreement for control of the barnyard runoff need not stipulate control of the cropland erosion. However, the county project staff will encourage landowners to control all Management Category II sources.

- **Management Category III:** Sources in this category do not contribute a significant amount of the pollutants affecting surface waters.

  Nonpoint sources in this category are not eligible for funding and/or technical assistance under the priority watershed project. However, other Department of Natural Resources programs (Wildlife and Fish Management) may assist county project staff to control these sources if warranted for other reasons. This may take the form of technical assistance, application of program funds to create wildlife habitat, or soliciting the help of local conservation groups for funds or labor. Such efforts will occur as part of implementing the integrated resource management plan for this watershed.

  Additionally, coordination of the nonpoint source control program with federal programs, such as Food Security, and state programs, such as Farmland Preservation, will also assist conservation efforts for these other pollution sources.

Change In Management Category

The priority watershed project offers flexibility during implementation for reassigning pollution sources to different management categories. For example, this may be necessary as a result of a change in farm operations, or other circumstances having occurred since completion of the inventories. Changes in management category must be consistent, however, with the management category criteria set forth below for the pollution sources.

Management Category Criteria For Barnyard Runoff

The 136 barnyards in the Cedar Creek Watershed are divided into five major classes depending on the destination of the polluted runoff water. The five classes are, in decreasing order of concern:

1. Barnyards draining to Cedar Creek and its tributary lakes and streams through the interconnecting network of surface channels (86 barnyards),

2. Barnyards draining to "pocket" wetlands (9 barnyards),

3. Barnyards draining to closed depressions where thin soils overlie the bedrock or groundwater table (1 barnyard),

4. Barnyards draining to closed depressions where thick mineral soils overlie the bedrock or groundwater table (18 barnyards),

5. Confined animal operations that do not generate runoff from a barnyard area (22 barnyards).

Barnyards Draining to Surface Waters

The management categories for barnyards in this class are defined in terms of the estimated mass loading of nutrients (phosphorus) discharged to surface waters under the 10-year, 24-hour rainfall event. As general guidelines, Management Category I is being established to provide the opportunity to control at least 30 percent of the barnyard phosphorus load to Big and Little Cedar Lakes and 60 percent of the watershed phosphorus load. This is consistent with the nutrient reduction goals for the watershed. Management Category II is being established to provide a "buffer" of about 10 percent. In addition, the targeting strategy seeks to achieve an adequate level of control (40 to 50 percent) in all subwatersheds.

Table 5-1 shows management category criteria for this class of barnyards, and the associated reduction in the watershed barnyard runoff loading that will occur if these barnyards are properly managed. The scenario assumes that the maximum phosphorus reduction achievable on any single barnyard is 90 percent. The criteria listed are the same for all subwatersheds with one exception: Lehner Creek. In the Lehner Creek Subwatershed, the sole barnyard (7 lbs. phosphorus) is placed in Management Category I because of the significance of this resource and the documentation of site-specific impacts.

Thirty-six barnyards in this class are targeted for control, making it possible to reduce barnyard pollutant loads by 70 percent for the watershed. Management Category I includes 24 barnyards and allows for a 60 percent reduction in the watershed's barnyard phosphorus load to rivers, lakes and streams. Management Category II includes 12 barnyards which will provide for a 10 percent buffer. Runoff from the remaining 50 barnyards in this class does not contain enough phosphorus to be of concern. Consequently, these barnyards are placed in Management Category III.

Table 5-2 shows that the reduction of barnyard phosphorus under this management scheme will be distributed throughout the watershed. Potential reductions from barnyards in Management Category I generally range from 36-90 percent for most subwatersheds. Exceptions include Upper Cedar Creek, Lower Little Cedar Creek and Trenton subwatersheds, where barnyard loads are relatively low. Potential reductions from barnyards in Management Category I are also adequate at three points along Cedar Creek: Point 1 just south of the village of Jackson, Point 2 just below the Jackson Marsh Wildlife Area and Point 3 at the mouth of Cedar Creek. This high level of treatment should also contribute towards a significant reduction of the fecal coliform counts in many portions of the watershed.

Table 5-1. Criteria and management categories for barnyards draining to surface waters in Cedar Creek Watershed[1]

Phosphorus Event Loading[2]	Management Category	Number of Barnyards	Potential Phosphorus Control
Over 10 pounds	I	24	60%
7 to 10 pounds	II	12	10%
Less than 7 pounds	III	50	20%
All Barnyards		86	90%[3]

1 These criteria apply to all subwatersheds except for Lehner Creek. In the Lehner Creek Subwatershed, the sole barnyard (7lbs) is assigned to Management Category I.
2 Event loads are calculated for the 10-year, 24-hour storm event.
3 Total potential control is assumed to be 90% due to practical limitations.

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade, and Consumer Protection; Ozaukee and Washington County Land Conservation Departments.

Residual phosphorus loads from barnyard runoff control systems should not exceed 5 pounds under the 10-year 24-hour design storm. In planning each barnyard runoff control system the LCD staff will use its judgement to determine whether additional practice components should be recommended to get the pollutant load below 5 pounds.

Barnyards Draining to Internally Drained Wetlands: Management categories for this class of barnyards are not established on a watershed or subwatershed basis, but are rather established based on site-specific field investigations. These individual site assessments are required because of the variation that wetlands display in their basic type, water quality, resource value and response to pollutant inputs.

Site-specific investigations will be made of the nine barnyards in the Cedar Creek Watershed that are draining to pocket wetlands. These investigations will be made jointly by staff from the DNR Southeast District Headquarters and the Ozaukee and Washington County Land Conservation Departments. The DNR, in consultation with LCD staff, will assign a management category to each of these barnyards based on an evaluation of each barnyard's impact on the water quality, wildlife habitat and ecological integrity of the receiving wetlands.

Barnyards Draining to Internally Drained Areas Overlaid with Shallow Soils

Management categories for this class of barnyards are not established on a watershed or subwatershed basis. Rather, categories are established based on site-specific field investigations.

Table 5-2. Proposed targeting of barnyards draining to surface waters for subwatersheds and river points in the Cedar Creek Priority Watershed Project

Subwatershed	Existing Yards	Problem Load[1]	Planned Cat. I	Control Cat. II	Total Yards	Control %
Big Cedar L.[1]	4	41	61%	18%	3	79%
Little Cedar L.[1]	2	32	79%		1	79%
Up. Cedar Cr.	3	13		51%	1	51%
Mayfield	11	93	44%	8%	5	52%
Lehner Cr.	1	7	90%		1	90%
POINT 1	15	113	38%	19%	7	57%
Jackson	6	26	55%	29%	2	84%
Up. Kressin Cr.	3	25	47%	32%	2	79%
Lo. Kressin Cr.	5	103	80%	7%	3	87%
Up. Little Cedar Cr.	4	19	50%	40%	2	90%
Mid. Little Cedar Cr.	3	24	80%		2	80%
Lo. Little Cedar Cr.	1	1			0	
Cedarburg Cr.	5	24	36%	27%	2	63%
Frieden's Cr.	6	47	43%	14%	2	57%
Evergreen Cr.	3	36	90%		1	90%
POINT 2	51	418	58%	15%	23	73%
Horn's Corners	15	109	54%	7%	4	61%
No. Br. Cedar Cr.	8	48	72%	15%	3	87%
Trenton	3	7			0	
Cedarburg Bog	2	33	81%		1	81%
Cedarburg	3	28	77%		1	77%
POINT 3	82	643	57%	10%	32	67%
WATERSHED	88	716	60%	10%	36	70%

1 Barnyards draining to these two lakes are not included in the calculated pollutant loadings to the three points along Cedar Creek.

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade, and Consumer Protection; Ozaukee and Washington County Land Conservation Departments.

A site-specific investigation will be made of the one barnyard in the watershed that falls into this class. The investigation should consider the potential for groundwater contamination, using the general guidelines presented in Appendix B. The site investigation will be made by staff from the Washington County Land Conservation Department. The site investigation results will be reviewed jointly by DNR and the LCD and a management category will be assigned.

Barnyards Draining to Internally Drained Areas Overlaid with Deep Mineral Soils

Generally, these sites have limited potential for surface or groundwater contamination. Consequently, they are assigned to Management Category III.

Confined Animal Operations

The 20 livestock operations that are totally confined are placed in Management Category III.

Management Category Criteria For Livestock Manure Spreading

Management categories were developed for livestock operations based on the pollution potential associated with winterspreading manure in critical areas. Management category criteria are expressed as the number of critical acres winterspread with manure annually. Management categories for this pollution source are developed and assigned independently from the barnyard runoff assessment explained above.

A preliminary assessment was made of each livestock operation to determine the potential of the operation to be winterspreading manure in environmentally sensitive areas. The potential is expressed in terms of critical acres spread per year. The purpose of the assessment is to identify a management approach to limiting the number of environmentally sensitive acres spread with manure each winter, and to make a preliminary identification of those livestock operators who have the greatest potential need for better manure management.

This statistical assessment is based on animal herd size and manure production, acreage needs for manure spreading, and environmental suitability of the available lands for manure spreading. For purposes of this assessment, a livestock operation is defined as one or more barnyards owned by the same operator who spreads manure from the animals in the same geographic area. To simplify the assessment, critical areas are tentatively defined as those lands having slopes of at least 6 percent or that are located in flood prone areas. The actual number of critical acres spread by livestock operators needs to be verified during implementation.

Management categories were established to reduce nutrient loading consistent with the watershed pollution reduction goals and the strategy developed for barnyard runoff, the other major source of animal waste pollution. Consequently, Management Category I was established to control 60 percent of this source while Management Category II was established to provide a buffer of 15 percent. This high level of treatment should also contribute towards a significant reduction of the fecal coliform counts in many portions of the watershed.

Table 5-3 shows management category criteria for this pollution source, and the potential reduction in critical acres spread if these sources are properly managed. The criteria listed are the same for all subwatersheds. There are an estimated 22 livestock operations in Management Category I. Each of these operations is estimated to be spreading in excess of 8 critical acres per year. As a group, the operations in Management Category I spread an estimated 275 critical acres per year. There are an estimated 12 additional livestock operations in Management Category II. Each of these operations is estimated to be spreading between 5 and 8 critical acres per year. As a group, the operations in Management Category II spread an estimated 71 critical acres per year.

Table 5-3. Proposed criteria and management categories for livestock operations that spread manure during winter in the Cedar Creek Watershed

Number of Critical Acres Spread Annually	Management Category	Number of Livestock Operations	Portion of Critical Acres Spread Annually
8 acres or more	I	22	60%
5 to 8 acres	II	12	15%
0 to 5 acres	III	85	25%
All Barnyards		119	100%

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade, and Consumer Protection; Ozaukee and Washington County Land Conservation Departments

The remaining 85 livestock operations are anticipated to be in Management Category III. Each of these is expected to be spreading fewer than 5 critical acres per year. As a group, this category accounts for an estimated 104 critical acres.

It is important to recognize that the current identification of high priority livestock operations is only preliminary because of the many assumptions made about manure spreading practices of each livestock operation. During implementation, land conservation department (LCD) staff will need to recalculate the actual number of critical acres that each livestock operation spreads annually. The definition of critical acres can use SCS Technical Standard 590, Appendix B, in lieu of the criteria used in this watershed plan. However, the acreage criteria presented in Table 5-3 must still be used in revising management categories for individual operations.

As with barnyards targeted for control, the pollution potential of manure spreading for targeted livestock operations does not need to be reduced to zero. At a minimum, targeted livestock operations should reduce critical acres winterspread with manure down to 5 acres. County LCD staff will use professional judgement in determining the need to obtain control beyond this minimum level. If a manure storage unit is cost-shared, however, there must be a requirement that critical acres be avoided entirely.

Management Category Criteria For Streambank Degradation

Management category criteria developed for eroding streambanks reflect the more localized nature of this impact. The criteria are based on three site factors:

1. the lateral recession rate (in feet/year), which indicates how actively the stream is cutting into the streambank,

2. the mass load of sediment (in tons/year) being eroded from the site and deposited in the stream,

3. cattle access which is causing either streambank erosion or trampling.

Eroding sites are placed into management categories based on the criteria shown in Table 5-4. In addition, any site that exhibits cattle access resulting in habitat degradation or surface water quality degradation is placed in Management Category I.

Table 5-5 shows that there will be little management of streambanks in the watershed unless there is a habitat or water quality problem resulting from cattle access. All of the 23 streambank sites in Management Category I are a concern due to unrestricted cattle access. Only one additional site in the watershed is targeted for management based on factors other than cattle access. Seventeen sites inventoried for streambank erosion are placed in Management Category III because they are neither degraded by cattle access nor exhibit lateral recession rates or sediment production at rates of concern.

Table 5-4. Criteria and management categories for degraded streambanks in the Cedar Creek Watershed

Site	Criteria[1]	Management Category
Lateral Recession Rate at Site	Sediment Produced at Site	
Moderate to Severe (At least .3 ft/yr)	At least 10 Less than 10	I II
Low to Moderate (Between .1 and .3 ft/yr)	At Least 10 Less than 10	II III
Slight (Less than .1 ft/yr)		III

1 Any site contributing to habitat loss or water quality degradation due to cattle access is placed in Management Category I regardless of sediment production or lateral recession rate.

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade and Consumer Protection; Ozaukee and Washington County Land Conservation Departments.

Table 5-5. Number of streambank sites needing management in the Cedar Creek Watershed

Problem	Management Category		
	I	II	III
Cattle Access	23		
Streambank Erosion	0	1	17
Total	23	1	17

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade, and Consumer Protection; Ozaukee and Washington County Land Conservation Departments.

Removal of dams and similar in-stream structures in the Cedar Creek Watershed may be evaluated under the previously integrated resource management planning effort for this watershed. If removal of these types of structures occurs, it is anticipated that newly exposed streambanks and lakebeds will become significant sediment sources unless adequately managed. In areas affected by removal of dams, the DNR and the appropriate unit of government will jointly evaluate the anticipated severity of the source and a site-specific management category will be assigned before the source develops.

Management Category Criteria for Eroding Croplands and Other Uplands

Uplands Delivering Sediment to Rivers and Streams

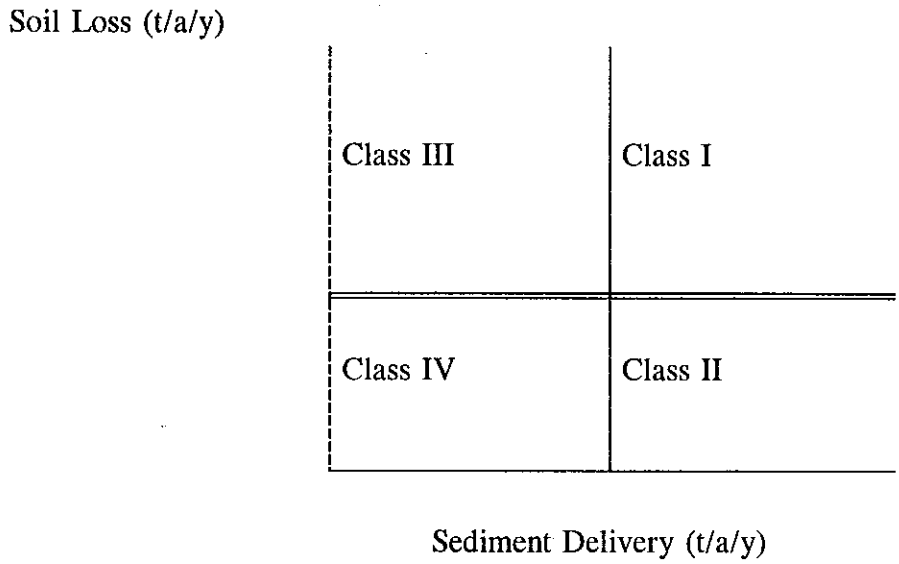
Chapter 4 of this plan shows that eroding agricultural fields are the dominant sources of sediment pollution throughout most of the Cedar Creek Watershed. This source contributes 75 to 100 percent of the annual sediment load to nearly all areas in the watershed. Consequently, successful control of this source is critical to meeting the project's water resource objectives.

Each eroding agricultural field falls into one of four classes, based on its soil loss and sediment delivery. These classes are shown in Figure 1 and described below.

- Class I: Lands in this class have high rates of soil loss, and this eroded soil is efficiently delivered to surface waters. Better management of these lands is important not only to maintain soil productivity, but to protect and improve water quality as well. Management of these lands should be feasible.

- Class II: Lands in this class have low rates of soil loss, but the soil that is eroded is efficiently delivered to surface waters. Better management of these lands is not essential to maintain soil productivity, since soil loss rates are already low. However, many of these lands will be important sources of sediment pollution and consequently need to be targeted for better management based on water quality concerns.

Figure 1



There will probably be practical limitations to further reducing the soil loss and sediment delivery from these lands.

- Class III: Lands in this class have high rates of soil loss, but do not deliver this eroded soil efficiently to surface waters due to the presence of buffers or, in some cases, internal drainage. Better management of these lands will improve soil productivity, but will not efficiently improve water quality. In some cases, treatment of these lands can provide some additional cumulative reduction in sediment delivery, but only if a disproportionately large number of fields is treated.

- Class IV: Lands in this class have low rates of soil loss and low rates of sediment delivery to surface waters. Existing management practices on these lands can be continued without impairing soil productivity or water quality.

Two management options for eroding uplands are: 1) controlling sediment production at its source, and 2) reducing sediment once it is in transport. Sediment production is controlled at its source by reducing soil loss rates. In some cases, adequate reduction can occur while keeping the field in agricultural production. In other cases, significant reductions in erosion will effectively mean taking the land out of production and establishing a permanent vegetative cover. Once in transport, sediment delivery can be reduced by establishing shoreline buffers, creating agricultural sediment basins, or restoring wetlands. Practices to control sediment already in transport are usually more expensive to construct than source area controls and tend to be less effective.

In the Cedar Creek Watershed, 59 percent of the agricultural sediment delivered to surface waters comes from lands with soil loss rates less than 2 t/a/y. Seventy-two percent of the delivered sediment comes from lands with soil loss rates less than 3 t/a/y, which is the average "T" value for soils in this area. Consequently, adequate source area controls will be

difficult while maintaining these lands in agricultural production. The management strategy must balance the desire to target those parcels having the highest sediment delivery rates with the practical limitations of reducing soil loss.

Table 5-6 shows the reduction in sediment delivery that can be obtained in each subwatershed using different targeting techniques. The following conclusions can be made from information in Table 5-6 concerning individual subwatersheds:

- Management Alternative 1 shows that sediment delivery rates ranging from .03 t/a/y (Lehner Creek Subwatershed) to .20 t/a/y (Cedarburg Subwatershed) must be attained in order to achieve subwatershed sediment reduction goals for eroding croplands.

- Management Alternative 2 shows that a significant portion of the needed control is lost if management under Alternative 1 is restricted to lands that are losing soil at rates exceeding 2 t/a/y. The loss of control ranges from 9 percent (Cedarburg Subwatershed) to 50 percent (Lehner Creek Subwatershed). The median loss in effectiveness is 28 percent.

- Management Alternative 3 shows that another significant portion of the needed control is lost if management under Alternative 1 is restricted to lands that are losing soil at rates exceeding 3 t/a/y. The loss of control ranges from 19 percent (Cedarburg Subwatershed) to 65 percent (Lehner Creek Subwatershed). The median loss in effectiveness is 42 percent.

- Management Alternative 4 shows that targeting only those lands with soil loss rates above 2 t/a/y soil loss gives less control than needed. The deficiency for various subwatersheds ranges from 9 percent (Cedarburg Subwatershed) to 50 percent (Lehner Creek Subwatershed). The median loss in effectiveness is 28 percent.

The selected management strategy will target for management all fields that deliver sediment at rates exceeding the management category criteria for the subwatershed. The goal is to reduce sediment delivery on these fields so that it does not exceed the management criteria. In this sense, the management category criteria become design criteria for best management practices. Fields targeted for management will be divided into two groups based on the feasibility of reducing sediment delivery:

1. Those that currently have soil loss rates in excess of 2 t/a/y will be placed in Management Category I. These fields must be controlled down to 2 t/a/y soil loss. Optionally, these fields may be controlled below 2 t/a/y if needed to achieve the chosen sediment delivery criteria for the subwatershed.

2. Those that currently have soil loss rates at or below 2 t/a/y will be placed in Management Category II.

Table 5-6. Management alternatives for reducing sediment delivered to surface waters from agriculture in the Cedar Creek Watershed

Subwatershed	Rural Sediment Delivery (t/y)	Rural Sediment Reduction Goal (%)		MGT. ALTERNATIVES			POLLUTION CONTROL		
				Target Sediment Delivery (t/a/y)	AND	Target Soil Loss (t/a/y)	Tons	%	Acres
Big Cedar Lake	538	30%	1)	.50		---	160	30%	339
			2)	.50		2	215	40%	339
			3)	.50		3	159	30%	319
			4)	---		2	253	47%	1,345
Little Cedar Lake	222	30%	1)	1.30		---	66	30%	61
			2)	1.30		2	124	56%	61
			3)	1.30		3	113	51%	61
			4)	---		2	161	73%	391
Upper Cedar C.	542	70%	1)	.16		---	382	70%	815
			2)	.16		2	300	56%	648
			3)	.16		3	225	42%	484
			4)	---		2	302	56%	813
Lehner C.	126	90%	1)	.03		---	113	90%	352
			2)	.03		2	50	40%	184
			3)	.03		3	31	25%	113
			4)	---		2	50	40%	228
Mayfield	1,097	75%	1)	.08		---	839	76%	2,619
			2)	.08		2	426	39%	1,461
			3)	.08		3	289	26%	674
			4)	---		2	426	39%	1,541

Table 5-6. Management alternatives for reducing sediment delivered to surface waters from agriculture in the Cedar Creek Watershed

Subwatershed	Rural Sediment Delivery (t/y)	Rural Sediment Reduction Goal (%)		MGT. ALTERNATIVES Target Sediment Delivery (t/a/y)	AND	Target Soil Loss (t/a/y)	POLLUTION CONTROL Tons	%	Acres
Upper Little Cedar C.	989	70%	1)	.14		---	697	70%	1,724
			2)	.14		2	462	47%	1,122
			3)	.14		3	336	34%	768
			4)	---		2	462	47%	1,553
Middle Little Cedar C.	373	50%	1)	.16		---	192	51%	738
			2)	.16		2	102	27%	363
			3)	.16		3	64	17%	193
			4)	---		2	102	27%	436
Lower Little Cedar C.	528	70%	1)	.10		---	380	72%	1,155
			2)	.10		2	195	37%	674
			3)	.10		3	114	22%	427
			4)	---		2	195	37%	776
Upper Kressin C.	284	70%	1)	.10		---	206	72%	672
			2)	.10		2	111	39%	325
			3)	.10		3	70	25%	259
			4)	---		2	111	39%	350
Lower Kressin C.	705	70%	1)	.12		---	494	70%	1,250
			2)	.12		2	293	42%	750
			3)	.12		3	198	28%	451

Table 5-6. Management alternatives for reducing sediment delivered to surface waters from agriculture in the Cedar Creek Watershed

Subwatershed	Rural Sediment Delivery (t/y)	Rural Sediment Reduction Goal (%)		MGT. ALTERNATIVES			POLLUTION CONTROL		
				Target Sediment Delivery (t/a/y)	AND	Target Soil Loss (t/a/y)	Tons	%	Acres
			4)	---		2	296	42%	916
Jackson	816	60%	1)	.14		---	496	60%	1,543
			2)	.14		2	286	35%	954
			3)	.14		3	172	21%	585
			4)	---		2	295	36%	1,485
Frieden's C.	784	70%	1)	.13		---	549	70%	1,334
			2)	.13		2	363	46%	836
			3)	.13		3	258	33%	544
			4)	---		2	366	47%	1,173
Evergreen C.	897	70%	1)	.10		---	637	70%	1,900
			2)	.10		2	301	34%	944
			3)	.10		3	172	19%	610
			4)	---		2	302	34%	1,128
Cedarburg C.	1,070	60%	1)	.15		---	649	61%	1,858
			2)	.15		2	418	39%	1,160
			3)	.15		3	277	26%	917
			4)	---		2	424	39%	1,740
North Branch Cedar C.	376	70%	1)	.08		---	258	69%	1,050
			2)	.08		2	90	24%	526
			3)	.08		3	49	13%	211
			4)	---		2	90	24%	821

Table 5-6. Management alternatives for reducing sediment delivered to surface waters from agriculture in the Cedar Creek Watershed

Subwatershed	Rural Sediment Delivery (t/y)	Rural Sediment Reduction Goal (%)		MGT. ALTERNATIVES			POLLUTION CONTROL		
				Target Sediment Delivery (t/a/y)	AND	Target Soil Loss (t/a/y)	Tons	%	Acres
Trenton Township	544	75%	1)	.08		---	404	75%	1,414
			2)	.08		2	161	30%	824
			3)	.08		3	91	17%	333
			4)	---		2	161	30%	930
Horn's Corners	1,141	60%	1)	.18		---	687	60%	2,248
			2)	.18		2	436	38%	1,221
			3)	.18		3	287	25%	829
			4)	---		2	439	38%	1,891
Cedarburg	590	60%	1)	.20		---	374	63%	770
			2)	.20		2	316	54%	493
			3)	.20		3	256	44%	372
			4)	---		2	319	54%	829

Source: Wisconsin Department of Natural Resources.

Table 5-7 summarizes the management category criteria for eroding uplands in the watershed. Fields that currently deliver sediment at rates less than the sediment delivery design target will not be eligible and are put in Management Category III. The exception to this rule includes eroding lands in the Cedarburg Bog Subwatershed. Since estimates of sediment delivery to the bog and its associated wetlands were not made, the strategy for this subwatershed is based solely upon reducing soil erosion rates. Consequently, all fields with soil loss rates greater than 2 t/a/y will be targeted for controls. This will provide a reduction in subwatershed soil loss of 45 percent.

Table 5-8 compares the desired reduction in sediment delivery from eroding uplands with what this strategy will achieve. All subwatersheds target sufficient lands in management categories I & II to meet the sediment reduction goal. On the average, however, only 58 percent of the control needed falls into Management Category I. This is an indication that addressing the problem through reducing soil loss will probably not be complete. In fact, practical limitations may result in only achieving half of the goal through this type of source control. Consequently, mechanisms such as shoreland buffers, wetland restoration and agricultural sediment basins may be needed to enhance cropland practices by reducing sediment already in transport.

According to Table 5-8, the need for these supplemental practices is greatest in the following subwatersheds: Lehner Creek, Evergreen Creek, North Branch Cedar Creek and Trenton Township. The need is extant, but less severe, in the Upper Cedar Creek, Upper Little Cedar Creek and Cedarburg subwatersheds.

Table 5-9 shows the overall impact on surface waters of this sediment reduction strategy for agricultural lands, assuming that construction site erosion controls recommended for urbanizing areas are also in place. This table shows that the desired sediment reduction goals can be achieved if all eligible lands are controlled, although practical limitations may decrease the achievable reduction to 50 to 75 percent of that required. Land use easements can be purchased from landowners to provide an economic incentive to remove land from intensive agricultural use, and increase the project's chances for success in reducing sediment loads from eroding uplands. Policies governing the use of easements are presented at the end of this chapter.

Table 5-7. Proposed management categories for eroding uplands in the Cedar Creek Watershed

	Management Category I		Management Category II		Mgt. Cat. III
Subwatershed	Sed. Del. (t/a/y)	Soil Loss (t/a/y)	Sed. Del. (t/a/y)	Soil Loss (t/a/y)	Sed. Del. (t/a/y)
Big Cedar L.	>.50	>2.0	>.50	<2.0	<.50
Li. Cedar L.	>1.3	>2.0	>1.3	<2.0	<1.3
Upper Cedar Cr.	>.16	>2.0	>.16	<2.0	<.16
Mayfield	>.08	>2.0	>.08	<2.0	<.08
Lehner Cr.	>.03	>2.0	>.03	<2.0	<.03
Jackson	>.14	>2.0	>.14	<2.0	<.14
Up. Kressin Cr.	>.10	>2.0	>.10	<2.0	<.10
Lo. Kressin Cr.	>.12	>2.0	>.12	<2.0	<.12
Up. Little Cedar Cr.	>.14	>2.0	>.14	<2.0	<.14
Mid. Little Cedar Cr.	>.16	>2.0	>.16	<2.0	<.16
Lo. Little Cedar Cr.	>.10	>2.0	>.10	<2.0	<.10
Cedarburg Cr.	>.15	>2.0	>.15	<2.0	<.15
Frieden's Cr.	>.13	>2.0	>.13	<2.0	<.13
Evergreen Cr.	>.10	>2.0	>.10	<2.0	<.10
Horn's Corners	>.18	>2.0	>.18	<2.0	<.18
No. Br. Cedar Cr.	>.08	>2.0	>.08	<2.0	<.08
Trenton Township	>.08	>2.0	>.08	<2.0	<.08
Cedarburg Bog		>2.0			
Cedarburg	>.20	>2.0	>.20	<2.0	<.20

Table 5-8. Proposed agricultural sediment controls for the Cedar Creek Watershed

Subwatershed Name	Agricultural Sediment Reduction Goal[1]	Total Agri. Control		Control From:	
		Acres[2]	Reduction	Category I	Category II[3]
Big Cedar L.	30%	339	40%	40%	0%
Li. Cedar L.	30%	61	56%	56%	0%
Upper Cedar Cr.	70%	815	70%	56%	14%
Mayfield	75%	2,619	75%	39%	37%
Lehner Cr.	90%	352	90%	40%	50%
Jackson	60%	1,543	60%	35%	25%
Up. Kressin Cr.	70%	672	72%	39%	33%
Lo. Kressin Cr.	70%	1,250	70%	42%	28%
Up. Little Cedar Cr.	70%	1,724	70%	47%	23%
Mid. Little Cedar Cr.	50%	738	51%	27%	24%
Lo. Little Cedar Cr.	70%	1,155	72%	37%	35%
Cedarburg Cr.	60%	1,858	61%	39%	22%
Frieden's Cr.	70%	1,334	70%	46%	24%
Evergreen Cr.	70%	1,900	70%	34%	36%
Horn's Corners	60%	2,248	60%	38%	22%
No. Br. Cedar Cr.	70%	1,050	69%	24%	45%
Trenton Township	75%	1,414	75%	30%	45%
Cedarburg Bog[4]		303	45%	45%	
Cedarburg	60%	770	63%	54%	9%

1 Based on needs of subwatershed and downstream waters. Figure represents reduction needed in sediment being delivered to the surface waters.
2 22,145 acres controlled, or 57% of the eroding croplands.
3 Assumes 100% participation in both Categories I & II.
4 Based only on controlling soil loss to 2 t/a/y.

Uplands Delivering Sediment to Wetlands

The management category criteria identified in Table 5-7 are based on sediment delivery to rivers and streams. Eroding uplands that are buffered from streams and rivers by wetlands are not identified through the criteria in the table as needing management, since the wetlands act as sediment traps that reduce the sediment reaching surface waters. It is recognized, however, that in the process the wetland may itself suffer environmental damage. If it is severe enough, the wetland may lose its ability to continue to trap the eroding sediment.

If wetland degradation associated with sediment deposited from eroding uplands is suspected, site-specific evaluations will be conducted during implementation by the DNR water resources management personnel and the county project management staff. The DNR and LCD staff will jointly determine eligibility for cost-sharing or technical assistance. As mentioned in the previous section, the unique Cedarburg Bog will be protected by reducing all soil loss rates to 2 t/a/y.

Cropland Eligible for Assistance to Comply With Other State or Federal Programs

Eligible croplands targeted through the priority watershed project may need practices in addition to those prescribed through the priority watershed project to meet other resource management objectives. In such cases, practices needed to further reduce erosion to levels which comply with requirements of the state Farmland Preservation or federal Food and Security Act programs may be eligible for funding under the priority watershed project. In general, funding for these additional practices will be eligible if the costs for these practices are low to moderate. Examples of such practices include contour strip cropping or reduced tillage. High-cost measures to provide additional erosion control on these lands will not be eligible for funding under the priority watershed project. Examples of such practices include field diversions or terraces. The county project management staff will make eligibility determinations for practices needed to achieve this additional level of soil loss control.

Table 5-9. Effectiveness of agricultural control strategy in meeting sediment reduction goals for surface waters in the Cedar Creek Watershed

Surface Waters	Reduction Goal	Planned Reduction (Year 1985-2000)*
	Lakes	
Big Cedar Lake	30%	32%
Little Cedar Lake	30%	47%
	Tributaries	
Lehner Creek	90%	40% to 90%
Upper Little Cedar Creek	60%	43% to 65%
Middle Little Cedar Creek	50%	25% to 47%
Lower Little Cedar Creek	70%	36% to 71%
Frieden's Creek	70%	45% to 69%
Evergreen Creek	70%	34% to 70%
North Branch Cedar Creek	40%	23% to 68%
Tributary to North Branch	75%	29% to 74%
	Mainstem	
Cedar Creek: River Point 1**	75% (Portion is 30%)	45% to 72%
Cedar Creek: River Point 2**	60%	41% to 67%
Cedar Creek: River Point 3**	60% (Portion is 30%)	45% to 67%

* Assumes 75% of all new construction erosion; no controls on established urban. Low end of range reflects control of Management Category I uplands, high end of range reflects control of Management Category I & II uplands.

** Assumes no input or reductions from Big Cedar Lake or Little Cedar Lake. River Point 2 includes Point 1. River Point 3 includes Points 1&2.

Rural Pollution Control Practices

This section describes the general types of rural nonpoint source control practices that will be needed to achieve the desired level of pollution control. It also contains special guidance on the use of terraces, shoreline buffers, agriculture sediment basins and easements. A full list of best management practices for use in the watershed project is presented in Chapter 6, along with estimates of the practice quantities needed.

Upland Erosion Control Practices

Acceptable sediment delivery rates on both rotated and continuous cropland can generally be achieved using a combination of rotation changes, reduced tillage, contour plowing and contour strip cropping. To control existing gullies and prevent new ones from developing, grassed waterways, field diversions and grade stabilization structures will be needed.

Cropland terracing will not be widely promoted in the watershed because it is not generally needed to meet sediment reduction goals and is expensive to construct. Terraces are eligible on a case-by-case basis, provided that the eroding field is in Management Category I and significant progress towards the sediment delivery target is not feasible using other practices. The county Land Conservation Department (LCD) and the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) should jointly determine the general criteria for the use of terraces.

Shoreline buffers, wetland restoration and agriculture sediment basins may be needed to augment source controls where soil erosion rates of contributing uplands cannot be sufficiently reduced. However, soil particles in motion are difficult and sometimes expensive to control. Consequently, these practices may only be used as off-site sediment filters provided that a reasonable level of control will be applied to tributary fields. The application of shoreline buffers, restored wetlands and agricultural sediment basins will probably be most widespread in the Lehner Creek, Evergreen Creek, North Branch and Trenton Subwatersheds. In these subwatersheds the potential limitations in reducing soil loss below 2 t/a/y may seriously affect the ability of the watershed project to achieve needed reductions in sediment delivery without these additional measures.

Shoreline buffers are vegetated filter areas adjacent to waterways. They should be used wherever possible in reducing sediment delivery from those targeted lands that are located immediately adjacent to intermittent or perennial surface channels. In addition, they should be used along intermittent channels where flows overtop channel banks and scour adjacent fields. Guidance on buffer widths are presented in Appendix C. Agriculture sediment basins should be used with great caution in the Lehner Creek Subwatershed to prevent thermal impacts of basin discharges on this cold water system. Use of wetland restoration as a cropland management technique is discussed later in this chapter.

Nutrient Management Practices

Improved nutrient management will be needed to protect surface and ground waters. At this time, nutrient management standards and cost-share policies are developed well enough for application in this watershed project. Specific guidance for nutrient management activities is as follows:

1. Landowners who receive cost sharing for either barnyard runoff controls or manure storage must follow a nutrient management plan.

    - SCS Technical Standard 590 will be used to protect groundwater. At a minimum, the plan must provide guidance for crediting manure on lands where it is spread. LCD staff should encourage the development of a nutrient management plan for other lands as well.

    - SCS Technical Standard 590, Appendix B, or the slope and soils limitations set forth in this plan, must be used as a basis for developing a manure spreading plan that protects surface waters. Maximum spreading rates for phosphorus management will be consistent with SCS Technical Standard 590.

2. Landowners who need neither barnyard runoff controls nor manure storage, but who still need to manage manure spreading, will be provided technical assistance in preparing a nutrient management plan and manure spreading plan that meets the conditions specified above. If the landowner is Management Category I for manure management, and if a cost-share agreement is developed for other sources, the management plan must be followed as a condition of cost sharing. Otherwise, adoption of the plan is optional.

Techniques for targeting pest management activities still need to be developed for the Nonpoint Source Program, along with appropriate cost-share policies. Consequently, no specific information on pest management can be presented at this time. As a general policy, the Nonpoint Source Program supports such strategies as "integrated crop management" and will work with other agencies to develop application procedures for use in this watershed project.

Animal Waste Management Practices

Barnyard runoff control systems and manure spreading management plans will be the principal control practices.

Streambank Stabilization Practices

Principal practices that will be needed include cattle exclusion, shoreline buffers, livestock and machinery crossings, shaping and seeding, and rip rap. Shoreline buffers may be used where streambank degradation results from intensive adjacent agricultural land uses such as livestock access or cropping too close to the stream.

Guidance For Use of Wetland Restoration

Wetland restoration is an eligible best management practice for the purpose of controlling nonpoint sources of pollution. Although secondary benefits of wetland restoration include enhancement of fish and wildlife habitat, the primary justification for restoration under this nonpoint source pollution control project must be water quality improvement.

Wetland restoration includes the plugging or breaking up of existing tile drainage systems; the plugging of open channel drainage systems; other methods of restoring the pre-development water levels of an altered wetland; and fencing livestock out of wetlands.

Wetland restoration is an eligible practice when applied to any of the following:

1. Cultivated organic soils with tile or open channel drainage systems discharging to a lake, stream or tributary.

   Wetland restoration will reduce the amount of nutrients and pesticides draining from the altered wetland to a water resource. Establishing permanent vegetation and disabling the drainage system will control this pollutant source.

2. Pastured wetlands riparian to lakes, streams or tributaries.

   Eliminating livestock grazing within wetlands will reduce the organic and sediment loading to the wetland and adjacent water resource, and reduce the direct damage to the wetland from the livestock. Livestock exclusion by fencing will control the pollutants and restore the wetland.

3. Prior converted wetlands down slope or up slope from fields identified as critical upland sediment sources.

   Restoration of wetlands in these situations will do one of two things. It can create a wetland filter which reduces upland pollutants from reaching surface waters. It can also reduce the volume and/or velocity of water flowing from an up-slope area to a down-slope critical field. Two eligibility conditions must be met to use wetland restoration as a BMP:

   - All upland fields draining to the wetland must be controlled to a soil loss rate that is less than or equal to 2 t/a/y.

   - One or more of these same fields must still have a sediment loss rate (after the application any erosion control measures) greater than the "sediment delivery rate" listed in Table 5-7 for the appropriate subwatershed.

Using Easements to Support Rural Pollution Control Practices

Nonpoint source program funds may be used to purchase land easements in order to support specified best management practices. These practices include shoreline buffers, critical area stabilization and wetland restoration. Easements may be contracts between the landowner and the DNR, or between the landowner and the local unit of government. The local unit of government will retain responsibility for identifying how the easement will be used in controlling targeted pollution sources. Final approval of the easement rests with the DNR. Easements shall be for a period of no less than 20 years, although perpetual easements are preferred. The easement will be developed as an agreement separate from the cost-sharing agreement for the best management practice.

The intent of the easement program is to make adoption of the management practice more acceptable by compensating the landowner for the decrease in market value associated with restricting land use. Easements may be purchased using program funds according to the following guidelines:

1. Easements to support critical area stabilization and shoreland buffers may be purchased anywhere in the watershed provided that the total cost of purchasing the easement and establishing the practice is the practicable least cost alternative to controlling the nonpoint pollution source.

   The least cost requirement is waived, however, in several areas of the watershed. The four types of "High Priority" areas are set forth below:

   - Riparian areas along intermittent and perennial streams in the Evergreen Creek, North Branch Creek and Trenton Township subwatersheds.

     These are three of the four areas in the watershed where practical limitations are expected to be most severe against meeting sediment reduction goals without removing lands from production. In addition, the North Branch of Cedar Creek (in the North Branch and Trenton subwatersheds) is designated as a Stewardship Stream.

     By placing eligible riparian lands in permanent vegetation, a large portion of the planned sediment reduction can be achieved in each of these subwatersheds. Riparian easements could achieve 20 percent of the planned reduction in the North Branch Subwatershed, 37 percent of the planned reduction in the Trenton Subwatershed and 63 percent of the planned reduction in the Evergreen Creek Subwatershed.

   - Riparian areas along intermittent and perennial streams in the Lehner Creek Subwatershed and upland areas in the Lehner Creek Subwatershed.

     This is the fourth area where practical limitations will make it difficult to meet sediment reduction goals without removing lands from production. Lehner Creek is

the only cold water stream in the watershed, and is also designated as a Stewardship Stream.

Placing only eligible riparian lands in permanent vegetation will not result in significant reduction of sediment loads, however. Consequently, the cost limitations will be lifted on the uplands in this subwatershed as well.

- Riparian areas along the mainstem of Cedar Creek.

  Cedar Creek is also designated as a Stewardship Stream.

- All areas where unrestricted livestock access has resulted in water quality, streambed and streambank degradation.

  This is based on the high level of bacterial contamination in the watershed and the public support towards proper livestock management in the riparian zone.

Acres Eligible for Easements

Table 5-10 shows the estimated acreage of areas eligible for easement purchase in "High Priority Areas" of the Cedar Creek Watershed. Using the criteria presented above, it is estimated that approximately 1,100 to 1,700 acres of agricultural land would be eligible for the purchase of easements in order to restrict certain land use activities.

Easements in riparian areas may be needed to reduce sediment delivery from croplands adjacent to surface waters and to reduce cattle access where it is causing a habitat or water quality problem. Eligible practices that these easements might support include wetland restoration, shoreline buffers and critical areas stabilization. It is estimated that 250 to 680 acres of land will be eligible for easement purchase in order to control sediment delivery from eroding agricultural land. This estimate assumes that buffer widths are 100 feet. Lesser widths would result in a proportional decrease in easement needs. The lower end of the estimate reflects acreage needs if easements are purchased only for High Priority riparian lands that exceed the sediment delivery criteria and are losing soil at rates less than 2 t/a/y. The upper end of the estimate reflects acreage needs if easements are purchased for all High Priority riparian lands that exceed the sediment delivery criteria. An additional 23 acres of land will be eligible for easement purchase in order to restrict cattle access to streams. The estimates for acreage needs to control cattle access assumes that about one acre of easements would need to be obtained for each site where cattle access is causing water quality or habitat problems.

The estimate for acreage needs to reduce wetland grazing by cattle is based on the estimated acreage that is currently in this land use. All types of wetlands are included in the estimate. Eligible practices would include wetland restoration, primarily through fencing. Site-specific determinations will be needed to assess which of the 91 grazed wetlands should be restored through easement purchase.

Table 5-10. Projected agricultural acreage eligible for easement purchase in "High Priority Areas" of the Cedar Creek Watershed[1]

AREA		RIPARIAN		AREAS		OTHER		AREAS
		Soil Erosion[2]		Cattle Access[3]		Grazed Wetlands[4]		Soil Erosion[5]
Lehner Creek	Subwatershed	3	ac.	2	ac.			160 to 350 ac.
Evergreen Creek	Subwatershed	40 to 360	ac.	3	ac.			
No. Br. Cedar Cr.	Subwatershed	50 to 60	ac.		ac.			
Trenton Township	Subwatershed	80 to 130	ac.	4	ac.			
Upper Cedar Cr.	Subwatershed	0	ac.	2	ac.			
Mayfield	Subwatershed	30 to 50	ac.	2	ac.			
Jackson	Subwatershed	30 to 40	ac.	2	ac.			
Cedarburg Cr.	Subwatershed	4	ac.	1	ac.			
Horn's Corners	Subwatershed	5 to 20	ac.	4	ac.			
Cedarburg	Subwatershed	10 to 15	ac.		ac.			
Up. Little Cedar Cr.	Subwatershed		ac.	2	ac.			
Frieden's Cr.	Subwatershed		ac.	1	ac.			
Watershed Total		252 to 682	ac.	23	ac.	630	ac.	160 to 350 ac.

1 Other easements may be eligible elsewhere in the watershed.
2 This source is high priority in areas riparian to all perennial and intermittent streams in these subwatersheds: Lehner Creek, Evergreen Creek, North Branch Cedar Creek, Trenton Township.
This source is high priority only when riparian to the mainstem of Cedar Creek in these subwatersheds: Upper Cedar Creek, Mayfield, Jackson, Cedarburg Creek, Horn's Corners, Cedarburg.
3 This source is high priority for easements anywhere in the watershed.
4 This source is high priority for easements anywhere in the watershed.
5 This source is high priority for easements only in the Lehner Creek Subwatershed.

Source: Wisconsin Department of Natural Resources.

The estimate for acreage needs to control upland erosion in other parts of the watershed include only the non-riparian High Priority Area in the Lehner Creek Subwatershed. The lower number in the estimate reflects lands that deliver sediment above the criteria and which have soil erosion rates less than 2 t/a/y. The upper number in the estimate includes all lands that have sediment delivery rates which exceed the criteria. Critical area stabilization and wetland restoration are likely practices for which easements could be purchased.

Assuming an easement purchase price of $500 to $1,000 per acre, and an average of 1,400 acres eligible for easement purchase, the total potential cost of easement purchase in the project is $700,000 to $1,400,000. However, several factors will reduce the actual amount spent on easement purchases. These include: 1) less than 100 percent landowner participation in the project, 2) ability to treat critical lands without removing lands from production, and 3) easement widths of less than 100 feet. The nonpoint source project budget for easements will be limited to $200,000. This represents about 15 to 25 percent of the potential need, and should be adequate.

Integrating Fisheries And Wildlife Management Concerns

Fisheries and wildlife concerns will be identified during implementation of the watershed project. County LCD staff will contact the DNR Southeast District Wildlife Management and Fisheries Management staffs for the Milwaukee River Basin as conservation plans and cost-share agreements are developed. This coordination will maximize the fish and wildlife benefits of nonpoint source control practices, to identify wildlife habitat mitigation measures needed to offset habitat loss occurring from installation of best management practices, and to prevent use of practices that may have an adverse impact on water resources.

The conditions under which LCD staff are to contact DNR staff for consultation and assistance, and the role of the DNR when contacted are discussed in Chapter 6, "Cost-share Agreement and Administration."

Urban Nonpoint Source Control Needs

Alternatives for Managing Urban Nonpoint Source Pollution

In order to meet the project's urban pollution goals, urban BMPs must:

1. Reduce the mass loading of urban pollutants so that the loading in year 2000 is 50 percent less than it was in 1985, and

2. Reduce the annual event mean concentration of any given pollutant discharged in stormwater so that it doesn't exceed acute toxicity standards for fish and aquatic life.

This plan quantitatively evaluates the effectiveness of alternative management strategies in reducing mass loadings of pollutants from urban areas in the Cedarburg and Jackson study areas. Base on this analysis, a management alternative is selected. The effectiveness of these alternatives in reducing stormwater pollutant concentrations being discharged from individual storm sewer pipes is not specifically evaluated as part of the alternatives analysis. However, some general conclusions are drawn concerning the effect of the selected alternative on the acute toxicity of stormwater discharges.

Selection of Management Alternatives

Management alternatives are defined as the application of one or more best management practices in a variety of locations for the purpose of controlling urban stormwater pollution. These alternatives address urban runoff from existing and planned urban land uses. Existing urban lands are those that are currently established, as measured in 1985. Planned urban lands are those additional urban areas that will be established during the planning period (1985-2000). Construction sites are not included in this analysis, but are recognized as significant pollution sources and are considered elsewhere in this management strategy.

There are many types of best management practices available for use in controlling urban stormwater pollution. For this analysis, two practices were selected as building blocks for the alternatives analysis. These include street sweeping and wet detention ponds. These were selected because the represent a range of control technology, pollutant control effectiveness, cost and community familiarity. Also, it is within the capability of the Department of Natural Resources to estimate the pollution control effectiveness, size requirements and cost of these practices. This analysis does not preclude the use of other practices in the project area, such as infiltration trenches, infiltration basins, grassed swale drainage, or source reduction efforts. These practices are described in more detail at the end of this chapter.

Table 5-11 shows how these urban best management practices are applied to both existing and planned urban areas to form various management alternatives.

The alternatives for existing urban areas are applied only to "critical urban land uses." These are land uses which produce high unit area pollutant loadings and which contribute a large portion of the mass loading. This designation of "critical urban land uses" is an attempt to focus management within existing urban areas where retro-fitting stormwater management practices is difficult and expensive. "Critical urban land uses" in this analysis include commercial strip, industrial and multi-family residential lands.

The alternatives for planned urban areas are applied in this analysis to all urban lands. This is because these practices can be incorporated into new developments through proper stormwater planning so that retro-fitting is not required. In many cases, stormwater practices for pollutant control can also provide other benefits such as modification of stormwater flows. Specifically, detention ponds will contribute towards reducing peak stormwater flows, while grassed swales and other infiltration devices can reduce flow volumes as well as peak discharges.

Table 5-11. Urban management alternatives for existing and planned urban areas in the Cedar Creek Watershed

Existing Urban Areas
1. Continue existing management only
2. Detain runoff from 50 percent of the critical urban land uses
3. Detain runoff from 100 percent of the critical urban land uses
4. Accelerate street sweeping on 100 percent of critical land uses
5. Detain runoff from 50 percent of the critical urban lands and accelerate sweeping on 50 percent of the critical urban lands
Planned Urban Areas
1. Do nothing
2. Detain runoff from 50 percent of all new land uses
3. Detain runoff from 100 percent all new land uses

Note: Wet detention practices are assumed to control the 5u particle size. Critical land uses include: high density residential, commercial and industrial areas. Accelerated street sweeping is approximately 28 passes per year for each curb mile located along streets in critical land uses.

Evaluation of Alternatives For Reducing Mass Loads

The management alternatives were evaluated for the Cedarburg and Jackson Study Areas. The areas were evaluated independently of each other. In each instance, the effectiveness of management alternatives in reducing pollutant loading from the future urban area was evaluated. The future urban area is that projected to be in existence in the year 2000, and will be made up of existing urban lands as well as those lands anticipated to be developed between 1985 and 2000.

In order to evaluate the effectiveness of these management alternatives on the pollutant loading from the future urban area, the management alternatives presented in Table 5-11 were combined into 15 new management alternatives. An analysis was completed to determine which of the 15 alternatives could sufficiently reduce the urban mass pollutant loading from the future urban area. Two constituents, lead (a heavy metal) and sediment, were used as indicator pollutants in evaluating these 15 alternatives.

Table 5-12 presents the results of the effectiveness analysis for the Cedarburg Study Area. The desired goal of management is to see a -50 percent change in the annual mass loading of

lead and other heavy metals over the time period 1985-2000. The following observations can be drawn from Table 5-12 concerning the impacts of varying levels of effort in stormwater management:

1. If no management action is taken (Alternative 1), the mass loading of urban pollutants will increase by nearly 75 percent.

2. Control of runoff is needed in both existing and planned areas. The urban pollutant loading will increase by 15 to 45 percent if existing urban areas are ignored, regardless of the level of management in planned areas (Alternatives 2 and 3).

3. Similarly, the urban pollutant loading will increase by 15 to 45 percent if planned urban areas are ignored, even though an extensive retro-fitting program for existing urban areas is in place (Alternatives 4, 7, 10, 13).

4. An extensive control program applied to both existing and planned urban areas will be needed. A level of control consistent with providing wet detention on all existing critical land uses (industrial, commercial, high density residential) and all planned land uses will achieve a -44 percent change in the pollutant urban load (Alternative 5). If the level of detention is decreased by 50 percent for existing critical land uses and replaced with more intensive street sweeping, then a change of about -30 percent is achievable (Alternative 14).

5. Other alternatives, which provide lesser levels of control in existing and planned areas, will achieve changes in loading of 15 percent to -14 percent (Alternatives 6, 8, 9, 11, 12, 15).

In conclusion, Alternative 5 in Table 5-12 is the only one that provides a level of reduction in mass loading that meets our management goal.

Accelerating the street sweeping programs in these two study areas would provide an interim means of reducing pollutant loadings from street surfaces, but many questions remain. Frequent sweeping of streets during early spring and fall periods, when street surfaces have accumulated a large mass of sediment and leaves, is clearly beneficial to water quality. This is probably justified for medium density residential areas as well as for the commercial, industrial and higher density residential areas. However, the water quality benefit of accelerated street sweeping at other times of the year is less clear. This is especially true for industrial and some commercial areas, where parking lot areas are more significant as pollutant sources than the streets themselves. More information is needed in several areas before recommendations can be made for accelerating a communities sweeping program during the late spring to early fall period. More information is needed concerning the affect on stormwater quality of: different types of sweeping equipment, sweeping of parking lots and institutional practices to enhance the effectiveness of sweeping equipment (such as alternate side parking). Table 5-13 presents the results of the effectiveness analysis for the Jackson Study Area.

Table 5-12. Effectiveness of urban stormwater management alternatives in reducing pollutant loads in the Cedarburg Study Area of the Cedar Creek Watershed: Year 2000

			LEAD		SEDIMENT	
	MANAGEMENT	ALTERNATIVE				
	Existing Area[1]	Planned Area[2]	Load[3]	% Change (1985-2000)	Load[3]	% Change (1985-2000)
1	Current Management	Do Nothing	1,742	74%	860,527	63%
2	Current Management	Detain 100%	1,151	15%	559,735	6%
3	Current Management	Detain 50%	1,450	44%	711,134	35%
4	Detain 100%	Do Nothing	1,158	15%	600,980	14%
5	Detain 100%	Detain 100% *	567	-44%	300,188	-43%
6	Detain 100%	Detain 50%	866	-14%	451,587	-15%
7	Detain 50%	Do Nothing	1,450	44%	730,753	38%
8	Detain 50%	Detain 100%	859	-14%	429,961	-19%
9	Detain 50%	Detain 50%	1,158	15%	581,360	10%
10	Sweep 100%	Do Nothing	1,452	45%	772,007	46%
11	Sweep 100%	Detain 100%	861	-14%	471,215	-11%
12	Sweep 100%	Detain 50%	1,160	16%	622,614	18%
13	Swp50%; Det50%	Do Nothing	1,305	30%	686,493	30%
14	Swp50%; Det50%	Detain 100%	714	-29%	385,701	-27%
15	Swp50%; Det50%	Detain 50%	1,013	1%	537,100	2%

1 Management practices applied to existing commercial, industrial, high density residential lands.
2 Management practices are applied to all planned land uses.
3 All pollutant loads are in pounds/year.

* Recommended management alternative to reduce mass pollutant loading.

Source: Wisconsin Department of Natural Resources.

Table 5-13. Effectiveness of urban stormwater management alternatives in reducing pollutant loads in the Jackson Study Area of the Cedar Creek Watershed: Year 2000

			LEAD		SEDIMENT	
	MANAGEMENT	ALTERNATIVE				
	Existing Area[1]	Planned Area[2]	Load[3]	% Change (1985-2000)	Load[3]	% Change (1985-2000)
1	Current Management	Do Nothing	957	206%	409,400	212%
2	Current Management	Detain 100%	396	27%	138,426	6%
3	Current Management	Detain 50%	702	124%	284,168	117%
4	Detain 100%	Do Nothing	730	133%	311,990	138%
5	Detain 100%	Detain 100% *	169	-46%	41,016	-69%
6	Detain 100%	Detain 50%	475	52%	186,758	42%
7	Detain 50%	Do Nothing	844	170%	360,694	175%
8	Detain 50%	Detain 100%	283	-10%	89,720	-32%
9	Detain 50%	Detain 50%	589	88%	235,462	80%
10	Sweep 100%	Do Nothing	845	170%	376,468	187%
11	Sweep 100%	Detain 100%	284	-9%	105,494	-20%
12	Sweep 100%	Detain 50%	590	88%	251,236	92%
13	Swp50%; Det50%	Do Nothing	788	152%	344,229	163%
14	Swp50%; Det50%	Detain 100%	227	-27%	73,255	-44%
15	Swp50%; Det50%	Detain 50%	533	70%	218,997	67%

1 Management practices applied to existing commercial, industrial, high density residential lands.
2 Management practices are applies to all planned land uses.
3 All pollutant loads are in pounds/year.

* Recommended management alternative to reduce mass pollutant loading.

Source: Wisconsin Department of Natural Resources.

The results show the same trend, and Alternative 5 is recommended. Controls will be needed in both existing and planned urban areas. The level of control needs to be significant in order to achieve mass loading reduction goals for urban stormwater pollutants.

Evaluation of Alternatives For Reducing Acute Toxicity

Several land uses including multi-family residential, commercial, industrial and institutional have been shown to produce stormwater concentration of lead, zinc and copper that exceed acute toxicity standards for point source discharges. If the mass loading of pollutants from these land uses can be reduced, concentrations may also be greatly reduced. Consequently, the effectiveness of wet detention and street sweeping practices in reducing mass loads will provide some indication of their effectiveness in reducing concentrations.

Table 4-9 shows that average event mean concentrations of copper and zinc coming from stormwater pipes draining commercial, industrial and high density residential land uses can be expected to exceed acute toxicity standards. Generally, a 50 to 80 percent reduction in these concentrations is required to achieve the acute toxicity standard at least half the time. Table 4-14 shows that the estimated average event mean concentration of zinc and copper coming from storm sewer pipes draining mixed land uses in Cedarburg and Grafton can be expected to exceed acute toxicity standards. Depending on the mix of land uses, it is estimated that a 20 to 80 percent reduction in average event mean concentrations is needed to meet acute toxicity standards at least half the time.

Detention ponds with design characteristics similar to those evaluated in Table 5-12 should reduce copper concentrations by 50 to 60 percent and zinc concentrations by 70 percent, based on their effectiveness in reducing mass loads. These reductions are in the range of those required for storm sewer pipes draining single, intensive land uses such as industrial, commercial or high density residential. In areas where the flow from critical land uses is greatly diluted with runoff from low intensity urban areas, accelerated street sweeping in combination with moderate stormwater detention may be adequate to reduce stormwater pollutant concentrations. Generally speaking, the strategy of targeting critical land uses is appropriate not only for controlling mass loadings to the creek and Milwaukee River, but is also appropriate for reducing high pollutant concentrations in stormwater discharges.

It is important to note that even though detention ponds can significantly reduce the magnitude and frequency of high pollutant concentrations, discharges from wet detention ponds will not consistently meet acceptable discharge standards. For example, recent monitoring of detention pond performance in Madison, Wis., has shown that the detention pond provided a high level of treatment. The detention pond reduced mass loads of suspended solids by 90 percent, reduced concentrations of lead, zinc and copper by 60 to 70 percent, and reduced concentrations of PAHs and pthalates by 80 to 90 percent. However, the average concentration of copper and zinc in the treated stormwater discharged by the pond still exceeded acute toxicity criteria by 30 to 40 percent. The average exceedance for PAHs was about 80 percent. Although detention ponds reduce bacteria concentrations by 70 percent, the discharge still exceeded standards over three-fourths of the time.

Recommended Urban Nonpoint Source Controls

The recommended nonpoint source control program for urban areas in the Cedar Creek Watershed is presented in four sections:

1. existing land uses in the Jackson and Cedarburg study areas,
2. planned land uses in the Jackson and Cedarburg study areas,
3. existing and planned urban land uses in other portions of the watershed,
4. construction site erosion throughout the watershed.

The recommended urban program is presented below:

Recommendations for Existing Critical Areas in the Study Areas

These recommendations apply to the following governments:

1. the cities of Cedarburg and Mequon,
2. the villages of Grafton and Jackson,
3. the towns of Cedarburg, Grafton, Jackson and Polk,
4. the Wisconsin Department of Transportation.

A level of control equivalent to providing wet detention for 100 percent of the critical land uses is required to meet the water quality goals set forth in this plan. Based on the analyses in this plan, critical land uses are defined as commercial, industrial and multi-family residential areas. In addition, the small stretch of US Highway 45 (freeway land use) that crosses and discharges stormwater directly to Cedar Creek west of Jackson should also be considered a critical land use. In some areas, parking lots may be designated as critical land uses for purposes of reducing effluent toxicity. Finally, medium density residential lands that drain to existing ponds in the city of Cedarburg will be evaluated on a case-by-case basis. If modifications to these ponds will cost-effectively reduce pollutant loads from these areas, such modifications are recommended as part of this targeting strategy.

Table 5-14 summarizes the amount of wet detention that would be needed to adequately control runoff from existing critical urban land uses. These estimates that follow are not meant to preclude the use of other types of urban structural practices such as infiltration devices or grassed swales.

Infiltration should be considered as an alternative to wet detention where conditions are suitable for providing an equivalent level of control and where the conditions for groundwater protection can be met. Infiltration basins or trenches may be used following wet detention where needed to provide groundwater recharge and base flow enhancement.

Table 5-14. Recommended urban best management practices for existing urban lands in the Jackson and Cedarburg Study Areas of the Cedar Creek Watershed[1]

Community	Management Plans (acs)[2]	Wet Detention[3]	
		Pond Area (acres)	Total Area (acres)
CEDARBURG STUDY AREA			
C. of Cedarburg	270 to 1,500	4.6	5.8
Tn. of Cedarburg	60	1.1	1.4
V. of Grafton	50 to 240	0.8	1.0
Tn. of Grafton	None	0.0	0.0
C. of Mequon	None	0.0	0.0
Study Area Subtotal	380 to 1,800	6.5	8.2
JACKSON STUDY AREA			
V. of Jackson	110 to 320	2.0	2.5
Tn. of Jackson	8 to 70	0.1	0.1
Tn. of Polk	12 to 60	0.2	0.2
Study Area Subtotal	130 to 450	2.3	2.8
WATERSHED TOTAL	510 to 2,250	8.8	11.0

1 Stormwater infiltration may be feasible in some areas as an alternative or addition to wet detention. In addition, all commercial, industrial and medium to high density residential areas should have intensive street sweeping in early spring and fall.

2 Low end of range includes only critical acres, high end represents all urban lands.

3 Pond area is surface area of wet pond needed to trap 5 micron particle size. Total area includes pond surface and surrounding land required to contain the pond.

Source: Wisconsin Department of Natural Resources.

In the Cedarburg Study Area a total of 6.5 acres of wet detention would be required. About 2 of these acres are designated for industrial land uses, some of which may be required to control stormwater pollution under the new Federal Stormwater Permit Program. In the Jackson Study Area a total of 2.3 acres of wet detention would be required. About 1.4 of these acres are designated for industrial land uses.

Feasibility studies will be needed to select and site-specific practices consistent with this watershed plan. The cost and complexity of studies will vary, depending on the availability of land for locating practices and the compatibility of the existing storm sewer networks with locating stormwater practices. According to Table 5-14, it is estimated that feasibility studies for existing urban areas will need to cover between 380 and 1,800 acres in the Cedarburg Study Area and between 510 and 2,250 acres in the Jackson Study Area.

In addition to structural urban practices, non-structural approaches are also recommended to reduce stormwater pollution from existing urban land uses. Street sweeping should be intensified during the early spring to remove the winter accumulation of sediment and its attached pollutants. Commercial, industrial, and medium to high density residential areas should all be targeted. Fall clean-up to remove leaf litter should also be intensified as appropriate. Recommendations on accelerated sweeping during other times of the year will not be made at this time. However, the intention of this plan is to make cost sharing available for accelerated sweeping as an interim measure to installing urban structural practices should future research or demonstrations show it to be a viable option.

Other urban housekeeping (or source control) practices, which should be used in all urban areas, are discussed at the end of this chapter. The urban information and education strategy in this plan is presented in Chapter 6.

Recommendations for Planned Urban Areas in the Study Areas

These recommendations apply to the following governments:

1. the cities of Cedarburg and Mequon,
2. the villages of Grafton and Jackson,
3. the towns of Cedarburg, Grafton, Jackson and Polk,
4. Ozaukee and Washington counties.

A level of control equivalent to providing wet detention for 100 percent of the planned urban growth is required.

Table 5-15 summarizes the amount of planned urban area that will need stormwater controls to sufficiently reduce stormwater pollutant concentrations and mass loads.
In the Cedarburg Study Area, the anticipated urban growth will require 12.6 acres of wet detention in order to reduce concentrations and mass loads of stormwater pollutants. About 2.2 of these acres would be designated for industrial land development, which may need to be controlled through the Federal Stormwater Permit Program. In the Jackson Study Area, the anticipated urban growth will require 10.3 acres of wet detention in order to reduce

concentrations and mass loading of stormwater pollutants. About 3.4 of these acres would be designated for industrial land development.

Stormwater plans for areas where development is expected to occur should be a top priority to assure that land is set aside for practices needed to meet the recommended flow and pollutant load reductions. Where appropriate, stormwater plans for new development should investigate the use of other types of controls including infiltration devices and grassed swale drainage. Infiltration should be considered as an alternative to wet detention where conditions are suitable for providing an equivalent level of control. In particular, grassed swale drainage systems in planned residential areas should be investigated to both control pollutants and decrease the size of wet detention facilities. Infiltration basins or trenches may be used in conjunction with wet detention to provide groundwater recharge and base flow enhancement.

It is important to note that of the 12.6 acres of detention that would be needed in the Cedarburg Study Area, about 4.7 acres are designated for low density development (low density residential, institutional, parks). If grassed swale drainage can be used in these areas, the acreage needed for wet detention ponds will be decreased. This is because grassed swale drainage systems will infiltrate a portion of the stormwater runoff, decreasing the size requirements for detention ponds serving the same area. Similarly, in the Jackson Study Area, 3.7 of the 10.3 acres of detention would be for low intensity land uses where grassed swales might be used.

In addition to structural urban practices, non-structural approaches are also recommended to reduce stormwater pollution from planned urban land uses. Recommended urban housekeeping (or source control) practices are discussed at the end of this chapter. The information and education strategy that is recommended to facilitate implementation of these urban recommendations is presented in Chapter 6.

Recommendations for Other Existing and Planned Urban Areas

Management of post-development runoff from existing and planned urban areas will be needed in areas outside of the Jackson and Cedarburg study areas. These recommendations are directed primarily to the following units of government:

1. Washington and Ozaukee counties,
2. the towns of Polk and West Bend,
3. the Big Cedar Lake Protection and Rehabilitation District,
4. the Little Cedar Lake Association,
5. the Wisconsin State Department of Transportation.

The focus of urban stormwater management in other areas of the watershed should include urban housekeeping programs (source controls) supported through information and education and stormwater planning for new development. More information concerning source controls and information and education strategies is presented at the end of this chapter and in Chapter 6.

Table 5-15. Recommended urban best management practices for planned urban areas in the Jackson and Cedarburg Study Areas of the Cedar Creek Watershed[1]

	Wet Detention [3]			
Study Area	Management Plans (acs)[2]	Pond Area (acres)	Total Area (acres)	Where Urbanization is Anticipated
Cedarburg	1,060	12.6	15.8	C. of Cedarburg; V. of Grafton C. of Mequon Tn. of Cedarburg Tn. of Grafton
Jackson	480	10.3	12.9	V. of Jackson Tn. of Jackson Tn. of Polk

1 Stormwater infiltration may be feasible in some areas as an alternative or addition to wet detention.
2 Sufficient to drain runoff from 100% of the planned urban use.
3 Pond area is surface area of wet pond needed to trap 5 micron particle size. Total area includes pond surface and surrounding land required to contain the pond.

Source: Wisconsin Department of Natural Resources.

Particular areas of need include:

- Planning and feasibility studies to determine how to limit gully formation and excessive sheet flows in urban areas around Big and Little Cedar Lakes, and implementation of these study recommendations.

- Stormwater planning for new urban development in the drainage areas to Big Cedar Lake, Little Cedar Lake and Gilbert Lake, and the implementation of those planning studies. Particular areas of concern include the expansion of State Highway 33 (including post development runoff from the roadway itself as well as from attendant urban development), and platted residential subdivisions in the drainage area to Little Cedar Lake.

- Evaluation of urban housekeeping measures, including but not limited to an evaluation of road salt use in the drainage areas to Big Cedar Lake, Little Cedar Lake and the Cedarburg Bog.

- Urban information and education programs, particularly for residents in the drainage areas to Big Cedar Lake, Little Cedar Lake and Gilbert Lake.

Recommendations for Construction Site Erosion Control

This plan assumes that effective construction erosion control programs will be in place throughout the watershed. These programs will be locally developed and administered. Each program requires a comprehensive ordinance, a set of practice standards and application guidelines, an effective administrative program and effective enforcement. In addition, training programs are needed for staff that must administer the ordinances, and for building industry people who must comply with ordinance requirements. Ordinances should meet the applicability requirements of NR 120.16. Ordinances should also meet the content requirements in NR 120.16 that deal with erosion control. Erosion control practice standards and applicability criteria for all municipalities should be consistent with those set forth in the publication Wisconsin Construction Site Best Management Practice Handbook (DNR, 1989).

To fully implement this recommendation, the following is needed:

1. improved ordinance coverage for the unincorporated areas of Washington and Ozaukee counties,
2. improved ordinance coverage for the village of Grafton,
3. effective ordinance administration and enforcement in all incorporated and unincorporated areas of the watershed.

Urban Best Management Practices

There are two general classes of management practices used to reduce water quality problems that urban stormwater flows and the associated pollutant loads cause. These are: 1) source reduction practices and 2) urban structural practices. Cost-share rates for these practices are presented in Chapter 6, along with performance and design standards for structural practices.

Source Reduction Practices

These practices are meant to curb the generation of urban pollutants as close to the source as possible. Ideally, pollutant generation is stopped. At a minimum, pollutants that are generated are controlled prior to entering the storm sewer system.

Source area controls are generally non-structural. Reducing the amount of automobile traffic in an area would be one example of a source control, since automobiles are the source of many urban pollutants. The current programs that remove lead from gasoline and asbestos from automobile brake linings are also examples of source controls. In other cases, such as for industrial materials storage areas, control of runoff may require a physical control structure such as a roof and diversion system.

Source area controls that prevent the generation of pollutants, such as the removal of lead from gasoline and asbestos from brake linings, are ultimately the most effective. However this type of control cannot be readily initiated at the local level. Regional and often national

action is required. Citizen action that leads to this type of control is an important component of a long range urban management strategy.

Source area controls that rely on better housekeeping practices, such as pet waste control programs and judicious use of lawn and garden products, can be initiated locally. These types of controls are an inexpensive and vital component of any urban stormwater management program. Information and education efforts are critical in supporting this approach since this type of urban action is only as good as the collective effort made by the general public responsible for carrying it out. Several source control alternatives recommended in this watershed are:

1. Reduce the use of galvanized roof materials and gutters, a primary source of zinc in urban runoff.

2. Remove pet wastes immediately from lawns, sidewalks and streets so that bacteria contamination of urban runoff can be reduced.

3. Manage the timing, amount and type of fertilizer and pesticide applications in urban areas.

4. Properly dispose automobile waste fluids, such as radiator water and engine oil, to keep them out of the storm sewer system.

5. Reduce the amount of vehicle traffic.

6. Reduce the areal extent of parking lots.

7. Encourage that urban developments take place on lands within urban service area boundaries.

8. Zone land use, in part, on site suitability for stormwater management practices needed to meet water quality, habitat and flood related objectives.

9. Strictly limit construction site erosion.

10. Keep use of street de-icing compounds to a minimum.

11. Promptly sweep streets in the early spring to remove accumulations of dirt and associated pollutants; repeat intensive street sweeping during autumn leaf fall.

Increased stormwater volumes and peak flows may result in part streambank erosion. Consequently, reducing stormwater flows through infiltration and detention can be considered a source area control approach to streambank erosion problems. Streambank erosion control may require a combination of stormwater flow management and stabilization of eroding sites.

Urban Structural Practices-Infiltration

The volume of urban runoff transporting pollutants to surface waters during a rainstorm is directly related to the amount of impervious urban area directly connected to the receiving waters. Impervious areas include rooftops, parking lots, streets and sidewalks. Directly connected areas are those that drain directly to storm sewer pipes or concrete channels.

One strategy of reducing pollutant transport to surface waters is to "disconnect" the impervious surface from the storm sewer system. This is accomplished by increasing the infiltration of stormwater into the ground. Stormwater infiltration on a suitable site will effectively reduce all major stormwater pollutants. In addition to reducing pollutant loads, groundwater infiltration can help stabilize the hydrology of small urban streams. This occurs because infiltration helps to maintain stream base flows during dry periods, and will decrease peak flow discharges responsible for streambank erosion and habitat scouring. Infiltration can be used jointly with wet detention where needed to augment the water resources management capabilities of the less versatile wet detention pond. In addition, infiltration can be used in the drainage area to a wet pond in order to reduce the pond size required to control stormwater pollutants.

Infiltration practices may be located very close to an urban source area, such as a parking lot or large rooftop, or located at the end of a storm sewer pipe that collects runoff from a larger area. Practices that promote on-site infiltration include porous pavements, redirecting roof downspouts to grassy areas and directing runoff waters to infiltration trenches. These practices are generally most applicable to small source areas such as rooftops and parking lots. The transport system that carries stormwater from impervious surfaces to surface waters can also be built to infiltrate stormwater. Grassed swale drainage systems, for example, work primarily through infiltration. Finally, infiltration basins can be located at storm sewer outlets for larger drainage areas. In this case, the basin is considered an off-site or end-of-pipe control measure.

Not all sites are appropriate for the use of infiltration practices. Heavy or poorly drained soils may limit the effectiveness of infiltration devices or result in practices too large to be practical. Slopes may limit the use of grassed swales in residential areas.

Most importantly, precautions must be taken when infiltrating urban stormwater to prevent groundwater contamination. Runoff from residential rooftops and driveways, and from rooftops in institutional, commercial and non-manufacturing industrial areas can generally be infiltrated with little risk of groundwater contamination. Runoff from parking lots in institutional and commercial areas, and from separate employee or visitor parking lots in non-manufacturing industrial areas can be infiltrated provided that some form of pre-treatment is provided. Pre-treatment devices, such as grit chambers with surface baffles or wet detention ponds, will reduce some of the pollutants available for groundwater contamination. Highly contaminated runoff, such as that from storage and loading areas in commercial and industrial areas should not be infiltrated.

All infiltration devices should have a minimum separation distance of three feet between the bottom of the infiltration device and the water table or bedrock surface. Infiltration may also

need to be restricted within certain distances of municipal wells. Finally, infiltration should occur wherever possible through a filtering layer of soil and sod.

Urban Structural Practices-Wet Detention

Wet detention ponds are effective at controlling particulate pollutants and can be designed to control peak flow discharges. Consequently, they can be employed to serve many needs including pollution control, flood control and control of stormwater flows that may be causing streambank erosion and streambed scour. These ponds have limited effectiveness in controlling urban pollutants in the dissolved state, and cannot effectively reduce the total stormwater volume or enhance stream base flows. The wet pond can be situated near a small source area, such as a parking lot, but are more commonly used to control runoff coming from a larger area.

Wet detention ponds must be lined in areas where potential groundwater contamination from the pond is a concern.

Using Easements to Support Urban Pollution Control Practices

Easements may be used to support wetland restoration, critical area stabilization and shoreline buffers in urban areas in order to reduce the water quality impacts of stormwater runoff. Use of these practices as stormwater runoff control measures, and the use of easements to support these practices, must be reviewed on a case-by-case basis by the DNR Resources. The same general rules set forth for the use of easements in rural areas also apply to urban stream reaches.

CHAPTER SIX
Detailed Rural & Urban Programs for Implementation

Introduction

This chapter describes the roles, responsibilities and procedures to be used by responsible parties in carrying out the management actions recommended in Chapter 5. Responsible parties include landowners and operators, local units of government and state agencies. This chapter also sets forth a schedule for implementing the project in rural and urban areas, presents cost-share guidelines, and estimates the project budget and staffing needs. This chapter is divided into three sections. These are: 1) the rural program for implementation, 2) the urban program for implementation, 3) the project information and education strategy.

Rural Program for Implementation

Project Participants: Roles and Responsibilities

Landowners and Land Operators

Owners and operators of public and private lands are important participants in the priority watershed program. They will be responsible for installing and maintaining the Best Management Practices (BMPs) needed to reduce nonpoint sources of water pollution. As such, they are eligible for technical and financial assistance through the watershed program.

In most instances landowners and operators will include individuals, partnerships and corporations. Local units of government identified in s. NR 120.02(19) Wisconsin Administrative Code may also be owners or operators of lands needing nonpoint source controls. In rural areas of the Cedar Creek Watershed, this will most likely include Ozaukee and Washington counties, the state of Wisconsin and the Big Cedar Lake Protection and Rehabilitation District.

Local Units of Government

This watershed project will be implemented by local units of government. As required by statutes and administrative rules, Ozaukee County and Washington County are the primary units of government responsible for implementing this plan in rural and unincorporated areas.

The Ozaukee and Washington county Land Conservation Committees (LCC) will act for their respective county boards and be responsible contractually and financially to the state of Wisconsin for management of the project in rural areas. The Ozaukee and Washington county LCCs will coordinate the activities of all other local agencies involved with the rural portion of the project.

The specific responsibilities for these counties are defined in NR 120.04 and are summarized below:

1. Identify in writing a person to represent the county during implementation of the project.

2. Contact all owners or operators of lands identified as significant nonpoint sources within one year of signing the nonpoint source grant agreement. The counties' strategies for contacting landowners are included in this chapter.

3. Develop farm conservation plans consistent with the needs of the project.

4. Enter into nonpoint source cost-share agreements with eligible landowners and enforce the terms and conditions of cost-share agreements as defined in s. NR 120.13, Wisconsin Administrative Code.

5. For lands the county owns or operates, enter into cost-share agreements with DNR to correct identified nonpoint sources and fulfill their obligations as a cost-share recipient.

6. Design best management practices and verify proper practice installation.

7. Reimburse cost-share recipients for the eligible costs of installing BMPs at the rates consistent with administrative rules and established in this plan.

8. Prepare and submit annual work plans for activities necessary to implement the project. The Ozaukee and Washington County LCDs shall submit a workload analysis and grant application to the Department of Agriculture, Trade and Consumer Protection (DATCP) as required in s. Ag. 166.50.

9. Prepare and submit to the Department of Natural Resources (DNR) and the DATCP the annual resource management report required under NR 120.21(7) to monitor project implementation by tracking changes in the nonpoint source inventory, and quantifying pollutant load reductions which result from installing BMPs.

Program (ACP). The LCC will coordinate ACP funding with NPS funding to the extent possible for the Cedar Creek Priority Watershed Project. In addition, other federally funded conservation incentives such as the Conservation Reserve Program (CRP) will be used whenever possible to control critical nonpoint sources of pollution.

Best Management Practices (BMPs)

BMPs Eligible for Cost Sharing and their Rates

Best management practices are those practices identified in NR 120 which are determined in this watershed plan to be the most effective controls of the nonpoint sources of pollution. The practices eligible for cost sharing and their cost-share rates are shown in Table 6-1.

Design and installation of all BMPs must meet the conditions listed in NR 120. Generally these practices use specific standard specifications included in the SCS Field Office Technical Guide. In some cases additional specifications may apply. The applicable specifications for each BMP can be found in NR 120.14. Appendix C includes guidelines for vegetative filter strips.

Following is a brief description of some of the most commonly used cost-shared BMPs included in Table 6-1. A detailed description of these BMPs is found in NR 120.14.

- Contour Farming - The farming of sloped land so that all operations from seed bed preparation to harvest are done on the contour.

- Contour and Field Stripcropping - Growing crops in a systematic arrangement, usually on the contour, in alternate strips of close grown crops, such as grasses or legumes and tilled row crops.

- Reduced Tillage - A system which leaves a roughened surface or substantial amounts of crop residue in or on the soil surface after crops are planted. The system consists of no more then one primary tillage pass in the fall or spring and no more than two passes with light or secondary tillage equipment prior to planting. It is utilized in two situations; one for continuous row crops or long corn rotations, the other for short crop rotations or for the establishment of forages and small grains.

- Critical Area Stabilization - The planting of suitable vegetation on critical nonpoint source sites.

- Grassed Waterways - A natural or constructed channel shaped, graded and established with suitable cover as needed to prevent erosion by runoff waters.

- Grade Stabilization Structure - A structure used to reduce the grade in a channel to protect the channel from erosion or to prevent the formation or advance of gullies.

- Livestock Exclusion from Woodlots - The exclusion of livestock from woodlots to protect the woodlots from grazing by fencing or other means.

- Shoreline and Streambank Stabilization - The stabilization and protection of stream and lake banks against erosion and the protection of fish habitat and water quality from livestock access. This practice includes streambank fencing.

- Terraces - A system of ridges and channels with suitable spacing and constructed on the contour with a suitable grade to prevent erosion in the channel.

- Field Diversions - This purpose of this practice is primarily to divert water from areas it is in excess or is doing damage to where it can be transported safely.

- Barnyard Runoff Management - Structural measures such as gutters, downspouts or diversions to redirect surface runoff around the barnyard, and collect, convey and temporarily store runoff from the barnyard.

- Manure Storage Facility - A structure for the storage of manure for a period of time that is needed to reduce the impact of manure as a nonpoint source of pollution. Livestock operations where this practice applies are those where manure is winter spread on fields that have a high potential for runoff to lakes, streams and groundwater. The facility is needed to store and properly spread manure according to a management plan.

- Agricultural Sediment Basins - A structure designed to reduce the transport of pollutants to surface waters and wetlands.

- Shoreline Buffers - A permanently vegetated area immediately adjacent to lakes, streams and wetlands designed and constructed to manage critical nonpoint sources or to filter pollutants from nonpoint sources. Guidance for estimating buffer widths is presented in Appendix C.

- Animal Lot Relocation - Relocation of an animal lot from a critical site such as a floodway to a suitable site to minimize the amount of pollutants from the lot to surface or groundwater.

- Wetland Restoration - The construction of berms or destruction of the function of tile lines or drainage ditches to create conditions suitable for wetland vegetation. Guidelines for the use of this BMP are presented in Chapter 5.

- Roofs for Barnyard Runoff Management and Manure Storage Facilities - Construction of roofs to prevent rain and snow from contacting manure.

- Nutrient Management - The management of the application of manure, legumes and commercial fertilizers including the rate, method and timing of application to minimize the amount of nutrients entering surface or groundwater. See Chapter 5 for guidelines in using this practice.

Table 6-1. State Cost-share Rates for Best Management Practices

BEST MANAGEMENT PRACTICE	STATE Cost-share RATE
Contour Farming	50% *
Contour Strip Cropping	50% *
Field Strip Cropping	50% *
Field Diversions and Terraces	70%
Grassed Waterways	70%
Reduced Tillage	50%
Grade Stabilization Structures	70%
Agricultural Sediment Basins	70%
Shoreline and Streambank Stabilization	70%
Barnyard Runoff Management	70%
Animal Lot Relocation	70%
Manure Storage Facilities	70%

(Maximum cost-share amount is $10,000 including no more than $5,000 for manure transfer equipment)

Livestock Exclusion from Woodlots	50%
Roofs for Barnyard Runoff Management and Manure Storage Facilities	70%
Nutrient and Pesticide Management	50%
Ag chemical Spill Control Basins	70%
Critical Area Stabilization	70% **
Shoreline Buffers	70% **
Wetland Restoration	70% **

* Wildlife habitat and restoration components of these practices are cost-shared at 70 percent.

** Easements may be entered into with landowners identified in the watershed plan in conjunction with these BMPs. Chapter 5 explains where easements may be used.

- Pest Management - The management of the handling, disposal and application of pesticides including the rate, method and timing of application to minimize the amount of pesticides entering surface and groundwater. See Chapter 5 for guidelines in using this practice.

- Easements - Easements are not considered a BMP. However, they are useful legal tools to encourage the installation of shoreline buffers, wetland restoration and critical area stabilization. Guidelines for using easements in this project are presented in Chapter 5.

BMPs Not Cost-shared

BMPs not cost-shared, but which shall be included on the cost-share agreement if necessary to control the nonpoint sources, are listed in NR 120.17. Several examples are:

- Practices to be funded through other programs.

- Practices previously installed and necessary to support cost-shared practices.

- Changes in crop rotations and other activities normally and routinely used in growing crops or which have installation costs that can be passed on to potential consumers.

- Changes in location of unconfined manure stacks involving not capital cost.

- Manure spreading management.

- Other activities the DNR determines are necessary to achieve the objectives of the watershed project.

Activities and Sources of Pollution Not Eligible for Cost-share Assistance

Priority watershed cost-share funds cannot be used to control sources of pollution and land management activities specifically listed in NR 120.10(2). The following is a partial list of ineligible activities most often inquired about for cost sharing in rural areas:

- Operation and maintenance of cost-shared BMPs.

- Actions which have drainage of land or clearing of land as the primary objective.

- Practices already installed.

- Activities covered under the Wisconsin Pollution Discharge Elimination System (WPDES) Program or covered in other ways by Chapter 147 of Wis. Stats. (including livestock operations with more than 1,000 animal units or livestock operations issued a notice of discharge under ch. NR 243).

- Septic system controls or maintenance.
- Dredging activities.
- Silvicultural activities.
- Bulk storage of fertilizers and pesticides.
- Activities and structures intended primarily for flood control.
- Practices required to control sources which were adequately controlled at the time the cost-share agreement was signed.
- Other practices or activities that DNR determines will not to meet the objectives of the program.

Nonpoint Source Grant Agreement and Administration

General Information

Ozaukee County and Washington County sign a "Nonpoint Source Grant Agreement" with the DNR in order to receive cost-share funds. As described below, the landowners will need to sign cost-share agreements with the county in order to receive the funding. From time to time, a portion of the Nonpoint Source Grant is forwarded to Ozaukee and Washington counties to allow each county to set up and maintain an "up-front" account. The funds obligated under cost-share agreements must never exceed the total funds in the NPS Grant Agreement between DNR and the county. Funds from this account will be used by the county to pay landowners after eligible BMPs listed on the landowner/county cost-share agreement are installed. As this "up-front" account is drawn down, the county will request reimbursements on a quarterly basis from DNR to replenish the account. This reimbursement schedule will insure that the "up-front" account balance is maintained at an adequate level. The NPS Grant Agreement will be amended annually to identify the NPS funding needed for cost sharing for the calendar year.

Fiscal Management Procedures, Reporting Requirements

Counties are required by NR 120 to maintain a financial management system that accurately tracks the disbursement of all funds used for the Cedar Creek Watershed Project. The records of all watershed transactions must be retained for three years after the date of final project settlement. A more detailed description of the fiscal management procedures can be found in NR 120.25 and NR 120.26.

Cost-Share Agreement and Administration

Purpose and Responsibilities

Consistent with s. 144.25, Stats. and NR 120, Wis. Adm. Code cost-share funding is available to landowners for a percent of the costs of installing BMPs to meet the project objectives (see Table 6-1). Landowners have three years after formal approval of the watershed plan to enter into cost-share agreements. Practices included on cost-share agreements must be installed within the schedule agreed to on the cost-share agreement. Unless otherwise approved, the schedule of installing BMPs will be within five years of signing of the cost-share agreement. Practices must be maintained for a minimum of 10 years from the date of installing the final practice included in the cost-share agreement.

The cost-share agreement is a legal contract between the landowner and the county. The agreement includes the name and other information about the landowner and grant recipient, conditions of the agreement, the practices involved and their location, the quantities and units of measurement involved, the estimated total cost, the cost-share rate and amount, the timetable for installation, and number of years the practice must be maintained. The agreements also identify and provide information on practices not cost-shared through the nonpoint program but that are essential to controlling pollution sources (such as crop rotations). Once it is signed by both parties, they are legally bound to carry out its provisions.

Cost-share agreements are filed with the county Registrar of Deeds. If land ownership changes, the cost-share agreement remains with the property and the new owner is legally bound to carry out the provisions. NR 120.13(9) and (10) has more information on changes of land ownership and the recording of cost-share agreements.

Local, state or federal permits may be needed prior to installation of some BMPs. The areas most likely to need permits are zoned wetlands and the shoreline areas of lakes and streams. These permits are needed whether the activity is a part of the watershed project or not. Landowners should consult with the county Planning and Zoning Department, the Environmental Health Department or the county Land Conservation Department offices to determine if any permits are required. The landowner is responsible for acquiring the needed permits prior to installation of practices.

The cost-share agreement binds the county to provide the technical assistance needed for the planning, design and verification of the practices on the agreement, and to provide the cost-share portion of the practice costs.

Counties are responsible for enforcing compliance of cost-share agreements to which they are a party. Where DNR serves as a party to an agreement with a unit of government, the DNR will take responsibility for monitoring compliance. The responsible party will insure that BMPs installed through the program are maintained in accordance with the operation and maintenance plan for the practice for the appropriate length of time. Ozaukee and Washington counties will check for compliance with practice maintenance provisions once

every three years after the last practice has been installed. The county must check maintenance at its own expense after the Nonpoint Source Agreement has lapsed.

Landowner Contact Strategy

At a minimum, Ozaukee County will do the following:

- During the first three months of the implementation period, all landowners or operators in Ozaukee County with eligible nonpoint sources will receive from the county a mailing explaining the project and how they can become involved.

- After the initial landowner mailings, Ozaukee county staff will make personal contacts with all landowners in Ozaukee County that have been identified as having critical nonpoint sources of pollution (Management Category I). These contacts will occur within a year of plan approval and a signed Nonpoint Source Agreement.

- The county will continue to make contacts with eligible (Management Category I and II) landowners and operators in Ozaukee County until they have made a definite decision regarding participation in the program.

- Ozaukee County will contact all eligible landowners (as defined in 3 above) not signing cost-share agreements by personal letter prior to the end of second year of the cost-share signup period.

At a minimum, Washington County will do the following:

- Within one year of the signing of a nonpoint source grant agreement, Washington County LCD staff will make personal contacts with all owners or operators of lands in Washington County identified as significant (Management Category I) nonpoint sources in the watershed plan.

- Washington County LCD staff will make personal contacts with all other operators or owners of lands identified as Management II lands by the end of the second year of the signup period.

Procedure for Developing Cost-share Agreements

Eligibility for cost sharing is verified following a site visit, using the criteria described in Chapter 5.

The development of farm conservation plans will be the primary method used to develop cost-share agreements. These plans are specific to a particular landowner and are a comprehensive approach to the abatement of the nonpoint sources of pollution, and the conservation of soil and other resources. The farm plan takes into consideration the sustainability of the agricultural resources and the management decisions of the owner or operator.

The cost-share agreement specifies the items listed in the farm conservation plan that are necessary to reduce the nonpoint sources of pollution. The conservation plan and cost-share agreement will document existing management which must be maintained to protect water quality. Nutrient management requirements for landowners who receive cost sharing are specified in Chapter 5.

The following procedure will be used by the county for developing and administering agreements. Below are the steps from the initial landowner contact through the completion of BMP maintenance.

- Landowner and county staff meet to discuss the watershed project, NPS control practice needs and coordination with conservation compliance provisions if applicable.

- Landowner agrees to participate with the watershed project.

- A farm conservation plan is prepared by the county.

- The landowner agrees with the plan, a Cost-share Agreement is prepared and both documents are signed by the landowner and the county. Two copies of the Cost-share Agreement (CSA) are sent to the DNR Southeast District Nonpoint Source

  Coordinator and a copy given to the landowner. The CSA will be recorded by the county with the County Register of Deeds.

- Practices are designed by the county, or its designee, and a copy of the design is provided to the landowner.

- Landowner obtains the necessary bids or other information required in the cost containment policy.

- Amendments to the CSA are made if necessary.

- The county staff oversee practice installation.

- The county verifies the installation.

- The landowner submits paid bills and proof of payment (cancelled checks or receipts marked "paid") to the county.

- Land Conservation Committees, and if required, county boards, approve cost-share payments to landowners.

- Checks are issued by the county to the respective landowners and project ledgers are updated.

- The county records the check amount, number and date.

- DNR reimburses the county for expended cost-share funds.

Identifying Wildlife and Fishery Needs

The Ozaukee and Washington county staffs will consult with DNR's Southeast District wildlife management and fisheries management staff to optimize the wildlife and fish management benefits of nonpoint source control BMPs. Specifically, the county staff will contact DNR staff if:

- Streambank protection practices, agricultural sediment basins or critical area stabilization practices are being considered.

- Fence rows, rock piles, wetlands or other wildlife habitat components will be adversely affected by installation of agricultural BMPs.

The DNR staff will assist county staff by:

- Identifying streambank protection practices that benefit fish and wildlife.

- Identifying wildlife habitat components that could be incorporated into vegetative filter strips along streams or in upland areas.

- Reviewing placement of agricultural sediment basins to assure that negative impacts on stream fish and aquatic life do not occur and recommending wildlife habitat components.

- Providing technical assistance when the installation of BMPs will require the removal of obstructions or other wildlife habitat by proposing measures to minimize impact on wildlife habitat.

- Assisting to resolve questions concerning effects of agricultural nonpoint source BMPs on wetlands.

Submittal to the Department of Natural Resources

Cost-share agreements do not need prior approval from DNR, except in the following instances:

- Where cost-share funds are to be used for practices on land owned or controlled by the county.

- For agreements or amendments where the cost-share amount for all practices for a landowner exceeds $50,000 in state funds.

- For grade stabilization structures and agricultural sediment basins with embankment heights between 15 and 25 feet and impoundment capacities of 15 to 50 acre feet.

- For streambanks to be controlled using rip-rap or other materials with banks over 6 feet high.

- For animal lot relocation.

- For roofs over barnyards or manure storage facilities.

Cost Containment Procedures

Chapter NR 120 requires that cost containment procedures be identified in this plan. The cost containment procedures to be used by Ozaukee and Washington counties are described below.

Cost-share payments will be based on actual installation costs. If actual installation costs exceed the amount of cost sharing determined by the bidding and average cost methods the amount paid the grantee may be increased with the approval of the appropriate land conservation committee. Appropriate documentation regarding the need for changes will be submitted to DNR.

- Bids. As determined by the project technicians, competitive bids will be required for any structural BMP component estimated to cost more than $5,000. The bidding process requires the cost-share recipient to receive a minimum of two bids from qualified contractors in lump sum bid. The cost-share recipient must provide copies of the bids to the county prior to initiating construction. In cases where the cost-share recipient provides proof that bids were requested from a minimum of three qualified contractors but only one bid was received, the county will determine if the bid constitutes an appropriate cost for the project. If no bids are received or if the lone bid is not deemed appropriate, the county will limit cost sharing based on average costs.

- Average Costs. Average costs will be used for all structural BMPs with an estimated total cost equal to or less than $5,000, unless the cost-share recipient decides to bid the installation of the BMPs. This average cost list will be reviewed periodically and appropriate changes made. If changes are made the list will be forwarded to DNR and DATCP.

- Flat Rates. Several of the BMPs listed in Table 6-1 will use flat rates for determining the state's cost-share funding amount. Practices using flat rates are shown in Table 6-2. The rates shown are the state's share of the practice installation costs.

Table 6-2. Practices Using a Flat Rate for State Cost-share Funding

BEST MANAGEMENT PRACTICE	FLAT RATE[3]
Contour Farming	$6.00/ac.
Strip Cropping	$12.00/ac.
Field Strip Cropping	$10.00/ac.
Reduced Tillage	$15.00/ac.[1]
Reduced Tillage	$45.00/ac.[2]

1 Reduced tillage systems for short crop rotations, and establishment of forages and small grains (includes no-till)

2 Reduced tillage systems for continuous row cropping or long rotations (does not include no-till)

3 Flat rates may be established for nutrient and pest management activities such as soil testing, manure testing, crop scouting or integrated pest management.

Local Assistance Grant Agreement Administration

General Information

The Local Assistance Grant Agreement (LAGA) is a grant from the DNR to Ozaukee and Washington counties for supporting their staffing and support costs of carrying out this watershed plan. Each county will have its own agreement. Consistent with NR 120, the counties will use funds from the LAGA for additional staff to implement the project and conduct information and education activities. Other items such as travel, training and certain office supplies are also supported by the LAGA. Further clarification of eligible costs supported by this grant is given in NR 120.14(4) and (6).

Grant Agreement Application Procedures

An annual review of the Local Assistance Grant Agreement is conducted through the development of an annual workload by the county. This workload estimates the work needed to be accomplished each year. The workload is provided to DATCP and DNR for review and clarification. Along with the workload analysis, a grant application form is sent. Funds needed to complete the agreed upon annual workload are amended to the local assistance grant agreement.

Fiscal Management Procedures, Reporting Requirements

Ozaukee and Washington counties are required by NR 120 to maintain a financial management system that accurately tracks the disbursement of all funds used for the Cedar Creek Watershed Project. The records of all watershed transactions must be retained for three years after the date of final project settlement. A more detailed description of the fiscal management procedures can be found in NR 120.25 and NR 120.26.

NR 120 requires quarterly reports to DATCP from each county in accordance with s. Ag. 166.40(4) accounting for staff time, expenditures and accomplishments regarding activities funded through the watershed project. Reimbursement requests may be included with the submittal of the quarterly project reports.

Budget and Staffing Needs

This section estimates the funding and staffing required to conduct the rural portion of this project. These estimates are based on needs identified for Ozaukee and Washington counties.

Costs of Installing BMPs

The quantity and type of management practices that are required to meet this projects water quality objectives are listed in Tables 6-3 and 6-4. These tables also show the capital cost of installing the BMPs, assuming landowner participation rates of 100 percent and 75 percent. Also included are the units of measurement and cost-share amount per unit for the various BMPs.

Table 6-3.Cost-share budget needs for rural management practices in Ozaukee County

Best Management Practices	Number	Cost/Unit	Total Cost(1)	100% Participation		75% Participation	
				State Share	Local Share	State Share	Local Share
Upland Erosion Control							
Change in Crop Rotation	885 ac	NA(3)	0	0	0	0	0
Contour Cropping	1,711 ac	$6	10,266	10,266	(2)	7,700	(2)
Contour Strip Cropping	1,280 ac	$12	15,360	15,360	(2)	11,520	(2)
Reduced Tillage(4)	125 ac	$45	5,625	5,625	(2)	4,219	(2)
Reduced Tillage(5)	367 ac	$15	5,505	5,505	(2)	4,129	(2)
Critical Area Stabilization	57 ac	$100	5,700	3,990	1,710	2,993	1,283
Grass Waterways	16 ac	$2,500	40,000	28,000	12,000	21,000	9,000
Field Diversions & Terraces	9,000 ft	$3	27,000	18,900	8,100	14,175	6,075
Grade Stabilization	8 ea	$3,000	24,000	16,800	7,2000	12,600	5,400
Agricultural Sediment Basin	0 ea	$3,000	0	0	0	0	0
Livestock Fencing from Woodlots	1,600 ft	$1	1,600	800	800	600	600
Pasture Management	26 ac	NA	0	0	0	0	0
Shoreline Buffers	85 ac	$150	12,750	8,925	3,825	6,694	2,869
Wetland Restoration	30 ea	$2,000	60,000	42,000	18,000	31,500	13,500
Pesticide Management(6)	3,135 ac	$30	94,050	47,025	47,025	35,269	35,269
Animal Waste Management							
Barnyard Runoff Control System	10 ea	$15,000	150,000	105,000	45,000	78,750	33,750
Manure Storage Facility(7)	7 ea	$20,000	140,000	70,000	70,000	52,500	52,500
Nutrient Management(8)	4,368 ac	$3.5	15,288	7,644	7,644	5,733	5,733
Streambank Erosion Control							
Shape and Seeding	2,500 ft	$4	10,000	7,000	3,000	5,250	2,250
Fencing	5,000 ft	$1	5,000	3,500	1,500	2,625	1,125
Rip-Rap	100 ft	$20	2,000	1,400	600	1,050	450
Livestock/Machinery Crossing	5 ea	$1,500	7,500	5,250	2,250	3,938	1,688
Subtotal:			$631,644	$402,990	$228,654	$302,243	$171,491
Easements	40 ac	$1,000	40,000	40,000	0	30,000	0
Total			$671,644	442,990	228,654	$332,243	$171,491

1 Total cost to control identified critical pollution sources
2 Local share consists of labor and any additional equipment costs, also see flat rates
3 NA means that cost-share funds are not available for this practice
4 This practice is reduced tillage on continuous row, or long rotational croplands
5 This practice is reduced tillage, including no-till, on short rotation croplands or for establishing forage crops
6 Assumes average cost of $10.00/acre/year for three years for integrated crop management
7 Maximum cost-share is $10,000 of which a maximum of $5,000 can be for waste transfer
8 Assumes average cost for soil testing for all farms requiring nutrient management plans

Source: WI Department of Natural Resources; WI Department of Agriculture, Trade and Consumer Protection; and the Land Conservation Department of Washington County

Table 6-4. Cost-Share Budget Needs for Rural Management Practices in Washington County

Best Management Practices	Number	Cost/Unit	Total Cost1	100% Participation		75% Participation	
				State Share	Local Share	State Share	Local Share
Upland NPS Control							
Change in Crop Rotation	900 ac	NA2	0	0	0	0	0
Contour Cropping	3,973 ac	$6	23,838	23,838	3	17,879	3
Contour Strip Cropping	6,961 ac	$12	83,532	83,532	3	62,649	3
Reduced Tillage 4	1,643 ac	$45	73,935	73,935	3	55,451	3
Reduced Tillage 5	718 ac	$15	10,770	10,770	3	8,078	3
Critical Area Stabilization	516 ac	$100	51,600	36,120	15,480	27,090	11,610
Grass Waterways	40 ac	$2,500	100,000	70,000	30,000	52,500	22,500
Field Diversions & Terraces	50,000 ft	$3	150,000	105,000	45,000	78,750	33,750
Grade Stabilization	5 ea	$3,000	15,000	10,500	4,500	7,875	3,375
Agricultural Sediment Basin	10 ea	$3,000	30,000	21,000	9,000	15,750	6,750
Livestock Fencing from Woodlots	3,200 ft	$1	3,200	1,600	1,600	1,200	1,200
Pasture	41 ac	NA	0	0	0	0	0
Shoreline Buffers	500 ac	$150	75,000	52,500	22,500	39,375	16,875
Wetland Restoration	5 ea	$2,000	10,000	7,000	3,000	5,250	2,250
Pesticide Management 6	11,198 ac	$30	335,940	167,970	167,970	125,978	125,978
Animal Waste Management							
Barnyard Runoff Control System	26 ea	$15,000	390,000	273,000	117,000	204,750	87,750
Manure Storage Facility 7	19 ea	$20,000	380,000	190,000	190,000	142,500	142,500
Nutrient Management 8	14,711 ac	$3.5	51,489	25,744	25,744	19,308	19,308
Streambank Erosion Control							
Shape and Seeding	5,000 ft	$4	20,000	14,000	6,000	10,500	4,500
Fencing	10,000 ft	$1	10,000	7,000	3,000	5,250	2,250
Rip-Rap	200 ft	$20	4,000	2,800	1,200	2,100	900
Livestock/Machinery Crossing	10 ea	$1,500	15,000	10,500	4,500	7,875	3,375
Subtotal:			$1,833,304	$1,186,809	$646,494	$890,108	$484,871
Easements	160 ac	$1,000	160,000	160,000	0	120,000	0
Total			$1,993,304	$1,346,809	$646,494	$1,010,108	$484,871

1 Total cost to control identified critical pollution sources
2 NA means that cost-share funds are not available for this practice
3 Local share consists of labor and any additional equipment costs, also see flat rates
4 Reduced tillage on greater than three years continuous row crops
5 Reduced tillage, including no-till, on rotations including hay
6 Assumes average cost of $10.00/acre/year for three years for integrated crop management
7 Maximum cost-share is $10,000 of which a maximum of $5,000 can be for waste transfer
8 Assumes average cost for soil testing for all farms requiring nutrient management plans

Source: WI Department of Natural Resources; WI Department of Agriculture, Trade and Consumer Protection; and the Land Conservation Department of Washington County

The total cost of installing the best management practices and purchasing easements in Ozaukee County is approximately $672,000 assuming 100 percent landowner participation. The total cost for Washington County is approximately $1,993,000.

- State funds necessary to cost-share this level of control would be about $443,000 for Ozaukee County and $1,347,000 for Washington County.

- The local share provided by landowners and other cost-share recipients would be about $229,000 in Ozaukee County and about $646,000 in Washington County.

At a 75 percent level of participation, the state funds needed to cover these costs would be about $332,000 in Ozaukee County and about $1,010,000 in Washington County.

Easement Costs

Chapter 5 identifies where nonpoint source program funds can be used to purchase easements. It is difficult to estimate the actual amount of money that will be spent on easement purchases, but approximately $700,000 to $1,400,000 would be needed to purchase easements in all eligible areas. This plan recommends that at least $200,000 be targeted initially for easement purchases. Based on Table 5-10, it is estimated that 20 percent of the potential easements will be located in Ozaukee County and 80 percent in Washington County. The planned distribution of funds for potential easements will reflect this apportionment.

Staff Needs

Tables 6-5 and 6-6 list the total estimated staff needed to implement the project in Ozaukee and Washington counties respectively. Figures are provided for both the 50 percent and 75 percent levels of participation. A total of about 7,000 staff hours is required (1,820 hours per staff year)in Ozaukee County and 27,100 staff hours is required in Washington County to implement this plan at a 75 percent landowner participation rate. This includes 200 staff hours in Ozaukee County and 200 staff hours in Washington County to carry out the information and education program. The estimated cost for staff at this landowner participation rate is approximately $104,000 in Ozaukee County and approximately $432,000 in Washington County. All of these costs, with the exception of some direct cost items, would be paid for by the state.

Total Project Cost

The total state funding required to meet the rural nonpoint source pollution control needs at a 75 percent level of landowner participation is presented Table 6-7. This figure includes the capital cost of practices, staff support and easement costs presented above. The estimated cost to the state would be about $436,000 in Ozaukee County and $1,442,000 in Washington County. The total cost to the state of implementing the rural portion of this project at a 75 percent participation rate is estimated to be about $1,878,000.

Table 6-5. Estimated County LCD Staff Needs for Project Implementation

Activity	Project Years When Work Will Be Done	OZAUKEE COUNTY	
		75% Landowner Participation (Staff Hours)	50% Landowner Participation (Staff Hours)
Project and Financial Management	1-8	1,705	1,705
Information and Education Program	1-8	200	200
Pre-Contact Office Inventory; Landowner Contracts and Progress Tracking	1-3	983	655
Conservation Planning and Cost-share Agreement Development	1-3	1,179	786
Practice Design and Installation	1-8		
Upland Sediment Control		1,892	1,261
Barnyard Runoff Control		392	261
Manure Spreading Management and Storage		308	206
Streambank Erosion Control		8	5
Training	1-8	325	325
Total LCD Workload:		6,992	5,404
Estimated Staff Required for Years 1-3:		0.7 per year	0.5 per year
Estimated Staff Required for Years 4-8:		0.5 per year	0.4 per year

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade and Consumer Protection and the Ozaukee County Land Conservation Department

Table 6-6. Estimated County LCD Staff Needs for Project Implementation

Activity	Project Years When Work Will Be Done	WASHINGTON COUNTY	
		75% Landowner Participation (Staff Hours)	50% Landowner Participation (Staff Hours)
Project and Financial Management	1-8	4,590	4,590
Information and Education Program	1-8	200	200
Pre-Contact Office Inventory; Landowner Contracts and Progress Tracking	1-3	3,618	2,412
Conservation Planning and Cost-share Agreement Development	1-3	10,854	7,236
Practice Design and Installation	1-8		
Upland Sediment Control		4,577	3,051
Barnyard Runoff Control		696	464
Manure Spreading Management and Storage		1,122	748
Streambank Erosion Control		600	400
Training	1-8	874	874
Total LCD Workload:		27,131	19,975
Estimated Staff Required for Years 1-3:		2.8 per year	2.0 per year
Estimated Staff Required for Years 4-8:		1.8 per year	1.3 per year

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade and Consumer Protection and the Washington County Land Conservation Department

Table 6-7. Total Project Costs at 75 percent Landowner Participation Rate

Item	Costs		
	Ozaukee County	Washington County	Watershed Total
Cost-share Funds: Practices	$302,243	$890,107	$1,192,349
Cost-share Funds: Easements	30,000	120,000	150,000
Local Assistance Staff Support*	99,300	417,400	516,700
Information/Education Direct			0
Other Direct (travel, supplies, etc.)	4,315	14,275	18,590
Total	$435,858	$1,441,782	$1,877,639

* Salary + Indirect = $32,000/year

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade and Consumer Protection and the Ozaukee and Washington County Land Conservation Departments

Grant Disbursement and Project Management Schedule

Implementation may begin upon approval of this watershed plan by the Ozaukee and Washington County Boards; Wisconsin Department of Agriculture, Trade and Consumer Protection; and the Department of Natural Resources. The priority watershed project implementation period lasts eight years. It includes an initial three-year period for contacting eligible landowners and signing cost-share agreements. Practices on any cost-share agreement must be installed within a five-year period.

Under extenuating circumstances, the initial period for entering into cost-share agreements can be extended by DNR for a limited period of time if it will result in a significant increase in nonpoint source control. Limited extensions for the installation period for practices on individual cost-share agreements must also be approved by DNR and DATCP.

The disbursement of the grants (Local Assistance and Nonpoint Source) to Ozaukee and Washington counties will be based on an annual workload analysis and grant application process. The estimated grant disbursement schedule based on 75 percent participation by eligible landowners can be found in Table 6-8 for Ozaukee County, and Table 6-9 for Washington County.

Coordination with State and Federal Conservation Compliance Programs

The Cedar Creek Watershed Project will be coordinated with the conservation compliance features of the Wisconsin Farmland Preservation Program (FPP) administered by DATCP and the federal Food Security Act (FSA), administered by the Soil Conservation Service. DATCP will assist Ozaukee and Washington counties, and the SCS offices to identify landowners within the watershed that are subject to the compliance provisions of FPP and FSA. Conservation Farm Plans were completed for all landowners in FPP and FSA on December 31, 1989.

There will be a need to implement the conservation plans and in the future amend these plans during the implementation phase of the watershed project. Watershed project staff will revise the conservation plans developed for FPP and FSA to include management decisions and the installation of needed BMPs for nonpoint source pollution abatement while addressing other resource conservation problems. This comprehensive approach to farm planning will facilitate consideration of the various goals and objectives for all the programs which the landowner participates.

Some eroding uplands in Management Categories 1 and 2 may need control, in addition to that required for meeting sediment delivery targets, in order to meet soil erosion program goals established through other state and federal programs. Where this occurs, technical and financial assistance from the Nonpoint Source Program can be used to support practice design and installation on these critical lands. This assistance applies only where the additional control needed to meet soil erosion goals can be achieved using low cost practices.

Table 6-8. Ozaukee County Grant Disbursement Schedule at 75 percent Landowner Participation

Item	Project Year			
	1	2	3	4 – 8
Cost-share Funds: Practices	$60,449	$120,897	$120,897	$0
Cost-share Funds: Easements	6,000	12,000	12,000	0
Local Assistance Staff Support	29,790	19,860	9,930	39,720
Information/Education: Direct				
Other Direct: (travel, supplies, etc.)	1,295	863	432	1,726
Total	$97,534	$153,620	$143,259	$41,446

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade and Consumer Protection and the Ozaukee County Land Conservation Department

Table 6-9. Washington County Grant Disbursement Schedule at 75 percent Landowner Participation

Item	Project Year			
	1	2	3	4 – 8
Cost-share Funds: Practices	$178,021	$356,043	$356,043	$0
Cost-share Funds: Easements	24,000	48,000	48,000	0
Local Assistance Staff Support	125,220	83,480	41,740	166,960
Information/Education: Direct				
Other Direct: (travel, supplies, etc.)	4,283	2,855	1,428	5,710
Total	$331,524	$490,378	$447,211	$172,670

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade and Consumer Protection and the Washington County Land Conservation Department

Urban Program for Implementation

Project Participants: Roles and Responsibilities

The roles and responsibilities of landowners, land operators, local units of government, DNR and UWEX in implementing the urban management recommendations parallel those identified for rural areas (pages 125-129). There are some additional points that are important, however. These are highlighted below.

Land Owners and Land Operators

It is anticipated that in many situations towns, cities and villages in the watershed will have a significant role in this regard. This will occur in instances where the government is providing a municipal service, such as providing off-site stormwater management practices that collect runoff from a larger area including many different land owners. In this role, municipalities in the watershed will work under cost-share agreements directly with DNR to design, install and maintain BMPs. Local governments will be responsible for providing the local share of the installation cost for urban best management practices. It is anticipated that this role will be played to varying degrees by the local units of government identified in Table 5-14. The Big Cedar Lake Protection and Rehabilitation District may also be involved in this role.

In other instances, individuals will install practices to control runoff from their own lands. In these cases, the individual landowner will pay the portion of the installation cost consistent with the cost-share guidelines in this plan.

Local Units of Government

This is the more traditional role that local units of government assume under the Nonpoint Source Program. In this role, cities, villages and towns will develop cost-share agreements with individual land owners for the installation of urban structural practices, and provide technical and financial assistance to individuals with funds obtained from the state. These governments will also conduct planning and administrative services in this role, such as stormwater planning and engineering feasibility investigations, and the administration and enforcement of construction site erosion and stormwater management ordinances. Finally, these governments will need to develop and conduct urban housekeeping programs and information/education programs.

Department of Natural Resources

In addition to the administrative and financial support which the Department provides, it maintains a staff of stormwater management engineers and technical specialists who will provide guidance and review directly to municipal staff. In addition, the DNR has a nonpoint source coordinator located in its Southeast District Headquarters who will provide guidance to towns, cities and villages in interpreting and implementing this plan.

University of Wisconsin-Extension (UWEX)

UWEX maintains an urban education specialist at its office in West Allis. This person is a regional resource to urban municipalities who are responsible for implementing the recommendations in this plan. In addition, UWEX sponsors training courses in construction site erosion control and stormwater management. DNR provides financial assistance to local units of government for sending staff and administrators to appropriate training sessions.

Relationship of this Project to the Federal Stormwater Permit Program

This plan recommends urban nonpoint source control activities to be conducted under the state's voluntary cost-share program. However, on November 16, 1990 the federal government enacted regulations controlling urban stormwater runoff. The Wisconsin Department of Natural Resources is the state agency designated to carry out this federal mandate. There will be some overlap between these two programs. In the short term, this overlap will affect selected industrial sites and construction sites. In the longer term, this overlap could be extended to affect existing and planned urban development of all types in the watershed. These areas of overlap are discussed below.

Industries

All industries in the state that are engaged in targeted activities must submit a stormwater permit application to DNR by the fall of 1991. Targeted activities include: mining operations; manufacturing industries; transportation facilities; hazardous waste treatment, storage or disposal facilities; landfills or land application sites receiving industrial waste; steam electric generating sites; wastewater treatment plants; pretreatment industries; any facility having a WPDES permit. Generally speaking if stormwater runoff quality from these industries is influenced by manufacturing, processing or materials storage then it will be targeted for management under the stormwater permit program. These facilities are targeted regardless of location.

The DNR will review these applications, determine additional monitoring requirements, and issue permits. Permits will specify the management needed at each site. It is likely, under current administrative rules for the Nonpoint Source Program, that many of the industrial activities targeted for permits will not be eligible for cost sharing through the Nonpoint Source Program.

Not all areas located on industrial properties will need management practices under the permit program. Examples include areas that are separate from industrial activity (office areas, employe parking lots) as long as runoff from the area does not mix with contaminated water from areas of industrial activity. Best management practices may be recommended for some of these areas through the Nonpoint Source Program, however. As the individual permit requirements are finalized by DNR for industrial sites in the Cedar Creek Watershed, decisions will need to be made concerning the eligibility of best management practices in these areas for cost-share and technical assistance.

Construction Sites

Construction sites exceeding 5 acres as a single or cumulative development are classified as industrial sites under the stormwater permit program. These sites will need permits as of October 1992. This watershed plan recommends that local units of governments control construction site erosion from a more inclusive set of development categories than those that will require a stormwater permit. Consequently, all of the sites needing a permit under the stormwater program should be covered under the local construction site erosion control programs recommended in this watershed plan. Hopefully, these local programs will meet most or all of the requirements of the stormwater permit program.

Municipal Storm Sewers

The regulations do not currently apply to urban areas within the Cedar Creek Watershed. It is possible, however, that some or all of the watershed's urban areas will have to comply with requirements of the stormwater permit program in the future. Cost-share policies for urban areas in the watershed will be reviewed and may be modified in the event that the stormwater permit program is extended to urban areas within the watershed.

Implementation Schedule

A phased approach to urban stormwater runoff control is being recommended for the Cedar Creek Watershed. This approach includes a program of "Core" activities that communities can begin to work on immediately. It also includes a program of "Segmented" activities that will need to be undertaken over a number of years. These are described in detail below.

The "Core" Urban Stormwater Program

The "Core" elements of the urban nonpoint source control program include basic measures that can be implemented without further study or significant local expenditures. Adopting a community specific core program is the first step in the implementation process.

The basic elements of the "Core" program are:

- Develop, adopt and enforce a construction erosion control ordinance consistent with the "model" developed jointly by the Wisconsin League of Municipalities and the DNR. Construction erosion control practices should be consistent with the standards and specifications in the "Wisconsin Construction Site Best Management Practice Handbook."

- Develop and implement a community specific program of urban "housekeeping" practices which reduce urban nonpoint source pollution. This may include a combination of information and education efforts, adoption of ordinances regulating pet wastes or changes in the timing and scheduling of leaf collection.

- Implement an information and education program containing the elements and achieving the goals of the urban information and education strategy.

Local Responsibilities and Timing for the "Core" Program

The following is a schedule for implementing the "Core" elements of the urban nonpoint source control strategy for this priority watershed project. Communities must commit, within the first three years of the project, to implement the core program. This is a requirement to receive technical and financial assistance through the priority watershed project. This requirement applies only to the receipt of funds used directly by the municipality as a grantee, such as where the municipality installs, owns and operates a management practice. It does not apply to those instances where the municipality acts as a grantor, passing cost-share funds through to private landowners. This means that individual landowners could receive cost-share funds from the DNR for the installation of management practices prior to a municipality's agreement to conduct core elements of the urban program.

To implement the "Core" program, each municipality should:

- Identify in writing an authorized representative for the local unit of government within 30 days of the start of implementation.

- Adopt an adequate construction site ordinance, develop administrative procedures and determine staff needs to enforce a construction erosion control ordinance in cities and villages within 12 months of the start of implementation.

- Identify the roles and responsibilities of towns and counties for controlling construction erosion in unincorporated areas within six months of the start of implementation. Adopt adequate ordinances, develop administrative procedures and determine staff needs to enforce a construction erosion control ordinance in unincorporated areas within 12 months of the start of implementation.

  Nonpoint source program funding to Ozaukee and Washington County for carrying out agricultural management recommendations is not contingent upon construction site erosion control coverage for the county.

- Develop and implement a community specific program of urban "housekeeping" practices which reduce urban nonpoint source pollution. The content of the community specific program and a schedule for implementation will be negotiated by the local unit of government and the DNR within 12 months of the start of implementation.

- Prepare and submit annual work plans for staff and activities.

- Apply for local assistance grants from DNR to support "Core" activities.

- Implement an information and education strategy consistent with this plan.

- Prepare and submit to the DNR tracking reports specified in Chapter 7.

- Participate in the annual watershed project review meeting.

The "Segmented" Urban Stormwater Program

The "Segmented" elements of the urban nonpoint source program include those that require site-specific investigations prior to implementation. It is anticipated that many of these segmented elements will be implemented individually as discrete nonpoint source control practices. An example would be construction of one or more detention ponds in a given subwatershed following completion of an engineering feasibility study.

Importantly, the higher costs of implementing this portion of the urban management program will require communities to budget expenditures over the course of several years. Best management practices implemented under this portion of the program likely will include detention ponds, infiltration devices, and other structural means for reducing urban nonpoint source pollution. These elements may also include changes in street sweeping schedules and equipment when used as a stepping stone to achieving the recommended level of urban structural practices.

The detailed studies will include engineering feasibility and other site-specific investigations for existing and new development. The results will determine the best means for reducing urban nonpoint sources in a specific community by more site-specific application of the plan's recommendations.

The basic elements of the "Segmented" program are:

- Conduct detailed engineering studies to determine the best means to implement community specific nonpoint source control measures for existing urban areas. This element may also consider accelerated street sweeping during the early spring and late fall time period. Eventually, it might also include accelerated sweeping (two to four times per month) during the period from late spring through early fall. However, more information will need to be collected through demonstration/research projects on the effects of accelerated sweeping during this time period on runoff water quality.

  The detailed engineering feasibility studies should set forth the allocation of local costs between municipalities where more than one municipality contributes runoff to an urban structural practice. The allocation should result in an equitable distribution of costs based on the contribution of each municipality to the total pollutant loading or stormwater runoff volume being controlled.

  The effect of source reduction activities on the extent of urban structural practices needed to meet pollution reduction goals should be considered in conducting these studies. Some examples of source reduction activities that may be considered are presented in this plan.

- Design and install structural urban best management practices for existing urban areas with completed detailed engineering studies. (Case-by-case consideration will be given to practices outside of areas having detailed engineering studies.)

- Develop, as needed, management plans for planned urban development. These plans will identify the type and locations of structural urban BMPs.

- Adopt and enforce a comprehensive stormwater management ordinance consistent with the State "model" stormwater ordinance under preparation.

- Conduct as needed detailed financing/implementation studies which determine the means to pay for administering an urban nonpoint source control program in each municipality. These studies will be conducted on a parallel schedule with the other initial high priority elements undertaken in the segmented program.

Local Responsibilities and Timing for the "Segmented" Program

The following is a schedule for the "Segmented" elements of the urban nonpoint source control strategy for this priority watershed project. Each community wishing to participate should:

- Identify within six months of the start of implementation, the high priority segments the community wishes to pursue in existing and planned urban areas through the priority watershed project. This list can be amended throughout the eight year project period.

- Enter into local assistance and nonpoint source grants as appropriate to secure state funding support for "Segmented" activities.

- Conduct engineering feasibility studies for urban nonpoint source control practices for existing urban development. The type and manner of practice installation will be guided by these studies.

  It is anticipated that a series of such studies will be needed to address all "Segments" within a community. A community must agree to carry out recommendations of a completed feasibility study before funds for additional feasibility studies will be released.

- Prepare stormwater management studies to identify the type and location of stormwater management practices for new development.

- Adopt, administer and enforce a comprehensive stormwater management ordinance for planned urban development within 12 months of completion of an approved state "model" ordinance.

- Enter into cost-share agreements for eligible best BMPs.

  1. For practices installed and maintained by private individuals, the cost-share agreement is between the landowner and the local unit of government. The local units of government will be required to:

- Design or contract for the design of best management practices and verify proper practice installation. Involve DNR in pre-design and pre-construction conferences as required by NR 120.
- Request reimbursement from the DNR for practices installed by private landowners, and in turn reimburse those landowners for the eligible amount of cost sharing.
- Monitor landowner compliance with provisions of the cost-share agreement.

2. For practices installed and maintained by the local unit of government, the cost-share agreement is between the unit of government and the DNR. Where more than one municipality contributes runoff to a control practice, the DNR will enter into cost-share agreements consistent with an equitable allocation based on municipal contributions to the pollutant loads and stormwater volumes being controlled.

3. Practice maintenance is the responsibility of the grant recipient.

- Submit information needed for project evaluation to DNR.

In some situations, private landowners will install BMPs on their property. As such, landowners can be important participants in the urban implementation strategy. Eligible land owners will participate in the project by signing cost-share agreements with local units of government.

Communities can implement the segmented elements of the urban management strategy any time following development and initial implementation of the "Core" program. However, cost sharing will be limited to those elements of the segmented program completed within the eight year implementation period.

State Funding for Best Management Practice (BMPs)

BMPs Eligible for Cost-Sharing and their Rates

Best management practices are those practices identified in NR 120 determined in this watershed plan to be the most effective in reducing nonpoint sources of pollution. Eligible practices and cost-share rates are shown in Table 6-10. Short definitions for structural urban practices and street sweeping are presented below. A more detailed discussion of these practices is presented in Chapter 5, as well as in NR 120.14.

- Structural Urban Practices - Measures such as constructed infiltration areas, infiltration trenches, detention basins and porous pavement designed to control runoff rate or volume as a means to reduce the amount of pollutants carried in runoff or to reduce the water resource impacts of excessive flows.

- Accelerated Street Sweeping - Use of brush or vacuum style sweepers to remove leaf litter and accumulated pollutants from street surfaces on an accelerated schedule.

Accelerated street sweeping (several passes for each curb mile) is recommended as early in the spring as possible to collect the debris, sediment and associated pollutants generated during the winter months. Accelerated sweeping is also recommended during the fall to remove leaves. The effectiveness of accelerated sweeping in residential areas during other times of the year is not cost-effective, but the effectiveness for commercial and industrial areas is less well understood.

Design Criteria and Performance Standards for Urban Practices

Design and installation of the best management practices must meet the conditions listed in NR 120. Practice standards and specifications for critical area stabilization, grade stabilization structures, shoreline and streambank stabilization, shoreline buffers and wetland restoration can be found in NR 120 and the "U.S. Soil Conservation Service Field Office Technical Guide".

NR 120.14(22) requires that the DNR participate in the process of selecting urban structural BMPs for site-specific application. The DNR role includes participation in a pre-design process, reviewing preliminary practice designs, and review and approve final practice designs. The guidelines in this section are presented to facilitate the urban practice design, review and approval phases that are required before controls can be installed and cost-shared through the nonpoint source program.

The following preliminary standards should be used to guide the design of individual practices. These preliminary standards will be superseded by standards developed as part of the model ordinance for stormwater, which the DNR is preparing.

- Wet detention ponds in existing and planned urban areas should be designed to control 90 percent of the incoming suspended sediment load. This will be achieved by trapping the 5 micron particle size. This will provide approximately 70 percent control of the annual lead load from lands tributary to the pond. Where retro-fitted, ponds should be located to control runoff primarily from the critical land uses. Where planned as part of new development, ponds should be located to control runoff from all land uses.

- Wet detention ponds in existing urban areas should contribute to reducing stream velocities to speeds that do not erode banks or scour habitat.

- Wet detention ponds in planned urban areas should maintain peak flows for the 2-year, 24-hour storm at pre-development levels.

- Infiltration devices in existing and planned urban areas should infiltrate all runoff from the one-inch storm. Infiltration basins and grassed swales are most effective, since they control runoff from all impervious surfaces (roofs, streets, parking lots) in the contributing area. If infiltration trenches are used that control selected impervious surfaces, such as parking lots and rooftops only, control efficiency drops

significantly since street runoff remains uncontrolled. Where retro-fitted, these devices should be located to control runoff primarily from the critical land uses. Where planned as part of new development, ponds should be located to control runoff from all land uses. In locating practices, infiltration rates should be carefully considered as these are prime determinants of the pollution control efficiency for infiltration practices, particularly in non-residential areas.

It is important to note the inclusion of pretreatment and groundwater monitoring in the practice design for infiltration devices. Providing pretreatment for these devices will greatly reduce required maintenance to reduce clogging and restore infiltration. Pretreatment could include a sediment trap, a wet detention pond, a grass filter strip or street sweeping. Selected practices should be equipped with groundwater monitoring wells to assure that groundwater contamination remains within acceptable bounds.

Finally, all detention and infiltration urban structural practices should be equipped with signs that clearly identify that the site contains urban stormwater pollutants. Such signs should also carry warnings, where appropriate, against using stormwater practices in ways which could endanger public health. Wet detention ponds should not be used for consumptive fishing, swimming or wading. Infiltration basins might pose a hazard if used during dry periods as open recreational space, due to possible suspension of contaminated dust.

- Infiltration devices in existing urban areas should contribute to reducing stream velocities to speeds that do not erode banks or scour habitat.

- Infiltration devices in planned urban areas should maintain peak flows for the 2-year, 24-hour storm at pre-development levels.

Appendices D,E and F provide additional guidance. Appendix D provides information concerning the use of infiltration devices in urban areas and steps that should be taken to protect groundwater quality. Appendix E presents preliminary design criteria for infiltration and wet detention practices. Appendix F provides some general recommendations concerning street sweeping in urban areas.

Using Easements To Support Urban Pollution Control Practices

Easements may be used to support wetland restoration, critical area stabilization and shoreline buffers in urban areas in order to reduce the water quality impacts of stormwater runoff. Use of these practices as stormwater runoff control measures, and the use of easements to support these practices, must be reviewed on a case-by-case basis by the DNR. The same general rules set forth for the use of easements in rural areas also apply to urban stream reaches.

Funding For Local Staff Assistance

Table 6-11 shows the types of local management activities that are supported by the state. The state funds these activities through local assistance grants. These grant funds may be used to support additional staff hired or contracted for by local units of government. Support for most activities is cost-shared at nearly 100 percent, since local governments cover only certain staff support costs. However, support for local staff to administer and enforce local ordinances is only meant to augment funds collected through local permit fees. State support will only be made available to provide that portion of the staff costs remaining after the use of permit fees. In many cases, ordinance administration and enforcement programs will be self-supporting.

Table 6-10. State Cost-share Rates for Urban Management Practices

BEST MANAGEMENT PRACTICE	STATE Cost-share RATE
Critical Area Stabilization	70%[1]
Grade Stabilization Structures	70%
Shoreline and Streambank Stabilization	70%
Shoreline Buffers	70%[1]
Wetland Restoration	70%[1]
Structural Urban Practices	70%[2, 3]
Street Sweeping	50%[2, 4]

1 Easements may be used in conjunction with these practices.

2 Applies only to practices to control pollutants from existing urban surfaces. Existing urban surfaces are considered to be those in existence prior to the date the DNR approves this watershed plan. Eligible land uses include commercial, industrial, multi-family and freeway lands identified in this plan. Modifications to existing ponds to control runoff from medium density residential areas in the city of Cedarburg may also be eligible.

3 Cost-share grants up to 50% can be made for associated costs including land acquisition, storm sewer re-routing and structure removal.

4 This is an alternative best management practice not listed in NR 120, of the Wisconsin Administrative Code. See Appendix F for more information.

Source: Wisconsin Department of Natural Resources.

Activities and Sources of Pollution Not Eligible for State Funding Assistance

Priority watershed cost-share funds cannot be used to control sources of pollution and land management activities specifically excluded in NR 120.10 and NR 120.17. The following is a partial list of ineligible activities most often inquired about for cost-sharing in urban areas.

- Operation and maintenance of cost-shared best management practices (BMPs).
- Construction erosion control practices.
- Structural BMPs for new urban development. New urban development is defined as that for which construction activity commences after the DNR approves this plan.
- BMPs installed prior to signing cost-share agreement.
- Most activities covered under the Wisconsin Pollution Discharge Elimination System (WPDES) Program.
- On-site septic system controls or maintenance.
- Dredging activities.
- Activities and structures intended primarily for flood control.
- Base levels of street sweeping (Will be defined on a case-by-case basis).

Urban Budget

The budgets for various components of the urban management program are presented in Tables 6-12 through 6-14, and summarized for the watershed in Table 6-15. It is assumed that most of the work associated with activities in Tables 6-12 through 6-14 will be contracted out to private consulting engineers. The consulting fees are included as part of the budget estimates.

Local units of government will probably need to hire additional municipal staff for certain activities, however. These are anticipated to include local ordinance administration and enforcement, overall project management and information & education. The local staffing needs are not included in Tables 6-12 through 6-14, but are included in Table 6-15. Additional information and education staffing and budget needs for urban areas are included in Tables 6-16 and 6-17.

Activities For Existing Urban Areas

Table 6-12 shows the cost of preparing detailed engineering feasibility studies that will be needed before practices are designed and installed to control runoff from existing urban areas. These studies are projected to cost $38,000 to $180,000 in the Cedarburg Study Area and $13,000 to $45,000 in the Jackson Study Area. No estimates are available for feasibility studies that may be needed in association with the stormwater problems around Big and Little Cedar Lakes. It is expected that DNR will pay for most of these costs.

Table 6-11. Urban Implementation Strategy Measures Eligible for State Funding Under Local Assistance Grants

ACTIVITY		SUPPORT RATE
Development of Construction Erosion Control Ordinances		100%
Development of Stormwater Management Ordinances		100%
Engineering Studies for Existing Urban Areas; Stormwater Planning Studies for Planned Urban Areas		100%[1]
Design and Engineering for Structural Best Management Practices to Control Existing Critical Land Uses		100%
Staff for Enforcing Construction Erosion and Stormwater Management Ordinances		100%[2,3]
Additional Staff Needed for Accelerated Street Sweeping		100% [4]
Development of Alternative Financing and Administration Strategies		100%
Information & Education Activities		100%

1 Funding not available for components dealing exclusively with drainage and flooding.
2 Funding limited to five years. Level of staffing based on a work plan submitted by local units of government and approved by the DNR.
3 DNR covers only that portion of the local staff support that cannot be met through local permit fees.
4 State cost-share rates for street sweeping will be negotiated on a case-by-case basis. Grants for accelerated on critical land uses sweeping during the late spring to early fall period may be limited to demonstration and research projects.

Source: Wisconsin DNR

Table 6-12. Estimated cost of preparing detailed engineering feasibility studies for existing urban areas in the Cedar Creek Watershed[1]

Community	Planning Needs (acs)[2]	Estimated Cost[3]
CEDARBURG STUDY AREA		
C. of Cedarburg	270 to 1,500	$27,000 to $150,000
C. of Mequon	None	None
V. of Grafton	50 to 240	$5,000 to $24,000
Tn. of Cedarburg	60	$6,000
Tn. of Grafton	None	None
Study Area Subtotal	380 to 1,800	$38,000 to $180,000
JACKSON STUDY AREA		
V. of Jackson	110 to 320	$11,000 to $32,000
Tn. of Jackson	10 to 70	$1,000 to $7,000
Tn. of Polk	10 to 60	$1,000 to $6,000
Study Area Subtotal:	130 to 450	$13,000 to $45,000
WATERSHED TOTAL	510 to 2,250	$51,000 to $225,000

1 Most of the cost for preparing feasibility studies will be borne by the state.
2 Low end of range includes critical urban land uses only; high end of range includes all urban land uses.
3 Estimated cost of feasibility studies is $100/acre.

Source: Wisconsin Department of Natural Resources.

Table 6-13. Cost of implementing wet detention recommendations in existing urban areas of the Cedar Creek Watershed[1]

Community	Total Cost[2]	State Share[3]	Local Share[4]
CEDARBURG STUDY AREA			
C. of Cedarburg	$1,840,000	$1,040,000	$800,000
C. of Mequon	$0	$0	$0
V. of Grafton	$320,000	$180,000	$140,000
Tn. of Cedarburg	$440,000	$250,000	$190,000
Tn. of Grafton	$0	$0	$0
Study Area Subtotal	$2,600,000	$1,470,000	$1,130,000
JACKSON STUDY AREA			
V. of Jackson	$800,000	$452,000	$348,000
Tn. of Jackson	$40,000	$23,000	$17,000
Tn. of Polk	$80,000	$45,000	$35,000
Study Area Subtotal:	$920,000	$520,000	$400,000
WATERSHED TOTAL	$3,520,000	$1,990,000	$1,530,000

1 Assumes practices for 100% of the critical urban land uses. Practice quantities are listed in Table 5-14.

2 Detention pond costs include: (a) capital expenses of pond excavation and development, (b) cost of storm sewer re-routing, (c) cost of land purchase, and cost of relocating businesses or homes, and (d) engineering. Table uses $400,000 per acre of pond. Cost assumes extensive storm sewer rerouting but no relocation of existing structures. Cost could rise to $800,000/acre if relocating existing structures such as businesses or homes is required. Where inexpensive open space is available that requires no re-routing of storm sewers, cost per acre of pond could be as low at $100,000.

3 Includes 70% of capital costs for pond excavation and pond development, 50% of land purchase and storm sewer re-routing, and 100% of design costs.

4 Does not include local operation and maintenance, estimated at $2,000 per surface acre per year.

Source: Wisconsin Department of Natural Resources.

Table 6-13 presents cost information for installing wet detention ponds in existing urban areas. The cost information assumes 100 percent detention of commercial, industrial and multi-family residential land uses. It does not include any estimates for making modifications to existing pond structures in the city of Cedarburg. The estimated cost of detailed engineering design and practice installation is $2.6 million for the Cedarburg Study Area and $.92 million for the Jackson Study Area. The state share under existing cost-share policy is about 57 percent, whereas the local share to be contributed by individual landowners and municipal governments is the remaining 43 percent. No estimates have been made for possible structures around Big and Little Cedar Lakes.

The total cost for installing these ponds in densely urbanized areas such as the city of Milwaukee ranges from $400,000 to $800,000 per surface acre of pond, depending on the need to condemn and relocate existing structures such as homes or businesses. The lower cost assumes open land is available for purchase, but that extensive rerouting of the storm sewer system is required. The upper end of the cost range assumes that land is completely developed, and condemnation of businesses or homes would be required. Both figures assume the cost of pond excavation and development, such as pond inlet and outlet structures and pond landscaping, costs about $70,000 per acre. In the Cedar Creek Watershed, an average figure of $400,000 per surface acre of pond is used. In cases where open land is available and storm sewer re-routing is not needed, the cost per acre would drop significantly.

Under all scenarios, the state share of the cost includes 70 percent of the cost for pond excavation and development and 100 percent of the design costs. This equal about $52,500 of state assistance per surface acre of detention pond. In addition, the DNR covers up to 50 percent of the costs for land purchase, storm sewer re-routing and building removal. Annual operation and maintenance are not eligible for cost sharing under the existing rules governing the state nonpoint source program. It should also be noted that about one-third to one-half of the estimated cost is expected to be associated with industrial development, which would probably be paid for by industries complying with permits being issued under the Federal Stormwater Permit Program.

Activities For Planned Urban Areas

Table 6-14 presents the cost of implementing the recommendations for planned urban areas. These costs are presented for study areas only, since projections of urban growth were not made by municipality. Stormwater planning costs are anticipated to be $60,000 for the Cedarburg Study Area and $30,000 for the Jackson Study Area. This cost would be borne primarily by DNR.

The cost of installing urban structural practices such as wet detention in areas of new development should be greatly reduced since proper planning can assure that land is set aside and stormwater practices are located in harmony with the conveyance systems. An estimated $.88 million will be required to install wet detention in the planned urban areas for the Cedarburg Study Area; $.72 million would be required for the Jackson Study Area. Land costs are additional. The entire cost of practice design and installation would be borne locally, as nonpoint source program funds are not used for practices in areas of new development. It is important to note that 20 percent-30 percent of this cost is designated for industrial land development, which may be controlled through the Federal Stormwater Permit Program. In addition, about 35 percent of the detention cost is associated with low intensity (low density residential, parks, institutional) land uses and can probably be sized down or eliminated through the use of grassed swales.

The cost of controlling construction site erosion is not included in these tables but would probably cost about $250 per acre for practice design and installation. This amounts to $250,000 for the Cedarburg Study Area and $120,000 for the Jackson Study Area. This cost would be paid locally by developers.

Table 6-14. Cost of implementing urban practices in planned urban areas in the Cedar Creek Watershed[1]

Study Area	Estimated Cost of Stormwater Planning[2]	Estimated Capital Cost of Detention	Where Urbanization is Anticipated[3]
Cedarburg	$64,000	$880,000	C. of Cedarburg
			C. of Mequon
			V. of Grafton
			Tn. of Cedarburg
			Tn. of Grafton
Jackson	$30,000	$720,000	V. of Jackson
			Tn. of Jackson
			Tn. of Polk
Watershed Total	$94,000	$1,600,000	

1 Based on recommendations presented in Table 5-15. Does not include construction site erosion control costs.
2 Planning costs are estimated to be $60/acre planned. State covers 100% of planning cost.
3 State cost-share assistance is not available through the Nonpoint Source Program for urban practices to control runoff from new development. Figures based on capital cost of $70,000 per acre of wet pond surface. Figure does not include cost of land or operation and maintenance.

Source: Wisconsin Department of Natural Resources.

Alternative Funding Sources

This plan recognizes that additional funding through new initiatives must be provided to improve full program implementation.

A substantial portion of the estimated costs of implementing this plan's urban management recommendations is for the construction of stormwater management practices in existing urban areas to control pollutants generated by a wide variety of activities.

This plan endorses continuing investigation into source control alternatives as well as development of alternatives for internalizing local pollution control costs. Alternatives such as the creation of local utility districts to finance the local share of these estimated costs should be investigated by respective municipalities. The DNR will help finance studies through the priority watershed program.

Summary of Project Costs

Table 6-15 summarizes the total cost of implementing the Cedar Creek Priority Watershed Project if 100 percent of the need is met. The total project cost is estimated to be $9.1 million. About $3.4 million, or 37 percent of the total cost, is needed for rural nonpoint source control. About $5.7 million, or 63 percent of the total cost, is needed for urban nonpoint source control. Overall, $4.7 million, or 52 percent of this need, would be provided by the state under existing cost-share policies and $4.4 million, or 48 percent of this need, would be provided locally.

The overall state support rate for rural areas is about 74 percent. In rural areas, individual landowners will provide the remaining match for the state funds. This match will be almost entirely for the installation of BMPs on private property.

The overall state support rate for existing urban areas is about 58 percent. In urban areas, the local share of the project costs will be provided in part by individual landowners and in part by municipal governments. The overall state support rate for planned and developing urban areas is about 5 percent. The local share of the project cost in these areas is expected to be paid for primarily by individual landowners and developers.

Information and Education Strategy

Purpose and Perspectives

The primary purpose of the information and education (I&E) strategy for the Cedar Creek Priority Watershed is to enhance implementation of watershed plan objectives. To achieve the most impact with available funds, educational program planning was viewed from several perspectives:

- Key audiences capable of having the greatest impact on the resource because they own, manage or help govern critical lands.
- Key messages from the watershed project that need to be relayed.
- Potential uses of activities such as providing information, promoting participation and instruction on specific practices.
- Opportunities for combining public and private efforts.
- Critical timelines associated with phases in the watershed project.
- Educational approaches that are most effective for given purposes.

Table 6-15. Estimated total cost of implementing the Cedar Creek Priority Watershed Project[1]

	Project Element	Total Cost	State Share	Local Share
	AGRICULTURAL AREAS			
1.	BMPs	$2,465,000	$1,590,000	$875,000
2.	Easement Purchases	$200,000	$200,000	$0
3.	LCD Staff Support	$714,000	$705,000	$9,000
	Subtotal	$3,379,000	$2,495,000	$884,000
	DEVELOPING URBAN AREAS			
4.	Construction Site BMPs	$370,000	$0	$370,000
5.	Ordinance Administration	[2]		
	Subtotal	$370,000	$0	$370,000
	PLANNED URBAN AREAS			
6.	Stormwater management Plans	$94,000	$94,000	$0
7.	Stormwater Management BMPs	$1,600,000	$0	$1,600,000
	Subtotal	$1,694,000	$94,000	$1,600,000
	EXISTING URBAN AREAS			
8.	Feasibility Studies	$138,000	$138,000	$0
9.	Structural BMPs (Detention)	$3,520,000	$1,990,000	$1,530,000
10.	Accelerated Street Sweeping	[2]	[3]	[3]
	Subtotal	$3,658,000	$2,128,000	$1,530,000
	INFORMATION AND EDUCATION[4]			
11.	Rural Staffing			
12.	Rural Direct Costs			
13.	Urban Staffing			
14.	Urban Direct Costs			
	Subtotal			
	WATERSHED TOTAL COST	$9,101,000	$4,717,000	$4,384,000

1 Costs are those needed to make 100% of the nonpoint source control needs.
2 No estimate of need has been made.
3 State and local shares will be negotiated with each community if needs are identified.
4 Regional UWEX Water Quality Agent and UWEX Urban Educator time and direct costs are accounted for elsewhere.

The resulting educational strategy includes recommendations for both general and specifically targeted activities. It recognizes that certain targeted audiences hold the key to actions that can produce the most immediate and substantial improvements in water resources, for example, those with large land holdings or management authority. At the same time, the plan acknowledges that educational activities designed for general audiences are important. This is a recognition that numerous encounters with information are often required to motivate positive action. The general activities also address public "right-to-know" and "momentum-building" objectives. Even so, targeting of audiences and refinement of messages will occur to the greatest degree possible to maximize both cost efficiency and program impact.

Key Audiences and Outcomes

Ideally, the watershed project would be able to reach all key audiences throughout project implementation. However, the realities of limited staff and resources require prioritizing activities for each stage of the project.

Key Audience Groups

Over the duration of the project, key audiences include:

1. Those who must act.
   Business and industry
   Local elected and appointed officials
   Rural landowners and operators (farmers)
   Urban homeowners/residents

2. Those who can support change.
   Agricultural organizations
   Civic and service groups
   Concerned citizens
   Conservation and environmental groups
   Fishing, boating and other water resource user groups

3. Future actors and supporters.
   Youth
   Teachers and youth leaders
   General public

Desired Outcomes

For the sign-up period, audiences will be addressed according to the following desired outcomes (in order of priority):

1. Watershed project participation, primarily:

a. Cost-sharing agreements with local governments or rural landowners;
b. Community action through regulation of nonpoint source pollution (ordinances) or proper management (public works programs).

2. Widespread individual action on a voluntary basis without a cost-share agreement including urban residents using good "housekeeping" practices and certain rural landowners using nutrient and pesticide best management practices.

3. Using other state and federal conservation programs to achieve water quality objectives which complement the Nonpoint Source Program.

4. Support of the watershed project through understanding, acceptance and advocacy of its goals.

5. Increased awareness of the project and its accomplishments.

More than one of these outcomes may apply to an activity and audiences may overlap. Also, priorities will change as the project moves beyond sign-up through implementation to evaluation.

Factors Affecting the I&E Strategy

Urban Area Considerations

In the municipalities, the I&E strategy generally needs to consider the issues of new development, pollution prevention and other water quality problems including PCB contamination and the existence of dams.

Village of Jackson. In Jackson, an important factor affecting watershed I&E will be the lack of a strong identity with Cedar Creek or any of its tributaries. Possibly the most visible highway crossing is west of the village, where the creek is still relatively obscure. More prominent is the small lake with swimming facilities near the village's western fringe. Educational activities noting this as a resource worth protecting could precede the transition to Cedar Creek discussions.

Jackson has been experiencing rapid growth since the recent conversion of state Trunk Highway 45 to freeway. Thus, growth management relating to water quality namely pollution prevention via construction erosion controls is the most important thematic consideration for I&E.

City of Cedarburg. Cedarburg has a relatively strong identity with Cedar Creek due to historic mill sites, tourism emphasis and a large park on the Creek. Due to impoundments and the collection of tributaries downstream from Jackson, the Creek has also become of size

sufficient to be noticed, if not fully appreciated. The overwhelming water quality issue here with associated interest is the PCB contamination from past industrial discharges. The numerous dams may also be an issue, but cannot effectively be addressed until the PCB issue is resolved.

As with Jackson, controlling pollution from new development is the major nonpoint source pollution issue with program changes related to street sweeping possibly being important in the higher density existing development. The visibility brought by PCBs, the historic mills, and community events along the creek could, from an I&E perspective, help elevate the importance of clean water. The effectiveness of instituting local government, homeowner and citizen group abatement of nonpoint pollution sources should thereby be enhanced.

Village of Grafton. Grafton, like Cedarburg, has a relatively strong water resource identity, though oriented around the Milwaukee River South rather than Cedar Creek. Nevertheless, an encompassing Milwaukee River Program should distribute benefits proportionately to Cedar Creek particularly where communitywide efforts like construction erosion controls are concerned. The need for the latter, with attendant I&E, is as important for Grafton as it is for Jackson and Cedarburg. Growth management compatible with water quality is thus the "bigger picture" concern. Additionally, quality redevelopment possibly in conjunction with riverwalk work along the Milwaukee River would help call attention to the need for nonpoint controls. Because of all the above, it is not recommended that improvements to the Cedar Creek watershed be highlighted in Grafton I&E activities separate from those that will also benefit the Milwaukee River. This would possibly confuse rather than clarify what is being done and why.

Summary of Specific Urban Themes. For urban areas in the Cedar Creek watershed, the following six themes will help govern I&E:

1. Environmentally sound growth, land use planning and the water-air quality interface (as related to transportation, for example).

2. Better construction erosion control.

3. Community acceptance of stormwater ponds/infiltration, especially in new development.

4. Citizen participation in home practices that will reduce pollution including improved leaf collection, expanded street sweeping, waste oil recycling, etc.

5. Changes in home practices that will reduce pollution including proper yard chemical use, composting and pet waste cleanup.

6. Coordination of the Nonpoint Program with PCB remediation, dam evaluation, park-riverwalk development and fisheries improvement.

Rural Area Considerations

Despite proximity to the Milwaukee Metropolitan area, the Cedar Creek watershed remains primarily rural. In part this is a reflection of, until recently, the trend toward concentration of development in the southeastern portion of the watershed associated with Cedarburg-Grafton, with lesser concentrations in the village of Jackson and somewhat around Big and Little Cedar Lakes. Nevertheless, agricultural stability and rural land use integrity via the dairy industry haven given way in recent decades to changing farming patterns, decentralized development and accompanying water quality problems. These affect the type of I&E strategy necessary to implement the Priority Watershed Plan.

Changing Agricultural Conditions. More intensive use of agricultural land has occurred in part because of the pressures to maximize per acre profitability in the face of higher real estate taxes following urban sprawl and in part because of changing agricultural technologies. Increased soil erosion and other types of nonpoint source pollution have resulted as cover crops have given way to row crops. Agri-chemicals have come into more widespread use, fencerows have been removed to form larger fields, and leasing of agricultural land has become widespread.

These all favor nonstructural nonpoint control practices (i.e. conservation tillage and nutrient and pest management with strong educational components). Many of the eroding fields at least in Washington County could be addressed by using contour strip-cropping. However, there are fewer livestock operations in certain areas to utilize the strips of cover crops (principally alfalfa). Canning company crops and farm-to-market fruit and vegetable operations also are becoming more common.

Significant Wetland Areas. For approximately the eastern two-thirds of the watershed, Cedar Creek and its tributaries are rather low-gradient streams. Many are bordered by wetlands, suffer from past channelization or traverse drained wetlands. From an I&E perspective, there may be receptivity to promoting set-aside riparian lands considered by some as "wasteland." With good potential for fish and wildlife improvements and enhanced recreation joining better water quality, the use of watershed program easements may be viable. The federal Conservation Reserve Program and Wisconsin Stewardship Program offer similar opportunities. From a 1986 I&E survey of rural landowners throughout the Milwaukee River Basin, the receptivity to such creek corridor options was more favorable than traditional practices.

Vast wetland areas in the watershed are presently in state ownership. Notably these include the Jackson Marsh in Washington County and Cedarburg Bog Scientific Area in Ozaukee County. Their water quality and multiple use benefits can be cited as goals toward which other reserve efforts are oriented.

Major Lakes. With 19 named lakes and ponds in the watershed having a combined surface area of 1,600 acres, major audiences of lake users and property owners will be important in the I&E program. In fact, Mud Lake (in Cedarburg Bog), Big Cedar Lake and Little Cedar Lake together comprise 40 percent of the lake acreage in the entire Milwaukee River Basin.

It is important that many of the educational materials of particular interest to lake-related audiences are also compatible with environmentally sound decision making at home generally (e.g., Yard Care and the Environment Series).

Active and Influential Organizations. An advantage inherent in the Cedar Creek watershed I&E strategy is the existence of key organizations. Perhaps most notable is the Cedar Creek Restoration Council, Inc., which has undertaken improvement and organizational (including recreation) events on its own since 1964.

Other important organizations are the Inland Lake Protection and Rehabilitation District and Property Owners Associations existing for Big and Little Cedar Lakes. These groups are able to undertake efforts and effect improvements in ways that the Priority Watershed Program cannot. One such emphasis relates to onsite septic tank systems. Coordinated I&E activities will be with the above and other organizations to avoid duplication and maximize accomplishment.

Finally, the schools cannot be overlooked as an existing organizational framework for I&E. With youth becoming future decision makers and influencing priority landowners today, the "Testing the Waters" Program should be expanded to high schools in Jackson and possibly Slinger (already functioning in the more urban Grafton and Cedarburg Districts).

Summary of Specific Rural Themes. For rural areas in the Cedar Creek watershed, the following themes will help govern I&E:

- Environmentally sound growth with the Milwaukee Metropolitan area.
- Changing character of the rural area with availability of certain agricultural practices best suited to those changes.
- Significant wetlands and stream corridors which may be eligible for restoration and protection via various "set aside" alternatives.
- Educational opportunities available with the major lakes and associated audiences, including proper "housekeeping" practices.
- Active and influential organizations in the watershed predating this project with which partnerships can be established.
- Continued and expanded youth education, including some of the more rural high schools in the Milwaukee River Basin.

Effective Methods to Reach Key Audiences

Educational Methods

The educational methods selected to reach key audiences in this watershed are methods used, to varying degrees, in other watersheds around the State:

- One-to-one contacts with a folder of materials tailored to each
- Watershed newsletters
- Demonstration projects and field days
- Watershed or basinwide tours
- Town and municipal meetings
- Agricultural practices meetings
- Workshops on construction erosion control and stormwater management
- Fact sheets on recommended practices
- Targeted mailings, particularly to priority landowners and local officials
- Local radio talk shows and news programs
- Articles in local newspapers
- Presentations to various organizations
- Development and use of audio-visual materials including slide programs and videos
- Exhibits at county fairs and local events, especially those relating to water
- Development and use of promotional materials including signs
- Youth group projects

Activity Types

Table 6-15 indicates the different types of information and education activities included in the educational strategy. They generally fit one or more of the following classifications:

- Activities that educate regarding resource conditions, management objectives and recommended plan options (the existing situation and what the program seeks to do).

- Activities designed to motivate individuals and groups to action, often by sharing problems under their control.

- Activities that provide instruction on how to take appropriate action, focusing on available best management practices.

- Activities that develop an understanding of how the priority watershed project works (describing steps involved in sign-up, timelines, etc.)

- Activities that share progress, to reinforce awareness and perhaps motivate by positive example.

- Activities that promote project visibility and the need for clean water in general.

There is no mutual exclusiveness among the above. In fact, some activities such as tours may accomplish most or all use classifications simultaneously. More often, however, there will be a more limited focus. Only brief background during an activity may then be given to accomplishing related things like problem awareness, for example, if it has been widely established addressed previously.

Educational Project Workload

During the sign-up period under the watershed project, there is a clear need to establish cost-share agreements with as many eligible individuals and communities as possible (ordinance development and housekeeping practices can be pursued after this period ends, as well as during it). In order to accomplish this, county staff must be available to make the necessary contacts and then commit to the necessary follow-through. These one-on-one contacts illustrate a most fundamental type of education. However, they are considered a part of the technical implementation process and are budgeted for elsewhere. Key educational materials, which will make this process more effective, are covered here.

The information and education strategy tables reflect somewhat a division of educational workload associated with the changing character of the watershed west to east roughly progressing from rural to urban, from central Washington County to central Ozaukee County. Most of the I&E related to lake groups, higher quality streams and "traditional" farm practices would take place in Washington County; most of the I&E related to urban practices would take place in Ozaukee County. Both also have small communities, very significant wetland areas and problems with urban sprawl.

Educational Strategy

The initial years of educational activity within the Cedar Creek watershed will be the most ambitious because the groundwork for a successful and extensive program needs to be laid. Therefore, activities for the first three years the sign-up period for cost sharing are set forth in greater detail in Tables 6-16 and 6-17 (Appendices H and H-A describe the activities). The tables indicate the need for approximately 900 hours and $8,000 per year to support information and education activities for the watershed project during the sign-up period.

Some general information for the remaining years of the watershed project is included in Appendices G through H-A, but most details will be filled in during the updating process. The educational strategy will thus be updated regularly-possibly on an annual basis. The first update will rank among the most important due to insights gained during the initial period of project sign-up and implementation. Updates more often than not will be reflected in memoranda and agency plans of work rather than a republished segment of this plan.