Aquatic Plant Management Program 2022 Annual Report

By

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1. Prior to 2014 this report series was published yearly by the Division of Ecological and Water Resources to monitor permitted aquatic plant management activities in Minnesota public waters.

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1 INTRODUCTION TO THE AQUATIC PLANT MANAGEMENT PROGRAM

A healthy lake is dependent on a healthy aquatic plant community to provide habitat for aquatic organisms, absorb & recycle nutrients, and to stabilize shorelines. These near-shore plants, which are frequently referred to as weeds, are often perceived as a nuisance. Minnesota state law allows lakeshore property owners the right to use and access the lake adjacent to their property, which includes managing the areas impacted by aquatic plants.

The purpose of the DNR's aquatic plant management (APM) program is to balance native plant conservation with the desires of lakeshore residents to recreate and access their property. State law establishes what property owners can do to control aquatic plants. DNR fisheries' APM staff administer those controls via a permitting system.

Other aquatic organisms can also interfere with the lakeshore property owner's enjoyment of the lake and the APM program issues permits to provide relief from them. Swimmer's itch, caused when an immature life stage of a parasite occurring in snails encounters a swimmer, 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.

This report will provide an overview of the following program details for the 2022 season:

- Summary details on the various types of permits we issue, including the number and their general location
- Survey data related to permit usage and user satisfaction from permit users
- Summary data on aquatic enforcement activity conducted by the DNR and Minnesota Department of Agriculture

1.1 Regulations

The APM Program operates within the bounds established by a set of state statutes (MS) and rules (MR):

- **MS 84.091, Subdivision 1** – The State owns wild rice and other aquatic plants growing in public waters.
- **MS 103G.615** – Authorizes 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.
- **MR 6280** – Details the standards for the issuance of permits to control aquatic plants and the permit fee structure

MR 6280.0250 also outlines certain conditions where an APM permit is not required due to the minimal impact expected from these activities; refer to 6280.0250 or visit our APM Website for further details: https://www.dnr.state.mn.us/apm/index.html

1.2 Administrative Regions & Permitting Process

The Section of Fisheries in the DNR's Division of Fish and Wildlife is responsible for the administration of the APM permit program. Permit application review, and permit issuance, is conducted by APM permitting staff located at three regional offices and three Area Fisheries offices based on where applicant's lake properties are located.

Permits are submitted online at https://www.dnr.state.mn.us/mpars/index.html, or by contacting the local Regional Fisheries Office to request a paper application.

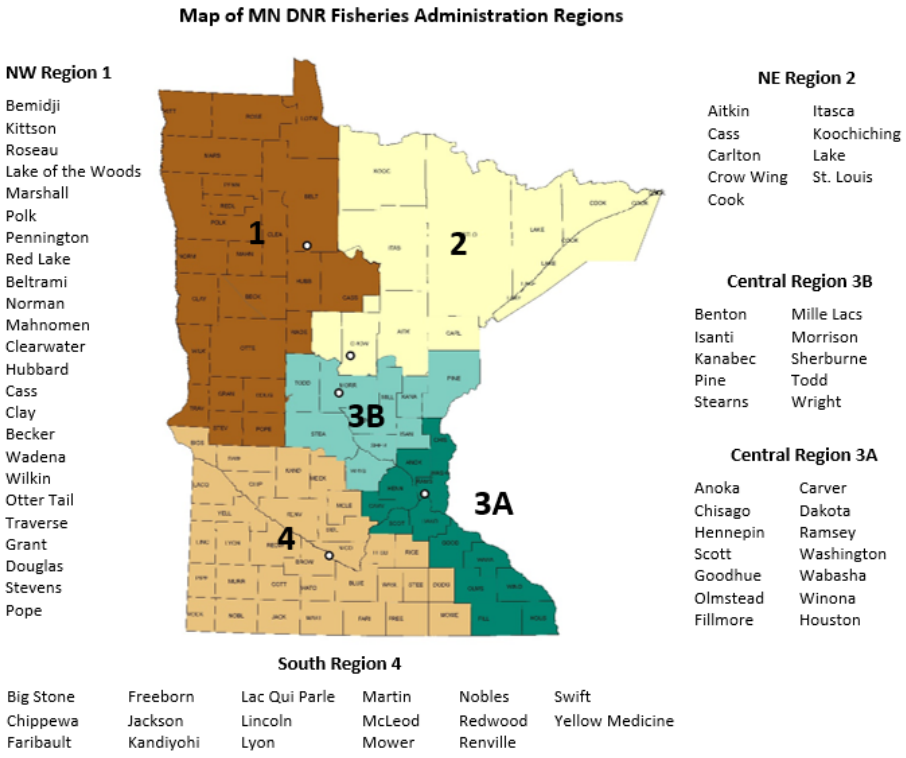


Figure 1.1 – Map of MN DNR Fisheries APM Boundaries 1, 2, 3A, 3B, and 4

A decision on a permit application's issuance depends on several factors listed in MR 6280, which includes the property's permitting history, the lake's development classification, and the amount of management requested. If an application is modified or denied, the applicant may appeal to the Commissioner's Office for review of the permit decision; this review determines if the permit decision was based upon rule standards. Finally, an unsatisfactory permit decision can be appealed to an Administrative Law Judge through the contested case hearing process.

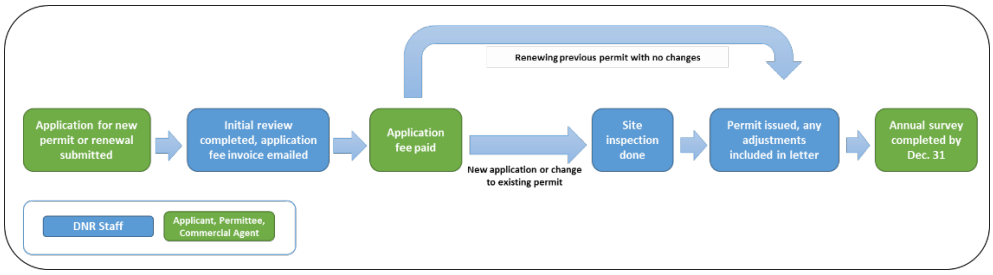


Figure 1.2 – Simplified flow diagram of the APM Permitting process, showing the actions completed by the permit applicant and those completed by DNR Staff.

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 leads 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 ensure compliance with state and federal pesticide law and responds to reports of pesticide misuse (Tables 4.A & 4.B). The U.S. Environmental Protection Agency (EPA) partially funds DNR's aquatic pesticide enforcement activities through a grant administered by MDA.

1.3 Site Inspections

Per MR 6280, a site inspection is required before a permit for aquatic plant control in public waters is issued for properties with no previous permit history. Site inspections are also conducted for renewals of previous permits when there are changes in treatment area size, methods used, or target plant species. 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. During 2022, staff conducted 1210 of these site inspections. The site inspection provides an opportunity to determine what kinds of plants and habitat are present in the proposed treatment area. Additionally, inspections serve as an outreach opportunity for staff to discuss the advantages of maintaining a healthy aquatic plant community and shoreline. Based on the inspection, DNR staff may reduce the size of the treatment area to protect important habitat based on their observations and professional judgment. 34% of all inspected near-shore control permit requests were issued with some reduction during 2022 (Table 1.A).

Table 1.A – Number of Site Inspections and Treatment Area Reductions by region during 2022.

	Region 1	Region 2	Region 3	Region 4	Statewide
Number of Site Inspections Conducted	330	225	489	166	1210
Reduced Following Inspection	144	61	174	31	410
Percent of Permits Reduced	44%	27%	36%	19%	34%

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

2 SUMMARY OF APM PERMITTING ACTIVITY

2.1 Permit Duration

Permits issued by the APM program are valid for one calendar year and expire on December 31 of the year they are issued. There are exceptions in state rule for of extended duration permits that are unique to a specific type of control method. Permittees may request them if they wish. Both permits types are intended to reduce the amount of aquatic vegetation removed by incentivizing the convenience of less frequent permit renewals:

- **Permanent Channel Permit:** this permit remains active as long as the permittee owns the property. The permit allows a 15-feet wide channel though cattails, bulrush, and other emergent vegetation maintained mechanically (no herbicides) as long as the channel's location is in the same place every year.
- **3-year AAPCD Permit**: this permit is valid for three years but limits the control area to no more than 2,500 square feet; also, the area of control must remain in the same location throughout the permit period.

2.2 Permit Fee Schedule

Table 2.A outlines the fees associated with the various permits issued by APM program; these fees are set within MR 6280.0450.

Table 2.A - Fee payment schedule for various APM permit types

Control Type	Lake size, if applicable	Fee	Max. fee per permit
Rooted Aquatic Vegetation (Submersed, Emergent, Floating-leaf)	Greater than 20 Acres	$35.00 per Property	$2,500.00
	20 Acres or less	$17.50 per Property	$1,250.00
Duckweed		$20.00 per Property	$200.00
Snails, Leeches, Chara, Filamentous Algae Control		$4.00 per 100 feet section of shoreline *Example: Less than 100 feet = $4.00* *100-199.99 feet = $8.00*	$200.00
Lakewide Algae Control		$20.00 plus an additional $0.40 per Acre *Example: 25 Acres = $20.00 + (25 x $0.40)= $30.00*	$200.00
Offshore Harvest of Submersed Plants (more than 150 feet from shore)	>20 Acres	$35.00 for 1st Acre plus $2.00 each additional Acre *Example: 150 Acres = $35.00 + (150 x $2.00) = $335.00*	$2,500.00
	≤20 Acres	$17.50 for 1st Acre plus $1.00 each additional Acre *Example: 15 Acres = $35.00 + (15 x $2.00) = $65.00*	$1,250.00

2.3 Permit Issuance

APM permits can authorize the use of three different methods of managing aquatic vegetation along lake fronts:

- Pesticide control – Various herbicides (a specific type of pesticide) registered by the EPA and MDA can be used to manage susceptible plants and pests.
- Mechanical control – Cutting, pulling, raking, or otherwise removing or altering aquatic plants by physical means, including by hand and motorized or non-motorized equipment.
- Automated Aquatic Plant Control Device (AAPCD) - A self-propelled device that is capable of destroying aquatic plants (does not include blowers, jet pumps, suction dredges or similar devices)

A given permit may have multiple control methods allowed for a single location, depending on the management strategy for the location; for example, mechanical control to reduce biomass followed by an herbicide to reduce the amount of product required for effective management.

Table 2.B details the different types of control activities that were permitted in 2022; these activities include 1-year pesticide and mechanical control, permanent channels, 1-year and 3-year AAPCD, and restoration projects. The table summarizes that different areas of the state not only authorize different amounts of APM activity but also that permittees rely on different management methods for nuisance relief. In 2022, Region 1 again issued the most control permits (1484) and had the most mechanical and AAPCD-related activity with 398 and 570 activities respectively. Statewide, most activities involve pesticides (3933 of 6019), followed by some kind of AAPCD (1194 combined), and then mechanical control (790).

Table 2.B - Number of control activities permitted in 2022 by Region. Note: a permit may have more than one control activity.

Region	1	2	3	4	Statewide
Pesticide	501	**792**	2219	421	3933
Mechanical	398	**115**	232	45	790
Channel	15	**51**	33	3	102
1-year AAPCD	145	**50**	82	12	289
3-year AAPCD	425	**204**	221	55	905
Restoration	0	0	0	0	0
Sum by Region	1484	1212	2787	536	6019

In addition to a permit having multiple permitted activities, a permit may also include multiple properties; for example, if a group of 15 lake home owners apply for a single multiparty permit. As shown in Table 2.B and 2.C, the 6019 permitted activities of 2022 were authorized across 5935 permits statewide. Additionally, the number of 3-year AAPCD permits issued in 2020 and 2021, and the previously issued permanent channels, raised the total number of active permits statewide in 2020 to 11,067 permits. These 11,067 permits allowed for various control activities on 893 lakes at 10,750 properties, the majority of which were in the Central Region (3A/3B) of the state (6687 properties).

Table 2.C - Regional summary of active Aquatic Plant Management permits for 2022.

Region	1	2	3	4	Statewide
# of Issued Permits	1479	1165	2757	534	5935
# of pubic waters	266	194	348	85	893
# of permitted properties	1555	1538	6687	970	10750
# of active permits	4138	2492	3657	780	11067
# of active channels	1438	704	479	120	2741

Over the past 20 years, APM activity has increased statewide. Figure 2.1 illustrates that while the number of AAPCD permits have stabilized over the past 10 years, the number of pesticide and mechanical control permits has increased from 1,060 in 1998 with a plateau of roughly 2,100 in the early-2010's to a high of 4,723 permits in 2022. The 2022 permit season was the third year of the Covid-19 pandemic. The impact of the pandemic had past its peak and the number of permits and permittees increased to new highs as people got back to their normal routines. The oscillation of the 3-year AAPCD permits is a result of their standard renewal cycle.

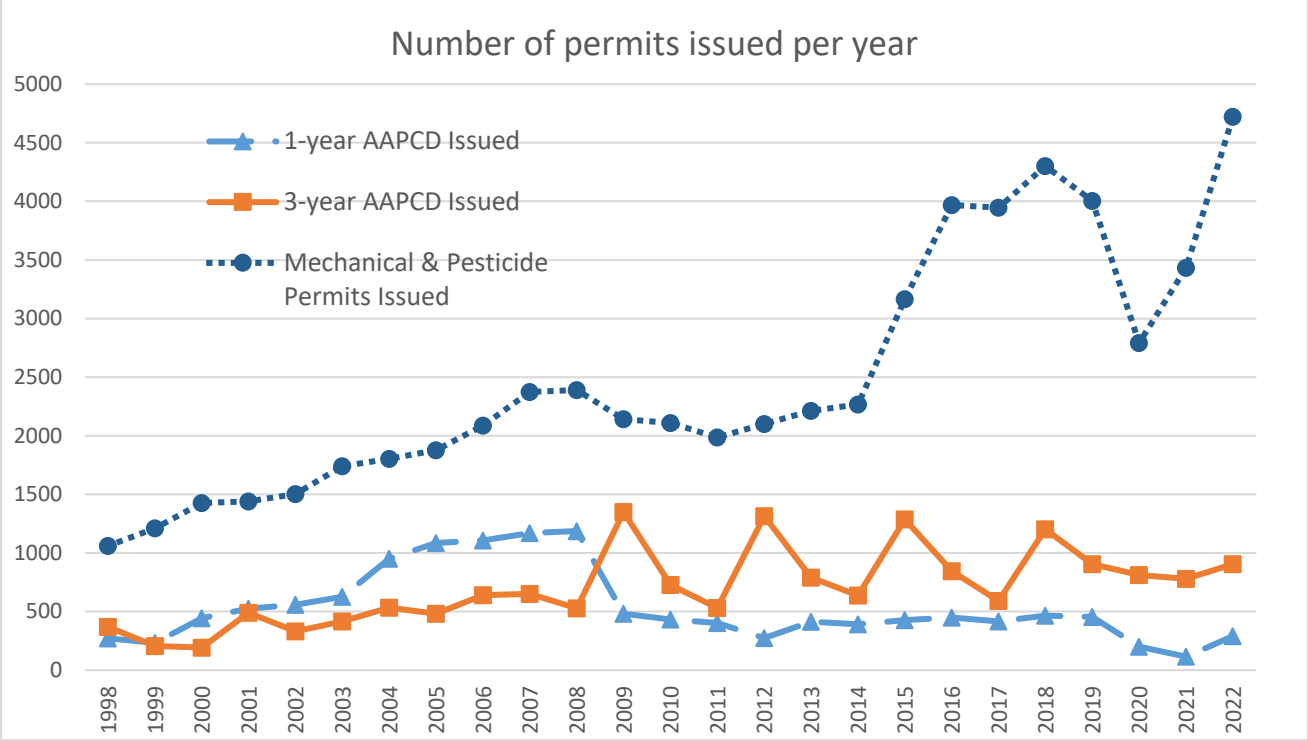


Figure 2.1 - Numbers of APM permits issued for mechanical and chemical control of aquatic vegetation, algae, and swimmer's itch; and number of 1-year and 3-year AAPCD Permits issued during 1999-2022.

The four DNR Fisheries Regions have different permitting loads based upon lake abundance, shoreline development, recreational use, and the prevalence of nuisance conditions. Figure 2.2 provides a graphic representation of Table 2.B. It illustrates that the majority of the APM activity in the state is permitted out of Region 1 and Region 3. Region 1 is split evenly between AAPCD, mechanical and pesticide treatment while Region 3

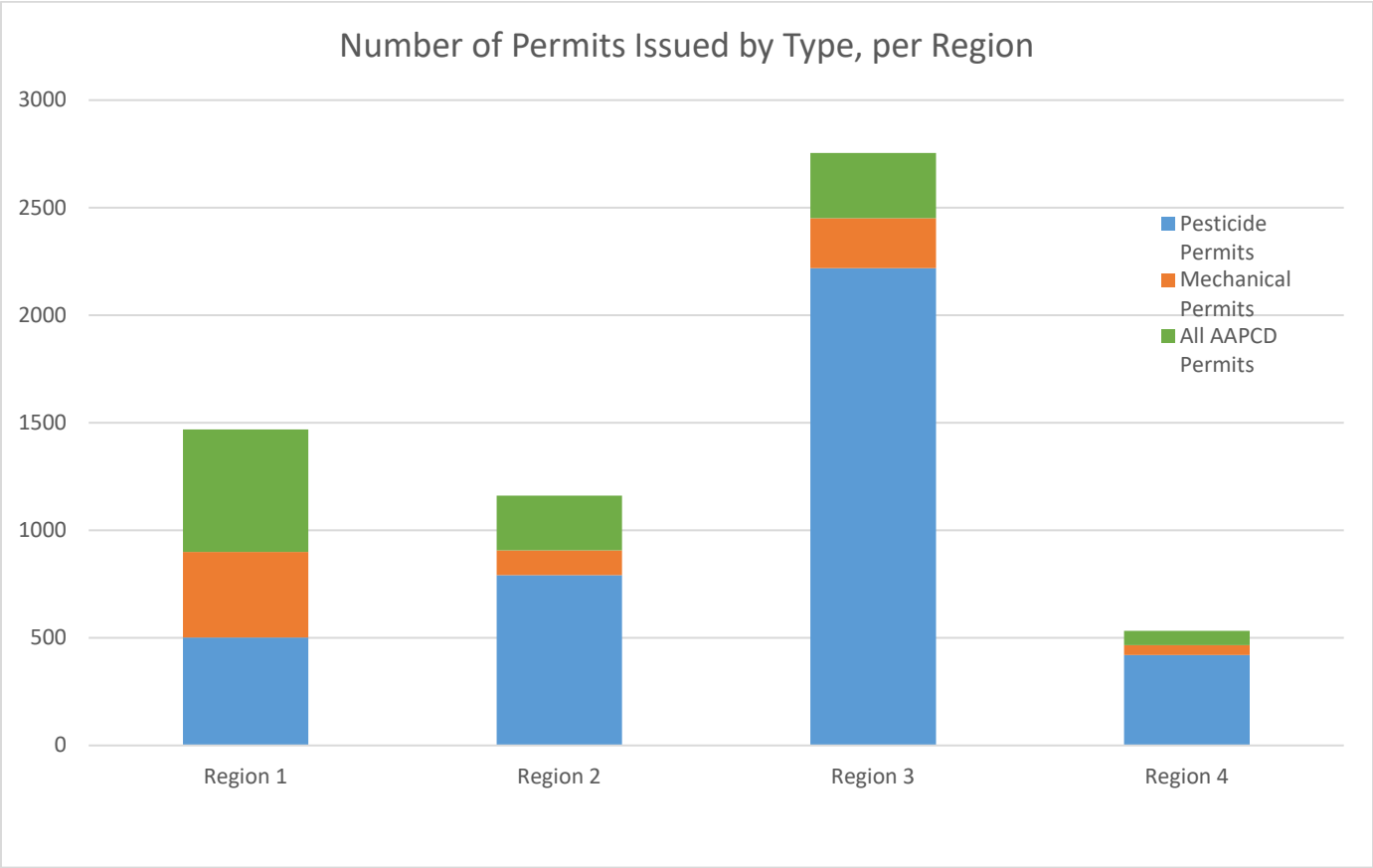


Figure 2.2 - Number of permits issued by Control type (Mechanical, Chemical, AAPCD) and Region where issued in 2022. Note: a permit may have multiple control types.

Since 1999, the number of properties permitted by the APM program has fluctuated between 7,432 and 11,939. In 1999, 8,023 properties were permitted, and that number rose steadily to its maximum of 11,939 in 2006 before dropping to a 7480 in 2014. Since then, the number of properties permitted rose, albeit erratically, to 11,188 properties in 2019. In 2022 the number of permitted properties rose back up after pandemic lows to 10750 properties to the fifth highest since 1999 (See Figure 2.3).

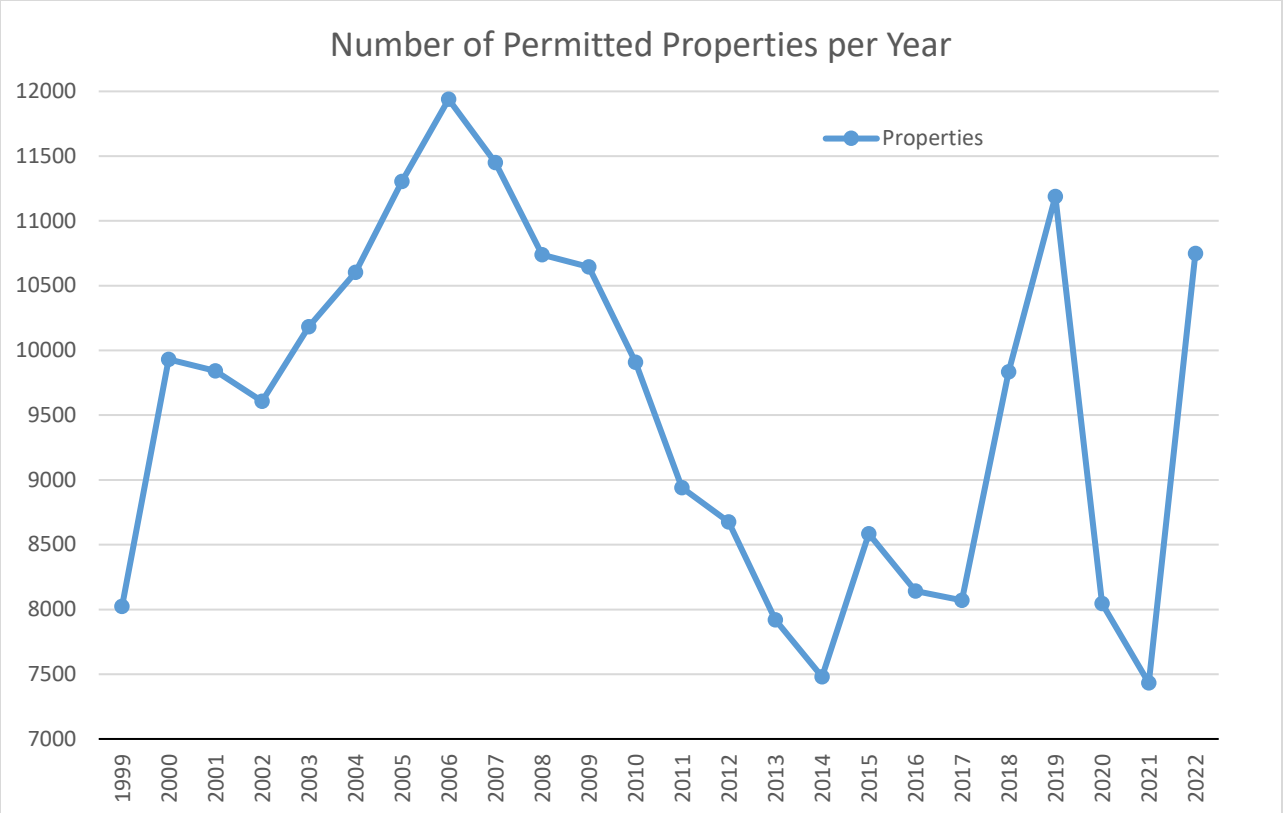


Figure 2.3 - Numbers of properties issued APM permits for aquatic plant control statewide, 1998-2022

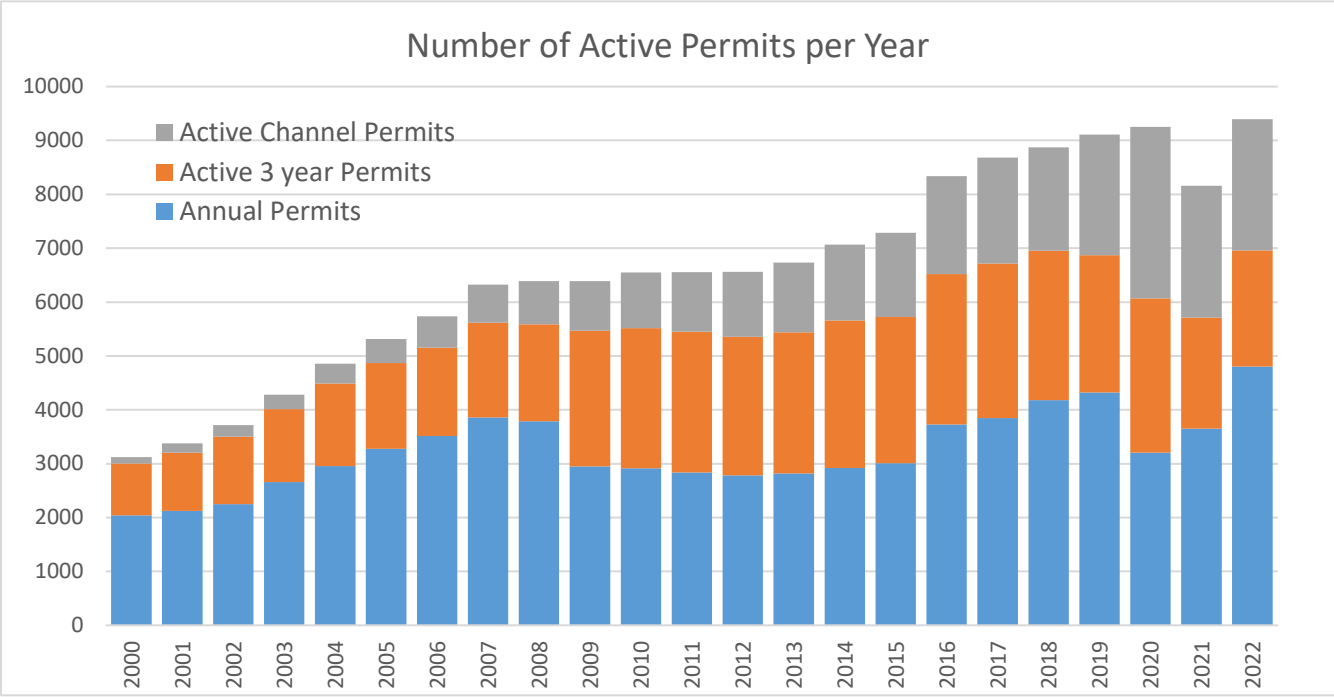


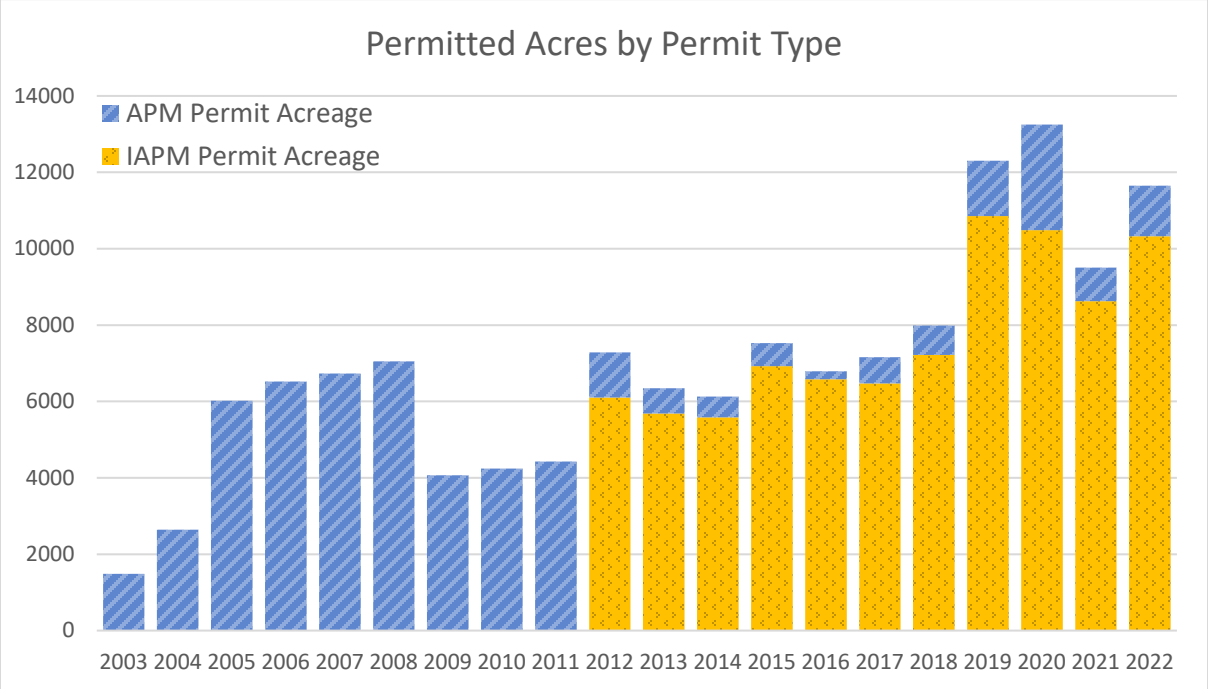
Figure 2.4 - Number of active APM permits of varying duration from 1999-2022

2.4 Permitted Offshore Acres for Aquatic Plant Control

Although Aquatic Plant Management in Minnesota seeks to balance the riparian rights of property owners, it is not uncommon for nuisance populations of plants to have a negative impact on other lake users. Eurasian watermilfoil can cover large areas of a lake, which in turn affects recreation. Most permits are issued for controlling plants along shoreline frontages, but we also issue permits for managing populations of nuisance plants that are more than 150 feet from the shoreline. These treatments are referred to as "Off-shore Treatments."

The number of acres permitted for control of aquatic plants has increased over time, with a few large Eurasian watermilfoil and curly-leaf pondweed treatments causing significant spikes in the total number of acres permitted for treatment. 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 3,000-acre lake in Lincoln County (South Region), were also treated with an aquatic herbicide to manage curly-leaf pondweed in 2006, 2007, and 2008. 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, the Invasive Aquatic Plant Management (IAPM) Program within the Division of Ecological and Water Resources was created to focus on the management of invasive aquatic plant populations. IAPM Staff assumed responsibility for issuing permits specifically for the management of invasive aquatic plants. The acres permitted for offshore control of submersed invasive aquatic plants in 2022 was 10,325 acres. The acres permitted for the offshore control for submersed species in 2021 in the APM program was 1325 acres.



** Acreage reported prior to 2012 did not distinguish between permits issued for the control of invasive aquatic plants (IAPM permits) and permits issued for native aquatic plant control (APM permits). Therefore, it should not be concluded that there were no permits issued for invasive species management prior to 2012.*

Figure 2.5 - Permitted off-shore herbicide control acreage of aquatic plants statewide from 2001-2022

2.5 Management of Invasive Aquatic Plants

In addition to issuing permits to property owners to improve access or enhance recreational use, the DNR has statewide control programs for a number of non-native invasive aquatic plants.

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

The Invasive Aquatic Plant Management program issued 404 permits in 2022. Most of these permits were for either Curly-leaf Pondweed or Eurasian Watermilfoil. Specifically, 50% of IAPM permits issued in 2022 included Curly-leaf Pondweed as a target. Permits targeting Curly-leaf Pondweed were issued for 5631 acres. Permits targeting Eurasian Watermilfoil covered less acreage but increased from 1416 acres in to 3600 acres in 2022.

Additional details on Invasive Aquatic Plant Management can be found in the IAPM annual report located online at: https://www.dnr.state.mn.us/invasives/ais/programs.html.

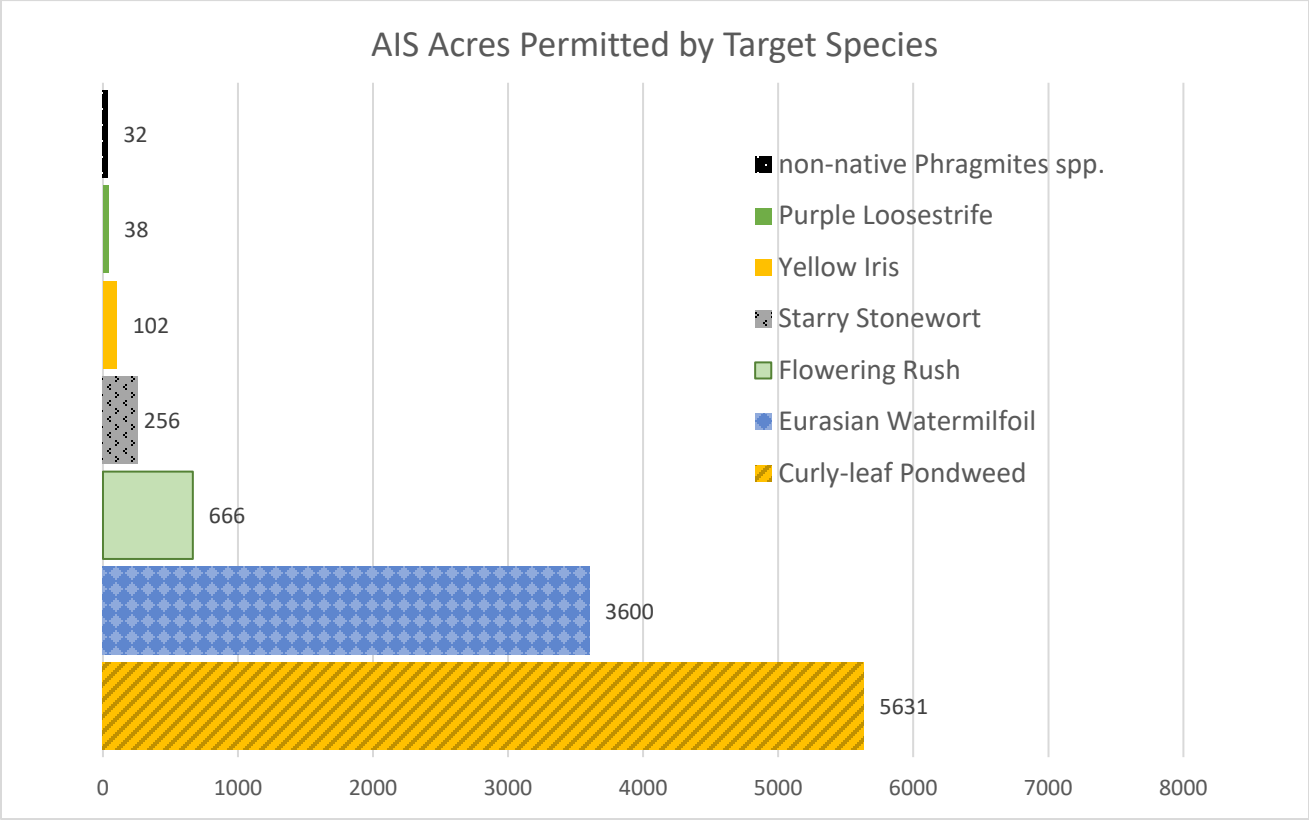


Figure 2.6 - Number of acres permitted under IAPM permits for selected target species in 2022.

3 REPORTED ACTIVITY

Individual who complete activities under an APM permit, commercial mechanical control permit, or commercial aquatic pest control license are required to report their activity by the end of the calendar year. The APM program uses this reported data to get a more complete picture of APM activity within the state, helping us to identify potential trends and issues. We also provide the data to other state and government agencies so they may comply with other state and federal laws as required.

3.1 Reportage usage of permits

Table 3.A - Total near-shore area permitted in acres by Region, number of properties, and median area controlled by treatment method for 2022.

Treatment Method	Region 1 (Acres)	Region 2 (Acres)	Region 3 (Acres)	Region 4 (Acres)	Total Acres	# of Properties	Mean Square Feet
AAPCD	33.7	12.1	17.6	4	67.4	1195	2457
Mechanical Control	25.4	32.5	25.4	23.5	106.8	905	5141
Pesticide Control (includes Swimmer's itch)	91.1	111.5	813.7	130	1146.3	8464	5899

In 2022, 1320.5 acres of lake area received some type of aquatic plant mangement; the majority (87%) of which involved the use of a pesticide, with the mean treatment area being slightly more than one tenth of an acre (5899 square feet). Table 3.A contains additional acreages of reported control divided by region.

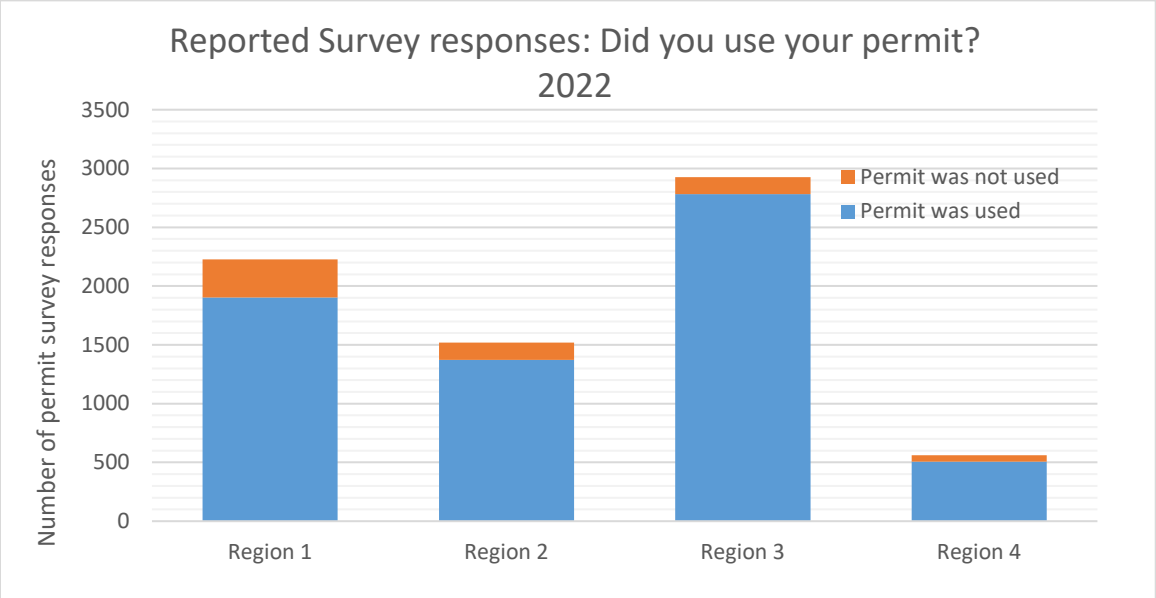


Figure 3.1 - Total reported number of permits used and not used by region, during 2022

Not all apm permits get used based on our survey responses. Roughly 32.7% of permits didn't get used, due to permittees not needing to use the permit (no nuisance). Figure 3.1 illustrates the regional differences in permits usage.

Table 3.B captures detail about why a permit isn't used. Our survey provides respondants an opportunity to explain in detail why they weren't able to use the permit. Statewide, the majority of unused permits were not used due to listing "other" as why the permit was not used.

Table 3.B - Survey responses for why issued permits were not used.

2022 Reason	Region 1	Region 2	Region 3	Region 4	Statewide
Nuisance condition didn't develop	59	21	37	20	32.7%
Received the permit too late	11	1	5	3	4.8%
Unable to do the work	131	67	44	15	61.3%
Other	3	0	2	0	1.2%

For annual reporting, commercial APM companies are required to report their activity to us, and we have a very high compliance rate in this regard. Figure 3.2 illustrates who, either the homeowner or a commercial company, is conducting the work by Region.

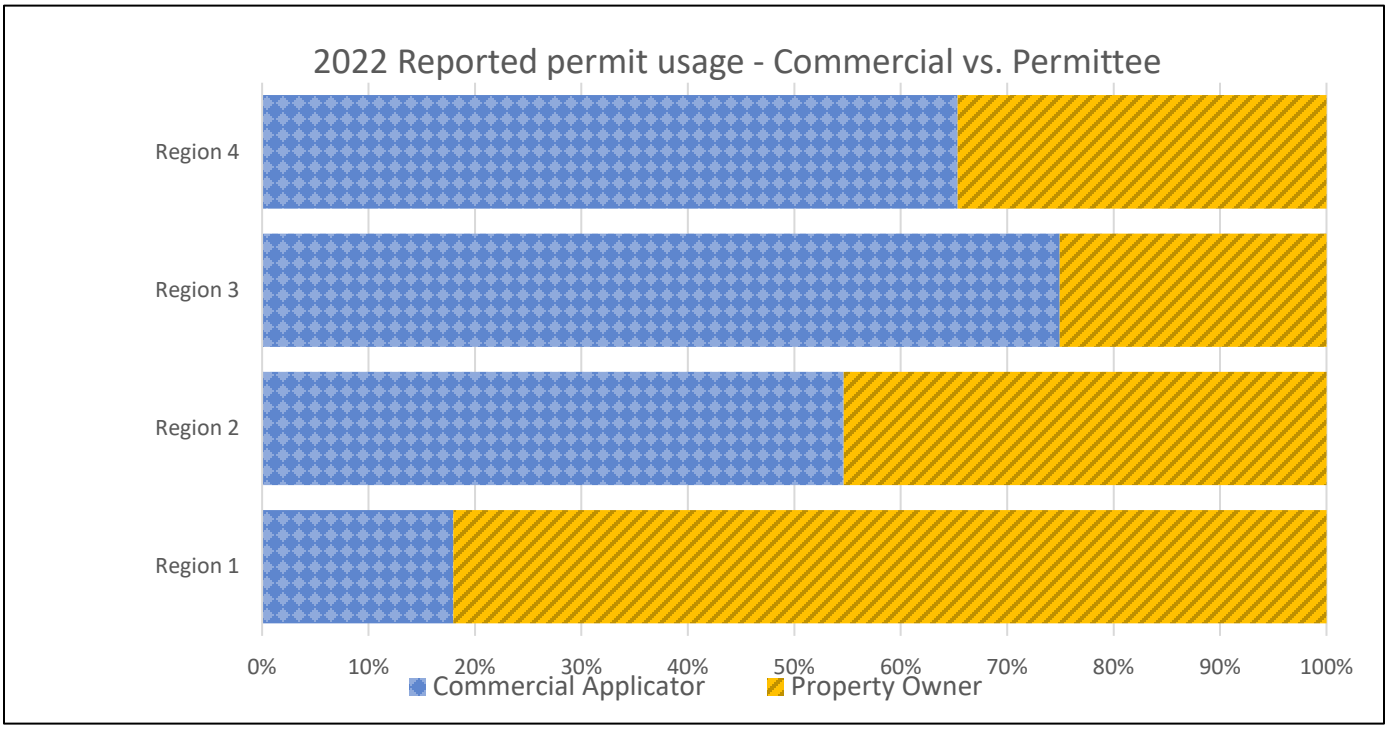


Figure 3.2 - Percent of reported APM work done by permittee or by a commercial service for each region in 2022

3.2 Satisfaction of permit user

Permittees who personally undertook aquatic plant control activities were asked to indicate their satisfaction with the results of the aquatic plant control. Of those who answered the question, 84 percent were satisfied with the work that was done during 2022. It is important to remember that landowners who hire commercial services do not complete the survey; the commercial companies complete the survey on their behalf.

3.3 Automated Aquatic Plant Control Devices (AAPCD) Permits

The APM Rules require a permit for the operation of AAPCD devices because of their potential to excavate bottom sediments, and impact spawning habitat. The APM rules provide two permit options for AAPCD operation. 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). Because of this 2009 rule change, many more permit holders became eligible for a three year AAPCD permit.

Since 2009, the popularity of three-year permits is clear, demonstrated by the start of an obvious three-year cycle of AAPCD permits issued. Given the cyclic nature of issuing three-year AAPCD permits, it is difficult to assess trends. However, an increasing trend is clear when considering the number of active three year AAPCD permits (Figure 3.3). When three-year AAPCD permits first became available in 1999 less than 1000 permits were active – this number has climbed steadily since, with a notable jump in 2009, through 2017 when 2,867 permits were active.

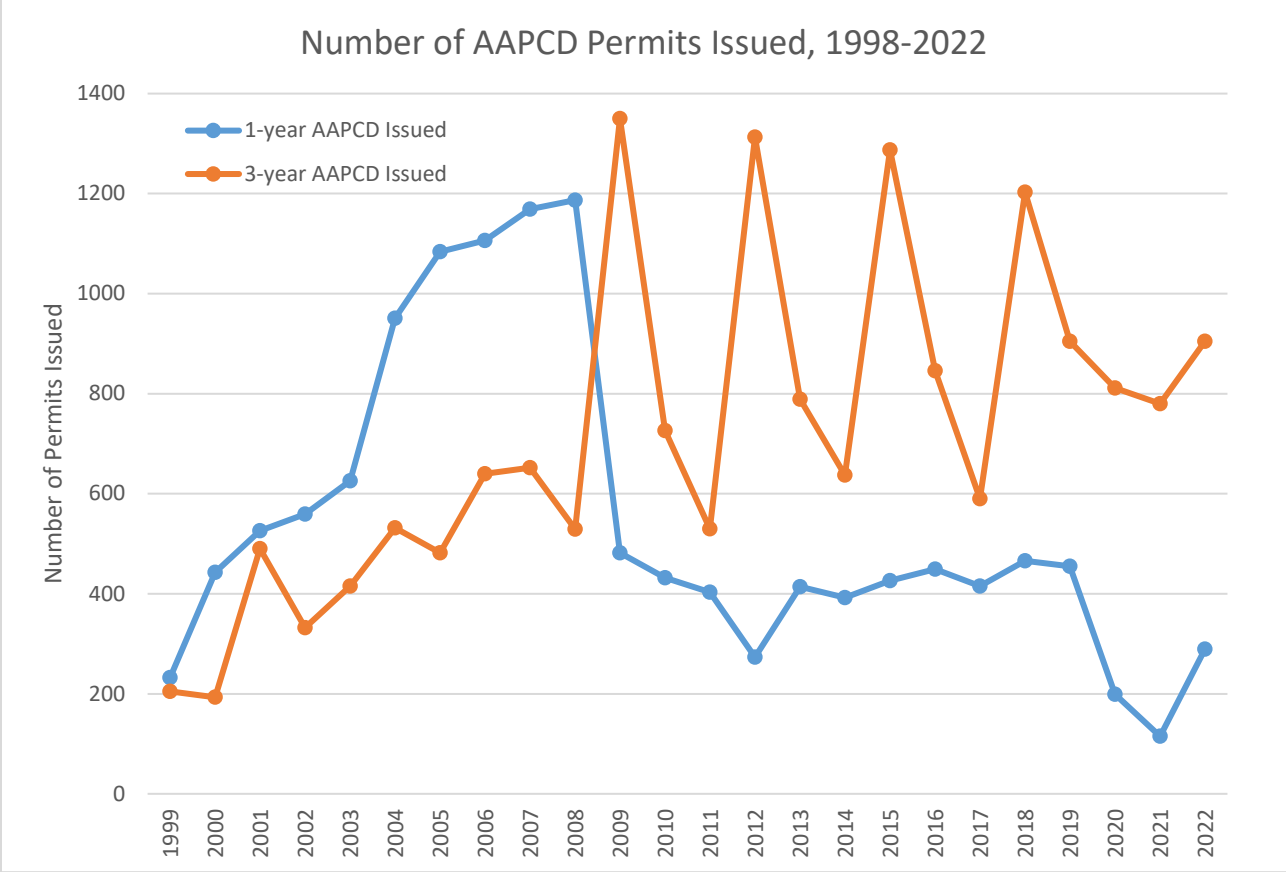


Figure 3.3 - Numbers of one-year and three-year AAPCD permits issued, 1998-2022

3.4 Copper-based Permits

High concentrations of copper are toxic to nearly all forms of life, with some species being more susceptible to the element than others. Additionally, unlike most other pesticides, elemental copper can accumulate in lake sediments over time. Currently, there is little research exploring the long-term impacts of copper use on lake sediments. Numerous copper-based pesticides are registered for aquatic use in Minnesota and have their role in nuisance management either as a stand-only agent or as a synergist with other pesticides. Copper is effective in managing filamentous and planktonic algae populations, although both groups recover over time. Additionally, copper has been shown to be effective in managing the macroalgae species Chara and Nitella. Copper is also effective against snails, which can function as an intermediate host for the swimmer's itch parasite in some lakes.

Figure 3.4 shows the number of permits issued for specific target pests that are susceptible to copper-based pesticides: 2869 for Swimmer's Itch, 1484 for Chara/Nitella species, and 2276 for Filamentous algae. These permits follow the trend of other APM permits issued in 2022.

It is important to note that a permit may be issued to manage multiple target pests (e.g. Submersed plants and chara), and not all permits will be used to manage all pests listed on the permit. Discussion with commercial aquatic pesticide applicators in Minnesota has revealed that they will frequently request the option to manage a pest at a location "just in case" it becomes a nuisance. Later in the season, they then use professional judgement as to whether it requires additional control.

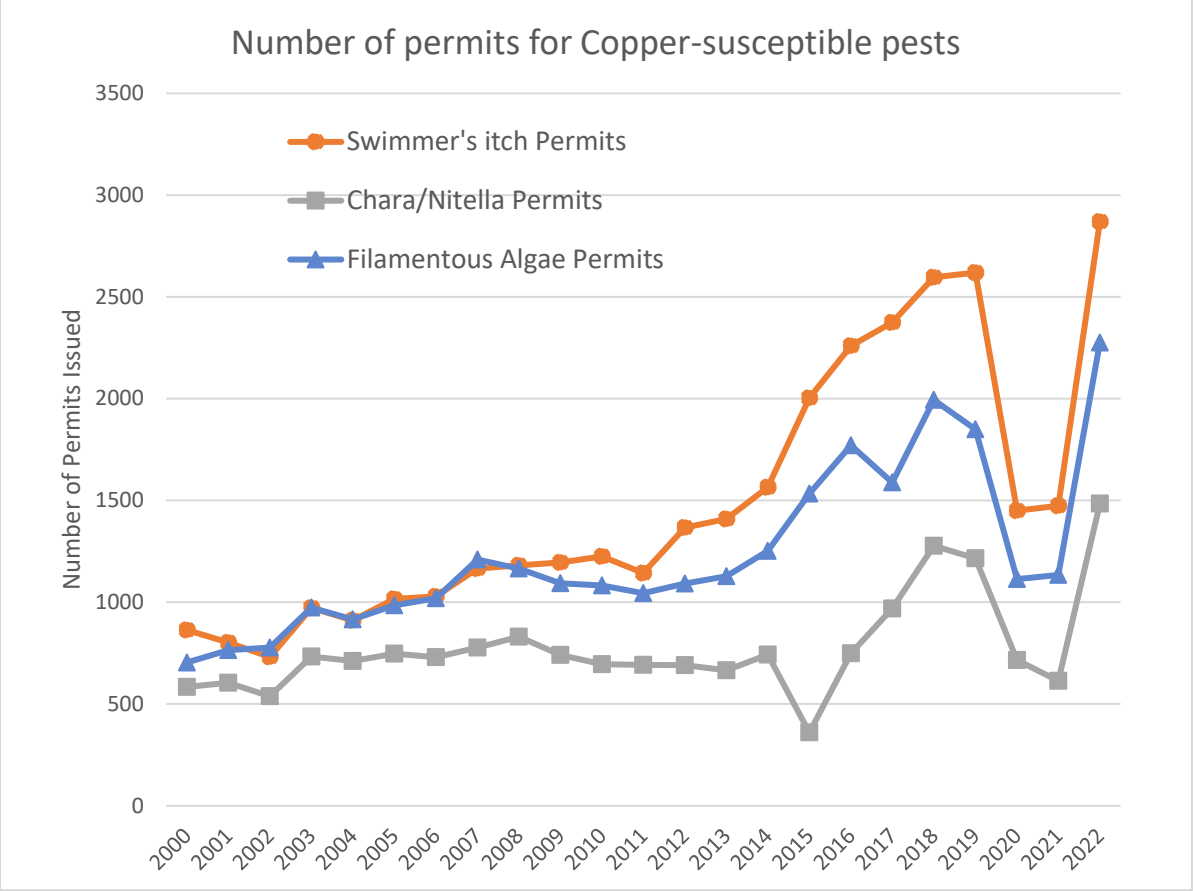


Figure 3.4 - Number of permits issued for the control Filamentous algae, Chara/Nitella, and Swimmer Itch

4 PROGRAM ENFORCEMENT

Program enforcement is carried out through inspections conducted by field staff over the course of the open water season. Permitting staff conduct compliance checks with conservation officers to verify permit conditions are being met while also inspecting shorelines for evidence of APM activity that was not permitted. DNR Conservation Officers have authority to issue citations for violations related to MR 6280. Table 4.A lists 43 enforcement actions taken in 2022 because of compliance checks, complaint follow-up, and pesticide misuse investigations.

Table 4.A - Enforcements actions issued 2022 for APM-related violations

Violation Description	Statute/Rule	Verbal Warning	Citation
Waters - Fail to file contractor form - wetland replacement plan form	103G.2212.1	2	1
Violate Cease and Desist / Restoration Order Relating to Use of Wetlands and Public Waters	103G.2372.2	4	0
State Waters - Work affects public waters - Fail to obtain and mail statements	103G.241.1	2	0
Dredge, fill, change course, current, or cross-section of public waters w/o permit	103G.245	9	7
Appropriate or Use Waters of This State Without Permission	103G.271.1(a)	0	1
Aquatic Plant management - fail to have a permit - Individual	6280.025	9	22
Exceed or fail to comply with APM permit conditions	6280.0250.6	3	2
APM Control-Individual-Fail to Remove Harvested Vegetation from Water	6280.0350.3(A)	1	0
Aquatic Plant management-Excavates or alters course/current/cross section public waters - Individual	6280.0350.3(C)	2	3
APM fail to display permit sticker	6280.0350.3(E)	0	3
Use Hydraulic jets or suction dredges to control aquatic plants - Individual	6280.0350.3(G)	3	4
Total		35	43

The APM program has one full-time aquatic pesticide enforcement specialist who conducts pesticide use inspections in public waters on behalf of the Minnesota Department of Agriculture (MDA), the state's regulatory authority on pesticide usage. Inspections verify legal use of pesticides in public waters per their labeling while also ensuring the treatments are conducted per the conditions of the APM permit, and MR 6280. In 2022 this position was vacant which resulted in no pesticide inspection to occur.

A list of herbicides commonly used for aquatic plant control and the amounts used under permit in Minnesota from 1981-2022 is found in Appendix Tables 6.A and 6.B.

5 REFERENCES

Invasive Species Program, 2022, Invasive Species of Aquatic Plants and Wild Animals in Minnesota; Annual Report for 2021, Minnesota Department of Natural Resources, St. Paul, MN

History and Timeline of Invasive (Exotic) Species Program and Aquatic Plant Management Program, Compiled by Jon Hansen and Wendy Crowell; February, 2019.

Minnesota Legislature. "The Office of the Revisor of Statutes." Web. http://www.leg.state.mn.us/statutes.asp

6 APPENDICES

Table 6.A - List common EPA-registered pesticides approved for aquatic use by the MN DNR

Product Name	Selective	Broad Spectrum	Active Ingredient (Formulation)
Part 1. Aquatically labelled systemic herbicides:			
Aquacide	X		2,4 Dichlorophenoxyacetic Acid (Sodium Salt)
Navigate®	X		2,4 Dichlorophenoxyacetic Acid (Butoxyethyl Ester)
Alligare 2,4-D Amine	X		2,4 Dicholorphenoxyacetic Acid (Dimethylamine Salt)
Weedtrine II	X		2,4 Dicholorphenoxyacetic (Isooctyl Ester)
DMA-4 IVM	X		2,4 Dicholorphenoxyacetic Acid (Dimethylamine Salt)
Sculpin-G	X		2,4 Dicholorphenoxyacetic Acid (Dimethylamine Salt)
Renovate MAX G	X		2,4 Dicholorphenoxyacetic Acid (Dimethylamine Salt), Triclopyr
Aquasweep	X		2,4 Dicholorphenoxyacetic Acid (Dimethylamine Salt), Triclopyr
Renovate, Navitrol (liquid or granular)	X		Triclopyr
Sonar, Avast! (liquid or granular)		X	Fluridone
Rodeo, Refuge, AquaPro, AquaNeat (		X	Glyphosate
Habitat		X	Imazapyr
Clearcast		X	Imazamox
Clipper, Schooner		X	Flumioxazin
Part 2. Contact herbicides:			
Aquathol (Liquid or Granular)		X	Dipotassium salt of endothall
Hydrothol (Liquid or Granular)		X	Mono-amine salt of endothall **(liquid by licensed applicator**
Dibrox, Reward, Tribune (Liquid)		X	Diquat dibromide **(use by licensed applicator only)**
Part 3. Copper Compounds (Algaecides & Herbicides):			
Mizzen, Symmetry (Liquid)	X		Copper Triethanolamine Complex
Captain, Cutrine Plus (Granular & Liquid)	X		Copper Ethanolamine Complex
Clearigate, Komeen, Nautique (Liquid)	X		Copper Ethylenediamine Complex
Part 4. Other:			
Copper sulfate	X		CuSO4 (wide variety of registered brands)

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.

The use of any pesticide (i.e. herbicide) in Minnesota's public waters requires a permit issued by the Aquatic Plant Management Program.

Table 6.B - Reported various aquatic herbicide use statewide 1981-2022

Year	2,4-D Ester lbs.	2,4-D Ester gal.	2,4-D Salt lbs.	2,4-D Salt gal	2,4-D Amine/ acid gal.	2,4-D Amine/ acid lbs.	Aquathol lbs.	Aquathol gal.	Diquat gal.	Hydrothol lbs.	Hydrothol 191 gal	Elemental Copper lbs	Triclopyr lbs	Triclopyr gal	2,4-D salt Triclopyr lbs.	Imazapyr gal.	Imazamox gal.	Flumioxazin lbs.	Glyphosate gal.	Other* gal.	Other* 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	13,905	*	*	*	*	*	*	*		
1992	81,000	*	320	*	0	*	870	1,600	1,700	9,000	67	16,064	*	*	*	*	*	*	*		
1993	96,000	*	400	*	0	*	830	1,000	1,600	5,000	240	8,685	*	*	*	*	*	*	*		
1994	45,000	*	700	*	0	*	710	940	1,800	10,000	510	15,010	*	*	*	*	*	*	*		
1995	80,000	*	87	*	0	*	930	700	2,300	8,300	420	13,805	*	*	*	*	*	*	*		
1996	39,000	*	400	*	0	*	1,000	730	1,900	8,900	830	8,158	*	*	*	*	*	*	*		
1997	46,000	*	290	*	0	*	1,200	700	2,400	7,800	820	9,965	*	*	*	*	*	*	*		
1998	47,000	*	440	*	0	*	790	1,280	2,580	4,460	670	12,751	*	*	*	*	*	*	*		
1999	39,800	*	650	*	0	*	1,050	740	2,280	4,190	740	7,932	*	*	*	*	*	*	*		
2000	41,500	*	700	*	0	*	1,380	1,850	2,970	5,820	530	10,517	*	*	*	*	*	*	*		
2001	49,300	*	1,000	*	0	*	700	2,600	2,700	3,900	950	14,608	*	*	*	*	*	*	*		
2002	49,400	*	700	*	20	*	540	2,660	2,530	4,220	760	10,592	*	*	*	*	*	*	*		
2003	71,100	*	634	*	336	*	339	2,515	2,370	7,610	429	11,822	*	*	*	*	*	*	*		
2004	64,100	*	1,068	*	216	*	366	5,200	2,856	8,040	643	13,479	*	*	*	*	*	*	*		
2005	48,800	*	1,154	*	533	*	1,077	7,054	2,773	6,744	715	15,939	*	*	*	*	*	*	*		
2006	53,400	*	805	*	215	*	1,530	8,757	2,953	11,653	126	11,797	2,189	28	*	*	*	*	*		
2007	57,700	*	971	*	85	*	1,320	9,838	3,665	10,105	782	11,546	1,400	46	*	*	*	*	*		
2008	56,000	*	655	*	7	*	2,462	13,208	2,643	10,693	550	8,105	17,025	1,882	*	*	*	*	*		
2009	48,250	*	655	*	939	*	725	13,801	1,791	7,963	1,758	6,334	63,896	662	*	*	*	*	*		
2010	39,932	*	731	*	1,070	*	737	10,238	1,501	7,973	900	5,823	47,379	1,371	*	*	*	*	*		
2011	16,233	*	775	*	1,066	*	578	10,936	1,760	5,426	626	5,608	151,593	587	3,120	*	*	*	*		
2012	19,007	*	847	*	7,233	*	1,140	12,992	2,197	5,967	493	9,239	74,086	1,014	2,488	*	*	*	*		
2013	22,486	2,005	753	*	6,108	2	5,423	8,778	2,489	4,889	440	5,131	37,305	573	*	6	9,113	146			
2014	22,265	0	451	11,147	894	585	424	12,524	2,214	6,027	169	5,714	3,847	1,047	*	4	12	155	2,647		
2015	16,484	*	686	1,787	7,498	3,113	583	15,866	2,469	6,596	533	6,062	80,660	689	1,200	151	140	138	112		
2016	820	0	1,872	2,192	*	*	263	2,782	1,427	8,393	219	6,169	25	1	*	3	*	203	46	33,593	121,590
2017	2,102	*	28,122	13,964	*	*	440	18,532	3,248	9,825	313	8,627	66,949	274	*	8	*	256	1,574		
2018	418	*	1,084	9,647	924	27,127	5,268	12,973	4,079	5,354	150	14,595	27,939	496	*	77	16	532	576	7	219
2019	2,711	*	957	*	7,029	4,583	326	10,128	4,933	*	314	16,477	15,310	79	55	*	1,031	334	46	164	122
2020	486	*	*	*	1,511	10,661	123	11,608	4,465	*	179	28,960	7,600	41	*	12	0	6,422	209	81	78
2021	498	*	1,536	*	122	185	80	2,025	1,987	*	478	28,389	124	>1	*	>1	137	17,523	343	3	25
2022	0	0	0	551	4,514	1,406	115	11,224	6,079	115	413	27,121	45,602	54	0	5	4	27,720	198	19	10

**2016 was the first year pesticide use was entered into MPARS and a new category for Other was offered. Due to some confusion, this category was overused and likely includes much of the 2, 4-D, Aquathol, and Triclopyr use for the year.*

Prior to 2018, Elemental Copper had been reported as only Copper sulfate; values in previous reports are roughly four time higher as a result. Elemental Copper reporting allows for the inclusion of various copper chelate products used in APM pesticide treatments.

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Table 6.C - History and Timeline of Invasive (Exotic) Species Program and Aquatic Plant Management Program

The timeline below summarizes important legal and programmatic changes related to how DNR manages aquatic plants, including native and invasive.

	Year
C.O. 1089: Permits required to destroy aquatic vegetation	1945
C.O. 1700: Permit required to use herbicides; spray permit for sodium arsenite; under 5000 sf mechanical = no permit; control cannot <100 ft. along shore, + channel	1965
C.O. 1734: Control area cannot exceed 0.5 acre; applicators mush have permit; only applicators can apply hazardous chemicals; potable water supply chemical restriction	1967
C.O. 1755: MDA administers commercial exams, DOC issues applicators permit	1968
C.O. 1775: Sodium arsenite prohibited; use of earth moving equipment prohibited; control coverage under D.O.W. Soils and Minerals permit	1969
C.O. 1850: under 2500 sf mechanical = no permit; authorized herbicide list removed; treatments signs required; applicator license issued by MDA	1972
C.O. 1938: Permit fees; inspection provision; littoral area restrictions based on classification (GD=10%, RD=5%, NE=0%, historical deference); 100 ft./property max; treatment notification required; permit decision review	1976
C.O. 2210: Emergent plants require permit; littoral area restrictions change from lake class to city (15%) vs. rural (10%); lake-wide mechanical restrictions = 50% of littoral zone	1985
Eurasian watermilfoil (EWM) found in MN. DNR designated lead agency for Purple Loosestrife (PL) control PL program established.	1987
M.S. 103G.617: DNR designated lead agency for coordinating control of EWM	1989
MS. 84.967 – 84.9691: DNR Exotic Species Program established to prevent and curb the spread of ecologically harmful exotic animals and aquatic plants, to prepare a statewide management plan for ecologically harmful exotic species, and was given rulemaking authority to restrict the introduction and spread of ecologically harmful exotic species in the state. DNR actively manages PL and EWM, monitors the results of management, and supports research to improve management of those species.	1991
DNR Exotic Species Program completes a comprehensive management plan for EWM written that establishes goals and objectives for the management and prevention of spread of EWM.	1992
M.S. 18.78: PL listed as a prohibited noxious weed. DNR surveys PL populations and prioritizes control. PL biocontrol program launched with research into potential biocontrol agents.	1992

	Year
M.R. 6280: All previous Conservation Orders converted to rule. **MS 86B.415:** established a watercraft license surcharge fee for the control, public education, law enforcement, monitoring and research of aquatic exotic species.	1993
M.R. 6216: Emergency rules adopted that established a list of "Undesirable ecologically harmful exotic species" and prohibits their transport, import, sale, possession, propagation, or release. The list of "undesirable exotic aquatic plants" included four species found in MN (EWM, curly-leaf pondweed (CLP), flowering rush, and PL) and two species not yet in Minnesota (water chestnut and hydrilla).	1993
CLP management review with PCA in response to algal bloom proliferation. Review found over 700 lakes in 65 counties with CLP. Researched timing of treatment to avoid algal blooms.	1994
M.S.84D: Invasive Species. Exotic species statutes recodified and expanded. The term "harmful exotic species" replaced with "Invasive Species" defined in law as: a nonnative species that: (1) causes or may cause economic or environmental harm or harm to human health; or (2) threatens or may threaten natural resources or the use of natural resources in the state. **M.S.84D.02:** The DNR is still required to establish and maintain a plan to curb the spread and manage the growth of aquatic invasive species, in particular PL, CLP, and EWM. **M.R. 6216:** updated to implement the new classification system of invasive species found in M.S. 84D	1996
PL leaf eating beetles were reared for the first time in MN, at the University of MN and DNR field sites. Research continued on root boring weevils for PL control.	1996
M.R. 6280: updated: 15% littoral area expanded to all lakes, 10% dropped; floating leaf control required permit except channel; perpetual channels; AAPCD require permit; LVMP provision	1997
Legislatively mandated review of APM program – citizen engagement, U of M survey, other states input, literature review. Led to proposed rule changes beginning in 2005.	2002
M.R. 6280: updated: Large overhaul of rules –criteria for issuing APM permits; no more than 100 feet or ½ frontage of submersed, whichever is less, or 35 feet if <70 feet of frontage; invasive control allowed on entire frontage if selective; clarify variance criteria with emphasis on role of invasive species permitting.	2009
M.S. 103G.615 subd.3a: Legislature creates definition of Invasive aquatic plant management permit: "aquatic plant management permit as defined in rules of the Department of Natural Resources that authorizes the selective control of invasive aquatic plants at a scale to cause a significant lakewide or baywide reduction in the abundance of the invasive aquatic plant	2011

	Year
Stakeholder dissatisfaction over APM permit issuance for invasive species treatments leads to split in permitting authority between the Division of Fish and Wildlife and the Division of Ecological and Water Resources. Invasive Species Specialists issue permits for projects targeting aquatic invasive species.	2011 - 2012
M.S. 103G.615 subd. 3a: Legislature removes scale reference "Invasive aquatic plant management permit": aquatic plant management permit as defined in rules of the Department of Natural Resources that authorizes the selective control of invasive aquatic plants to cause a significant reduction in the abundance of the invasive aquatic plant.	2014
APM and IAPM processed electronically through the MPARs system	2016