Management of Rooted Aquatic Vegetation, Algae, Leeches, Swimmer's Itch, 2012

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Executive Summary 2012 Aquatic Plant Management Program

In Minnesota the state is the owner of wild rice and other aquatic vegetation growing in public waters (*Minnesota Statutes* 84.091). The Minnesota Department of Natural Resources (DNR) regulates the harvest, transplanting, and destruction of aquatic plants in public waters through a permit program (*Minnesota Statutes* 103G.615). The purpose of the aquatic plant management (APM) permit program is to protect the beneficial functions that aquatic plants provide to lakes, while allowing riparian property owners to obtain reasonable access to public waters.

The 2012 legislature amended *Minnesota Statutes* 103G.615 to include a definition for invasive aquatic plant management permits. The amendment defined an invasive aquatic plant management permit as an APM permit that authorizes the selective control of invasive aquatic plants at a scale to cause a significant lake or bay-wide reduction in the abundance of the invasive aquatic plant. The legislature also added a provision to statute to allow the DNR to waive the requirement for dated signatures of approval by landowners for invasive aquatic plant management permits.

In 2012 the coordinator of the APM program was located in the Section of Fisheries where the APM program specialists are located. This was a consequence of a reorganization of the program in the fall of 2011 when the coordinator was moved from the Division of Ecological and Water Resources. In addition, the responsibility for the issuance of permits for the lake or bay-wide management of invasive aquatic plants was transferred from the Section of Fisheries to the Division of Ecological and Water Resources, invasive species program (ISP).

The ISP received approximately 219 applications for invasive aquatic plant management permits. Of the 219 applications received nine applications were withdrawn, three applications were denied and 207 permits were issued for the selective management of invasive aquatic plants on a lake or bay-wide basis.

Public Waters/Permits/Properties/Fees

In 2012 there were 1,218 public waters with active APM permits. Of the 1,218 public waters with active permits, 875 public waters had permits that were issued 2012. The number of public waters where aquatic plant management is permitted increased gradually from 1953 until 2000. In recent years the number of lakes with permitted APM activity stabilized at around 900 per year. In 2012 there were 43 more lakes with permitted APM activity than in 2011.

In 2012 permit issuance increased in all DNR regions when compared to permit numbers in 2011. The number of APM permits issued statewide reached its peak in 2007 at 4,633 permits. Statewide permit numbers have decreased from 2008 through 2011. In 2012 there were 4,177 permits issued, 864 more permits than in 2011. In 2012 the Central Region issued 124 more permits than in 2011. The largest regional increase in the number of permits issued was in the Northwest Region, 597 additional permits from 2011.

The number of property owners applying for APM permits statewide continued to decrease in 2012. The number of properties with permitted aquatic plant management activities increased in regions 1 and 2 and decreased in the Central and Southern Regions. Even with the increases in properties in Regions 1 and 2 the number of properties was still down by 256 from 2011. This is likely due to the transfer of invasive aquatic plant management permits to the Division of Ecological and Water Resources.

In 2012 it was also determined that permits for invasive aquatic plant management would be issued without fee. This new development in addition to the decrease in the number of properties applying for permit and the decrease in permit fee for property owners living on lakes that are 20 acres or less are responsible for the decline in permit revenue in 2012. In 2011 permit fees generated $238,352 in revenue and in 2012 permit fees generated $229,464 a reduction of $8,888. The average fee per property in 2012 was $26.43, up slightly from the average fee per property in 2011. Likely due to an increase in the number of single property permits.

Automated Aquatic Plant Control Devices

The Department first began issuing permits for Automated Aquatic Plant Control Device's (AAPCD's) in 1997. In 2012 permits for AAPCD's accounted for about 42% of the total number of APM permits issued. The remaining 58% of the APM permits issued allowed chemical or other mechanical removal as the method of control.

The APM rules provide two permit options for AAPCD operation. A person applying for a permit to operate the device in an area greater than 2,500 square feet is required to obtain an annual permit. However, a three-year permit option is available for persons who limit the size of the area of AAPCD operation to 2,500 square feet or less (*Minnesota Rules*, part 6280.0450, subp.3, item A). Revisions to the APM rules implemented in the 2009 permit season restrict submersed aquatic plant removal to 100 feet of shoreline or one-half the owner's frontage whichever is less (*Minnesota Rules*, part 6280.0350, subp. 1a). Due to this change many more permit holders became eligible for an AAPCD permit of three year duration in 2009.

In 2012 there were 770 more three-year AAPCD permits than were issued 2011. The number of single season permits issued in 2012 (273) decreased by 130 from 2011. The total number of AAPCD permits issued in 2012 was up by 640 permits when compared to 2011. Persons who obtained a three-year permit in 2012 will not have to apply for a permit again until the year 2015.

Most AAPCD permits are issued to a single property owner. In 2012 AAPCD's made up 42% of the permits issued and accounted for 20% of the total number of properties permitted.

Summary of Aquatic Plant Management permits issued in 2012 and active permits.

Region	Mechanical Chemical***	2012 Issued Channel*	<2012 Active Channel**	AAPCD's with chemical control	AAPCD Issued 2012 1 year	AAPCD Issued 2012 3 year	AAPCD Issued 2011 3 year	AAPCD Issued 2010 3 year	All Active Permits	Restoration Permits Issued
Reg 1	444	40	-	89	132	718	186	294	1814	10
Reg 2A	74	14	-	0	0	10	6	8	112	1
Reg 2B	56	20	-	53	55	296	205	191	1332	6
Reg 3A	776	14	-	9	49	49	19	48	955	14
Reg 3B	326	9	-	21	26	169	79	127	736	4
Reg 4	142	2	-	3	11	58	35	58	306	4
All	2327	99	1106	175	273	1300	530	726	6536	39

* Channel permits are of unlimited duration and issued to the property owner to mechanically maintain a channel no more than 15 shoreline feet wide in emergent vegetation.

** All active permits as of 12/28/2012. Total by Region cannot be calculated because Region boundaries were changed in 2003. *All Active Permits* = Permits issued in 2010 and all active AAPCD and channel permits excluding restoration permits.

*** Excludes permits for AAPCD's and channel permits.

It is important to note that the numbers of permits and applicants in a single year is only part of the story. In addition to AAPCD permits that can be issued for up to 3-years, a lakeshore property owner can obtain a permit of unlimited duration to mechanically maintain a channel 15 feet wide through emergent vegetation. Multi-year AAPCD permits account for roughly 39% of the total number of active permits in 2012. In 2012 there were 1,205 active channel permits (permits of unlimited duration allow maintenance of a 15 foot wide channel through emergent aquatic plants), for about 18% of the total number of active permits. The total number of active permits in 2012 was 6,536 including 2,775 annual permits. This does not include 207 permits issued by the Division of Ecological and Water Resources for lake or bay-wide management of invasive aquatic plants.

Summary of all APM permits issued for control of aquatic plants and nuisances, fees collected, numbers of lakes and properties treated in 2012.

Region	All Permits Issued in 2012*	All Lakes**	Fees***	Properties Permitted in 2012	Ave. Fee/ Property	All Reporting ****		
						Mechanical Work	Chemical Treatment	Both
Reg 1	1423	257	$49,169	1423	$ 34.55	115	199	36
Reg 2A	98	46		98		18	39	5
Reg 2B	990	135		1335		30	144	27
Reg 2 total			$ 38,340	1433	$ 26.76			
Reg 3A	900	233		3843		67	541	16
Reg 3B	550	128		1512		21	221	19
Reg 3 total			$ 129,910	5355	$ 24.26			
Reg 4	216	76	$ 12,045	472	$ 25.52	10	84	6
2012 TOTAL	4177	875	$229,464	8683	$26.43	261	1525	109
2011 TOTAL	3313	832	$ 238,352	8939	$ 25.73	219	1604	103
CHANGE	864	43	-$8,888	-256	$0.70	42	-79	6

* Permits issued for restoration work are excluded.
** Includes all lakes, ponds, ditches and streams listed on APM permits for 2012.
*** Revenue from the APM database as of 12/28/2012.
**** Data tabulated from the surveys and commercial applicator reports returned as of 1/25/2012.

Trends and Observations

Aquatic plant control in Minnesota is highly seasonal. Most aquatic plant control in Minnesota takes place in the months of June, July and August. This trend has been consistent for many years because much of the aquatic plant control is recreationally motivated.

Lakeshore residents often hire commercial services to perform aquatic plant control. Statewide commercial services perform approximately 59% of permitted aquatic plant control. However, in the Central Region commercial services perform more than 80% of permitted aquatic plant control. Commercial services perform much less of the permitted control in Greater Minnesota.

Many APM permits are issued on an annual basis. Approximately 76% of 2012 permit holders responding to the survey indicated that they would reapply for a permit in 2013. In 2012, roughly 80% of APM permit holders that did their own control and nearly 90% of the permit holders hired a commercial service used their permit.

Lakeshore property owners may apply for a permit to control filamentous algae and chara (a form of macro-algae) with copper sulfate. Applications requesting filamentous algae control were up 4% over 2011and chara control has been stable over the last 3 years.

Blue green algae blooms are a common nuisance in eutrophic Minnesota lakes. Copper sulfate, a common algaecide, can provide temporary relief from nuisances caused by blue green algae. However, the control obtained by lake-wide application of copper sulfate is usually temporary and treatment is often required at least twice per season. In addition, there is the threat of fish kill from oxygen depletion caused by the decomposition of dead algae. The numbers of lakes where the residents seek a permit to control blue green algae with copper sulfate has been declining since 1997 and continued to decline in 2012.

Swimmer's itch, an infection caused by an immature life stage of flukes common in waterfowl, is present in many Minnesota lakes. Lakeshore property owners can get a permit to use copper sulfate to control snails that harbor the immature life stage. The numbers of permits issued for swimmer's itch control has been increasing steadily since 1997 and was up 16% in 2012 compared to 2011.

INTRODUCTION

Value of Aquatic Plants

Aquatic plants are essential components of most freshwater ecosystems. In many lakes, plants are the base of the aquatic food chain. The habitat aquatic plants provide in the shallow near- shore areas is important to both aquatic and terrestrial animals. They also serve important functional roles in lakes by stabilizing the lake bottom, cycling nutrients, and preventing shoreline erosion.

Many of Minnesota's most sought-after fish species depend heavily on aquatic vegetation throughout their life histories. Yellow perch, northern pike, muskellunge, panfish, and bass all depend on aquatic vegetation to provide food, spawning habitat, and nursery areas. Juvenile fish of most species feed on small crustaceans and insects that are abundant in stands of aquatic vegetation. Even species that may not require vegetation for spawning depend on the cover and forage found in aquatic vegetation.

Many species of wildlife are dependent on aquatic plants for food and nesting sites. Ducks eat the seeds and tubers produced by various water plants. Other aquatic plants, which are not eaten directly by waterfowl, support many insects and other aquatic invertebrates that are important sources of food for migratory birds and their young. Ducks have been known to alter migration patterns in response to food availability. Emergent aquatic vegetation provides nesting cover for a variety of waterfowl, wading birds, shorebirds and songbirds. The reproductive success of ducks that nest near lakes is closely tied to available aquatic plants and the cover it provides to hide young birds from predators.

The muskrat, an important furbearer, is almost entirely dependent on aquatic vegetation for food and shelter. Minnesota's largest mammal, the moose, also relies heavily on aquatic vegetation for food.

The distribution of many amphibians and reptiles is directly linked to the vegetation structure of aquatic habitats. Species preference of particular habitat types is related to food availability, types of escape cover, and specific microclimates. Emergent and submerged vegetation support invertebrate populations that are an important food source for amphibians and reptiles. During the breeding season some species of frogs call from emergent vegetation at the water's edge and their egg masses are often attached to aquatic plants. Freshwater turtles often eat submerged vegetation, which is an important source of calcium.

Beyond providing food and shelter for fish and wildlife, aquatic vegetation is important in maintaining a stable lake environment. Aquatic vegetation helps maintain water clarity by limiting the availability of nutrients, and preventing suspension of bottom sediments. Aquatic plants limit erosion of shorelines by moderating the effects of wave and ice erosion. A healthy native plant community is also important in preventing the establishment of non-native invasive aquatic plants. In short, aquatic plants serve many

important functions for lakes, fish, and wildlife. Many of the things that we enjoy most about lakes are directly linked to aquatic vegetation.

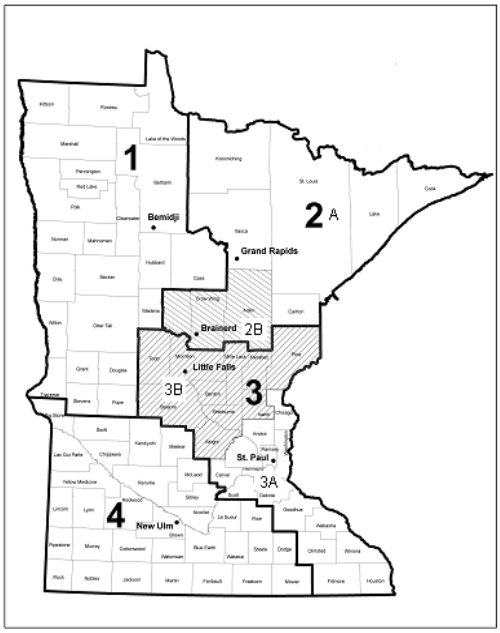
The Aquatic Plant Management Program (APM)

Riparian property owners (lakeshore property owners) in Minnesota have a right to use and access the lake adjacent to their property. Aquatic vegetation may interfere with a lakeshore homeowner's ability to exercise that right. The purpose of the DNR's APM program is to regulate how much aquatic vegetation lakeshore residents can control to ensure that the beneficial functions aquatic plants provide are preserved.

Other aquatic organisms can also interfere with the lakeshore property owner's enjoyment of the lake. Swimmer's itch, caused by the immature life stage of a parasite common in waterfowl, can cause significant and sometimes severe discomfort in humans depending upon a person's sensitivity to the organism. Algae (plankton and filamentous) can also create a nuisance and occasionally unhealthy conditions when they become overabundant. Relief from these nuisances may also be sought under an APM permit.

Administrative Regions

DNR Administrative Regions by county as of October 2006



NW Region 1

Bemidji
Kittson
Roseau
Lake of the Woods
Marshall
Polk
Pennington
Red Lake
Beltrami
Norman
Mahnomen
Clearwater
Hubbard
Cass
Clay
Becker
Wadena
Wilkin
Otter Tail
Traverse
Grant
Douglas
Stevens
Pope

NE Region 2

Grand Rapids (2A)
Koochiching
Itasca
St. Louis
Lake
Cook
Carlton

Brainerd (2B)
Crow Wing
Aitkin
Cass

Central Region 3

St. Paul (3A)
Anoka
Carver
Chisago
Dakota
Hennepin
Ramsey
Scott
Washington
Goodhue
Wabasha
Olmstead
Winona
Fillmore
Houston

Little Falls (3B)
Benton
Isanti
Kanabec
Pine
Mille Lacs
Morrison
Sherburne
Stearns
Todd
Wright

South Region 4

Big Stone
Swift
Kandiyohi
Meeker
McLeod
Renville
Chippewa
Lac Qui Parle
Yellow Medicine
Lincoln
Lyon
Redwood
Nobles
Jackson
Martin
Faribault
Freeborn
Mower

The DNR's Division of Fish and Wildlife is responsible for the administration of the APM permit program. Riparian property owners apply for an aquatic plant control permit to the Regional Fisheries Manager in the region where their lake property is located. APM specialists in each region conduct application review, site inspections when necessary, and make permit recommendations.

The recommendation for the decision on the permit application (approval, modification, or denial) is determined during the review process. This decision often involves a discussion with the lakeshore property owner. When applications for APM permits are received for shallow lakes where waterfowl management is the primary focus, the APM specialist will seek the advice of the Area Wildlife Manager. When applications are modified or denied, the applicant may appeal to the Commissioner's Office for review of the permit decision. The purpose of this review is to determine if the permit decision was based upon rule standards. Finally, permit decisions can be appealed to an Administrative Law Judge through the contested case hearing process.

In 2012 the coordinator of the APM program was located in the Section of Fisheries where the APM program specialists are located. This was a consequence of a reorganization of the program in the fall of 2011 when the coordinator was moved from the Division of Ecological and Water Resources. In addition, the responsibility for the issuance of permits for the lake or bay-wide management of invasive aquatic plants was transferred from the Section of Fisheries to the Division of Ecological and Water Resources, invasive species program (ISP).

The APM program coordinator is the department's contact with commercial mechanical control businesses, commercial aquatic pesticide applicators, and the Minnesota Department of Agriculture (MDA). The coordinator provides technical expertise on aquatic plant control methods and permitting requirements to lakeshore property owners and Department staff. The coordinator works to insure consistent interpretation of the APM rules throughout the Department. This position administers exams and issues operating permits to commercial mechanical control companies. This person also reviews appeals of permit decisions for the Commissioner. The program coordinator prepares an annual report on program activities (this document) and coordinates the development of informational materials and forms provided to riparian property owners interested in aquatic plant management.

The APM program coordinator supervises staff whose job responsibilities include enforcement of aquatic pesticide rules and pesticide label requirements. The Aquatic Pesticide Enforcement Specialist conducts inspections of herbicide treatments in public waters to monitor compliance with state and federal pesticide law and responds to reports of pesticide misuse (Appendix Table A). The U.S. Environmental Protection Agency (EPA) partially funds DNR's aquatic pesticide enforcement activities through a grant administered by MDA.

Regulations

Authority for the DNR's APM program is found in Minnesota Statutes M.S. 84.091 Subdivision 1, which designates ownership of wild rice, and other aquatic vegetation growing in public waters, to the State and M.S. 103G.615 which authorizes the Commissioner of the DNR to issue permits to harvest or destroy aquatic plants, establish permit fees, and prescribe standards to issue or deny permits for aquatic plant control. The standards for the issuance of permits to control aquatic vegetation and the permit fee structure are found in MN Rules Chapter 6280. Minnesota Statutes and Rules can be reviewed at the Revisor of Statutes website http://www.leg.state.mn.us/leg/statutes.asp.

The 2012 legislature amended *Minnesota Statutes* 103G.615 to include a definition for invasive aquatic plant management permits. The amendment defined an invasive aquatic plant management permit as a permit that authorizes the selective control of invasive aquatic plants at a scale to cause a significant lake or bay-wide reduction in the abundance of the invasive aquatic plant. Invasive aquatic plant management permit applications are reviewed, and permits issued, by the invasive species program within the Division of Ecological and Water Resources.

The invasive species program received 219 applications for invasive aquatic plant management permits. Of the 219 applications received nine applications were withdrawn, three applications were denied and 207 permits were issued for selective management of invasive aquatic plants on a lake or bay-wide basis. Invasive aquatic plant management permits are issued without fee.

The rules governing aquatic plant management (M.R. chapter 6280) were revised in 2009. Significant changes to the APM rules include:

- The addition of specific criteria used to evaluate applications for permit. The decision to issue, modify or deny permits is based on these criteria;
- The revised rules specify conditions that can be placed on permits such as limits on amount of control, restrictions on method and timing of control, and restrictions on the species of plant targeted by the control.
- The revised rules reduce the amount of near shore vegetation that can be removed under permit by individuals to 100 feet or one-half their frontage whichever is less.
- The revised rules specify that automated plant control devices may not be used in areas of soft sediment with an average sediment depth of 3 inches or greater.
- Under the revised rules a provision that allowed certain lakes to exceed the 15% littoral zone limit on plant control with herbicides will sunset in 5 yrs (2014). This provision also requires DNR to work with the affected lake associations to develop a lake vegetation management plan (LVMP).
- The revised rule clarifies conditions for "commercial harvest permits" that allow the harvest of aquatic plants, and plant parts from public waters for purposes of sale.

- The revised rules specify when variances may be issued, the criteria to be considered, and allows for mitigation for adverse effects on aquatic habitat caused by an APM permit that includes a variance.
- The revised rules specify when an LVMP can be used and what information the LVMP should contain.

A permit from the DNR is required to use pesticides for aquatic plant and nuisance control in public waters (generally any body of water 2.5 acres or larger within an incorporated city limit, or 10 acres or larger in rural areas, *Minnesota Statutes* 103G.005, subd. 15 and 15a), to use an automated aquatic plant control device, to control emergent vegetation such as cattails, wild rice, or bulrush and to control submerged or floating leaf vegetation above specified limits. A riparian property owner may, without a permit, physically remove (cut, pull, or harvest) *submerged* vegetation along one half the individual's lake frontage or 50 feet, whichever is less. The total area may not exceed 2,500 square feet. In addition, a boat channel up to 15 feet wide, and as long as necessary to reach open water, may also be maintained by mechanical means without a permit. If floating leaf vegetation is interfering with riparian owner access a channel, not more than fifteen feet wide, extending to open water, may be mechanically maintained without a permit. Aquatic plants that are cut or pulled must be removed from the lake and the managed area must remain in the same location each year.

The mechanical control of purple loosestrife, a plant on the Minnesota Department of Agriculture's noxious weed list, does not require a permit from the DNR. However, herbicide control of purple loosestrife below the ordinary high water level on public waters does require a permit. Because of the plant's status as a noxious weed, these permits are issued free of charge.

Beyond the permit requirement, pesticides used in surface waters must be registered with the Department of Agriculture for sale and use in Minnesota. The product must also be registered for aquatic use by the United States Environmental Protection Agency. When using an aquatic herbicide all label instructions and precautions must be followed. The permittee must post areas treated with herbicides so that anyone entering the area is informed of the herbicide application. The signs contain the following information: the name of the applicator, the treatment date, the name of the product used, expiration dates of any water use restrictions on swimming, fishing, household, and other uses. The DNR provides these signs to permit holders and commercial applicators at no cost. A list of herbicides commonly used for aquatic plant control and the amounts used under permit in *Minnesota from 1987-2012* is found in Appendix Tables B and C.

NPDES/SDS permit

In November of 2011 the Minnesota Pollution Control Agency (MPCA) published the National Pollution Discharge Elimination System (NPDES) permit for the application of pesticides to water. This is the MNG87D000 Vegetative Pests and Algae Control Pesticide General Permit. Because the DNR's aquatic plant management rules are

more restrictive in many ways than the NPDES permit requirements, the DNR and the MPCA entered into an interagency agreement that allows DNR's aquatic plant management permit to satisfy requirements of the NPDES/SDS permit. The threshold for a notice of intent (NOI) is for treatment of greater than 15% of the littoral zone of lakes that are 20 acres or larger in size. DNR rules require a permit for all aquatic pesticide applications for aquatic plant and nuisance control in Minnesota public waters. Persons who obtain an aquatic plant management permit do not need to apply for an NPDES permit for pesticide control of aquatic plants or nuisances in public water.

Summary of APM Program Activities in 2012

The following summary of APM program activities in 2012 comes from four sources: permittee survey forms (Appendix Tables D and E), commercial aquatic applicator and commercial mechanical control reports, and the APM permit database. When we describe information taken from permit holder or commercial company surveys in a table or figure in the report, the term "*reported*" is used. When we discuss data in the report taken from the APM permit database the term "*permitted*" is used.

Commercial applicators, mechanical control companies, and riparian property owners who do control work in public waters are required to provide a yearly summary of their APM activity. With this information the past year's activities can be summarized, the control of aquatic vegetation in public waters is monitored, and trends in aquatic plant management are identified.

Survey forms are mailed to permit holders that did their own aquatic plant control work. Prior to 2000, permit holders that hired commercial applicators to perform the control work for them were included in the survey. They were asked to answer only those few questions pertinent to their situation. This often caused confusion and permittees would either not respond or would send the form to the commercial service for completion. In addition, when commercial applicators do the control work there are usually many customers on a single permit. Nevertheless, only one of those customers is listed as the permittee. Hence, this approach relied on one individual to provide accurate information for up to 100 or more other people. Since commercial pesticide applicators are required by law to keep detailed records and their reporting is generally more precise, permit holders who hire a commercial firm are no longer asked to complete a survey form. Survey forms were sent to all permittees that did their own chemical or mechanical control work. Of the 1,250 surveys mailed 1,002 (80%) were returned. A separate survey was sent to 1,741 AAPCD permit recipients and 1,550 (89%) were returned.

Permit Issuance

In 2012, a total of 4,177 permits were issued statewide for APM activities (this excludes 39 shoreline habitat restoration permits), 864 more than in 2011 (Appendix Table F provides the county by county distribution of permits and permitted properties). Figure 1

provides the regional breakdown of permit issuance, including the number of lakes in each region with permitted APM activity.

In 2012, there were 1,748 permits issued for the operation of Automated Aquatic Plant Control Devices (AAPCD). The remaining 2,390 aquatic plant control permits were issued to municipalities and lakeshore homeowners for pesticide use (includes algae and swimmer's itch control), and mechanical control (cutting, pulling, or harvesting) of aquatic vegetation.

Over the last 16 years, the number of public waters where permits are issued has almost doubled. Little increase occurred until 1999 when the number of public waters with permitted APM activity increased sharply (Figures 2 and 3). The number of public waters permitted in 2012 for APM activity was 875, an increase of 43 lakes over 2011.

There were 158 lakes with APM permits in 2011 where APM permits were not issued in 2012. These lakes averaged slightly more than 1 permit per lake. Finally, 604 lakes had permitted APM activity in both 2011 and 2012. These numbers exclude lakes with multiple year permits (3-year AAPCD and channel permits of unlimited duration).

In 2012, 404 of the APM permits issued were reported not used for various reasons, and 198 of these were for AAPCD use. In 2012, 206 permit holders (excluding the AAPCD permit holders) surveyed said they did not use their 2012 permit. Of the 206 permit holders that did not use their permit 111 indicated that they would reapply for APM permit in 2013.

Figure 1. All APM permits issued, and the number of lakes with permitted aquatic plant control, by region, in 2012.

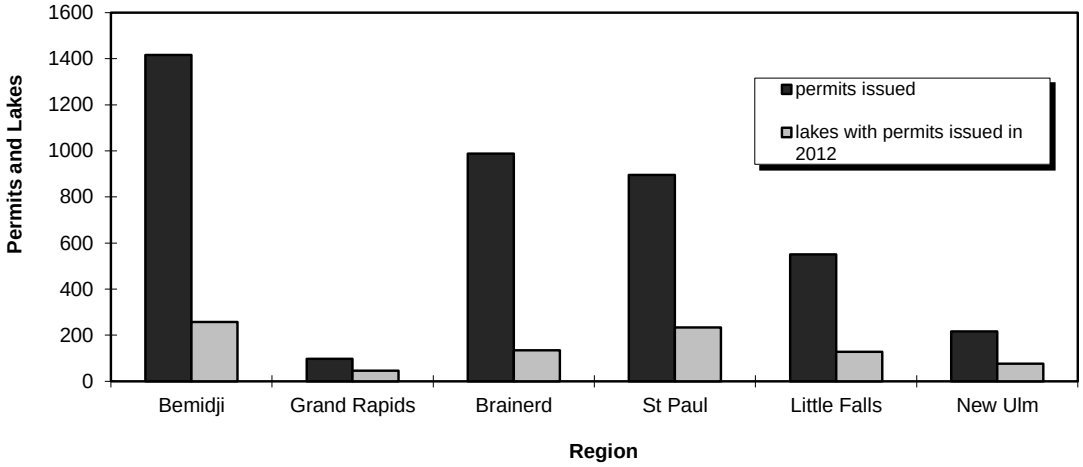


Figure 2. Numbers of APM permits issued for mechanical and chemical control (excluding AAPCD) of aquatic vegetation, algae, and swimmer's itch, and numbers of lakes where permits were issued 1992-2012.

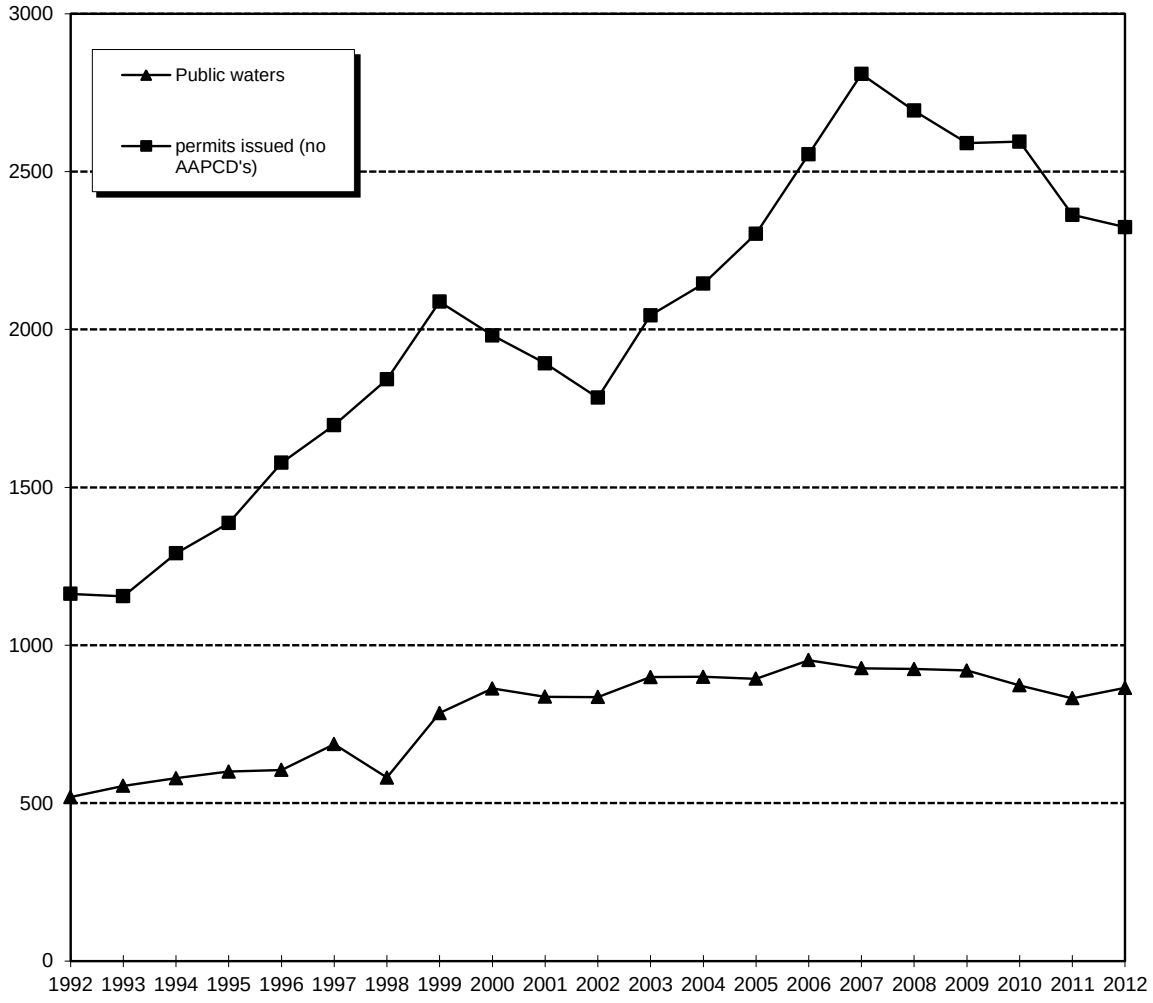
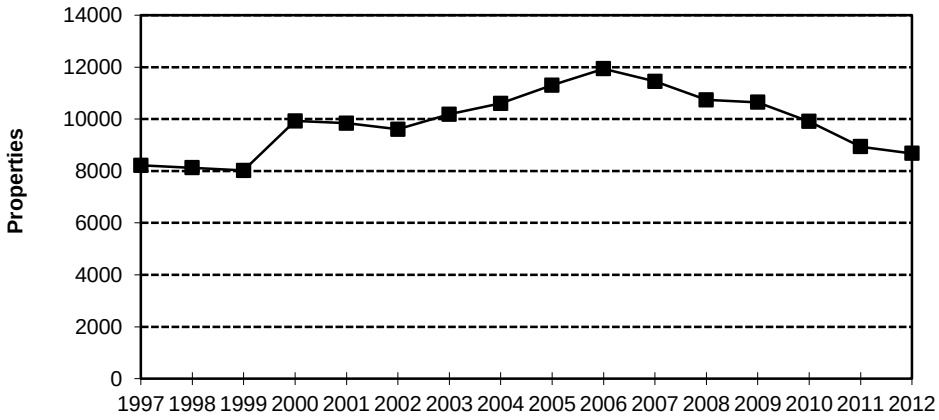


Figure 3. Numbers of properties issued APM permits for aquatic plant control statewide, 1997-2012.



APM permit issuance increased annually from 1992 until about 1999. In the early 2000's, the numbers of permits issued decreased and there was a corresponding decrease in the numbers of participating properties. Permit numbers and properties began to increase again in 2003 through 2006. In 2012 the total number of property owners participating in the aquatic plant management program decreased for the sixth year in a row. Cooler temperatures in the early part of the open water season resulting in slower plant growth, colder water for swimming, and a sluggish economy may have contributed to the decline in lakeshore property owners participating in the APM program.

Lakeshore homeowners can apply for an APM permit as a group. The average number of properties per permit statewide in 2012 was 2.1, down by 0.6 from 2011. Group permits are more popular in the Twin Cities metropolitan area than in Greater Minnesota (Table 1). Homeowner's on large group permits can benefit from the $750 cap on permit fees. The individual permit fee ($35.00 per property) begins to decrease for multiparty permits with more than 21 applicants. There are a few permits with more than 100 applicants, or properties, participating on a single permit. In 2012 there were 8,683 properties covered by the 4,177 permits issued. This number excludes the 39 permits issued to lake shore property owners for restoration of aquatic habitat.

The Central Region, which includes the Twin Cities metropolitan area, typically has larger group permits than other areas of the state. In 2012, the Central Region averaged 4.3 properties per permit, down by one property per permit from 2011. The Northwest averaged one property per permit. The Northeast Region averaged 1.3 properties per permit. The average number of properties per permit in the Southern Region in 2011 was 3.6, but decreased to 2.2 properties per permit in 2012.

Table 1. APM Permits grouped by the number of properties listed (excluding AAPCD) by Region, 2012.

Region		1	2A	2B	3A	3B	4
Permits/property	>100	0	0	1	1	1	0
	51-100	0	0	2	8	2	1
	21-50	0	0	1	42	13	4
	11-20	0	0	2	41	11	1
	2-10	0	0	8	129	29	16
	1	469	88	571	565	279	122

1 = Bemidji, 2A = Grand Rapids, 2B = Brainerd, 3A = St. Paul, 3B = Little Falls, 4 = New Ulm

The rules regulating aquatic plant removal from public waters require an inspection of the treatment site for properties with no previous permit history, or when there are changes in the size of the treatment area, methods used, or the target plant species, requested from the previously issued permit. APM specialists and area fisheries staff visit these sites to determine if the permit application is consistent with the criteria for permit issuance in APM rules. In 2012 there were 996 site inspections conducted. The site inspection provides an opportunity to determine what kinds of plants and habitat are present in the proposed treatment area. During the inspection, the size of the area may be reduced to protect important habitat based on the observations and professional judgment of the APM specialist. Approximately 77% of all near-shore control permit requests were issued unchanged (Table 2).

Table 2. Percent of permits requesting near-shore control that are issued as requested by region in 2012.

	Region						
	1	2A	2B	3A	3B	4	Statewide
number of applications requesting near-shore control	1412	89	973	844	482	172	3,972
permits issued as requested*	1139	70	759	608	342	138	3056
% of permits issued as requested	81	79	78	72	71	80	77

1 = Bemidji, 2A = Grand Rapids, 2B = Brainerd, 3A = St. Paul, 3B = Little Falls, 4 = New Ulm

*Includes permits that allowed more shoreline than requested

Permit Duration

Until 1997 aquatic plant management permits were issued for a one year term. However, in 1997 the APM rules were revised allowing two types of permits to be issued for longer than a single season. Emergent vegetation control permits can be

issued for a period of unlimited duration if the control is limited to a channel not more than 15 feet wide, that remains in the same location each year, and is maintained mechanically after the first year. A person requesting a permit to use an automated aquatic plant control device can obtain a permit of three years duration if they agree to operate the device in an area not to exceed 2,500 square feet and the device remains in the same location each year. The permit fee for the longer term permits is the same as the permit fee for annual permits.

These longer term permits are intended to offer an incentive to the property owner to remove less aquatic vegetation. In exchange for the smaller area of control the property owner does not have to make an application for a permit on an annual basis and they receive a permit of extended duration at the same cost as a permit issued for a single year. The extended duration permit also benefits the DNR by reducing the annual permit work load for program staff.

As shown in Figure 3a the number of permits of more than annual duration (active permits) is slightly lower than the number of annual permits issued in 2012. Permits issued for more than one year are most often issued to individuals. The number of emergent vegetation permits of continuous duration and the number of three year duration AAPCD permits represents an additional estimated 3,653 properties under DNR APM permit in 2012. Figure 3b shows the number of emergent vegetation channel permits issued annually since 1997. The difference in the total number of permits between years is the number of permits issued that year. For example the total number of active emergent vegetation permits in 2011 was 1,106. The total number of active permits in 2012 was 1205, therefore 99, the difference between the two totals, is the number of emergent vegetation unlimited duration permits issued in 2012.

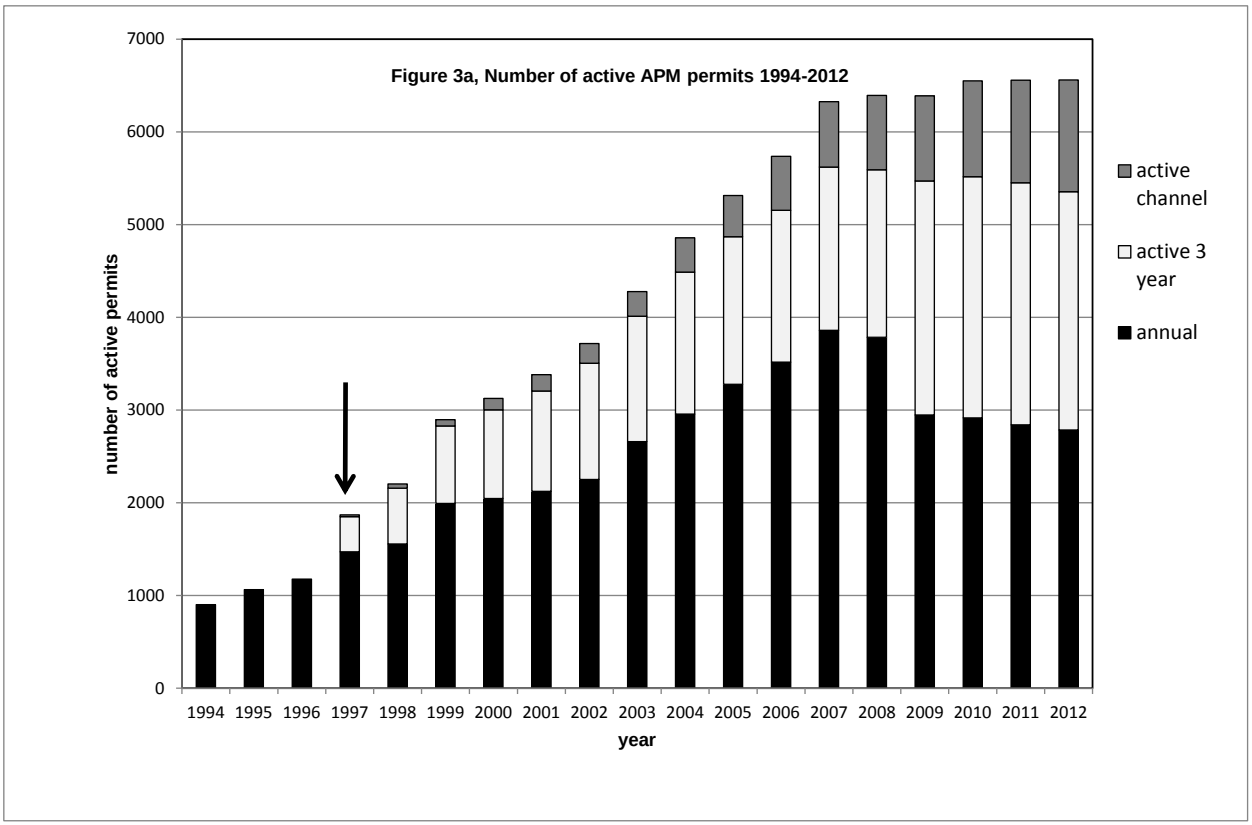


Figure 3a, Number of active APM permits 1994-2012
number of active permits
year
active channel
active 3 year
annual
0
1000
2000
3000
4000
5000
6000
7000
1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012

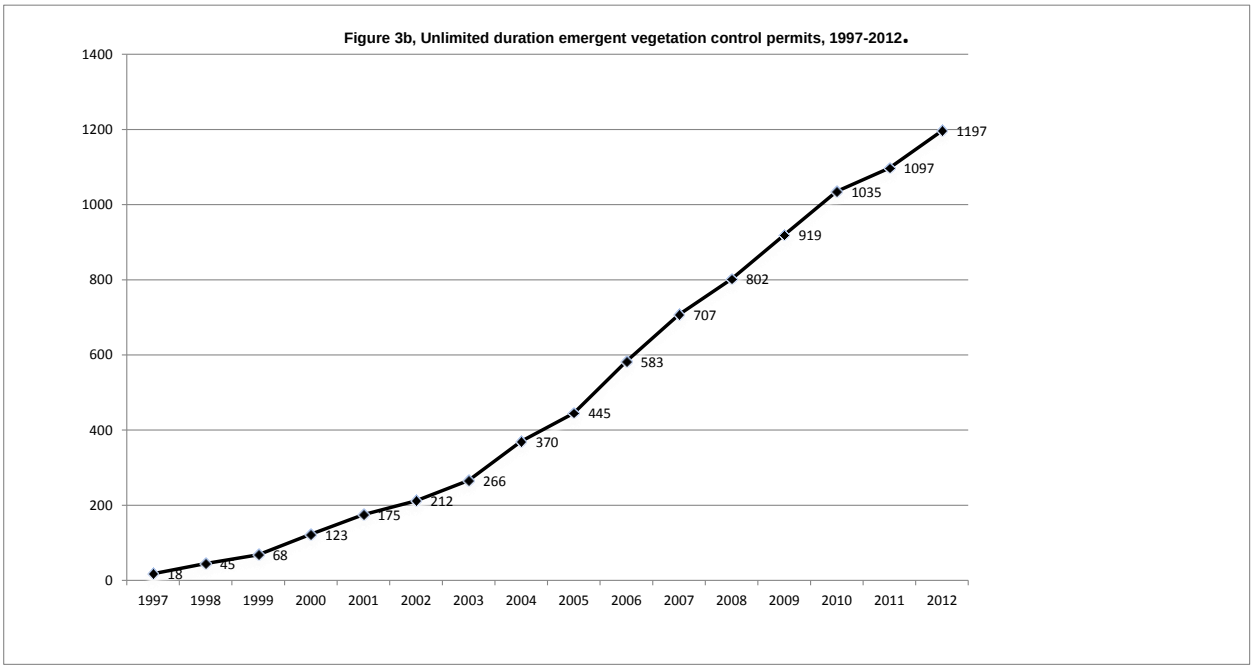


Figure 3b, Unlimited duration emergent vegetation control permits, 1997-2012.
0
200
400
600
800
1000
1200
1400
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012
18
45
68
123
175
212
266
370
445
583
707
802
919
1035
1097
1197

Permit Fees
Fees for APM permit were last increased during the 2003 legislative session. The fee increased many types of APM permits from $20.00 per property to $35.00 per property. The cap on group permits to control submersed vegetation was increased from $200 to $750.

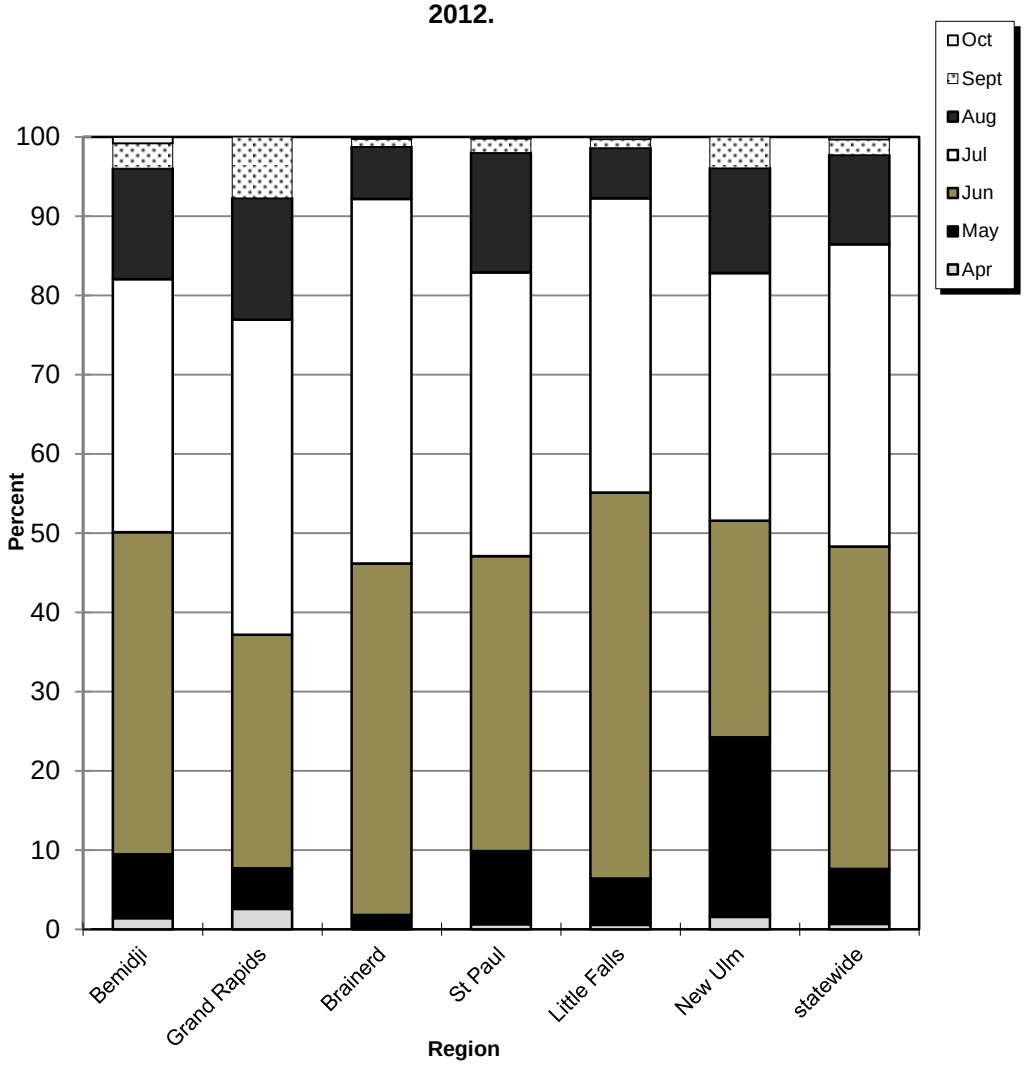
During the 2010 legislative session some permit fees were reduced. The fee for aquatic plant control on water bodies 20 acres or less was reduced to half of the permit fee for larger lakes. The fee for aquatic plant control on water bodies 20 acres or less in size for an individual is $17.50 and the cap on permit fees for group permits is $375.00. The reduction went into effect after most permits had been issued for 2010, therefore the reduction was not evident until 2011.

In 2009, prior to the fee change enacted by the 2010 Legislature, there were 71 permits issued for macrophyte control on lakes less than 20 acres in size. Those 71 permits generated approximately $15,800.00 in permit fee revenue. In 2012, there were 69 permits issued for macrophyte control on 61 lakes 20 acres or less in size.

Permit fee revenues in 2012 were lower than 2010 or 2011. In 2012 permit fees were approximately $229,464, about $8,888 less than 2011. Prior to the legislative change during the 2011 Session that defined an invasive aquatic plant management permit (IAPM), these permits were issued with fee. Issuing the IAPM permit free of charge also contributed to the reduction in permit fee revenues. The average permit fee per property owner in 2011 was $25.73. In 2012 the average fee per property was $26.43. The slight increase in the average permit fee is likely due to a reduction in the numbers of properties on multi-property permits and an increase in permits issued to individual property owners in 2012.

Timing of Treatment
Permits are issued for the open water season, generally from May through September 1. However, aquatic plant control can begin as early as January and extend through November. In 2012 about 90% of the permitted work, reported statewide, was completed in June, July, and August (Figure 4).

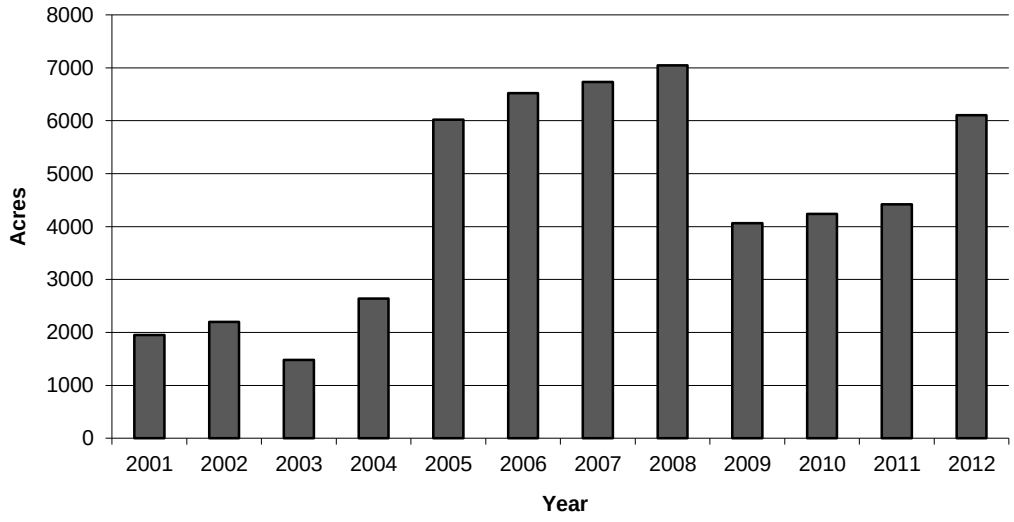
Figure 4. Percent of reported APM work by month for each region in 2012.



Acres of off-shore aquatic plant control permitted

The number of acres permitted for chemical control of submersed aquatic plants has fluctuated annually until 2005 when a sharp increase was recorded followed by continued modest annual increases (Figure 5). One contributing factor is the offshore control of aquatic vegetation focused primarily on non-native invasive species. A few large Eurasian watermilfoil and curly-leaf pondweed treatments can have a significant influence on the total number of acres permitted for treatment. This was evident between 2004 and 2005. In 2005, several lake-wide treatments of curly-leaf pondweed in the Central Region were responsible for the increase in treated acres. These lakes, in addition to Lake Benton, a 3000-acre lake in Lincoln County (South Region), were treated again in 2006, 2007, and 2008 with an aquatic herbicide to manage curly-leaf pondweed. In 2009, the curly leaf-pondweed treatment in Lake Benton was reduced to 254 acres. In 2010 approximately 120 acres of curly-leaf pondweed was treated in Lake Benton, resulting in a 2,630 acre decrease from Lake Benton alone. In 2012, 302 acres were permitted for treatment in Lake Benton for IAPM work.

Figure 5. All permitted off-shore chemical control acreage of aquatic vegetation statewide from 2001-2012.



Aquatic plant control methods

In 2012, about 42% of all permits issued for aquatic plant control allowed plant removal with AAPCD's, down 9% from 2011. Aquatic plant control using herbicides, commercial mechanical control, and plant removal by hand, accounted for the remaining 58% of the APM permits issued (Figure 6). It is important to remember that a limited amount of mechanical control of submerged and floating leaf vegetation can be done without a permit and a permit is always required when herbicides or automated devices are used

for aquatic plant control. The total area permitted statewide for the various methods of near shore aquatic plant removal and the average area permitted per property in 2012 are found in Table 3. Permit holders were asked if they performed the control over the entire area allowed in their permit. Nearly 33% of those responding indicated that they treated less than the area permitted, a 7% increase over the 2011.

Figure 6. Numbers of APM permits issued for aquatic vegetation control including chemical, mechanical, chemical and mechanical, AAPCD and algae and snail control, 1994-2012

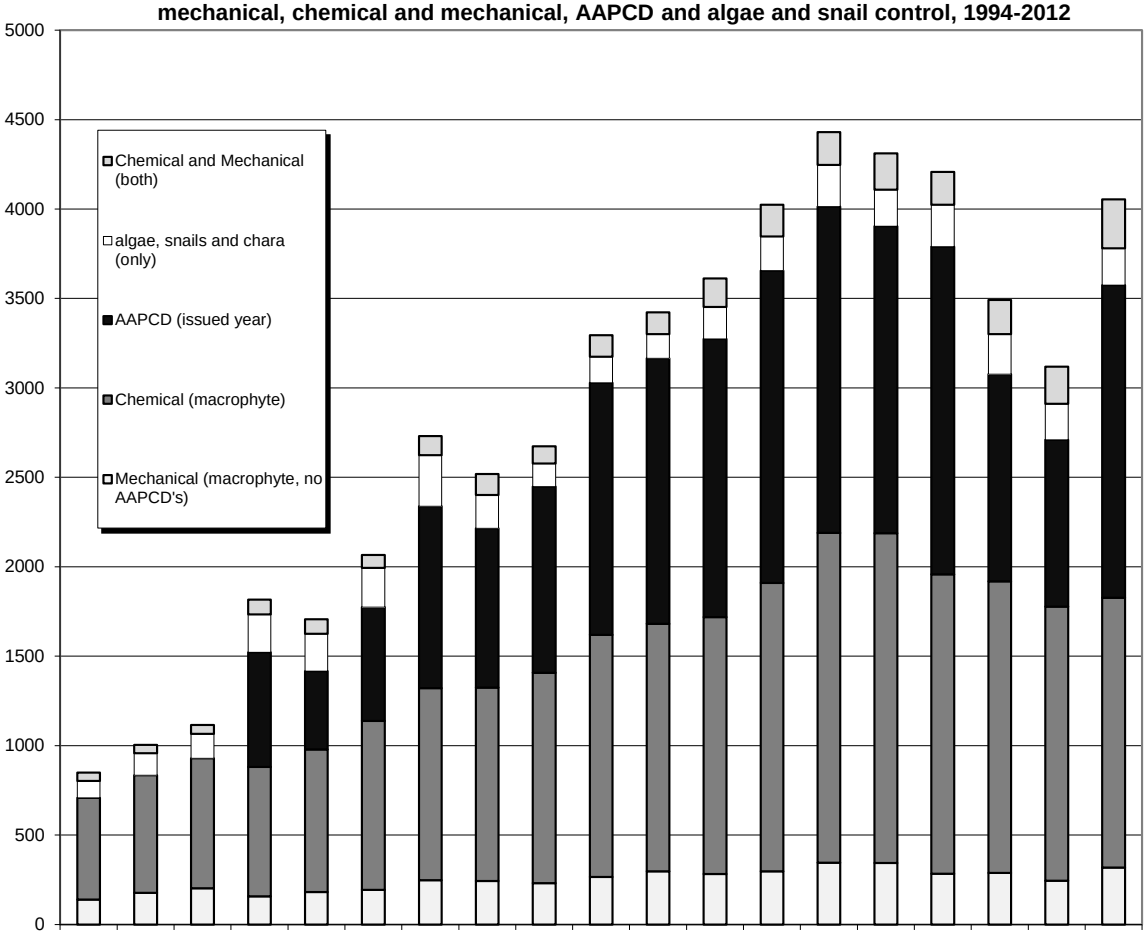


Table 3. Total near-shore area permitted, in acres, by region, for control of submerged vegetation, swimmer's itch and AAPCD use in 2012.

Control	Region						Total number of acres	Props	Ave.Per Prop. (sq. ft.).
	1	2A	2B	3A	3B	4			
Herbicide control excluding open water treatment	40	9	69	483	122	51	776	4924	6,700
Mechanical control excluding open water removal	83	1	37	47	14	20	202	2334	3700
Swimmer's itch control *	24	6	26	3	19	4	84	382	9200
AAPCD 2012issued	62	0.4	27	8	12	5	114	1732	2800

* includes all permits with swimmers itch control

1 = Bemidji, 2A = Grand Rapids, 2B = Brainerd, 3A = St. Paul, 3B = Little Falls, 4 = New Ulm

Percent of Aquatic Plant Removal Permits Used

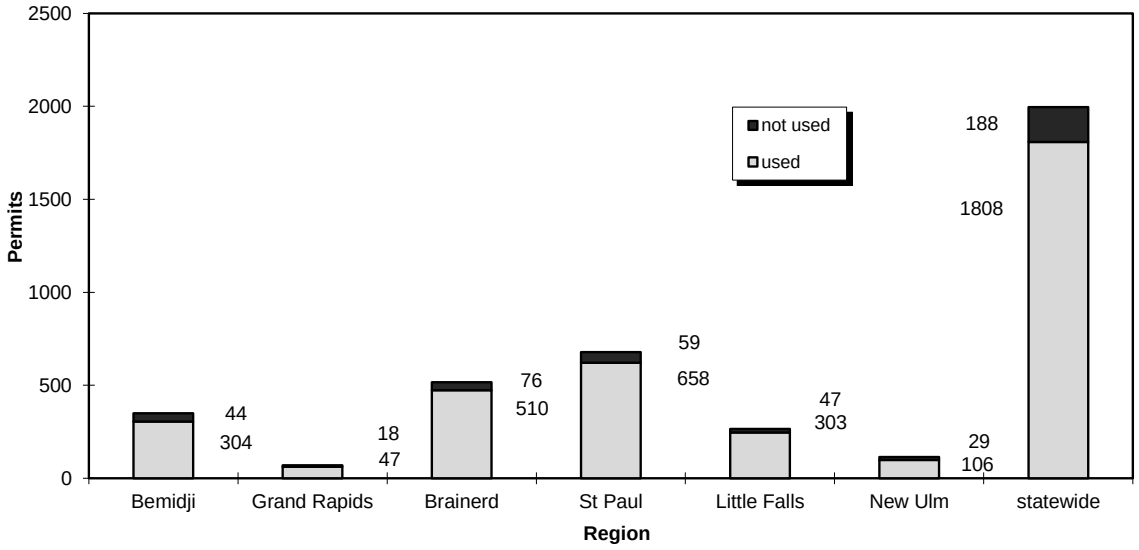
Each year some permits issued for aquatic plant management activities are not used (Figure 7). Statewide, 80% of permits issued were reported used by permittees who did their own control. Commercial applicators/operators reported using 90% of the permits issued for work they did. Permittees indicating that their permit was not used were asked to indicate why by responding to one or more choices provided on the survey. The results are summarized in Table 4, below. In 2012, the reason most frequently given (61%) for not using an APM permit was for unidentified reasons.

Table 4. Response by permit holders to choices indicating that their APM permit was not used, expressed as a percent by region in 2012.

Region	1	2A	2B	3A	3B	4	Statewide
nuisance condition did not develop	9	0	6	0	16	16	8
got permit too late	7	0	5	3	8	4	5
unable to do the work	30	50	25	15	37	12	26
other	54	50	64	82	39	68	61
total	100	100	100	100	100	100	100

1 = Bemidji, 2A = Grand Rapids, 2B = Brainerd, 3A = St. Paul, 3B = Little Falls, 4 = New Ulm

Figure 7. Total reported number of permits used and not used by region (excluding AAPCD permit holders), 2012.



Who does control

Commercial applicators and mechanical control companies performed about 59% of the permitted control statewide in 2012. This represents a 6% decrease from the percent of the permitted control done by commercial applicator and commercial mechanical control companies in 2011 and the same level as 2010. Permit holders in the Central Region hire commercial services more frequently than any other region (Figure 8a). In 2012 commercial aquatic plant control companies performed about 80% of the permitted control in the Metro Area. In 2012, 21% of the permitted control in the Northeast Region was performed by commercial service. Most of this control is in the Brainerd Lakes Area of the NE Region. In the Grand Rapids area (2A) of the NE Region most permitted control is done by the homeowner. Permit holders perform about 72% of the permitted control in the Northwest Region and 63% in the South Region. Homeowner conducted control has increased slightly compared to 2011 (Figure 8b).

Satisfaction

Permittees who personally undertook aquatic plant control activities were asked to indicate their satisfaction with the results of the aquatic plant control. Generally, permit holders were satisfied with the results of the control. About 59% of the respondents were satisfied with the results of herbicide control. About 76% of those responding were satisfied with the results of treatments to control swimmer's itch and 58% of respondents were satisfied with results of mechanical control. It is important to

Figure 8a. Percent of reported permitted APM work done by permittee and by commercial service for each region in 2012.

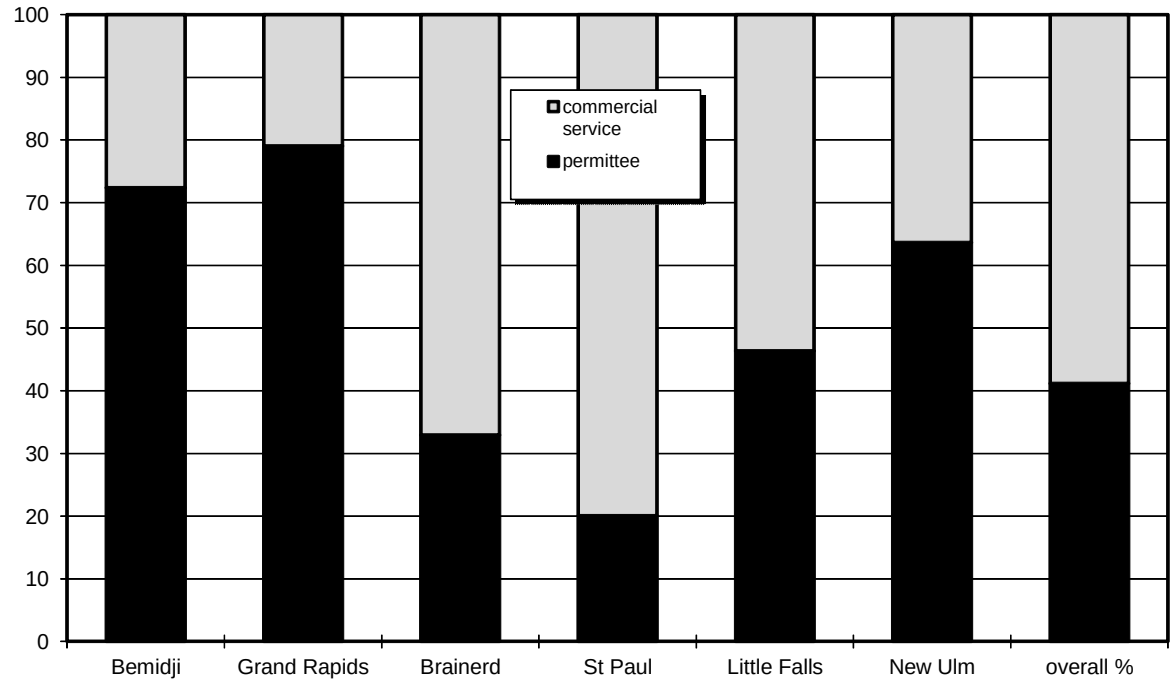
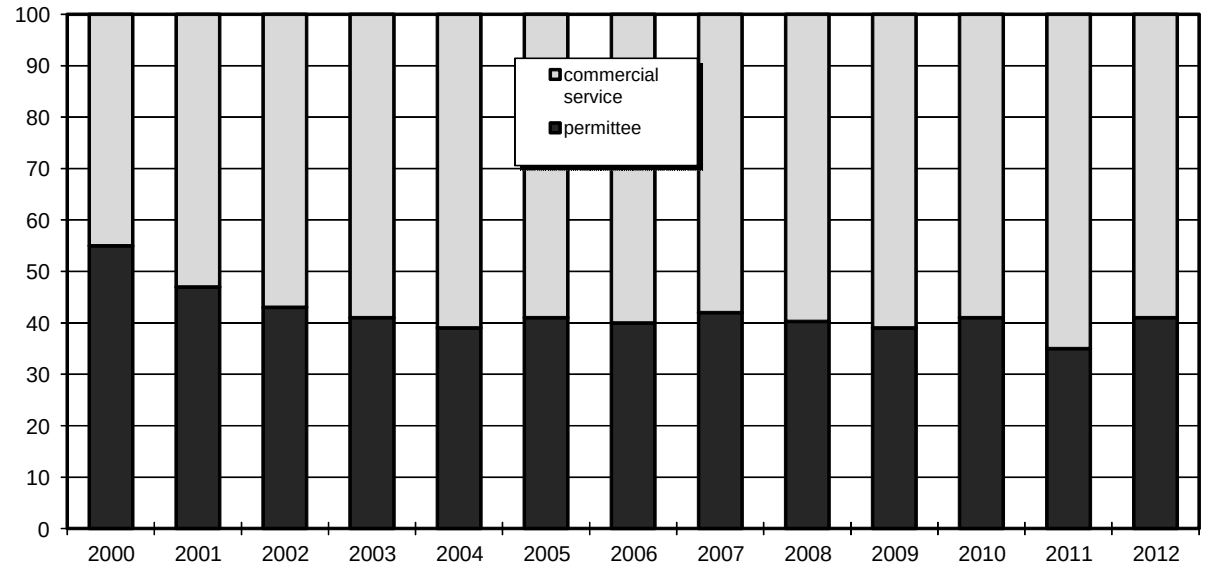


Figure 8b. Percent of reported permitted APM work done by permittee and by commercial service statewide from 2000-2012.



remember that permit holders hiring commercial services were not included in the survey.

Reapply for permit

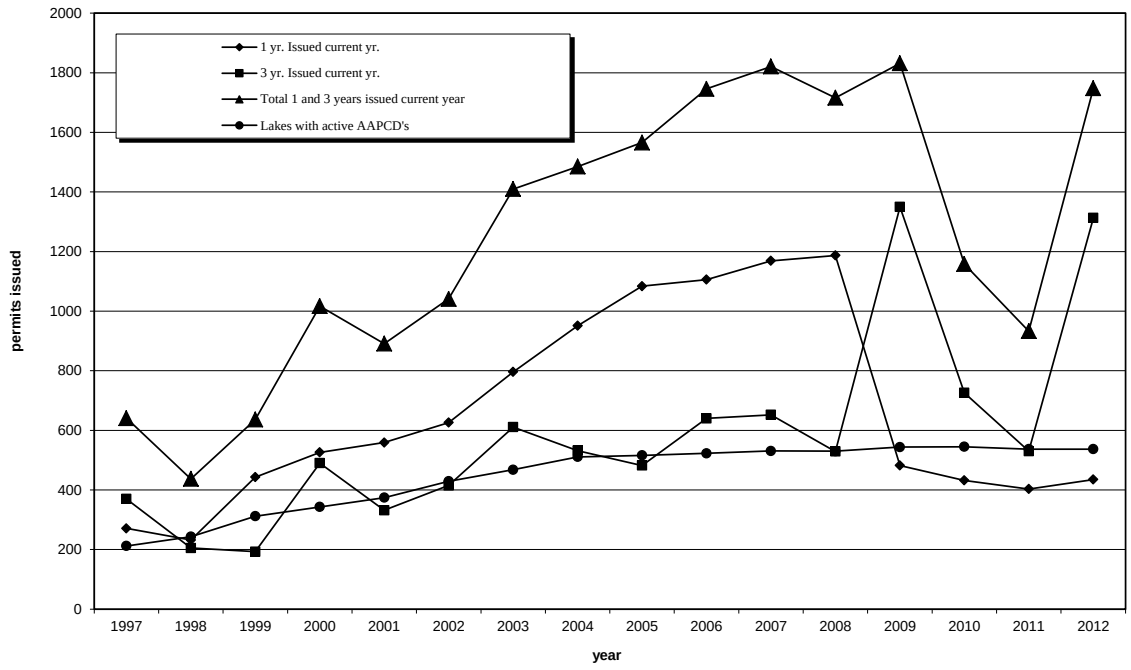
Permit holders, excluding AAPCD permittees, were asked if they would apply for a permit in 2013. Of the 961 responses, 728 (76%) said they would reapply for an APM permit next year, unchanged from 2011. Approximately 14% (125) of the permit holders responding indicated that they were unsure if they would reapply for a permit in 2013. The number of permittees reporting that they would not apply (30 or 3.3%) was slightly higher than in 2011. Regardless of their response, all 2012 permit holders, whose permits expire, will receive permit application materials prior to the start of the 2013 open water season.

Automated Aquatic Plant Control Devices (AAPCD)

Before 1997 the operation of an AAPCD did not automatically require an APM permit, and few AAPCD permits were issued. The APM Rules were revised in 1997 to require a permit for the operation of these devices because of their potential to excavate bottom sediments, and impact spawning habitat. In 2012 there were 1,748 permits issued for these devices statewide. Of those permits 448 were issued for a one-year term and 1,300 were issued for a three-year permit term. About 77 percent of the AAPCD permits were issued in the Northwest and Northeast Regions; up about 3% from 2011. In addition to the permits issued in 2012, there are active three-year permits issued in 2010 and 2011 (726 and 530 respectively). Of the 1,741 surveys mailed to AAPCD permit holders, 1,550 (89%) responded to the survey. Three-year AAPCD permit holders issued permits in 2010 and 2011 were not surveyed.

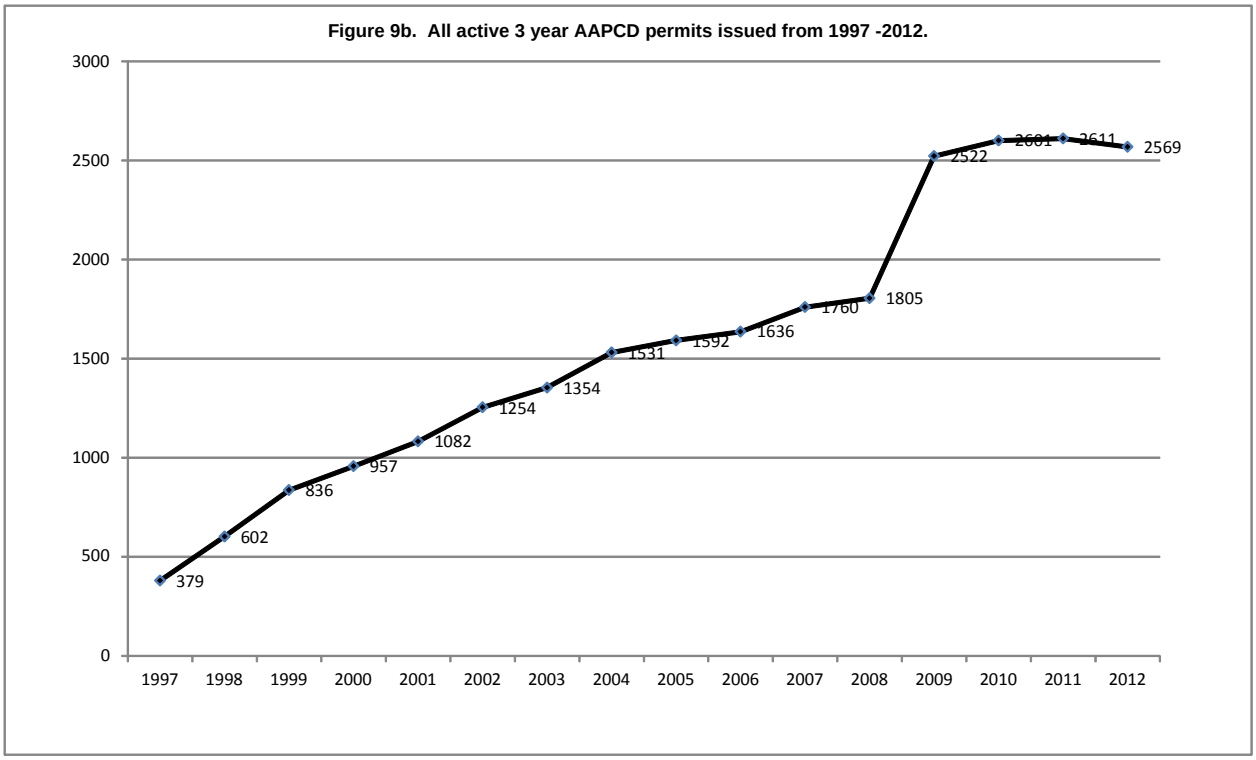
The APM rules provide two permit options for AAPCD operation. A person applying for a permit to operate the device in an area greater than 2,500 square feet is required to obtain an annual permit. However, a three-year permit option is available for persons who limit the size of the area of AAPCD operation to 2,500 square feet or less (*Minnesota Rules*, part 6280.0450, subp.3, item A). In addition, revisions to the APM rules implemented in the 2009 permit season restrict submersed aquatic plant removal to 100 feet of shoreline or one-half the owner's frontage whichever is less (*Minnesota Rules*, part 6280.0350, subp. 1a). Due to this rule change many more permit holders became eligible for an AAPCD permit of three year duration in 2009. In 2012, 1,300 three year AAPCD permits were issued. Three year AAPCD permit issuance in 2012 increased by 770 permits over 2011.

Figure 9a. Numbers of permits issued allowing the use of AAPCD's in Minnesota public waters, 1997-2012



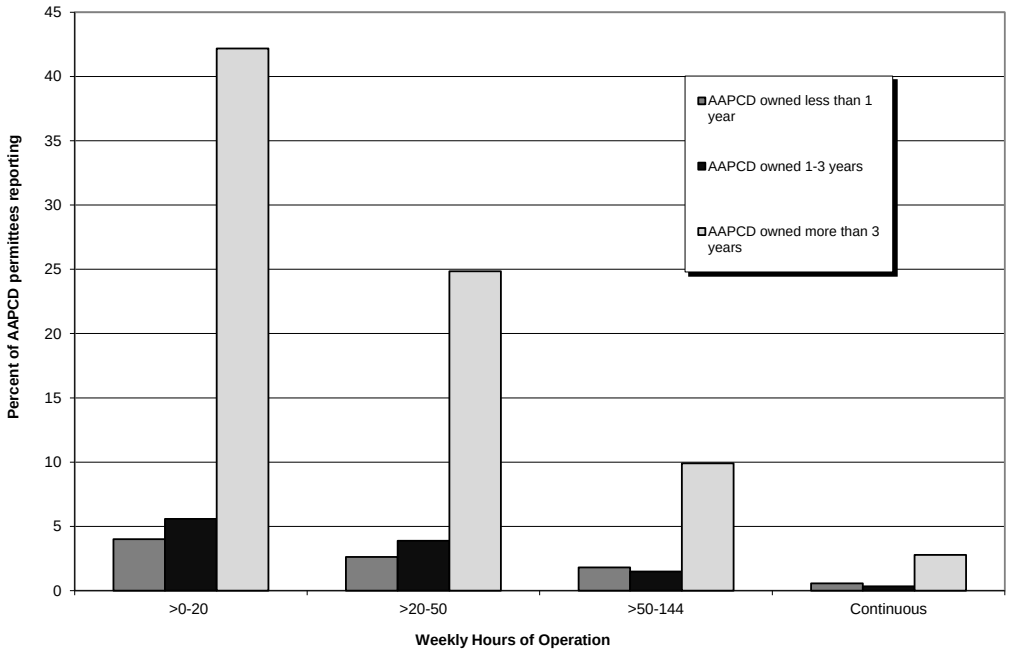
In 2012 there were 770 more three-year AAPCD permits than were issued 2011. There were 1,748 total AAPCD permits issued in 2012, 597 more than in 2011. The number of single season permits issued in 2012 increased by 91 over 2011 (Figure 9a).

The numbers of permits issued for AAPCD use increased in 2012. Figure 9b shows all active 3-year AAPCD permits in 2012. If you include the 448 one-year permits issued in 2012 there are approximately 3,004 AAPCDs authorized to operate in Minnesota public waters. There were about 146 fewer active AAPCD permits in 2012 than in 2011.



The manufacturer of the WeedRoller® has stated that with time people will need to use the WeedRoller® less frequently to achieve acceptable control. The company explained that once the plants were gone there would be little need to use the machine. AAPCD permit holders were asked, “How frequently do you operate your AAPCD?” These responses were sorted by the length of time people had indicated they had owned the machine. Recent AAPCD owners are more likely to operate the device longer than those people who have owned the device for several years (Figure 10). About 198 persons permitted to operate an AAPCD stated that, for various reasons, they did not operate the device in 2012, up slightly from 2011.

Figure 10. AAPCD use from May through August, 2012 catagorized by length of ownership expressed as a percent of all AAPCD permittees reporting.



Filamentous algae control

The APM rules allow the control of filamentous algae with copper sulfate. Filamentous algae can become a nuisance by interfering with swimming and wading. Permit issuance for filamentous algae control mirrors permit issuance for submerged vegetation control (Figure 11). Filamentous algae control is commonly requested on applications for control performed by commercial services. After four consecutive years of decline, requests for filamentous algae control were up slightly over 2011.

Chara control

The APM rules allow the control of chara with copper sulfate. As a result of revisions to the APM rule in 2009, the limits on submersed aquatic plant control (lake shore property owners may receive a permit to control submersed aquatic plants on up to 100 ft, or one-half their frontage whichever less) now apply to the management of Chara. Chara is a macro-algae that can interfere with recreation in some lakes. In 2011 there were approximately 257 lakes where permits were issued for chara control (Figure 12). Applications for chara control were stable in 2012.

Figure 11. Numbers of permits issued for filamentous control, and numbers of lakes where permits were issued 1997-2012.

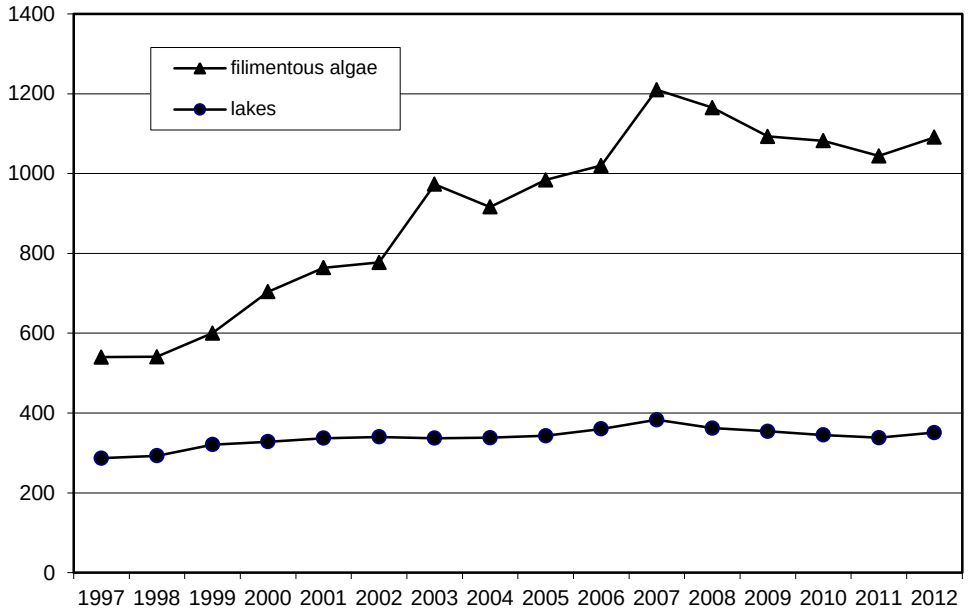
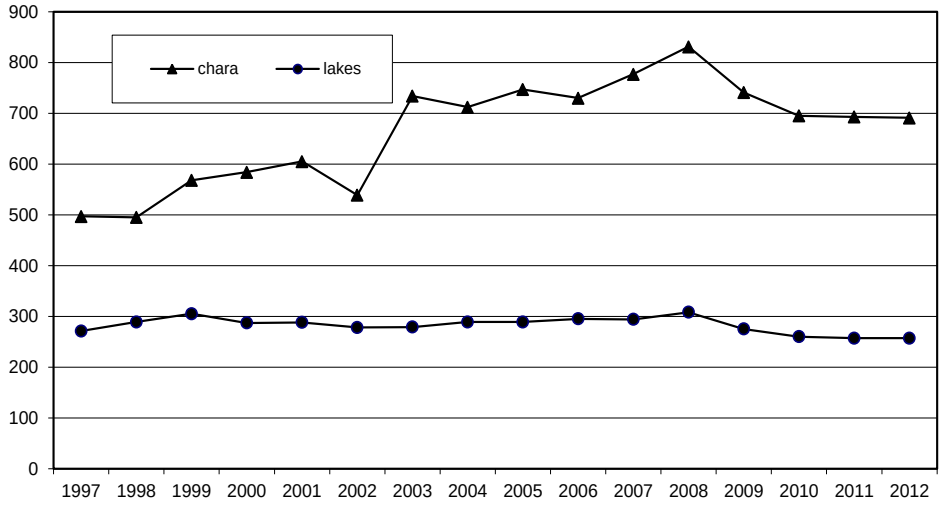


Figure 12. Numbers of permits issued for chara control, and numbers of lakes where permits were issued 1997-2012.



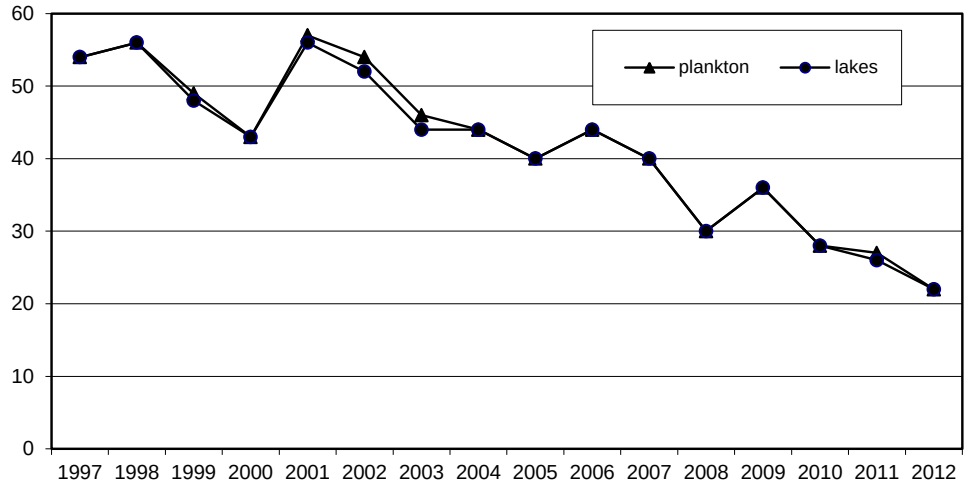
Plankton algae control

The APM rules allow the control of plankton algae when there is an "excessive algae bloom." The characteristics of an "excessive algae bloom" as defined by the rules are:

an algae population dominated by blue green algae, a Secchi disc reading typically 2 feet or less, floating mats or scums of algae accumulating on the downwind shore, or decomposition of accumulated algae has occurred releasing a blue-green pigment and causing an offensive odor.

The numbers of lakes treated with algaecides to control plankton algae has been decreasing over the last ten years (Figure 13). Copper sulfate treatments can cause an increase in water clarity when the turbidity is due to algae, but the increased water clarity is usually temporary and the treatment may need to be repeated. Due to the temporary nature of control, the possibility of a fish kill caused by a dissolved oxygen decline from decomposing algae, the buildup of copper in lake sediments, and the potential for algae to become resistant to copper, lake-wide plankton algae treatments are discouraged.

Figure 13. Numbers of permits issued for lake-wide plankton algae control, and numbers of lakes treated 1997-2012.



Swimmer's itch control in Minnesota lakes

A condition known as Swimmer's itch (a.k.a. lake itch, wader's itch) has garnered complaints from swimmers in Minnesota lakes since at least the 1800's and has likely been around for much longer. The cause of this irritating skin condition was discovered by W.W. Cort in 1928 at the University of Michigan Biological Station (Blankespoor and Reimink, 1991). Cort discovered that swimmer's itch (cercarial schistosome dermatitis) is caused by the immature life stage of common non-human schistosome trematodes called the cercaria.

These parasites have a complex life history. The adult fluke lives in the blood vessels lining the intestine of its definitive host where it reproduces and releases eggs. The eggs enter the gut and leave the animal in the feces. The eggs hatch when they enter

the water becoming a larvae called a miracidia. The miracidia then infects a snail where it develops into a life stage called the cercaria. The cercaria, upon release from the snail, seeks its definitive host, usually some sort of waterfowl. The cercaria does not feed and will only live for about 24 hours unless it finds a proper host. When a proper host is located the cercaria penetrates the skin, finds its way to the blood vessels lining the gut, and becomes an adult completing its life history.

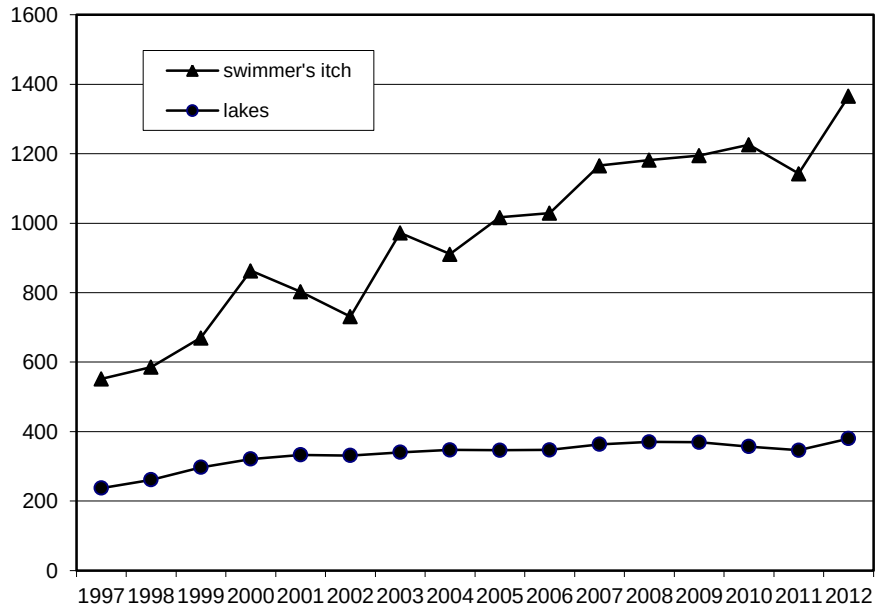
The problem for humans occurs when the cercaria mistakes us for its proper host. When a cercaria penetrates a human's skin it is attacked and killed by the person's immune system. Although the organism cannot complete its life history in humans, individuals sensitive to the infection can suffer from an allergic reaction. The symptoms will appear on areas of the body submersed in the lake and are typified by areas of redness and swelling, similar to a mosquito bite, and are accompanied by a severe itching sensation. These symptoms can last up to two weeks.

Not everyone is bothered by swimmer's itch; about 30 to 40% of the population is sensitive to swimmer's itch infection. This explains why some people swimming in a lake at the same time and place as a person severely affected, experience no symptoms. Like other allergic reactions, a person's degree of sensitivity increases with each exposure.

Lakeshore property owners may get a permit from the DNR that allows the application of copper sulfate to the lake for the control of swimmer's itch. The intent of the copper sulfate application is to kill snails that harbor the immature life stage of the fluke that causes swimmer's itch. Individuals receiving a permit to control swimmer's itch with copper sulfate are generally allowed to treat the permitted area 2 times per summer if allowed by the products label.

The numbers of permits issued for swimmer's itch has increased steadily since 1997. The Brainerd Lakes Region has had more lakes per year with permitted swimmer's itch control than any other area of the state. In 2012 there were nearly 380 lakes statewide where permits were issued for swimmer's itch control (Figure 14, Appendix Table G). About 64% of those responding were satisfied with the results of treatments to control swimmer's itch, down by 3% from 2011.

Figure 14. Numbers of permits issued for swimmer's itch control, and numbers of lakes where permits were issued 1997-2012.



Management of invasive aquatic plants

In addition to oversight (permitting) responsibilities for aquatic plant management efforts conducted by individuals to improve access or recreational use, the DNR has statewide control programs for four, non-native invasive aquatic plants: curly-leaf pondweed, purple loosestrife, flowering rush, and Eurasian watermilfoil.

In 2011, Invasive Aquatic Plant Management (IAPM) permit was defined in *Minnesota Statues* 103G.615, subd. 3a. The purpose of this new type of aquatic plant management (APM) permit is to authorize "the selective control of invasive aquatic plants at a scale to cause a significant lake or bay-wide reduction in the abundance of the invasive aquatic plant." The IAPM permit was first implemented in 2012.

Prior to 2012, APM permits authorizing lake or bay wide control of invasive aquatic plants were issued by the DNR's Division of Fish and Wildlife, aquatic plant management program. After a series of stakeholder meetings in the fall of 2011 it was determined that permits for lake or bay wide control of invasive aquatic plants would be issued by the Division of Ecological and Water Resources, where the invasive species program is located. Other changes made in 2012 to facilitate the management of invasive aquatic plants include; lake or bay-wide control of invasive aquatic plants may include significant near-shore areas and numerous property owners; the commissioner may waive the property owner signature requirement in rule, where obtaining signatures from all property owners would create a hardship; the new statutory provision requires the notification of property owners near treated areas; and IAPM permits are issued without fee.

In 2011 there were approximately 170 permits issued for the lake or bay-wide treatment of invasive aquatic plants. In 2012 there was a total 204 IAPM permits issued. Table 5 below provides a breakdown of IAPM permits issued in 2012 by DNR region.

Table 5. Numbers of Invasive Aquatic Plant Management Permits issued in 2012 classified by district and type.

		Curly-leaf pondweed					
Region	District	Early	Not early	Milfoil	Curly & milfoil	Sum	Number of permits for > 15%
1	N	2	1	3	-	6	1
	S	4	4	1	-	9	3
2	-	17	2	8	-	27	9
3	N	23	19	22	-	64	13
	S	10	5	20	9	[70] 44	11
4	N	5	0	7	-	12	2
	S	9	2	3	3	17	3
Sub-Total		70	33				
Total		103		64	12	179	42

Curly-leaf pondweed

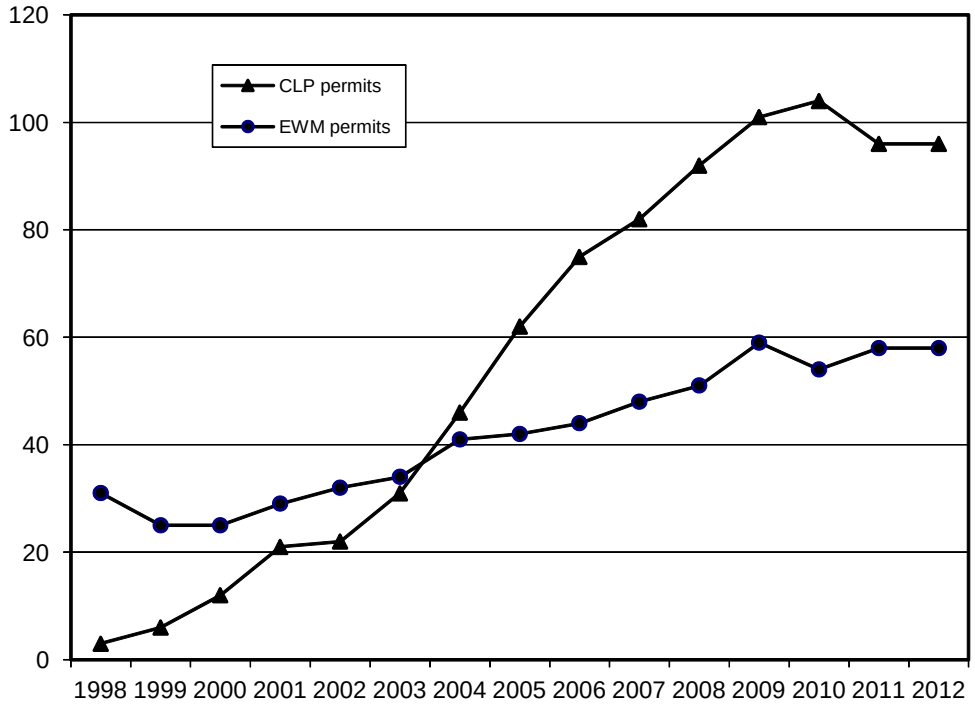
Curly-leaf pondweed (*Potamogeton crispus*) is a non-native invasive, submersed aquatic plant species introduced to Minnesota at the turn of the 20th century. Curly-leaf pondweed is known to occur in 752 Minnesota lakes in 70 of the 87 counties in Minnesota. In many lakes this plant causes severe recreational nuisances.

Curly-leaf pondweed thrives in disturbed lake environments with moderate to high total phosphorous concentrations and is hypothesized to contribute to algae blooms after the plant dies back in midsummer (Heiskary and Valley 2012). Curly-leaf pondweed's life cycle is considerably different than native aquatic plants. New plants sprout from vegetative propagules called turions (hardened stem tips) in the fall (Catling and Dobson, 1985). When native aquatic plants are just beginning to grow (mid to late May) curly-leaf pondweed may already be forming dense mats on the lakes surface that can interfere with recreation and the growth of native aquatic plants. By midsummer, (early to mid July) curly-leaf plants begin to die back, which results in rafts of dying plants piling up on shorelines. Before the plants die they form turions (hardened stem tips) which will be the source of next year's growth. The die back may also be followed by an increase in phosphorus (Bolduan et al., 1994) and undesirable algal blooms. These

algae blooms interfere with light penetration and can also reduce native plant abundance.

Standard control methods provide relief to lakeshore property owners from the recreational nuisances caused by surface mats of curly-leaf pondweed, but have no long-term effect on the abundance of the plant. Research conducted by the U.S. Army Corps of Engineers (ACE) described control strategies that may reduce the abundance of this plant. The key to the new strategies for the control of curly-leaf pondweed is treating the plant early in the season (when water temperatures are between 50 and 60 degrees F). If this early season treatment strategy is repeated in successive years the turion bank should become depleted, resulting in the reduction of overall abundance of the plant, the severity of algae blooms, and give native vegetation a competitive advantage. Figure 15 shows how interest, reflected by the numbers of permits issued, in curly-leaf pondweed control has increased since the completion of the Army Corp of Engineers research on early season cold-water control.

Figure 15. Numbers of permits issued for curly-leaf pondweed and Eurasian watermilfoil control 1998-2012.



Following the establishment of an Invasive Species Program at the Minnesota Department of Natural Resources, interest in possible management of curly-leaf pondweed increased In the 1990s. In the late 1990s, researchers with the Army Corps

of Engineers learned that there is potential to control curly-leaf growing during early spring by treatment with endothall or diquat herbicides. Not only did these treatments reduce growth of the plant, they also appeared to have the potential to disrupt reproduction. Production of turions can be prevented by early season treatment with herbicide.

Following the early work by the Army Corps on control of curly-leaf, the MnDNR initiated a number of lake-wide, pilot projects in Minnesota with five goals:

1) Reduce curly-leaf pondweed during the year of treatment. An immediate or principal benefit is reduction in interference with lake use
2) Reduce curly-leaf pondweed beyond the year of treatment – long-term control. It was hypothesized that treatment that prevents production of turions would lead to long-term control.
3) Increase native submersed plants.
4) Increase water clarity.
5) Accomplish goals 1-4 with three to five years of successive lake-wide treatment, followed by a number of years when lake-wide treatment would not be necessary.

Increases in native submersed plants and water clarity would be ecological benefits. These efforts were called pilot projects because it was not known whether the goals of the projects could be met. To determine whether ecological benefits could be obtained by repeated lake-wide treatment, the DNR supported a limited number of well-planned and well-monitored projects. Some of these lakes were monitored by the University of Minnesota under a contract with the MnDNR. In 2012, researchers at the University published results of their efforts (Johnson et al. 2012 and Jones et al. 2012). It is important to note that they reported results for eight (Jones et al. 2012) or nine (Johnson et al. 2012) treated lakes. Of these, six were eutrophic or hypereutrophic, i.e. Secchi depth less than 1.6 m for the lakes studied, and the other two or three were mesotrophic, i.e. Secchi depth greater than 2 m. As a consequence, the conclusions based on this research probably are more helpful in understanding effects of management in eutrophic lakes as compared to mesotrophic lakes. Additional analysis of observations from mesotrophic lakes would be useful. Based on these publications and review of results from additional lakes, it is evident that:

- Lake-wide treatments with herbicides can reduce curly-leaf pondweed during the year of treatment.

- Lake-wide treatments with herbicides may or may not reduce curly-leaf pondweed beyond the year of treatment.

- Although treatment can reduce or prevent production of turions, significant numbers of turions can remain in the lakes after as many as five years of lake-wide treatment.

- Overall, most native aquatic plants were not harmed by lake-wide treatments of curly-leaf pondweed with endothall.

- Overall, there did not appear to be a consistent trend of increasing water clarity following lake-wide treatments to control curly-leaf pondweed. The plant does not appear to be a significant driver of water quality in these lakes.

- Three to five years of successive lake-wide treatment generally were not followed by a number of years when lake-wide monitoring or large treatment would not be necessary.

More detailed information on this project can be found in the 2012 Invasive Species Program Annual report:
(http://files.dnr.state.mn.us/ecological_services/invasives/annualreport.pdf)

Purple Loosestrife

Purple loosestrife, a non-native invasive plant that can out compete native wetland vegetation, was introduced to North America from Europe in the 1800's and until 1987 was a common ornamental sold by nurseries and landscape companies. Natural resource managers became aware of the plant's invasive nature and disruptive effects on native wetland vegetation in the early 1980's. The DNR, concerned about the plants impact on native species and wildlife habitat, conducted preliminary surveys to determine the status of the plant in Minnesota. The survey revealed that 77 of Minnesota's 87 counties had populations of purple loosestrife in wetlands, lakeshore, stream banks and ditches. In 1987 Minnesota became one of the first states in the nation to develop a program to control this invasive plant. Minnesota has designated purple loosestrife as a noxious weed, which makes it illegal to import, buy, sell, propagate and transport.

The main components of the purple loosestrife program are:

1. Inventory purple loosestrife sites to prioritize control efforts.
2. Carry out management activities including chemical and biological control.
3. Support research to evaluate and improve control efforts.
4. Monitor and evaluate the success of biological control and other management efforts.
5. Public education/awareness efforts to involve the public in the management of this plant.

Large stands of purple loosestrife are extremely difficult to control because of their enormous seed bank; therefore, it is necessary to prioritize purple loosestrife control efforts. The highest priority stands for herbicide treatment are small, recently established stands, located near the top of the watershed. Because of their small size these newly established sites are poor candidates for biocontrol. Rodeo, a broad-spectrum glyphosate herbicide, is used to spot treat high priority purple loosestrife sites with a backpack sprayer.

Minnesota's herbicide control effort has been reduced dramatically since the introduction of bio-control agents began in 1992. In 2012, DNR staff treated a total of 29 purple loosestrife sites with 0.08 gallons of herbicide. Most of these sites were very small with the majority having fewer than 100 plants. For more detailed information on Minnesota's purple loosestrife program, see the 2012 Invasive Species Annual Program report. (http://files.dnr.state.mn.us/ecological_services/invasives/annualreport.pdf)

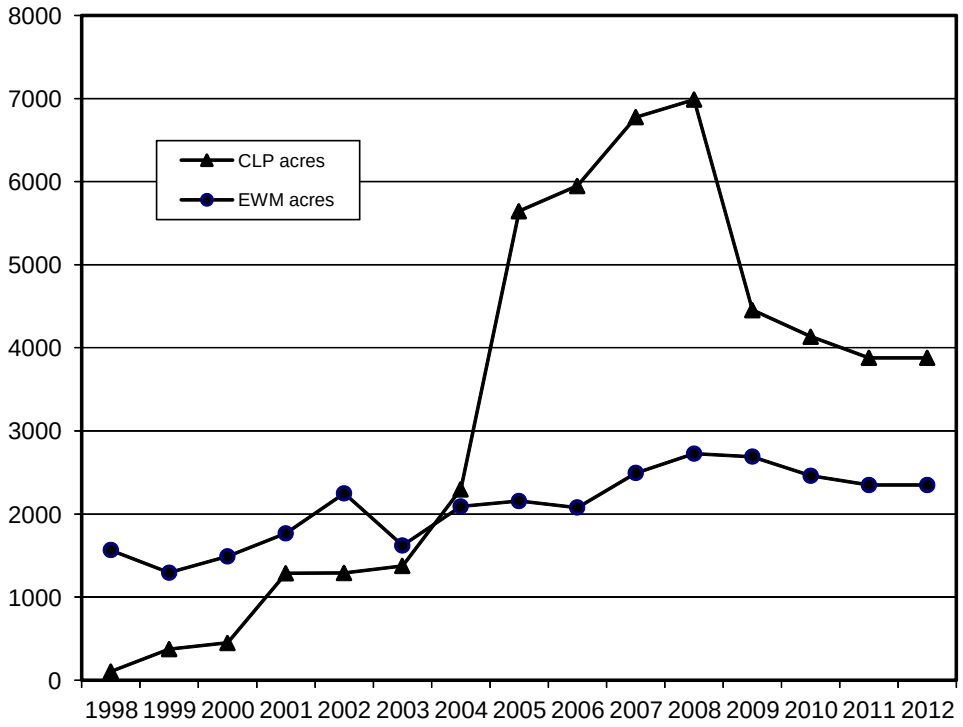
Eurasian Watermilfoil

Eurasian watermilfoil, hereafter called milfoil, is an invasive, aquatic plant introduced to North America in the mid-1900's. It was first identified in Minnesota in 1987 in Lake Minnetonka. Milfoil is a submerged aquatic plant that can displace native vegetation. The plant reproduces by fragmentation, establishes itself readily in disturbed areas, and has the potential to become a nuisance in Minnesota lakes. The main strategies of the Eurasian watermilfoil program are:

1. Slow the spread of the plant through public education and awareness activities.
2. Support management by lake associations and local units of government of problems caused by milfoil.
3. Maintain an accurate inventory of populations.
4. Investigate new control methods and the biology of the plant.

Eurasian watermilfoil was discovered in 16 additional water bodies in 2012. There are now 273 bodies of water in Minnesota known to have populations of this invasive submersed aquatic plant. The acres of Eurasian watermilfoil and curly-leaf pondweed control managed in offshore areas since since 1998 is found in Figure 16.

Figure 16. Acres of off-shore curly-leaf pondweed and Eurasian watermilfoil control 1998-2012.



The most commonly used herbicide for control of milfoil is a granular 2,4-D ester product labeled for aquatic use. In 2001, a liquid dimethylamine salt 2,4-D product was registered for aquatic use and has been applied to milfoil in Minnesota. Late in 2002, a liquid trimethylamine salt, triclopyr product, was registered for aquatic use and is available for control of milfoil in Minnesota. These systematic herbicides are preferred because they are the most selective products available.

The total reported 2,4-D use in 2012 for milfoil was 19,007 pounds. The total reported annual use of 2,4-D ester products since 1987 is provided in Figure 17. Figure 18 shows the use of triclopyr since 2006.

For more detailed information on the management of invasive species see the 2012 Invasive Species Program Annual Report. The report may be reviewed on line at http://www.dnr.state.mn.us/ecological_services/invasives/index.html.

Figure 17. Permitted 2,4D Ester (lbs,) use in Minnesota after identification of Eurasian watermilfoil in Minnesota, 1988.

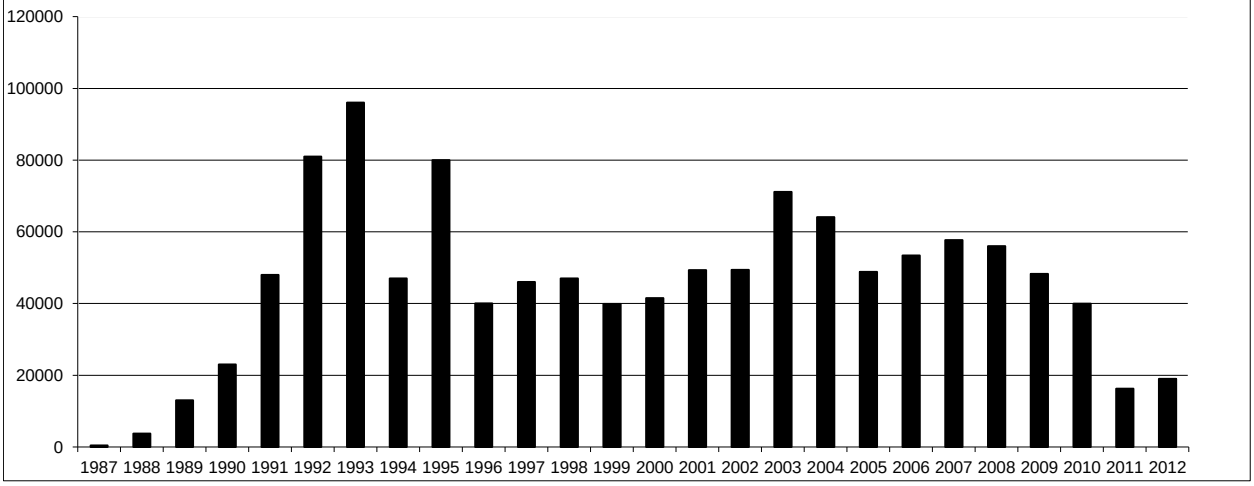
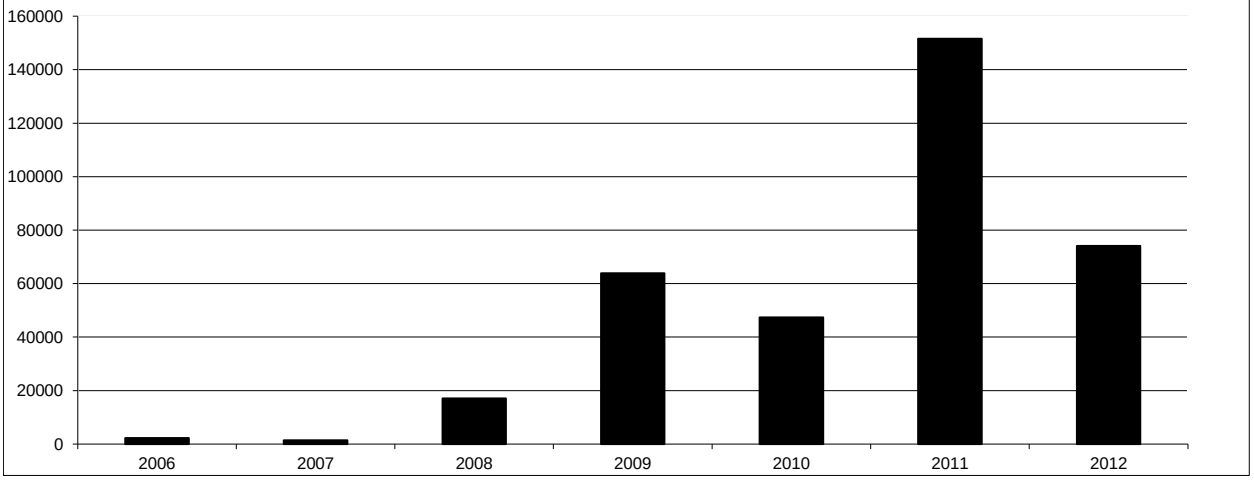


Figure 18. Permitted triclopyr (lbs,) use in Minnesota after identification of Eurasian watermilfoil in Minnesota, 2006.



Mention of trademarks or proprietary products does not constitute a warranty of the products by the Minnesota Department of Natural Resources and does not imply its approval to the exclusion of other products that may also be suitable.

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APPENDIX

Table: Page

Appendix Table A. Aquatic pesticide use inspections in 2012				
Treatment Date	**County**	**Lake Name**	**Applicator**	**Permit Number**
04/25/2012	Crow wing	Lower Cullen	Professional Lake Management, 4597 Morehouse Dr., Pequot Lakes, 56472	12W-2B003
05/02/2012	Wright	Sylvia	Greater Lake Sylvia, 5617 Quiner Ave NW, Annandale, 55302	12W-3006
05/03/2012	Chisago	Rush (west)	Lake Restoration, 12425 Ironwood Circle, Rogers, 55374	12W-3080
05/09/2012	Washington	Forest	Lake Management, 10400 185th St. N. Marine St. Croix, 55047	12W-3055
05/09/2012	Scott	Prior	Prior Lake Homeowners, 5465 Shore Tr., Prior Lake, 55372	12F-3A95
05/10/2012	Wright	Pulaski	Lake Restoration, 12425 Ironwood Circle, Rogers, 55374	12W-3050
05/21/2012	Hennepin	Mooney	Lake Restoration, 12425 Ironwood Circle, Rogers, 55374	12W-3033
05/21/2012	Wright	Clearwater	Clearwater Lk Property Owners, 10937 Lawrence Ave. NW, Annandale, 55302	12W3021
05/30/2012	Chisago	North Center	Lake Restoration, 12425 Ironwood Circle, Rogers, 55374	12F-3A247
05/30/2012	Chisago	North Center	Lake Management, 10400 185th st. N., Marine St. Croix, 55047	12F-3A580
06/04/2012	Hennepin	Libbs Mtka	Midwest Aquacare, 10001 Great Plains Blvd., Chaska, MN 55318	12F-3A610
06/06/2012	Carver	Minnewashta	Lake Restoration, 12425 Ironwood Circle, Rogers, 55374	12F-3A266
06/08/2012	Ramsey	McCarrons	Kaari Paul S. DBA Lake Improvement Consulting, 13787 40th St., Stillwater, 55082	12F-3A199
06/11/2012	Ramsey	Bald Eagle	Jacobson Environmental PLLC, 5821 Humboldt Ave. N., Brooklyn Center, 55430	12F-3A472
06/12/2012	Chisago	Rush (west)	Lake Restoration, 12425 Ironwood Circle, Rogers, 55374	12F-3A358
06/12/2012	Washington	Clear	Lake Management, 10400 185th St. N., Marine St. Croix, 55047	12W-3001
06/15/2012	Washington	Big Marine	Lake Management, 10400 185th St. N., Marine St. Croix, 55047	12F-3A072
06/18/2012	Ramsey	Bald Eagle	Jacobson Environmental PLLC, 5821 Humboldt Ave. N., Brooklyn Center, 55430	12F-3A470
06/21/2012	Anoka	Coon	Professional Lake Management, 4597 Morehouse Dr., Pequot Lakes, 56472	12W-3123
06/25/2012	Ramsey	Bald Eagle	Lake Restoration, 12425 Ironwood	12F-3A248

			Circle, Rogers, 55374	
Appendix Table A. Aquatic pesticide use inspections in 2012 (cont)				
06/27/2012	Wright	Howard	Howard Lake Watershed Alliance, P.O. Box, 438, Howard Lake, 55349	12W-3100
07/10/2012	Washington	Bone	Lake Management, 10400 185th St. N., Marine St. Croix, 55047	12W-3118
07/11/2012	Carver	Minnewashta	Jacobson Environmental PLLC, 5821 Humboldt Ave. N., Brooklyn Center, 55430	12F-3A865
07/12/2012	Washington	Long	Lake Restoration, 12425 Ironwood Circle, Rogers, 55374	12F-3A592
07/17/2012	Todd	Mound	Central Minnesota Aquatics Inc, 26735 Middle Cullen Rd., Nisswa, 56468	12F-3B449
07/19/2012	Dakota	Parkers	Lake Restoration, 12425 Ironwood Circle, Rogers, 55374	12W-3081
07/20/2012	Hennepin	Bryant	Midwest Aquacare, 10001 Great Plains Blvd., Chaska, 55318	12F-3A704
07/23/2012	Hennepin	Carsons Mtka	Lake Management, 10400 185th St. N., Marine St. Croix, 55047	12F-3A382
07/26/2012	Hennepin	Weaver	Lake Restoration, 12425 Ironwood Circle, Rogers, 55374	12F-3A408
07/26/2012	Chisago	Green	Green Lake Association, 9475 Jennifer Ct., Chisago City, 55013	12W3119
07/31/2012	Chisago	Ditch to Wallmark	Critical Connections Ecological Services Inc, 14760 Oakhill Rd, Scandia, 55073	12F-3A605
07/31/2012	Washington	Big Marine	Lake Management, 10400 185th St. N., Marine St. Croix, 55047	12W-3027
08/06/2012	Ramsey	Gervais	Kaari Paul S. DBA Lake Improvement Consulting, 13787 40th St., Stillwater, 55082	12F-3A651
08/20/2012	Hennepin	Upper Twin	Upper Twin Lake Association, 5225 Twin Lake Blvd. E. Brooklyn Center, 55429	12W-3130

Appendix Table B. A list of commonly used herbicides registered by the EPA for aquatic use and approved by the MN DNR.

Product Name	Selective	Broad Spectrum	Active Ingredient (Formulation)
Part 1. Aquatically labelled systemic herbicides.			
Aquacide (Pellet)	X		2,4 Dichlorophenoxyacetic Acid (Sodium Salt)
Navigate® (Granular)	X		2,4 Dichlorophenoxyacetic (Butoxyethyl Ester)
SEE 2,4-D (Liquid)	X		2,4 Dichlorophenoxyacetic (Isooctyl Ester)
Weedtrine II (Granular)	X		2,4 Dichlorophenoxyacetic (Isooctyl Ester)
Sonar (Liquid or Granular)		X	Fluridone
Rodeo (Liquid)		X	Isopropylamine salt of Glyphosate
Pondmaster (Liquid)		X	Isopropylamine salt of Glyphosate
Renovate		X	Triclopyr
Kraken		X	Triclopyr
Part 2. Contact Herbicides			
Aquathol (Liquid or Granular)		X	Dipotassium salt of endothall
Hydrothol 191 (Liquid or Granular)		X	mono-amine salt of endothall *(liquid by licensed applicator only)*
Reward, Redwing, Knockout (Liquid)		X	Diquat dibromide *(licensed applicator only)*
Part 3. Copper Compounds (Algaecides and Herbicides)			
Cutrine Plus (Liquid or Granular)	X (A)		Copper-Ethonalamine complex
Komeen (Liquid)	X (H)		Copper-Ethylenediamine complex
Symmetry	X (A)		Copper-Triethanolamine complex
Part 4. Other			
Copper sulfate	X (A)		CuSO4 (wide variety of registered brands)
Aquashade (Liquid)			Acid Blue 9/Acid Yellow 23 (Filters light in wavelengths required for plant growth)

Mention of trademarks or proprietary products does not constitute a warranty of the products by the Minnesota Department of Natural Resources and does not imply its approval to the exclusion of other products that may also be suitable.

Appendix Table C. Reported various aquatic herbicide use statewide in lbs. and gallons of product, 1981-2012.

Year	2,4-D ester lbs.	2,4-D salt lbs.	2,4-D amine/ acid gal.	Aquathol lbs.	Aquathol gal.	Diquat gal.	Hydrothol 191 lbs.	Hydrothol 191 gal.	copper sulfate lbs.	Triclopyr lbs.	Triclopyr gal.	2,4-D salt Triclopyr lbs.
1981	150	370	0	1,900	1,300	730	3,200	390	*	*	*	*
1982	120	320	0	1,700	1,500	550	4,200	44	*	*	*	*
1983	0	350	0	1,400	1,500	560	11,900	31	*	*	*	*
1984	110	130	0	730	980	780	7,300	80	*	*	*	*
1985	25	270	0	740	1,200	870	14,000	100	*	*	*	*
1986	25	370	0	1,100	1,400	1,200	6,900	170	*	*	*	*
1987	100	1,400	0	1,100	1,400	1,400	13,000	62	*	*	*	*
1988	3,700	600	0	950	1,300	1,300	11,000	100	*	*	*	*
1989	13,000	470	0	910	1,300	1,700	12,000	200	*	*	*	*
1990	23,000	290	0	680	1,100	1,500	9,500	130	*	*	*	*
1991	48,000	1,300	0	1,400	850	1,400	9,600	210	55,400	*	*	*
1992	81,000	320	0	870	1,600	1,700	9,000	67	64,000	*	*	*
1993	96,000	400	0	830	1,000	1,600	5,000	240	34,600	*	*	*
1994	45,000	700	0	710	940	1,800	10,000	510	59,800	*	*	*
1995	80,000	87	0	930	700	2,300	8,300	420	55,000	*	*	*
1996	39,000	400	0	1,000	730	1,900	8,900	830	32,500	*	*	*
1997	46,000	290	0	1,200	700	2,400	7,800	820	39,700	*	*	*
1998	47,000	440	0	790	1,280	2,580	4,460	670	50,800	*	*	*
1999	39,800	650	0	1,050	740	2,280	4,190	740	31,600	*	*	*
2000	41,500	700	0	1,380	1,850	2,970	5,820	530	41,900	*	*	*
2001	49,300	1,000	0	700	2,600	2,700	3,900	950	58,200	*	*	*
2002	49,400	700	20	540	2,660	2,530	4,220	760	42,200	*	*	*
2003	71,100	634	336	339	2,515	2,370	7,610	429	47,100	*	*	*
2004	64,100	1,068	216	366	5,200	2,856	8,040	643	53,700	*	*	*
2005	48,800	1,154	533	1,077	7,054	2,773	6,744	715	63,500	*	*	*
2006	53,400	805	215	1,530	8,757	2,953	11,653	126	47,000	2,189	28	*
2007	57,700	971	85	1,320	9,838	3,665	10,105	782	46,000	1,400	46	*
2008	56,000	655	7.4	2,462	13,208	2,643	10,693	550	32,290	17,025	1,882	*
2009	48,250	655	939	725	13,801	1,791	7,963	1,758	25,234	63,896	662	*
2010	39,932	731	1,070	737	10,238	1,501	7,973	900	23,200	47,379	1,371	*
2011	16,233	775	1,066	578	10,936	1,760	5,426	626	22,341	151,593	587	3120
2012	19,007	847	7,233	1,140	12,992	2,197	5,967	493	36,810	74,086	1,014	2488

* Data not available

Appendix Table D. Aquatic Plant Management Survey, Chemical-Mechanical, 2012.

1. Was your 2012 permit used?

797 Yes, permitted work was done.

25 No, because: The nuisance conditions did not develop.
18 No, because: I got the permit too late.
89 No, because: I was unable to get the work done.
74 No, because: Thanks! Please use the back for comments

1003 total

2. When my permit expires:

728 I will reapply for a permit. 30 I will not apply for a permit. 125 I am undecided at this time.
50 Permanent and Non-transferable

3. The method of control was: 42 did not answer the question

207 mechanical or hand removal. 409 chemical treatment. 104 mechanical and chemical treatment.

4. A. Were you satisfied with the aquatic plant control work done (**for Swimmers Itch control only skip to 4.B)** ?

382 YES 54 NO 160 wasn't as good as expected

B. If you treated for **Swimmers Itch** were you satisfied with the control ? 79 did not answer the question

139 YES 9 NO 35 wasn't as good as expected

5. When was the work done? 8 did not answer the question

17 April 126 May 389 June 316 July 189 August 51 September 7 October 1 Nov. 1 Dec.
33 uncertain

6. To provide us with some idea of how much control actually took place we would like to know if the control work done was the entire area allowed by the permit or less than the allowed area.

574 Yes, control work was done on the entire area permitted
192 No, less control work was done than the permit allowed
24 did not answer the question

7. **If you used herbicide**, please indicate what you used and how much?

What Did You Use?	**How Much Did You Use?** (concentrated product before mixing)				
Copper sulphate	17802.05	lbs.	Aquakleen		
gran.Hydrothol 191	5741.55	lbs.	Navigate	14503.50	lbs.
liq. Aquathol K	511.00	gal.	Renovate	0.15	gal.
Super K Aquathol	659.70	lbs.	Redwing	0.00	gal.
liq. Hydrothol 191	9.50	gal.	Aquacide	846.50	lbs.
Tribune	210.00	gal.	liq Cutrine Plus	92.75	gal.
Habitat	0.13	gal.	Renovate OTF	1100.00	lbs.
Aaqua Neet	0.08	gal.	gran Cutrine Plus	25.00	lbs.
Rodeo	35.21	gal.	DMA	483.75	gal.
Shoreclear	0.26	gal.	Glyphosate	0.17	gal.
			Weedtrine D	7.50	gal.

Appendix Table E. Aquatic Plant Management Survey for automated aquatic plant control device (AAPCD) permit holders 2012

2012 AQUATIC PLANT MANAGEMENT SURVEY
Automated Aquatic Plant Control Device (AAPCD)

Please check the appropriate circle.

1. The type of AUAPCD device I use is a:

1380	Crary WeedRoller®
20	Lake Restoration Lake Maid
142	Colman Beach Groomer
7	home made
4	unknown

2. I used an AUAPCD this year. 1553

1355 Yes 0 blank

198 No, I did not use an AUAPCD this year.

1553

3. The AUAPCD I used in 2009-

I have owned for:

124 less than 1 year
130 1 - 3 years
906 more than 3 years

Is jointly owned and shared with the other co-owners and has been for:

9 less than 1 year
12 1 - 3 years
160 more than 3 years

0 was rented.
9 was borrowed.

4. How often monthly did you operate the AUAPCD you used ?

	not used	few hours >0-20	several hours >20-50	many hours >50-144	continuous
In May:	804	347	132	60	9
In June:	173	577	400	162	40
In July:	104	562	439	192	55
In August:	267	612	310	121	40

Appendix Table F. Statewide umbers of APM permits and properties by county, 2012.		
County	permits	Properties
AITKIN	148	158
Anoka	41	103
Becker	296	296
Beltrami	20	20
Blue Earth	3	25
Brown	1	1
Carlton	17	17
Carver	81	285
CASS	234	236
CHISAGO	79	297
CLAY	8	8
CLEARWATER	5	5
Cottonwood	2	2
CROW WING	665	1004
CROWWING/MORRISON	3	94
Dakota	61	284
Douglas	209	209
Faribault	2	59
Freeborn	3	3
GRANT	6	6
Hennepin	328	1345
Hubbard	70	70
ISANTI	33	99
Itasca	56	56
Jackson	6	6
Kanabec	4	170
Kandiyohi	73	76
Kittson	1	1
Koochiching	1	1
Lac Qui Parle	1	1
Lake of the Woods	1	1
LeSueur	39	150
Lincoln	1	1
Mahnomen	3	3
Martin	7	7
McLeod	1	1
Meeker	25	38
MILLE LACS	16	16
Morrison	84	175
MTKA-COOKS	1	1
Murray	7	7
Nobles	2	2
Olmsted	1	1
Otter Tail	593	593

Pine	20	74
Pipestone	1	1
Polk	3	3
Pope	65	65
Ramsey	131	754
Rice	20	68
Rock	1	1
Scott	58	262
SHERBURNE	38	153
St. Louis	19	19
Stearns	113	134
Steele	2	2
Todd	109	118
TODD & STEARNS	1	1
Wadena	8	8
Waseca	2	2
Washington	112	509
Watonwan	3	3
Wright	187	533

Appendix Table G. Lakes with nine or more total permits issued for swimmers itch from 1997 through 2012

Region	County	Lake	Total permits issued
3	AITKIN	BIG SANDY	58
3	AITKIN	CEDAR	20
3	AITKIN	FARM ISLAND	188
3	AITKIN	GUN	60
3	AITKIN	HANGING KETTLE	13
2	AITKIN	HORSESHOE	9
3	AITKIN	MINNEWAWA	35
3	AITKIN	PINE	9
3	AITKIN	PINE	19
3	AITKIN	PINE	28
2	AITKIN	ROUND	25
3	AITKIN	SPIRIT	22
6	ANOKA	CENTERVILLE	15
6	ANOKA	COON	89
6	ANOKA	GEORGE	24
6	ANOKA	GOLDEN	33
6	ANOKA	HAM	24
6	ANOKA	HARRIS POND	10
6	ANOKA	LABELLE POND	12
6	ANOKA	LINWOOD	32
6	ANOKA	OTTER	28
1	BECKER	Detroit	69
1	BECKER	HEIGHT OF LAND	11
1	BECKER	SALLIE	23
1	BELTRAMI	JULIA	14
1	BELTRAMI	MARQUETTE	10
2	CARLTON	Eagle	94
2	CARLTON	Tamarack	16
6	CARVER	BAVARIA	24
6	CARVER	BURANDT	32
6	CARVER	EAGLE	11
6	CARVER	FIREMANS	14
6	CARVER	GRACE	12
6	CARVER	LOTUS	108
6	CARVER	LUCY	14
6	CARVER	MINNEWASHTA	111
6	CARVER	PIERSON	63
6	CARVER	RILEY	66
6	CARVER	SCHUTZ	16
6	CARVER	VIRGINIA	41
6	CARVER	WACONIA	41

3	CARVER	Wassermann	10
6	CARVER	ZUMBRA	20
1	CASS	BIRCH	20
3	CASS	GULL	409
3	CASS	HARDY	12
2	CASS	MARGARET	20
3	CASS	NORWAY	18
3	CASS	ROOSEVELT	71
3	CASS	SYLVAN	44
1	CASS	TEN MILE	10
3	CASS	UPPER GULL	32
3	CHISAGO	CHISAGO	37
3	CHISAGO	Fish	18
3	CHISAGO	GOOSE	22
3	CHISAGO	GREEN	91
3	CHISAGO	HORSESHOE	11
3	CHISAGO	KROON	16
3	CHISAGO	LITTLE COMFORT	13
3	CHISAGO	Mandall	10
3	CHISAGO	NORTH CENTER	93
3	CHISAGO	NORTH LINDSTROM	13
3	CHISAGO	RUSH	92
3	CHISAGO	SOUTH CENTER	111
3	CHISAGO	SOUTH LINDSTROM	34
1	CLAY	BLUE EAGLE	16
1	CLEARWATER	LAMONT	13
3	CROW WING	BAY	121
3	CROW WING	BERTHA	107
3	CROW WING	BIG TROUT	118
3	CROW WING	BLACKHOOF	12
3	CROW WING	CLAMSHELL	30
3	CROW WING	CLARK	20
3	CROW WING	CLEARWATER	9
3	CROW WING	CROOKED	21
3	CROW WING	CROSS	132
3	CROW WING	CROW WING	79
3	CROW WING	DAGGETT	97
2	CROW WING	EAGLE	13
3	CROW WING	EDWARD	17
3	CROW WING	GILBERT	85
3	CROW WING	GLADSTONE	21
3	CROW WING	HUBERT	23
3	CROW WING	ISLAND	26
3	CROW WING	LITTLE HUBERT	25
3	CROW WING	LITTLE PINE	66
3	CROW WING	LOVE	30
3	CROW WING	LOWER CULLEN	46
3	CROW WING	LOWER HAY	49
3	CROW WING	LOWER MISSION	31
3	CROW WING	MIDDLE CULLEN	33

3	CROW WING	NISSWA	39
3	CROW WING	NORTH LONG	125
3	CROW WING	O'BRIEN	44
3	CROW WING	OSSAWINNAMAKEE	61
3	CROW WING	PELICAN	70
3	CROW WING	PERCH	65
3	CROW WING	PIG	24
3	CROW WING	PINE	23
3	CROW WING	PORTAGE	22
3	CROW WING	RED SAND	21
3	CROW WING	RICE	31
3	CROW WING	ROUND	160
3	CROW WING	ROY	69
3	CROW WING	RUSH	147
3	CROW WING	SERPENT	139
3	CROW WING	SIBLEY	28
3	CROW WING	SOUTH LONG	164
3	CROW WING	UPPER CULLEN	25
3	CROW WING	UPPER HAY	82
3	CROW WING	UPPER MISSION	32
3	CROW WING	UPPER SOUTH LONG	78
3	CROW WING	WEST FOX	19
3	CROW WING	WHITE SAND	61
3	CROW WING	WHITEFISH	191
6	DAKOTA	CRYSTAL	110
6	DAKOTA	LEE	11
6	DAKOTA	MARION	41
6	DAKOTA	ORCHARD	29
6	DAKOTA	ROSEBERGER	13
6	DAKOTA	SALEM	17
6	DAKOTA	SUNFISH	13
6	DAKOTA	WARRIOR POND	12
1	DOUGLAS	CARLOS	31
1	DOUGLAS	DARLING	35
1	DOUGLAS	GENEVA	17
1	DOUGLAS	HENRY	9
1	DOUGLAS	IDA	52
1	DOUGLAS	IRENE	102
1	DOUGLAS	LE HOMME DIEU	57
1	DOUGLAS	MILTONA	61
4	FARIBAULT	Bass	21
4	FREEBORN	Morin	10
1	GRANT	PELICAN	20
1	GRANT	POMME DE TERRE	13
6	HENNEPIN	ARROWHEAD	13
6	HENNEPIN	BASS	17
6	HENNEPIN	BRYANT	43
6	HENNEPIN	BUSH	16
6	HENNEPIN	CASTLE RIDGE	15
6	HENNEPIN	CHRISTMAS	37

6	HENNEPIN	DUCK	27
6	HENNEPIN	DUTCH	19
6	HENNEPIN	EAGLE	53
6	HENNEPIN	FISH	60
6	HENNEPIN	FOREST	26
6	HENNEPIN	GLEASON	33
6	HENNEPIN	GREENTREE POND	15
6	HENNEPIN	HADLEY	20
6	HENNEPIN	INDEPENDENCE	69
6	HENNEPIN	INDIANHEAD	11
6	HENNEPIN	LONG	13
6	HENNEPIN	LOWER TWIN	24
6	HENNEPIN	MEDICINE	88
6	HENNEPIN	MELODY	16
6	HENNEPIN	MINNETONKA COOKS	92
6	HENNEPIN	MTKA BLACK	57
6	HENNEPIN	MTKA BROWNS	37
6	HENNEPIN	MTKA CARMANS	80
6	HENNEPIN	MTKA CARSONS	64
6	HENNEPIN	MTKA CRYSTAL	72
3	HENNEPIN	MTKA E. UPPER LAKE	33
6	HENNEPIN	MTKA E. UPPER LAKE	72
6	HENNEPIN	MTKA EMERALD	35
6	HENNEPIN	MTKA EXCELSIOR	51
6	HENNEPIN	MTKA GIDEONS	92
6	HENNEPIN	MTKA GRAYS BAY	39
6	HENNEPIN	MTKA HALSTEDS	95
6	HENNEPIN	MTKA HARRISONS BAY	46
6	HENNEPIN	MTKA JENNINGS	53
6	HENNEPIN	MTKA LAFAYETTE	84
6	HENNEPIN	MTKA LOWER LAKE N.	31
6	HENNEPIN	MTKA LOWER LAKE S.	64
6	HENNEPIN	MTKA MAXWELL	64
6	HENNEPIN	MTKA NORTH ARM	98
6	HENNEPIN	MTKA PHELPS	79
6	HENNEPIN	MTKA PRIESTS	62
6	HENNEPIN	MTKA ROBINSONS	33
6	HENNEPIN	MTKA S. UPPER LAKE	78
6	HENNEPIN	MTKA SETON	18
6	HENNEPIN	MTKA SMITHS	19
6	HENNEPIN	MTKA SMITHTOWN	60
6	HENNEPIN	MTKA SPRING PARK	50
6	HENNEPIN	MTKA ST. ALBANS	85
6	HENNEPIN	MTKA ST. LOUIS	25
6	HENNEPIN	MTKA STUBBS	38
6	HENNEPIN	MTKA WAYZATA	60
6	HENNEPIN	MTKA WEST ARM	55
6	HENNEPIN	PARKERS	39
6	HENNEPIN	REBECCA	15
6	HENNEPIN	RED ROCK	57

6	HENNEPIN	ROSE	9
6	HENNEPIN	ROUND	14
6	HENNEPIN	SARAH	95
6	HENNEPIN	SCHMIDT (SMITH)	19
6	HENNEPIN	SHADY OAK	15
6	HENNEPIN	STAUDER POND	12
6	HENNEPIN	WEAVER	33
6	HENNEPIN	WESTLING (UNNAMED)	12
1	HUBBARD	ALICE	14
1	HUBBARD	BAD AXE	11
1	HUBBARD	BIG SAND	25
1	HUBBARD	FISHHOOK	12
1	HUBBARD	PORTAGE	17
3	ISANTI	BLUE	40
3	ISANTI	FANNIE	29
3	ISANTI	LONG	15
3	ISANTI	PAUL	23
3	ISANTI	SKOGMAN	9
3	ISANTI	SPECTACLE	21
2	ITASCA	Bass	16
2	ITASCA	Bowstring	14
2	ITASCA	Jessie	22
2	ITASCA	North Twin	9
2	ITASCA	Sand	22
2	ITASCA	Swan	89
3	KANABEC	FISH	30
3	KANABEC	MUD	13
4	KANDIYOHI	Eagle	56
4	KANDIYOHI	Elkhorn	17
4	LESUEUR	Sakatah	20
4	LESUEUR	Tetonka	53
4	LESUEUR	WASHINGTON	67
4	MEEKER	Long	18
2	MILLE LACS	MILLE LACS	62
3	MORRISON	ALEXANDER	89
3	MORRISON	CROOKNECK	76
3	MORRISON	FISH TRAP	40
3	MORRISON	Green Prairie Fish	11
3	MORRISON	PLATTE	136
3	MORRISON	SHAMINEAU	21
3	MORRISON	SULLIVAN	22
4	OLMSTED	George	10
1	OTTER TAIL	DEER	58
1	OTTER TAIL	EAST BATTLE	19
1	OTTER TAIL	EAST LEAF	9
1	OTTER TAIL	JEWETT	25
1	OTTER TAIL	MARION	38
1	OTTER TAIL	RUSH	29
1	OTTER TAIL	STALKER	20
1	OTTER TAIL	WALL	26

3	PINE	BIG PINE	75
3	PINE	CROSS	41
3	PINE	Pokegama	18
3	PINE	Sand	15
3	PINE	UPPER PINE	17
1	POPE	AMELIA	30
1	POPE	LINKA	58
1	POPE	MINNNEWASKA	40
1	POPE	SCANDINAVIAN	12
1	POPE	VILLARD	14
6	RAMSEY	BALD EAGLE	83
6	RAMSEY	DUMBELL POND	11
6	RAMSEY	GERVAIS	40
6	RAMSEY	GILFILLAN	19
6	RAMSEY	ISLAND	17
6	RAMSEY	JOHANNA	35
6	RAMSEY	JOSEPHINE	43
6	RAMSEY	KELLER	19
6	RAMSEY	KERRY POND	17
6	RAMSEY	KOHLMAN	25
6	RAMSEY	MCCARRONS	42
6	RAMSEY	OWASSO	38
6	RAMSEY	PEPPERTREE POND	17
6	RAMSEY	PLEASANT	11
6	RAMSEY	SILVER (NSP)	24
6	RAMSEY	SNAIL	50
6	RAMSEY	TURTLE	41
6	RAMSEY	WABASSO	25
4	RICE	Cedar	13
4	RICE	Mazaska	10
4	RICE	Roberds	19
6	SCOTT	CEDAR	64
3	SCOTT	CLEARY	9
6	SCOTT	FISH	21
6	SCOTT	O'DOWD	38
6	SCOTT	PRIOR	184
6	SCOTT	SPRING	44
6	SCOTT	THOLE	33
6	SCOTT	UPPER PRIOR	88
3	SHERBURNE	BIG	54
3	SHERBURNE	BRIGGS	24
3	SHERBURNE	Eagle	20
3	SHERBURNE	Elk	16
3	SHERBURNE	FREMONT	17
3	SHERBURNE	JULIA	23
3	SHERBURNE	MITCHELL	34
3	SHERBURNE	RUSH	16
2	ST. LOUIS	Big Sturgeon	24
2	ST. LOUIS	LONG	24
3	STEARNS	BIG FISH	19

3	STEARNS	BIG SPUNK	23
3	STEARNS	CARNELIAN	9
3	STEARNS	GRAND	35
4	STEARNS	Koronis	20
3	STEARNS	Marie	9
3	STEARNS	MIDDLE SPUNK	10
3	STEARNS	NORTH BROWNS	13
3	STEARNS	PEARL	29
3	STEARNS	PELICAN	107
3	STEARNS	RICE	41
4	STEELE	Kohlmeier	9
3	TODD	BIG BIRCH	26
3	TODD	BIG SWAN	56
3	TODD	CHARLOTTE	9
3	TODD	LITTLE BIRCH	15
3	TODD	Mons	15
3	TODD	MOUND	39
1	TODD	OSAKIS	135
4	WADENA	Clear	16
6	WASHINGTON	BIG CARNELIAN	72
6	WASHINGTON	BIG MARINE	41
6	WASHINGTON	DEMONTREVILLE	17
6	WASHINGTON	FOREST	207
6	WASHINGTON	JANE	23
6	WASHINGTON	LILY	15
6	WASHINGTON	MARY	16
6	WASHINGTON	OLSON	16
6	WASHINGTON	PINE TREE	10
6	WASHINGTON	SYLVAN	11
6	WASHINGTON	TANNERS	22
6	WASHINGTON	WHITE BEAR	125
3	WRIGHT	AUGUSTA	15
3	WRIGHT	BASS	35
3	WRIGHT	BEEBE	10
3	WRIGHT	CEDAR	45
3	WRIGHT	CHARLOTTE	26
3	WRIGHT	CLEARWATER	154
3	WRIGHT	CONSTANCE	9
3	WRIGHT	CRAWFORD	14
3	WRIGHT	DEER	18
3	WRIGHT	EAGLE	14
3	WRIGHT	Fish	18
3	WRIGHT	FRENCH	32
3	WRIGHT	GRANITE	12
3	WRIGHT	Howard	16
3	WRIGHT	Locke	12
3	WRIGHT	MAPLE	66
3	WRIGHT	Martha	12
3	WRIGHT	MINK	21
3	WRIGHT	PLEASANT	53

3	WRIGHT	PULASKI	53
3	WRIGHT	ROCK	20
3	WRIGHT	SOMERS	14
3	WRIGHT	SUGAR	97
3	WRIGHT	SYLVIA	62
3	WRIGHT	TWIN	9
3	WRIGHT	WAVERLY	52