Physical Setting

Climate and Precipitation

The Arrowhead River, Rat River and Daggets Creek watershed lies in the continental climate zone which characteristically has short spring and autumn seasons, mild humid summers, and long, cold, snowy winters. The annual growing season averages about 148 days. Average annual precipitation in the watershed, including snowfall, is 28 inches. Approximately 55% of the precipitation occurs from May through September. Runoff averages about nine inches per year.

Topography

For the most part the watershed is nearly level or gently sloping, with a large percentage of it having slopes less than 6%. General drainage patterns in the watershed are to the southwest toward the lakes.

Soils and Geology

The limestone and sandstone bedrock formations in the watershed are covered by glacial drift. Bedrock consists mainly of Cambrian Sandstone, Prairie du Chien Dolomite, and Platteville, Decorah, and Galena Dolomite.

The main soils of the watershed are the Kewaunee, Manawa, and Hortonville soil series. These soils are well drained to somewhat poorly drained. They are nearly level to sloping and have a loamy or clayey subsoil underlain by loamy or clayey glacial till. These soils are mainly used for corn, alfalfa, oats, and winter wheat. Seasonal wetness, poor tilth, water and wind erosion are the main crop management concerns.

Zittau and Poy soils make up much of the remaining portion of the watershed. These soils are somewhat poorly and poorly drained so wetness and poor tilth are the main crop management concerns. Drainage is needed for dependable crop production on these two soil types.

Water Resources

Streams

There are three major stream systems within the watershed: Arrowhead River, Rat River, and Daggets Creek (see map of watershed). Approximately 143 miles of perennial and intermittent streams drain the watershed, providing some recreational opportunities for hunters, trappers, anglers, and canoeists. The main stems of these streams account for 39 miles, while the unnamed intermittent streams and ditches make up the remaining 104 miles.

The Arrowhead River is a turbid, hard water stream tributary to Lake Winneconne. Silt is the major bottom material with a few areas covered by detritus. In-stream cover is provided by logs, trees, and aquatic vegetation. Adjacent land uses are primarily agricultural; however, some grassland and woodland areas are present. The lower portion of the stream is, in reality, a bayou off Lake Winneconne which contains a fishery similar to that of the lake. The upper portion has been ditched to a large extent and contains a forage fish population.

Daggets Creek is a turbid, hard water stream tributary to Lake Butte des Morts. The lower portion contains a fishery that is essentially the same as Lake Butte des Morts while the upper portion has a forage fish population. Stream characteristics are very similar to those of the Arrowhead River.

The Rat River is a medium brown, hard water stream that enters the Wolf River just above Lake Poygan. Silt is the predominant bottom material. The lower portion of the river supports a fishery similar to the Wolf River while the remainder of the stream contains a marginal sport fishery. About three and one-half miles of the stream lie within the Rat River State Wildlife Area. Due to the shifting of floating bogs, a blockage of normal water flow has occurred on the Upper Rat River causing large areas of stagnant marsh to develop.

Desirable aquatic vegetation is common to abundant in all three streams with bulrush, American Lotus, white water lily, coontail, wild rice, arrowhead, reed canary grass, and filamentous algae the most prevalent. Cattails have significantly encroached into the system resulting in a loss of plant diversity in many areas. Purple loosestrife is also beginning to get a foothold in the area with projected results also devastating to plant diversity.

Lakes

The shorelines of three lakes, Winneconne, Poygan, and Butte des Morts, form the southern boundary of the watershed. These lakes, along with Lake Winnebago, make up the Winnebago Pool, one of Wisconsin's most significant water resources. The Winnebago Pool comprises 17% of the State's surface water acreage. The lakes average 7 feet in depth, and receive water from the Fox and Wolf River drainage basins, some 6000 square miles. Water levels of the lakes are controlled by dams located at each of the two outlets of Lake

Winnebago at Neenah and Menasha. These dams date back to the 1850's, and raised the water levels of the lakes 2.5 to 3 feet to form the Winnebago Pool.

Aquatic habitat changes have occurred over the last 100 years as a result of impoundment, point and nonpoint source pollution, water level management strategies, and other factors. The most significant change was the loss of vast areas of floating bogs and rooted aquatic vegetation which has drastically affected the quality of fish and wildlife habitat. Currently, poor water clarity due to suspended sediments and algae is the greatest factor limiting the growth of desirable aquatic vegetation. Some fish populations, such as walleye, sauger, and lake sturgeon have continued to maintain relatively stable numbers despite deterioration of the pool lakes water quality and habitat. Important game fish species such as northern pike, largemouth bass, panfish, and muskellunge have experienced significant reductions in numbers. Others like sheepshead, white bass and gizzard shad have thrived as a result of the changed conditions.

Wetlands

There are a number of large wetland areas within the watershed. The Rat River State Wildlife Area accounts for much of the wetland acreage. Other large wetland complexes include the Dale Swamp, the Clark's Bay marsh, and the Arrowhead River marsh. Significant loss of wetlands have occurred over the past 100 years as a result of drainage practices to create more cropland. These areas are normally located on the Zittau - Poy soil types and easily lend themselves to wetland restoration projects.

Wetlands serve an important role as groundwater recharge and discharge areas, spawning, rearing, and over-wintering areas for fish and wildlife, flood water storage, and removal and retention of sediment and nutrients contained in upland runoff.

Groundwater

There is presently an abundant supply of groundwater in the watershed. Three aquifer systems supply groundwater to watershed residents; the Upper Cambrian Sandstone aquifer, the Platteville, Decorah, Galena aquifer, and the water table aquifer. The Upper Cambrian Sandstone aquifer is the thickest and most extensive and supplies the largest volume of water. The Platteville, Decorah, Galena aquifer does not supply water as readily as the underlying sandstone, but it is capable of supplying adequate amounts of water to private systems. The water table aquifer is composed of glacial sediments from four different glacial advances. This aquifer also supplies an adequate amount of water for private water systems.

Table 2-1. Arrowhead River, Rat River, Daggets Creek Well Monitoring Results: Nitrates

Subwatershed	# of Samples	Nitrate Analysis Results					
		Samples 2.0 - 9.9 mg/L		Samples >10.0 mg/L		Ave.	Max.
		#	%	#	%	(mg/L)	(mg/L)
Arrowhead River	32	3	9%	6	18%	3.4	20.2
Daggets Creek	15	4	26%	2	13%	4.3	24.1
Dale Swamp	44	13	30%	8	18%	3.9	17.4
Lake Butte des Morts	3	0	0%	1	33%	5.2	14.8
Lower Rat River	29	5	17%	4	13%	3.0	15.1
Upper Rat River	63	23	36%	13	20%	4.4	18.2
Winneconne-Poygan	5	0	0%	2	40%	5.1	13.2
Totals:	191	48	25%	36	18%	3.9	24.1

Table 2-2. Arrowhead River, Rat River, Daggets Creek Well Monitoring Results: Atrazine

Subwatershed	# of Samples	Nitrate Analysis Results					
		Samples 0.3 - 2.9 ug/L		Samples >3.0 ug/L		Ave.	Max.
		#	%	#	%	(ug/L)	(ug/L)
Arrowhead River	29	5	17%	0	0%	0.16	1.8
Daggets Creek	14	0	0%	0	0%	0.03	0.2
Dale Swamp	42	4	10%	2	5%	0.78	23.2
Lake Butte des Morts	3	0	0%	0	0%	0	0.0
Lower Rat River	27	1	0.03%	1	0.03%	0.48	9.3
Upper Rat River	57	9	0.15%	1	0.01%	0.20	3.1
Winneconne-Poygan	4	0	0%	0	0%	0.02	0.02
Totals:	176	19	10%	4	2%	0.35	23.2

The natural quality of the groundwater in the watershed is, for the most part, very good. Local problems have been reported in the eastern part of the watershed where the Platteville, Decorah, Galena dolomite exists. High sulfate and iron concentrations and excessive hardness are the most frequent complaints. These conditions exist due to the geochemistry of the dolomite formation.

Human impacts to the overall quality of the groundwater are evident throughout the watershed. The data shown in table 2-1 indicates that nitrate contamination above the State enforcement standard of 10 milligrams per liter occurred in 18% of the 191 wells tested within the watershed. This percentage is near the average of wells above the nitrate enforcement standard within other recent watershed projects in the state. Throughout the state in watershed projects started in 1991, 1317 well samples were analyzed for nitrates and 216 or 16.4% exceeded the groundwater enforcement standard.

Table 2-2 shows the results of the "triazine screening" for atrazine that was conducted in the watershed. Only 2% or 4 of the 176 samples analyzed exceeded the State standard of 3.0 micrograms per liter. Again, the average for triazine screening in other recent watershed projects was similar. Out of 1220 well samples analyzed for atrazine in other watershed projects in 1991, only 16 or 1.3% exceeded the enforcement standard for atrazine.

In some areas of the watershed, the combination of permeable soils over coarse sand material or fractured bedrock allow contaminants to be carried into the groundwater. Because of these conditions, nonpoint source pollutants such as fertilizers, leaking silo septage, livestock wastes, and pesticides have high potentials for reaching the groundwater.

Endangered and Threatened Resources

Information on endangered resources was obtained from the Bureau of Endangered Resources of the Department of Natural Resources. Endangered resources include rare species and natural communities.

It should be noted that comprehensive endangered resource surveys have not been completed for the entire Arrowhead River, Rat River, and Daggets Creek Priority Watershed. The lack of additional occurrence records does not preclude the possibility that other endangered resources are present in the watershed.

In addition, the Bureau's endangered resource files are continuously updated from ongoing field work. There may be other records of rare species and natural communities in the process of being added to the database and so are not in the following lists. Updates or revisions of this watershed plan should be reviewed by the Bureau of Endangered Resources to include new records.

Rare Species

Rare species are tracked by Wisconsin's Natural Heritage Inventory of the Bureau of Endangered Resources. Species tracked by the Inventory include those that are listed by the U.S. Fish and Wildlife Service or by the State of Wisconsin.

- **Wisconsin Endangered Species:** Any species whose continued existence as a viable component of this state's wild animals or wild plants is determined by the Department of Natural Resources to be in jeopardy on the basis of scientific evidence.

- **Wisconsin Threatened Species:** Any species that appears likely, within the foreseeable future, on the basis of scientific evidence, to become endangered.

- **Wisconsin Special Concern Species:** Any species with some problem of abundance or distribution is suspected in Wisconsin, but not yet proven. The purpose of this category is to focus attention on certain species before they become endangered or threatened.

The following rare species are found within the Arrowhead River, Rat River, and Daggets Creek Priority Watershed.

Wisconsin Endangered Species:
Notropis chrysocephalus, striped shiner
Platanthera leucophaea, prairie white-fringed orchid**
Sterna forsteri, Forster's tern
Sterna hirundo, common tern

Wisconsin Threatened Species:
Casmerodius albus, great egret
Clemmys insculpta, wood turtle
Cypripedium candidum, white lady's slipper
Moxostoma valenciennesi, greater redhorse
Notropis anogenus, pugnose shiner
Viola novae-angliae, New England violet***

Wisconsin Special Concern Species:
Acipenser fulvescens, lake sturgeon***
Erimyzon oblongus, creek chubsucker (now extirpated in Wisconsin)
Erimyzon sucetta, lake chubsucker

* This species is also on the Federal Endangered Species list as Endangered. A federally Endangered species is any species or subspecies which is in danger of extinction throughout all or a significant portion of its range.

** This species is also on the Federal Endangered Species list as Threatened. A federally threatened species is any species or subspecies likely to become endangered throughout all or a significant portion of its rangewithin the foreseeable future.

*** This species is also a candidate for federal listing

Natural Areas

Natural areas are sites that contain high quality examples of natural communities. State Natural Areas (SNA's) have been officially designated by the DNR Natural Areas Program as deserving protection. They are owned by the DNR, other state and local agencies, or conservation organizations, and are managed to protect the natural resources.

The following State Natural Areas and natural areas have been identified in the Arrowhead River, Rat River, and Daggets Creek Priority Watershed. The natural communities found at each area are also listed.

State Natural Areas:

Oshkosh-Larsen Trial Prairies - wet-mesic prairie

Natural Areas:

Medina Swamp - floodplain forest, northern wet-mesic forest, northern wet forest
Much Swamp Hardwoods - floodplain forest
Rat River Wildlife Area - floodplain forest, northern wet-mesic forest, southern sedge meadow, southern dry-mesic forest
Roscoe Tellock Pine Woods - northern dry-mesic forest
Strusinske Woods - southern dry-mesic forest, northern dry-mesic forest
Winneconne Wet Prairie - wet prairie
Wolf River Terraces - floodplain forest

If specific location or other information is needed about these species or natural communities, contact the Bureau of Endangered Resources. Please note that the specific location of endangered resources is sensitive information. Exact locations should not be released or reproduced in any publicly disseminated documents.

Cultural Resources

The Arrowhead River, Rat River and Daggets Creek watershed is rich in Native American archeological and cultural resources. The State Historical Society of Wisconsin has been charged with ensuring the preservation of these resources. Chapter five outlines a procedure for use within this project to minimize the disturbance of these resources while allowing for implementation of the watershed plan.

CHAPTER THREE
Water Quality Conditions, Objectives, and Nonpoint Sources

Introduction

The first part of this chapter presents a general description of how nonpoint source pollutants impact water quality. The remainder of the chapter discusses: 1) the water resource conditions present in each of the seven subwatersheds, 2) the results of the nonpoint source inventories, 3) other potential pollutant sources, 4) the improvements that could be achieved in the streams if nonpoint sources of pollution were controlled, and 5) the amount of pollutant control necessary to achieve the desired water resource conditions.

The amount of pollutants generated from the following five nonpoint sources were inventoried and analyzed by subwatershed. The results are summarized in tables 3-1 to 3-4.

- eroding uplands (sediment and nutrients)
- degraded streambanks and shoreline (sediment and direct habitat impairment)
- eroding gullies (sediment and nutrients)
- animal lots (oxygen demand and nutrients)
- winter spread manure (oxygen demand and nutrients)

Water Quality Basics

Nonpoint source pollution is responsible for degraded conditions of the streams in this watershed. Excessive amounts of sediment, nutrients, organic material, and bacteria degrade the water quality, resulting in streams unable to meet their full use potential. Furthermore, sediment from the watershed settles out in Lakes Poygan, Winneconne, and Butte Des Morts causing both degradation of fish habitat and diminished recreational value. In this watershed the most serious pollutants are nutrients (phosphorus), sediment, and manure in surface water, and nitrates in groundwater.

Nutrients

Nutrient loading adversely affects water quality by promoting excessive plant growth (macrophytes and algae) in the streams and lakes. Phosphorus is the most significant nutrient promoting macrophyte and algae growth. Excessive macrophyte growth causes severe oxygen fluctuations in the streams. As plants produce oxygen as they photosynthesize in the daylight, but this oxygen is then used during plant respiration at night. Large swings in the daily level of dissolved oxygen can stress fish and other aquatic life. Also, excessive macrophyte growth in the streams restrict water flow and increase sedimentation rates.

The high nutrient loading also causes algal blooms to occur in the streams and lakes every summer. The density of these blooms varies according to the amount of nutrient loading and wave action. The blooms affect aesthetics, interfere with boating, swimming, and other recreational use of the waters, and further impact water quality and aquatic life. The blooms reduce sun light penetration which prevents more desirable rooted aquatic plants from growing. Aquatic insects, fish, waterfowl, and wildlife all depend on these rooted aquatic plants for survival. In addition, when the algae and other undesirable macrophytes die, they consume oxygen during decomposition that can contribute to fish kills.

Sediment

Sediment adversely impacts water resources in a number of ways. Suspended sediment decreases water clarity making it difficult for fish to see and catch food. High sediment concentrations abrade fish gills making the fish more susceptible to disease. The sediment also affects light penetration reducing the ability of rooted aquatic plants to survive. Sediment serves as the transport mechanism for nearly 75% of the phosphorus in this watershed. Finally, the sediment covers and eliminates the bottom habitat critical for aquatic insects and fish spawning.

In this watershed, sediment settles out in all the streams and tributaries, and the lakes to which all three major streams drain. The major sources of sediment are upland erosion (primarily from relatively flat fields located close to a drainage ditch or tributary), gully erosion, and streambank or shoreline erosion. Also, tremendous amounts of sediment enter the streams periodically as side channels along the lake shores and drainage ditches in the upper reaches of the watershed are dredged out.

Manure

Manure contains several components that adversely affect water quality and aquatic life. Manure entering a stream decomposes, resulting in depletion of dissolved oxygen in the water. Dissolved oxygen at sufficient levels is critical for fish to survive. Also, manure contains ammonia, which is toxic to fish and other aquatic life in high concentrations. The nutrients in manure (including nitrogen and phosphorus) also promote nuisance algae and weed growth in streams and lakes. Finally, bacteria found in livestock manure may be harmful to livestock drinking the contaminated water, and to humans using the water for recreation.

The major sources of manure in this watershed are runoff from animal concentration areas (barnyards), and runoff from manure improperly applied on fields (winter spreading on steep crop fields and on flood plain cropped fields).

Nitrates

Nitrate levels in the groundwater exceeding a concentration of 10.0 mg/l violate state groundwater standards as defined in chapter NR 140, Wis. Adm. Code. At this level it is recommended that infants not consume the water because the nitrate interferes with the ability of the blood to carry oxygen. High levels of nitrates may also indicate other contaminants are present in the drinking water. High nitrate concentrations in the drinking water have also been linked to spontaneous abortions in livestock.

The most likely sources of nitrates in the groundwater in this watershed are nitrogen fertilizers applied to croplands and failing septic systems.

Establishing Water Resource Objectives

Water quality objectives were developed by DNR staff with assistance from the Outagamie and Winnebago county staffs and the DATCP. Water quality objectives were identified for the entire watershed area while water resource objectives were identified individually for each subwatershed. Details of objective development can be found in the *Arrowhead River, Rat River and Daggets Creek Priority Watershed Water Resources Appraisal Final Report.*

A need to reduce both phosphorus and sediment by a high level (50% reduction from current estimated loading levels) was identified as the water quality objective for the entire watershed. Common to all seven subwatersheds were the water resource objectives of increasing aquatic life through improved habitat conditions, and protecting and enhancing wildlife through improved wetland and grassland habitat. Controlling shoreline erosion was identified as an objective for the Daggets Creek, Winneconne-Poygan, and Lake Butte Des Morts subwatersheds. Reducing urban or developed area nonpoint source pollution was identified as an additional objective for the Winneconne-Poygan and Lake Butte Des Morts subwatersheds.

The management strategies developed to achieve the water resource objectives are based on voluntary participation in the program by landowners controlling all nonpoint sources on their property identified as critical. Further clarification of the voluntary nature of the program and the requirements of participants may be found in chapter four.

Table 3-1. Summary of Upland Sediment Loading by Land Use: ARD Priority Watershed

Subwatershed		Cropland	(%)	Developed	(%)	Grassland	(%)	Woodlot	(%)	Wetland	(%)	Totals	(%)
Arrowhead River	Acres	10,523	54	851	4	2,363	12	2,355	12	3257	17	19,349	23
	Sediment	5,066	91	243	4	65	1	85	2	79	1	5,538	29
Daggets Creek	Acres	5,203	71	296	4	557	8	640	9	683	9	7,379	9
	Sediment	2,906	91	189	6	22	1	44	1	17	1	3,178	17
Dale Swamp	Acres	5754	45	1,789	14	589	5	1,153	9	3,519	27	12,804	15
	Sediment	1,299	72	394	22	10	1	16	1	97	5	1,816	9
Lake Butte Des Morts	Acres	2,431	61	266	7	139	4	340	9	788	20	3,964	5
	Sediment	1,037	88	107	9	4	0	15	1	19	2	1,182	6
Lower Rat River	Acres	4,704	34	557	4	1,556	11	3,518	25	3,685	26	14,020	17
	Sediment	1,476	75	145	7	64	3	205	10	89	4	1,979	10
Upper Rat River	Acres	11,036	62	1,517	9	1,208	7	1,169	7	2,915	16	17,845	21
	Sediment	3,262	80	701	17	26	1	40	1	60	1	4,089	21
Winneconne - Poygan	Acres	3,379	38	410	5	710	8	2,009	23	2,295	26	8,803	10
	Sediment	1,152	78	175	12	23	2	70	5	55	4	1,475	8
Totals	Acres	43,030	51	5,686	7	7,122	8	11,184	13	17,142	20	84,164	1
	Sediment	16,198	84	1,954	10	214	1	475	2	416	2	19,257	1

Table 3-2. Summary of Sediment Loading by Source in Tons/Year				
Subwatershed	Upland Land Uses	Gullies	Streambanks Shorelines	Total
Arrowhead River	5538	2909	15	8462
Daggets Creek	3178	147	4	3329
Dale Swamp	1816	1540	30	3386
Lake Butte Des Morts	1182	174	24	1380
Lower Rat River	1979	52	0	2031
Upper Rat River	4089	1733	50	5872
Winneconne-Poygan	1475	29	144	1648
Watershed Totals	19257	6584	267	26108
Percent Total	74%	25%	1%	100%

Table 3-3. Inventory Results: Streambank and Shoreline Degradation Sites				
Subwatershed	Total Length of Degraded Sites* (ft.)	Total Sediment Loss (tons/yr.)	Associated Phosphorus Load (lbs.)	Banks With Cattle Access (ft.)
Arrowhead River	595	15	19	800
Daggets Creek	255	4	5	0
Dale Swamp	3478	30	37	820
Lake Butte Des Morts	750	24	30	0
Lower Rat River	0	0	0	0
Upper Rat River	5128	50	62	1335
Winneconne-Poygan	5065	144	179	0
Watershed Totals	15271	267	331	2955

* eroded, trampled, or slumped

Table 3-4. Inventory Results: Animal Lot Runoff Summary				
Subwatershed	Total # Animal Lots*	% of Total Animal Lots	Phosphorus Load (lbs.)	% of Total Animal Lot Phos. Load
Arrowhead River	30	19	1140	31
Daggets Creek	14	9	327	9
Dale Swamp	30	19	606	16
Lake Butte Des Morts	6	4	197	5
Lower Rat River	25	16	496	13
Upper Rat River	45	29	790	21
Winneconne-Poygan	6	4	123	3%
Watershed Totals	156	100%	3679	100%

* some barnyards consist of more than one lot or segment.

Results of Nonpoint Source Inventories

Upland Sediment

Intensive agricultural tillage practices cause considerable amounts of soil to erode and reach the surface waters of the Arrowhead River, Rat River and Daggets Creek watershed. Upland sheet and rill erosion is the major source of sediment and phosphorus that is carried downstream, beyond individual subwatershed boundaries. The sediment and phosphorus eventually reaches the pool lakes of Poygan, Winneconne, and Butte Des Morts. Gully erosion from upland fields also contributes significant amounts of sediment.

Upland sediment sources were evaluated for the entire watershed (132 square miles) based on the extrapolation of data gathered from representative subareas of each subwatershed (22% of the total watershed area). The results of this inventory are summarized in table 3-1. An estimated 16,198 tons of sediment per year (62% of the total sediment load) are delivered directly to surface waters in the watershed from croplands. Developed areas, grasslands, woodlots, and wetlands combined contribute less than 12% of the total sediment load. Estimates indicate gullies contribute 6584 tons (25%) of the 26,108 tons of sediment delivered to surface waters annually. Table 3-2 summarizes sediment loading from all sources.

In general, the inventory found many farmers in the watershed are already controlling upland erosion on their fields to some degree. However, many of these same fields are still

delivering a substantial amount of the sediment that is eroded to the surface waters even though the overall erosion rate may be relatively low with regard to "T", or tolerable soil loss. Despite the lack of steep topography and high erosion rates, cropland erosion still represents a significant sediment source.

Water quality objectives require sediment and phosphorus to be reduced by 50% throughout the watershed. This objective will be met for upland sediment sources if the following is achieved:

- Reduce sediment delivery from fields identified as Category I to no greater than 0.20 tons per acre per year (see chapter 4).
- Reduce the sediment delivery from gullies by 75%.

Streambank and Shoreline Erosion

Streambank and shoreline erosion are not significant contributors of sediment in this watershed, however, these erosion sites contribute all of their sediment directly to the surface water and have an immediate impact on habitat quality. Combined, these sources contribute an estimated 267 tons (1%) of the total sediment delivered to surface waters in the Arrowhead River, Rat River and Daggets Creek watershed. Of the 15,271 feet of degraded streambank and shoreline sites in the watershed, agriculturally impacted sites account for only 3337 feet. Approximately 2955 feet of streambank are open to cattle access with 1440 feet currently in a trampled condition. Erosion is occurring on over 5500 feet of shoreline resulting in a loading directly to the lakes of an estimated 152 tons of sediment. Table 3-3 summarizes the streambank and shoreline inventory results.

Water quality and habitat improvement objectives will be met with regard to degraded streambank and shoreline sites if the following is achieved:

- Reduce sediment tonnage from streambank sites impacted by agriculture by 75%.
- Reduce sediment tonnage from shoreline sites by 75%.
- Install habitat structures if determined to be appropriate by DNR Fisheries Management staff.
- Restrict livestock access through fencing or grazing management as specified in chapter 4.

Animal Lot and Winter Spread Manure Runoff

Runoff carrying a variety of pollutants from barnyards and other livestock feeding, loafing, and pasturing areas, and also from winter spread manure, is a significant source of pollutants

in the Arrowhead River, Rat River and Daggets Creek watershed. Inventory results show that 156 animal lots contribute 3679 pounds of phosphorus on an annual basis. Also, An estimated 2664 pounds of phosphorus are attributable to improper storage and spreading of manure during the winter months. Most of the oxygen demanding pollutants and nutrients associated with these operations drain via concentrated flow to the tributaries and ditches in the watershed. The most significant water quality problems associated with the land spreading of livestock manure occur when wastes are spread on "high hazard areas" such as steeply sloped frozen ground, land in floodplains, or areas within a given distance to surface water depending on factors such as drainage area and surface condition. Table 3-4 summarizes the animal lot inventory results.

Water quality objectives will be met if the following is achieved:

- Reduce organic pollution from livestock wastes 51%.
- Landowners participating in the project and installing barnyard systems will use SCS 590 Appendix B criteria for determining suitable acres for winter manure spreading.
- Landowners will be identified as Category I for winter spread manure management and potential storage eligibility based on SCS 590 Appendix B criteria (chapter four).

Subwatershed Discussions

The Arrowhead River, Rat River and Daggets Creek Priority Watershed Project is divided into seven subwatersheds. Current water resource conditions, nonpoint source pollutant loadings, potential uses, and water resource objectives vary somewhat between these subwatersheds. The subwatersheds are listed in table 3-5.

Table 3-5. Subwatersheds of the Arrowhead River, Rat River and Daggets Creek Watershed.

Subwatershed Name	Location (County)
Arrowhead River	Winnebago
Daggets Creek	Winnebago
Dale Swamp	Outagamie, Winnebago, Waupaca
Lake Butte des Morts	Winnebago
Lower Rat	Winnebago, Waupaca
Upper Rat	Outagamie, Winnebago
Winneconne-Poygan	Winnebago

Arrowhead River Subwatershed

Subwatershed Description

Arrowhead River is the largest subwatershed with a drainage area of 30.2 square miles. The river flows southeasterly for approximately 9 miles before it empties into the east shore of Lake Winneconne just south of Clark's Point (See map 3-1). The Arrowhead is a low gradient river that has been ditched extensively in the past. Very little grazing occurs on the Arrowhead, but in many cases the soil is tilled right up to the edge of the banks which makes it easy for eroded soil to enter the river.

Water Resources Conditions

The Arrowhead River is a warm water sport fishery in the lower section and a warm water forage fishery in the upper portion. The 1991 fish survey found sunfish, largemouth bass, northern pike, and five different forage species in the lower part of the river. The upper part of the river yielded only mudminnows, a very tolerant forage species.

The HBI (Hilsenhoff Biotic Index) was poor, indicating very significant organic pollution, and the Habitat Rating was fair to poor. Summer of 1991 bacteriological monitoring documented high fecal coliform and fecal streptococcus levels. Elevated water temperatures were also documented during the summer of 1991.

Some streambank erosion exists, but the total amount is relatively small compared to the estimated sediment contribution from cropland.

Water Resource Objectives

The following water resource management objectives are recommended for the Arrowhead River subwatershed:

- Increase aquatic life in the Arrowhead River by improving overall habitat conditions.

  a. Reduce sedimentation of gravel and rubble.
  b. Increase available cover using streambank stabilization.
  c. Reduce nutrient loading to reduce macrophyte growth and improve overall dissolved oxygen levels.

- Protect and enhance wildlife habitat by improving wetland and grassland habitat through reduction of phosphorus and sediment loadings.

Daggets Creek Subwatershed

Subwatershed Description

Daggets Creek subwatershed is 11.5 square miles in size and is primarily agricultural land. Daggets Creek flows southeasterly for 4.3 miles before entering Lake Butte des Morts just north of Plummers Point Road. Except for the lower half mile, the stream is intermittent and to a large extent ditched. The lower half mile, a dredged channel some 50 feet wide, contains a fishery similar to Lake Butte des Morts. Lands adjacent to this channel have been subdivided and developed (see map 3-2).

Water Resource Conditions

Daggets Creek fish populations primarily consist of young sportfish at the lowest sampling site and tolerant forage species at the furthest upstream site. The middle sampling site was completely dry at the time of the evaluation. Habitat evaluations rated the middle site as fair and poor, and the upstream and downstream sites as good, fair, and poor.

Water resource problems include sedimentation of the tributaries and sediment loading to the lakes, limited habitat, channelization, excessive filamentous algae and periphyton growth from nutrient loading, low dissolved oxygen levels, high bacteriological levels, and low stream flows during dry weather periods in some sections. Some streambank erosion was observed during the inventory, but it is not considered to be significant.

Water Resource Objectives

The following water resource management objectives are recommended for the Daggets Creek subwatershed:

- Increase aquatic life in Daggets Creek by improving overall habitat conditions.

    a. Reduce sedimentation of gravel and rubble.
    b. Increase available cover using streambank stabilization.
    c. Reduce nutrient loading to reduce macrophyte growth and improve overall dissolved oxygen levels.

- Protect and enhance wildlife habitat by improving wetland and grassland habitat through reduction of sediment and phosphorus loadings.

- Control lake shoreline erosion by installing rock rip-rap or GEOWEB type materials.