DEPARTMENT OF AGRICULTURE

Minnesota Pesticide Management Plan - DRAFT

A Plan for the Protection of Groundwater and Surface Water

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Minnesota Department of Agriculture
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Contents

Acronyms

ACRRA:	Agricultural Chemical Response and Reimbursement Account
BMP:	best management practice
BWSR:	Board of Water and Soil Resources
DNR:	Department of Natural Resources
EPA:	Environmental Protection Agency
EPT:	Education and Promotion Team
EQB:	Environmental Quality Board
FANMAP:	Farm Nutrient Management Assessment Program
FIFRA:	Federal Insecticide, Fungicide and Rodenticide Act
HBV:	Health Based Value
HRL:	Health Risk Limit
IPM:	integrated pest management
MAWQCP:	Minnesota Agricultural Water Quality Certification Program
MCL:	Maximum Contaminant Levels
MCLG:	Maximum Contaminant Level Goals
MDA:	Minnesota Department of Agriculture
MDH:	Minnesota Department of Health
MGS:	Minnesota Geological Survey
MPCA:	Minnesota Pollution Control Agency
NARS:	National Aquatic Resource Surveys
NASS:	National Agricultural Statistics Service
NRCS:	Natural Resources Conservation Service
OLA:	Office of the Legislative Auditor
PMP:	Pesticide Management Plan
PMPC:	Pesticide Management Plan Committee
PMR:	Pesticide Monitoring Region
RAA:	Risk Assessment Advice
SMP:	state management plans
SSURGO:	Soil Survey Geographic Database
SWCD:	Soil and Water Conservation District
TMDL:	total maximum daily load
UMN:	University of Minnesota
USDA:	United States Department of Agriculture
USGS:	United States Geological Survey
WIN-PST:	Windows Pesticide Screening Tool
WRPRs:	Water Resource Protection Requirements

Chapter 1: Introduction to the Minnesota Pesticide Management Plan

Introduction

Pesticides are used by a variety of individuals and industries to manage pest problems. For example, many agricultural producers use pesticides (most commonly herbicides, insecticides, and fungicides) to protect crops. Homeowners and municipalities may use pesticides to manage pests around homes and in lawns, gardens, and parks. Lake managers and lakeshore owners might use aquatic pesticides to control aquatic plants or other aquatic organisms considered to be a nuisance or that have an impact on valuable aquatic habitats. Public health officials may request the use of pesticides to control or prevent disease outbreaks. Pesticides are useful tools that can provide many benefits; however, these chemicals and their breakdown products also have the potential to negatively impact water quality. Some pesticides can leach through soil and enter groundwater or be lost from surfaces such as fields or lawns in surface water runoff and enter rivers, streams, and lakes. To address the potential effects of pesticides on water quality, the commissioner of the Minnesota Department of Agriculture (MDA) was directed by the Legislature in 1989 to develop a pesticide management plan for the prevention, evaluation, and mitigation of occurrences of pesticides or pesticide breakdown products in groundwaters and surface waters of the state. Additionally, the Pesticide Control Law (MINN. STAT. 18B.045) mandates that the MDA develop a Pesticide Management Plan (PMP).

The Minnesota Pesticide Management Plan is designed to guide the MDA in its efforts to coordinate activities necessary to protect Minnesota's groundwater and surface water resources from pesticide contamination. Many of the steps outlined in the PMP are directly linked to the statutory requirements and guidance in the Pesticide Control Law (MINN. STAT. 18B) and the Groundwater Protection Act (MINN. STAT. 103H). In addition, the commissioner of agriculture has broad authority, both within and separate from the PMP, to take any actions necessary to protect public health and the environment from harmful exposure to pesticides, and to prevent unreasonable risk to humans or the environment.

The PMP was initially published in 1996 and briefly revised in 1998 to refine guidance for surface water decisions. In June 2005, the MDA published revisions to the 1998 PMP designed to reflect the changes in MDA program resources; the need for greater clarity in PMP references to groundwater versus surface water statutes and programs (including new federal Clean Water Act program activities in Total Maximum Daily Load assessments); changes to the scope of federal pesticide management plan requirements; and changes in various technical references, the MDA monitoring program, and other outdated information. Additional revisions to the PMP were incorporated in November 2007 based on the Office of the Legislative Auditor (OLA)'s 2006 review of the MDA's pesticide programs.

In December 2019, the MDA published a notice in the State Register (Vol. 44, No. 27) announcing its intention to again revise the PMP, and public comments concerning the scope of the revisions were accepted. In 2019-2020, the OLA followed up on the 2006 review of the MDA's pesticide programs and evaluated current pesticide regulation activities at the MDA. One recommendation of the 2020 OLA report was that "the Department of Agriculture should review the Minnesota Pesticide Management on a regular basis (such as every five years), and revise it when necessary."

The current PMP addresses the recommendations of the OLA. In addition, edits have been made to address outdated information, expand select protocols, reflect a greater emphasis on diversity, equity, and inclusion, and improve the overall clarity of the plan.

Purpose

The purpose of the PMP is to carry out requirements of MINN. STAT. 18B.045:

> *Subdivision 1. Development. The commissioner shall develop a pesticide management plan for the prevention, evaluation, and mitigation of occurrences of pesticides or pesticide breakdown products in groundwaters and surface waters of the state. The pesticide management plan must include components promoting prevention, developing appropriate responses to the detection of pesticides or pesticide breakdown products in groundwater and surface waters, and providing responses to reduce or eliminate continued pesticide movement to groundwater and surface water. By September 1 of each even-numbered year, the commissioner must submit a status report on the plan to the Environmental Quality Board for review and then to the house of representatives and senate committees with jurisdiction over the environment, natural resources, and agriculture.*
>
> *Subdivision 2. Coordination. The pesticide management plan shall be coordinated and developed with other state agency plans and with other state agencies through the Environmental Quality Board. In addition, the University of Minnesota Extension Service, farm organizations, farmers, environmental organizations, and industry shall be involved in the pesticide management plan development.*

The PMP is written to fulfill the MDA's mandate under the Pesticide Control Law (MINN. STAT. 18B) while maintaining consistency with other statutes designed to protect the quality of the state's water resources and ensure participation in timely and meaningful consultation with Minnesota Tribal governments.

For groundwater, the Groundwater Protection Act (MINN. STAT. 103H) serves as the foundation of the PMP's groundwater-related activities. The degradation prevention goal is defined in MINN. STAT. 103H.001:

> *It is the goal of the state that groundwater be maintained in its natural condition, free from any degradation caused by human activities. It is recognized that for some human activities this degradation prevention goal cannot be practicably achieved. However, where prevention is practicable, it is intended that it be achieved. Where it is not currently practicable, the development of methods and technology that will make prevention practicable is encouraged.*

For surface water, MINN. R. 7050.0150 states that:

> *The intent of the state is to protect and maintain surface waters in a condition that allows for the maintenance of all existing beneficial uses.*

For Tribal rights, MINN. STAT. 10.65 states that:

> *Subdivision 1. Recognition of Tribal status and relationship with the state of Minnesota.*

> *(b) The United States and the state of Minnesota have a unique relationship with federally recognized Indian Tribes, formed by the Constitution of the United States, treaties, statutes, case law, and agreements.*
>
> *(c) The state of Minnesota and the Minnesota Tribal governments significantly benefit from working together, learning from one another, and partnering where possible.*
>
> *(d) Timely and meaningful consultation between the state of Minnesota and Minnesota Tribal governments will facilitate better understanding and informed decision-making by allowing for communication on matters of mutual interest and help to establish mutually respectful and beneficial relationships between the state and Minnesota Tribal governments.*

Subdivision 3. Consultation duties.

> *(f) An agency must develop and maintain ongoing consultation with the Minnesota Tribal governments related to matters that have Tribal implications. Agencies must consider the input gathered from Tribal consultation into their decision-making processes, with the goal of achieving mutually beneficial solutions.*

The PMP is a generic plan that provides the framework and process for protecting both groundwater and surface water from pesticide contamination.

Scope

The Minnesota Pesticide Management Plan will:

1. Guide the MDA in its efforts to coordinate activities necessary to protect Minnesota's groundwater and surface water resources from pesticide contamination
2. Address the terrestrial use of pesticides in agricultural settings (Pesticide “use” means activities conforming to product labeling which include mixing, loading, disposal, application, and storage of pesticides as opposed to pesticide misuse or spills)
3. Address terrestrial pesticide use in settings that are non-agricultural or urban (e.g., landscape and structural settings, forest management, rights-of-way)
4. Address use of pesticides in aquatic settings intended to manage aquatic plants and animal pests in compliance with product labeling
5. Guide the MDA in the development of pesticide best management practices (BMPs), the promotion of judicious pesticide use (including through integrated pest management), or other necessary responses

The Minnesota Pesticide Management Plan will not:

1. Address non-labeled, non-target uses of pesticides

2. Determine how the MDA will respond to spills, incidents, or fires (a description of the process by which detections of pesticides in wells are evaluated and referred is provided in Chapter 6 – Statewide Water Quality Monitoring)
3. Promote or discourage differing philosophies on pest management, except as noted above or, in some cases, as part of specific BMPs

Goals and Approaches

The PMP outlines goals and approaches for the prevention, evaluation, and mitigation of occurrences of pesticides or pesticide breakdown products in groundwaters and surface waters of the state. Recommended actions to accomplish these goals are highlighted in the appropriate portions of the plan.

Prevention Goal

The prevention goal of the PMP is to prevent occurrences of pesticides or pesticide breakdown products in groundwaters and surface waters of the state through education and the promotion of practices that protect water quality.

Prevention Approach

It is intended that this prevention goal be accomplished by promoting practices based on the criteria outlined in the Groundwater Protection Act (i.e., economic factors, availability, technical feasibility, implementability, effectiveness, environmental effects, and the beneficial uses of pesticides and applicable water quality standards), label instructions, and other factors. The prevention goal will be accomplished through education and the promotion of science-based actions that prevent the degradation of water resources (i.e., "prevention actions"). The MDA's approach will involve:

1. Utilizing available data, such as geologic atlases, to focus resources in scientifically defensible ways and in high-risk areas
2. Establishing an Education and Promotion Team (EPT) to assist in coordinating prevention activities and programs
3. Working with various groups to develop, adopt, and promote BMPs
4. Encouraging the adoption of integrated pest management (IPM) which includes a wide range of pest management strategies and promotes the judicious use of pesticides
5. Implementing a range of educational and promotional strategies through programs and activities such as applicator training and certification and demonstration projects

The prevention approach includes two main objectives.

Objective 1: Educate key target groups on pesticide water quality issues in Minnesota, risks versus benefits of pesticide use as it impacts water quality, and strategies to prevent contamination of water resources. Education topics may include voluntary actions as well as restrictions and regulations. Target groups may include pesticide

users, crop advisors, retailers, policymakers, landowners, organizations, institutions, agencies, residents, and other interested parties.

Objective 2: Promote effective prevention strategies including the adoption of BMPs by pesticide users that consider all management tools available and support the proper distribution, storage, handling, use, and disposal of pesticides.

Evaluation Goal

The evaluation goal of the PMP is to: (1) evaluate detections of pesticides and breakdown products in groundwater and surface water resources from monitoring data; and (2) evaluate the adoption and effectiveness of prevention and management strategies, including pesticide BMPs.

Evaluation Approach

The evaluation goal will largely be accomplished through the review and analysis of water monitoring data. Additional evaluation strategies, such as surveys, may also be implemented, depending on available resources. The MDA's approach will involve:

1. Establishing a Pesticide Management Plan Committee (PMPC) to support the MDA's evaluation activities
2. Annually reviewing detections of pesticides and pesticide breakdown products in groundwater and surface water monitoring data
3. Assessing changes in management practices, water resource impacts and trends, information delivery systems, and factors that affect implementation

Findings from the MDA's evaluations will be used to refine prevention practices and management strategies and guide future mitigation efforts.

Mitigation Goal

The mitigation goal of the PMP is to reduce or eliminate movement of pesticides or pesticide breakdown products in areas or for specific active ingredients where there are elevated concentrations in groundwater or surface water.

Mitigation Approach

The mitigation goal will be accomplished first through targeted voluntary efforts, and, if necessary, regulatory actions. The MDA's approach will involve:

1. Intensifying and targeting education and outreach (preventative) efforts
2. Refining or developing BMPs, incentives, or regulatory options
3. Considering the cost versus benefit and technical feasibility of mitigation measures

4. Exercising regulatory authority through mandatory use changes by adoption of water resource protection requirements or the restriction or cancellation of product registration, if necessary

Minnesota PMP and Federally Mandated State Management Plans

In 1996, a federal rule that required states to develop state management plans (SMPs) for certain pesticides found in groundwater was proposed by the U.S. Environmental Protection Agency (EPA) Office of Pesticide Programs. The proposed rule was established to focus on the development of management plans specific to five pesticide compounds that were commonly found in groundwater across the nation: alachlor, atrazine, cyanazine, metolachlor, and simazine. The guiding philosophy of the SMP was that successful management of pesticides for the protection of water resources could only be accomplished by accounting for differences in crops grown, hydrology, geology, sociology, and regulatory framework of each state. To do this would require dedication on behalf of the states to manage pesticides in a nationally consistent fashion while accounting for their own state's unique characteristics. The EPA believed that to ensure compliance by the states, a rule mandating the development of a SMP was necessary. A plan framework was developed that listed twelve requirements that each state had to meet in order to have an acceptable SMP and be allowed to continue to register the five named pesticides. Those twelve components are listed below:

1. State's philosophy and goals toward protecting groundwater
2. Roles and responsibilities of state agencies
3. Legal authority
4. Resources
5. Basis for assessment and planning
6. Monitoring
7. Prevention actions
8. Response to detection of pesticides
9. Enforcement mechanisms
10. Public awareness and participation
11. Information dissemination
12. Records and reporting

In late 2000, a rule mandating the development of a SMP was proposed; however, no rule has been promulgated to date.

The MDA believes that the current plan exceeds the generic SMP requirements originally proposed by the EPA. In the event a rule is promulgated by the federal government, the MDA will adjust the plan as needed to remain in compliance with federal regulations. Further, if a pesticide specific SMP is required by the EPA, the MDA will develop a plan that will comply with requirements specified by EPA.

Chapter 2: Minnesota's Philosophy, Goals, and Approaches for Protecting Water Resources

Introduction

Minnesota's PMP philosophy, goals, and approaches for preventing, evaluating, and mitigating water resource degradation are designed to comply with applicable statutes and rules. Minnesota recognizes that prevention is the best strategy for protecting water quality. Preventing the degradation of water resources by pesticides is key to achieving the goals of maintaining groundwater in its natural condition and maintaining the highest possible water quality in surface water, pursuant to Minnesota statutes and rules. Prevention is considered the best course of action because contamination of water resources is exceedingly difficult and expensive to correct and, in some instances, may be impossible to reverse.

Groundwater

Philosophy and Goals

Minnesota has a groundwater degradation prevention goal, articulated in MINN. STAT. 103H.001:

> *It is the goal of the state that groundwater be maintained in its natural condition, free from any degradation caused by human activities. It is recognized that for some human activities this degradation prevention goal cannot be practicably achieved. However, where prevention is practicable, it is intended that it be achieved. Where it is not currently practicable, the development of methods and technology that will make prevention practicable is encouraged.*

Minn. Rules Chapter 7060 is a rule of the Minnesota Pollution Control Agency (MPCA) which regulates discharges of pollutants to groundwater. The degradation prevention policy is stated in MINN. R. 7060.0200:

> *For the conservation of underground water supplies for present and future generations and prevention of possible health hazards, it is necessary and proper that the agency employ a nondegradation policy to prevent pollution of the underground waters of the state.*

More detail is provided in MINN. R. 7060.0400:

> *The waters of the state are classified according to their highest priority use, which for underground waters of suitable natural quality is their use now or in the future as a source of drinking, culinary, or food processing water. Suitability is to be construed as meaning that the waters in their natural state can be used for such purposes after such purification or treatment processes as may be prescribed by the Minnesota Department of Health or the Minnesota Department of Agriculture. This classification is established to protect the underground waters as potable water supplies by preventing and abating pollution. In making this classification, the agency [MPCA] recognizes that the underground waters of the state are contained in a series of related and often interconnected aquifers, such that if sewage,*

> *industrial waste, other waste or other pollutants enter the underground water system, they may be spread both vertically and horizontally.*

In MINN. R. 7060.0300, the term "underground water" is defined as:

> *…the water contained below the surface of the earth in the saturated zone including, without limitation, all waters whether under confined, unconfined, or perched conditions, in near surface unconsolidated sediment or regolith, or in rock formations deeper underground. The term groundwater shall be synonymous with underground water.*

Note that the term "suitable natural quality" is used to define groundwater in Minnesota as a source of drinking water. This is because many near-surface aquifers in the state are of sufficient natural quality that they may be used as sources of drinking water. In some areas, deeper aquifers are used because of aesthetic concerns or because of human-induced pollution, either actual or potential. By acknowledging the interconnectedness of groundwater and the need to provide as clean of a supply of groundwater as possible for future generations, the degradation prevention policy will support prevention of additional pollution and improvement of groundwater quality as pollution sources are controlled or removed and the most serious problems addressed.

Approach

Water quality standards and other numeric limits (guidance values) are used to help evaluate potential contamination of groundwater from pollutants. Numeric limits for groundwater protection can also be applied in areas already impacted by human-induced pollution as action levels, cleanup goals, and water consumption advisory levels; however, these values are not used to set protection goals (Numeric limits are discussed in more detail in Chapter 7 – Water Quality Standards). Under the Groundwater Protection Act, Minnesota does not allow degradation to occur up to a certain limit before requiring action be taken. The MDA also has the authority to take action to protect groundwater under MINN. STAT. 18B.

The pesticide management approach outlined in the PMP starts with voluntary prevention measures. The approach then relies on the evaluation of detections in water, among other pesticide-related factors, to determine where mitigation efforts may be required. Mitigation strategies are similarly evaluated to determine their effectiveness and guide further actions.

To protect water resources, the PMP approach involves the development of best management practices (BMPs), such as generic BMPs for all herbicides, before potential problem compounds cause contamination or are detected. These BMPs should be promoted in areas where water resource impacts may be expected based on vulnerability analyses and pesticide usage patterns. BMP adoption and effectiveness are evaluated before regulatory options are considered.

Surface Water

Philosophy and Goals

The Minnesota PMP also incorporates protection of surface water. The commissioner of agriculture, in addition to the prevention, evaluation, and mitigation strategies for groundwater, will utilize related strategies to protect surface water quality. The basis upon which the surface water protection philosophy is founded is within the Pesticide Control Law (MINN. STAT. 18B.04 and 18B.045) and the authorities vested in the MPCA via the Clean Water Act.

In addition, Minnesota maintains an antidegradation purpose for surface water, as stated in MINN. R. 7050.0250:

> *The purpose of the antidegradation provisions in parts 7050.0250 to 7050.0335 is to achieve and maintain the highest possible quality in surface waters of the state. To accomplish this purpose:*
>
> > *A. existing uses and the level of water quality necessary to protect existing uses shall be maintained and protected;*
> > *B. degradation of high water quality shall be minimized and allowed only to the extent necessary to accommodate important economic or social development;*
> > *C. water quality necessary to preserve the exceptional characteristics of outstanding resource value waters shall be maintained and protected…*

Approach

The PMP will utilize, to the extent practicable, the classification system, standards, and authorities provided in MINN. STAT. 115.03, which give the MPCA authority to adopt standards and prohibit discharges that would cause those standards to be exceeded. Section 115.44 directs the MPCA to develop a classification system for surface waters that allows differential standards for water bodies based upon their use and quality. The MPCA follows Minn. Rules Chapter 7050 in administering these statutory authorities. These rules establish a protection goal for surface water in MINN. R. 7050.0170:

> *The waters of the state may, in a natural condition, have some water quality characteristics or properties approaching or exceeding the water quality standards. Natural conditions exist where there is no discernible impact from point or nonpoint source pollutants attributable to human activity or from a physical alteration of wetlands. Natural background levels are defined by water quality monitoring. Where water quality monitoring data are not available, background levels can be predicted based on data from a watershed with similar characteristics.*
>
> *Where natural background levels do not exceed applicable standards, the addition of pollutants from human activity and resulting point or nonpoint source discharges shall be limited such that, in total, the natural background levels and the additions from human activity shall not exceed the standards. When reasonable justification exists to preserve the higher natural quality of a water resource, the commissioner may use the natural background levels that are lower than the applicable site-specific*

> *standards to control the addition of the same pollutants from human activity. The reasonable justification must meet the requirements under parts 7050.0250 and 7050.0335.*
>
> *Where background levels exceed applicable standards, the background levels may be used as the standards for controlling the addition of the same pollutants from point or nonpoint source discharges in place of the standards.*
>
> *In the adoption of standards for individual waters of the state, the agency will be guided by the standards herein but may make reasonable modifications of the same on the basis of evidence brought forth at a public hearing if it is shown to be desirable and in the public interest to do so in order to encourage the best use of the waters of the state or the lands bordering such waters.*

The designated uses of a water body are determined by their attainable water quality. As of 2022, all lakes in Minnesota are classified for aquatic life and recreation use. Ninety-nine percent of Minnesota river miles are classified for aquatic life and recreation use. All rivers are classified for agricultural, navigational, and industrial use. Each use has a specific set of water quality standards that must be maintained in order for the water body to support that particular use. Minnesota water use classifications are:

- Class 1 - Domestic consumption
- Class 2 - Aquatic life and recreation
- Class 3 - Industrial consumption
- Class 4 - Agriculture and wildlife
- Class 5 - Aesthetic enjoyment and navigation
- Class 6 - Other uses
- Class 7 - Limited resource value waters

The state's water use classifications may contain both numeric and narrative standards designed to be protective of the designated uses.

Water quality standards and other benchmarks can be used to help guide actions to protect surface waters. Exceedances of pesticide water quality standards in Minn. Rules Chapter 7050 may result in the listing of water bodies as "impaired" on the Clean Water Act's 303(d) list and trigger protective actions (see Chapter 9 – Evaluation). The MPCA is the lead state agency for managing pollution in surface waters under Minn. Rules Chapter 7050; however, the MDA works closely with the MPCA to evaluate pesticide detections and may lead efforts to address pesticide-related impairments.

As with groundwater, the pesticide management approach for surface water starts with voluntary prevention measures and uses an evaluation approach (Chapter 9 – Evaluation). To protect water resources, the PMP approach involves the development of some best management practices (BMPs), such as generic BMPs for all herbicides, before potential problem compounds cause contamination or are detected. These BMPs should be promoted in areas where water resource impacts may be expected to occur based on vulnerability analyses and pesticide usage patterns.

Summary

Minnesota's PMP philosophy, goals, and approaches for preventing, evaluating, and mitigating water resource degradation are designed to comply with applicable statutes and rules.

In practical application, the groundwater and surface water policies outlined in this chapter mean that:

1. All water resources are protected (not just current drinking water supplies) before contamination occurs.
2. The protection goal is the maintenance of the natural quality of water where possible, and minimization of impacts where this goal cannot be met.
3. Groundwater resources are not prioritized for protection according to use, but all are protected as sources of drinking water.
4. Surface waters are protected according to classifications set forth in Minn. Rules Chapter 7050.
5. Additional protective measures may be required for waters vulnerable to contamination.

BMPs based on sound technical knowledge are an important part of the MDA's approach for both preventing and mitigating pesticide contamination. Generic BMPs are to be developed before potential problem compounds cause contamination or are detected. Furthermore, detections of pesticides or pesticide breakdown products in water may lead to the development and promotion of pesticide-specific voluntary BMPs. The MDA's approach also involves the evaluation of BMP adoption and effectiveness before regulatory options are considered.

State statutes and rules establish a framework for protecting Minnesota's groundwater and surface water through prevention. Details of the PMP's prevention, evaluation, and mitigation components are provided in Chapters 8, 9, and 10.

Chapter 3: Minnesota's Natural Setting, Pesticide Use Patterns, and Information Sources

Minnesota's Water Resources

Minnesota is a state rich in water resources, including lakes, rivers, wetlands, and extensive aquifers. Minnesota contains some of the most pristine waterbodies in the country. These resources provide a variety of services to all Minnesotans including drinking water, wildlife habitat, and water for agriculture and industrial uses. Many Indigenous peoples, whose cultural, spiritual, and economic practices are intrinsically woven to this landscape, hold this land sacred. These waterbodies also offer opportunities for recreation (e.g., fishing, boating, swimming) and support tourism, which represents an important part of Minnesota's economy.

Minnesota is located at the headwaters of three major drainage basins. Hudson Bay is the ultimate destination of runoff from the Red River of the North and the Rainy River. Lake Superior accepts runoff from the St. Louis River, the Nemadji River, and many small streams along the North Shore. Water from Lake Superior discharges through the other Great Lakes and the St. Lawrence River to the Atlantic Ocean. The Mississippi River is the largest drainage system in Minnesota and receives runoff from the majority of the state.

The advance and retreat of vast ice sheets during the Ice Age left behind a very complex system of unconsolidated geologic deposits in Minnesota. Both surficial and buried glacial drift aquifers are present in most of the state, especially in river and stream valleys where the interconnection between surface and groundwater is dynamic. Glacial drift aquifers are important sources of drinking water, for both public and private supplies. In many parts of the state, bedrock aquifers are present under the glacial drift.

Bedrock aquifers supply drinking water for public and private use, as well as maintaining base flow for the surface waters of the deep river valleys cut by the Mississippi and Minnesota Rivers. In some areas, the glacial deposits are shallow or nonexistent. This is particularly important in Southeastern Minnesota, where the dissolution of the underlying carbonate, limestone rock has resulted in Karst formations; here, bedrock aquifers are particularly susceptible to direct impacts from surface activities.

It is possible to make broad generalizations on subsurface and surface conditions in Minnesota, and the ability to make specific recommendations on smaller areas continues to improve. When it comes to preventing, evaluating, and developing responses to pesticide detections in water resources, it is important to utilize the most precise and scientifically defensible information available.

Published Reports and Maps

Subsurface geologic information is the basis for assessing the susceptibility of groundwater to contamination. Land use practices, climate, irrigation, and other factors also play a role in whether susceptibility results in actual contamination. There are various descriptions of subsurface conditions, ranging from detailed maps and reports to uninterpreted records of water wells and borings. For example, detailed maps of regional groundwater pollution sensitivity (Figure 1) have been developed by the Minnesota Department of Natural Resources (DNR)

that depict areas of the state where the threat to groundwater is greatest and can be considered in PMP implementation.

Surface topography and soil types influence overland runoff and the recharge of local and regional lakes, rivers, and springs. As with groundwater susceptibility and sensitivity, the ability to predict surface water impacts is related to various factors, including land use practices, topography, soil properties, and climate. The MPCA developed a map (Figure 2) to guide development and implementation of water quality plans for 10 separate basins in Minnesota. The MPCA sets surface water standards (including standards, criteria, or advisory values for several pesticides) which are used to evaluate relative impairment of rivers and lakes within each basin, and it employs a watershed approach to restoring and protecting Minnesota's rivers, lakes, and wetlands.

Planning activities for some basins may include utilization of an agro-ecoregion framework to help develop best management practices (BMPs) appropriate for a given area and broadly target basins for water quality effectiveness. Minnesota has 39 agro-ecoregions which are each associated with a specific combination of soil types, landscape and climatic features, and land use. Each agro-ecoregion contains unique physiographic factors that influence the potential for production of non-point source pollution and the potential for adoption of farm management practices. Agro-ecoregions can be associated with a specific set of soil and water resource concerns and with a specific set of management practices to minimize the impact of land use activities on soil and water resource quality. Maps of agro-ecoregions within three of Minnesota's 10 basins are shown in Figure 3. Information associated with the ago-ecoregions and their various land use and physiographic characteristics relative to surface water quality can be considered in PMP implementation.

In 2004, the MDA, with assistance from the University of Minnesota, divided the state into 10 Pesticide Monitoring Regions (PMRs) to facilitate water quality monitoring. PMRs are based on areas with similar cropping practices, soil characteristics, hydrogeologic conditions, climate, and agro-ecosystem classifications. These regions may also be considered in PMP implantation with respect to the promotion and evaluation of BMPs. A map of the PMRs and descriptions of each region are available in Chapter 6 - Statewide Water Quality Monitoring.

Ground and surface water features are described in varying degrees of detail and coverage in additional published reports and maps, depending on the level of intensity of various investigative and mapping efforts. Soil atlases and county soil surveys cover the entire state but are concerned with only the upper 5-6 feet of the Earth's surface. Geologic and hydrogeologic maps of Minnesota at various scales are available from the Minnesota Geological Survey (MGS) and the DNR for many parts of the state. Hydrologic Atlases published by the U.S. Geological Survey (USGS) and DNR provide statewide coverage and are useful for establishing the general hydrogeologic setting for the area to be assessed. Other sources of information include MGS county atlases and USGS reports (e.g., water resources investigations, water supply papers, open-file reports) and datasets (e.g., mean annual potential groundwater recharge rates). Additional information can be found in studies conducted by state agencies, colleges and universities, and consulting firms.

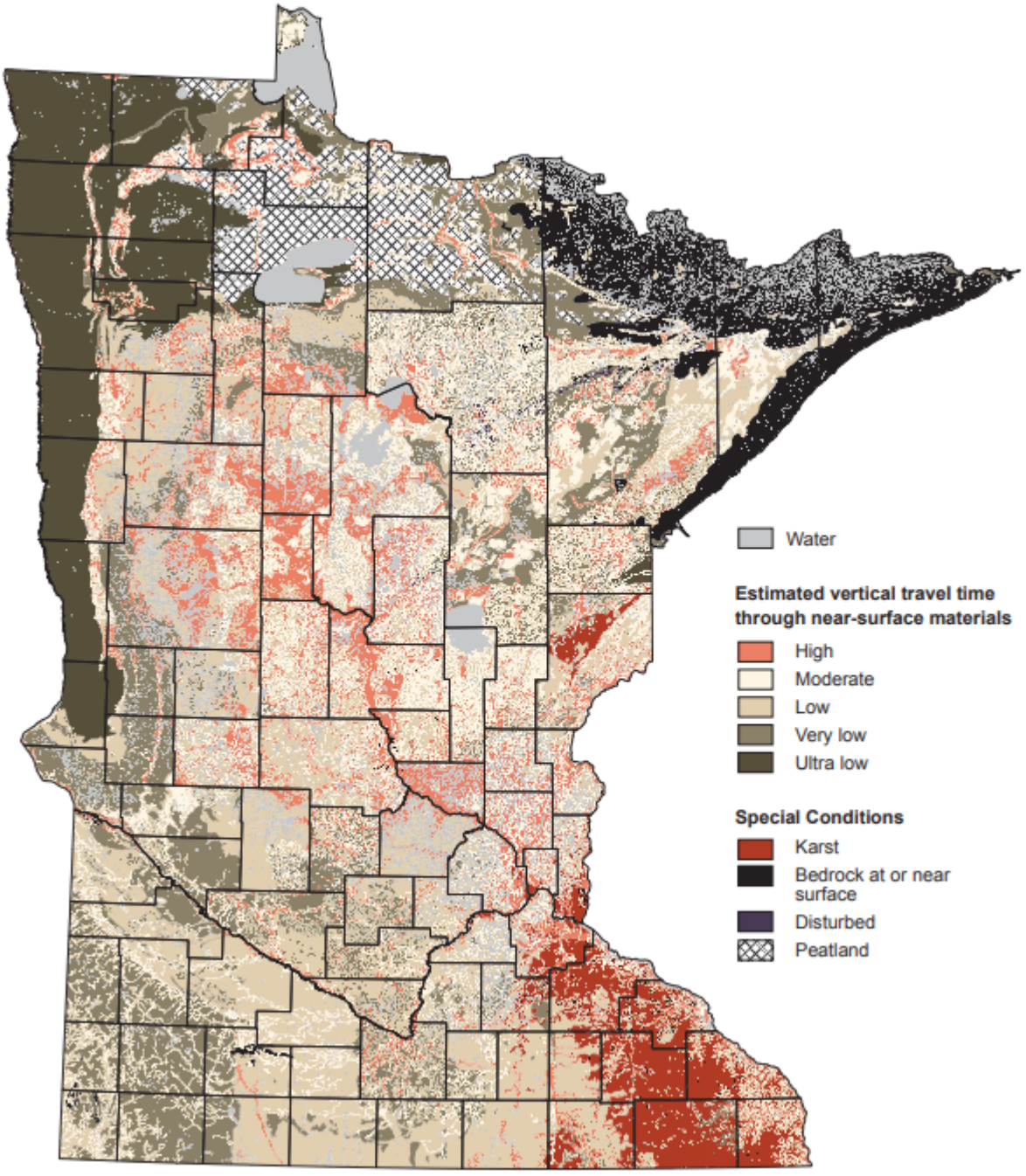

Figure 1. Map for pollution sensitivity of near-surface materials for Minnesota. The sensitivity to pollution of near-surface materials is an estimate of the time it takes for water to infiltrate the land surface to a depth of 10 feet. Source: Minnesota Department of Natural Resources Minnesota Hydrogeology Atlas Series HG-02 Report, Plate 1, June 2016.

Figure 2. Basins and Major Watersheds in Minnesota. Surface water basin boundaries are used for basin planning and water body impairment listings under the Clean Water Act and total maximum daily load (TMDL) programs. The 80 major watersheds in Minnesota are also shown on the map. Source: Minnesota Pollution Control Agency, www.pca.state.mn.us/air-water-land-climate/watershed-approach-to-water-quality; Accessed 1/14/25.

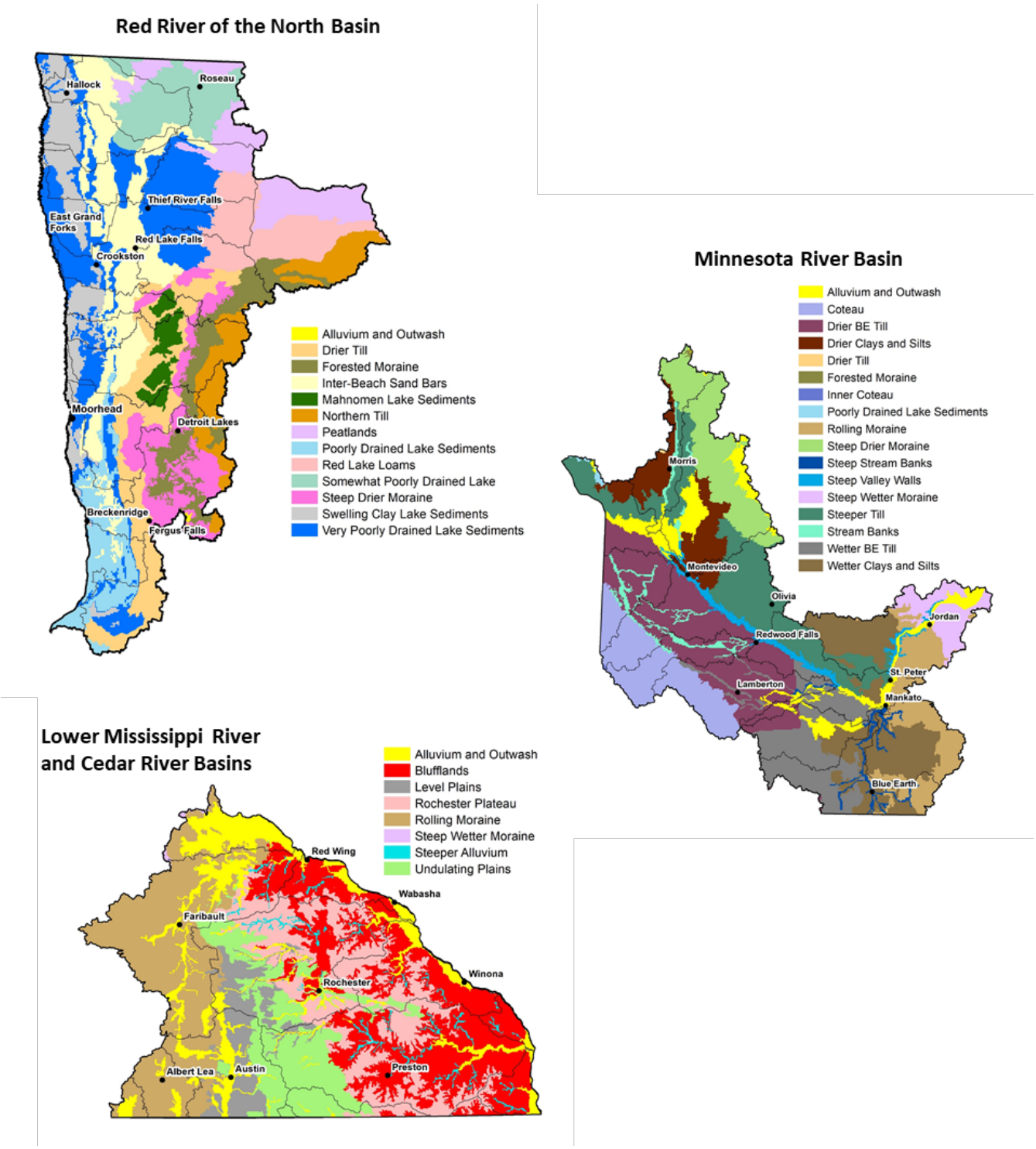

Figure 3. Agro-Ecoregions for the Red River of the North, Minnesota River, and Lower Mississippi and Cedar River Basins. Maps of all agro-ecoregions are available through the Minnesota Geospatial Commons. Source: gisdata.mn.gov/dataset/agri-agroecoregions; Accessed 1/26/21.

Well Records and Boring Logs

Records from water wells and test borings are the most important and basic source of subsurface geologic information for the state. Since 1975, water well contractors have been required to submit a record (driller's log) to the Minnesota Department of Health (MDH) for each well drilled. The location and geologic information contained in water well records ranges in quality from very good to poor. The MGS organizes and interprets water well records as part of state efforts to develop a groundwater information system. Information about wells and borings in Minnesota can be obtained from the MDH.

Various types of test drilling also provide valuable information about subsurface and hydrogeologic conditions. For example, the Minnesota Department of Transportation has many engineering test boring records acquired from road and bridge construction projects. Test boring records may be obtained for other types of construction projects from private consultants. Environmental borehole and monitoring well records from landfills and other types of environmental assessments are another source of data.

Minnesota's Soil Resources

Soil type can affect the rate at which water moves through the soil and the potential for pesticides to leach with the moving water or to run off in overland flow, either dissolved in runoff water or attached to soil particles. There are many soil types in Minnesota, and each has its own specific characteristics. Soil surveys are available to aid in identifying the soil's characteristics in almost every area of Minnesota. Soil surveys consist of detailed maps which outline areas of specific soil types by name. In addition, soil surveys contain information to aid in the proper identification of soils, to describe suitability for numerous applications, and the limitations associated with these uses for most Minnesota counties.

Published Reports and Maps

State soil surveys are produced and published for individual counties by the U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). They are a product of cooperation and effort from individual counties, the University of Minnesota, NRCS, and the Legislative Commission on Minnesota Resources. Soil atlases and county soil surveys cover the entire state, and digital data sets that describe the soils of Minnesota are available online through the Minnesota IT Services Geospatial Information Office. The Soil Survey Geographic data set (SSURGO) from NRCS provides digital soils data for Minnesota and can be accessed through the Web Soil Survey. In 2005, the USDA phased out the printing of soil survey reports and made the Web Soil Survey the official source of information, though archived reports can still be accessed through the NRCS website.

The NCRS soils database for most Minnesota counties can be used in conjunction with a database of pesticide leaching and runoff characteristics to aid in the development of pesticide management plans for individual fields that include the evaluation of pesticide loss ratings for soil type and pesticides used (see "Physical and Chemical Properties of Pesticides" for more information).

Pesticide Use in Minnesota

A variety of sources publish information related to pesticide use in Minnesota. Each source has a particular reason for collecting information and a set of assumptions underlying its collection and reporting methods.

1. The MDA publishes annual pesticide sales data for crop production pesticide active ingredients based on pesticide registrant and agricultural pesticide dealer reporting requirements. The MDA also seeks to publish information on non-agricultural pesticide use, including annual pesticide sales data for select non-agricultural and urban pesticides. Care must be used when interpreting pesticide use or sales data. Pesticides reported as sold in Minnesota may not be used in the same year they are sold, or in some cases may never be used in Minnesota. However, these sales data provide an indication of long-term pesticide use trends.
2. The Agricultural Resource Management Survey, which is collected and published by USDA National Agricultural Statistics Service (NASS), provides data and reports of major crop pesticide use, use rates, and pesticide management practices. Survey respondents are randomly selected, and the reported results are based on standardized statistical analyses conducted by USDA NASS nationwide.
    - The USDA NASS publishes annual chemical usage reports, including pesticide use and use rate information for Minnesota.
    - The USDA NASS online database can be searched for specific crop/pesticide information.
3. The MDA conducts additional surveys with USDA NASS to evaluate pesticide use and related pesticide management practices. Project results are published by the MDA separate from NASS and are posted on the MDA's website. These surveys are designed to capture information from a relatively large sample population on pesticide use or use practices (including BMP adoption) in specific crops and regions of the state and are used to fulfill statute requirements.
4. The MDA occasionally conducts surveys of farms in localized areas (several hundred acres) where community water supplies exhibit vulnerability to land use impacts or where other water quality concerns exist. Survey results are published by the MDA or other cooperators.
5. Additional studies are occasionally or periodically conducted by the MDA to assess pesticide use and use practices in both urban and rural settings.
6. The DNR's Aquatic Plant Management Program publishes an annual report which covers the use of aquatic pesticides permitted under its authority.

Physical and Chemical Properties of Pesticides

The potential impact of a pesticide on water quality is determined in part by its physical and chemical characteristics, the properties of the soil or water body to which it is applied, rates and methods of application, and weather patterns. A pesticide may move from its application site to groundwaters and surface waters by a variety of mechanisms (Becker, 1989).

Transport pathways include:

1. In solution with surface runoff
2. Adsorbed to sediment particles carried by surface runoff

3. In solution with subsurface drainage and infiltration through soil pores, root channels, cracks, etc. (i.e., leaching)
4. As spray drift at the time of application
5. As vapors that leave the soil or plant surface

An additional transport mechanism potentially important in parts of Minnesota is the wind-borne movement and deposition of pesticide residues bound to soil in drainage ditches, waterways, and surface waters. Similarly, contaminated dust from pesticide-treated seeds during planting can potentially move with wind and be deposited in ditches, waterways, and surface waters. Movement of pesticides with infiltrating solution into agricultural drain tiles may also act as a means of transport to surface waters in some Minnesota fields.

Pesticides may directly enter groundwater when spilled or used near naturally occurring sink holes, and poorly sealed or abandoned wells. These sites provide direct conduits for the transport of water and pesticides to groundwater. Contamination by the less direct route of leaching through the soil profile may occur in areas of concentrated pesticide handling, such as mixing and loading facilities and disposal sites. Certain pesticides may leach to groundwater or runoff to surface water in Minnesota under conditions of normal use.

Key properties influencing a pesticide's potential to reach groundwater or surface water include its solubility, adsorption, persistence, and volatility.

- **Solubility:** Solubility is the ability of a pesticide to dissolve in water. As the solubility of a pesticide increases, there is a greater potential for transport to groundwater (leaching) or surface water (runoff). Pesticides with solubilities below 30 parts per million (ppm) are considered to have relatively low potentials for leaching. If the solubility is 1 ppm or less and adsorption occurs, the product will tend to remain at the soil surface but may move off-site with soil sediment (USEPA, 1986). The amount of pesticide that will solubilize tends to decrease with an increase in dissolved salts and increase in the presence of dissolved organic matter.
- **Adsorption:** Retention of pesticides by soil particles is referred to as adsorption. Adsorption can decrease the concentration of pesticides in solution and thus decrease the availability of the pesticide to move off site with water. Adsorption also increases the length of time pesticides are available for decomposition by microorganisms in the biologically active surface soil. Pesticides are retained by soils to different degrees depending on the properties of the pesticide, the soil, and their interaction.

  The mobility of a chemical substance is primarily measured by its soil adsorption coefficient (K_d or K_{oc}). Low K_d or K_{oc} values indicate high mobility in soil. A highly mobile pesticide is more likely to leach to groundwater or run off to surface water. A pesticide with a K_{oc} value <10 is typically classified as highly mobile whereas a pesticide with K_{oc} value > 100,000 is classified as immobile (FAO, 2000).
- **Persistence:** Persistence refers to the amount of time a pesticide will remain in the environment. The half-life of a pesticide is the length of time required for 50% of the pesticide to break down and is used as a measure of persistence. The persistence of a pesticide is one of the most important factors in determining its leaching or surface runoff potential.

The persistence of a pesticide affects its concentration in soil and the length of time it is available for movement. Chemical and microbial transformations, physical losses, and plant uptake reduce the concentration and the amount available for loss in water and sediment. Therefore, all other factors being equal, the shorter the time a pesticide persists in the soil, the less chance for movement with water or sediment. Pesticide persistence is categorized as non-persistent (half-life of 30 days or less), moderately persistent (half-life of 30 to 99 days), or persistent (half-life greater than 100 days) (Kerle, 1996).

- **Volatility:** Volatility is the tendency of a pesticide to enter the air as a vapor and is primarily a function of a pesticide's vapor pressure. Non-volatile pesticides have low vapor pressures while volatile pesticides have higher vapor pressures. Volatile pesticides are more likely to move via vapor drift which can reach surface waters. Though volatile pesticides are less persistent in soil, they have been found to leach to groundwater, particularly if applied through direct injection (USEPA, 1986). Environmental conditions such as temperature and wind speed can strongly influence pesticide volatility.

The NRCS has developed a screening tool to evaluate relative loss potential of pesticides from agricultural soils (referenced earlier in this chapter under Minnesota's Soil Resources), the Windows Pesticide Screening Tool (WIN-PST). Pesticide loss from leaching and runoff are both considered in conjunction with soil type and slope. This potential risk modeling system combines a pesticide database and a soils database. Modeling results are a useful tool to express overall potential for loss of a specific agricultural pesticide when used on a specific soil map unit. The procedure provides a relative estimate of pesticide loss risk. The generalized information resulting from such estimates can be used as a component of pesticide management plans for agricultural fields and to minimize pesticide loss in high-risk areas of Minnesota. The EPA also uses various models to estimate pesticide concentrations in food, water, non-target organisms, residential and occupational environments. These estimated concentrations are used to assess exposure to aquatic organisms, humans, and the environment as part of the pesticide registration process.

Methods for screening and evaluating pesticide movement to groundwater and surface waters in non-agricultural and urban settings are less well-developed than those available for agricultural settings. Education and promotion of BMPs specific for these settings, including integrated pest and weed management, are very useful in preventing and mitigating pesticide losses through leaching, runoff, or drift.

Aquatic Pesticide Behavior and Dispersion

Use of aquatic pesticides according to their labels to control aquatic pests typically results in localized pesticide concentrations sufficient to effectively control the target pest, followed by pesticide dispersion, degradation, and adsorption by sediments. Potential impacts to non-target organisms, when a pesticide product is used in compliance with the label or application permit, are addressed or considered as part of EPA product registration.

If the DNR has specific concerns about impacts to non-target organisms associated with a pesticide application authorized by one of its permits, requirements to minimize those impacts are included as permit conditions.

Modeling of aquatic pesticide behavior in such settings is extremely complex, and must account for many non-static variables, such as temperature changes in the water column, water movement, depth of ultraviolet

radiation, etc. Nevertheless, the basic characteristics of pesticides that guide their behavior in soil may provide insight into their behavior in aquatic environments. In addition to efficacy and dissipation studies required of the registrant, EPA's pesticide registration process examines the environmental fate and effects of pesticide products. For aquatic use pesticides, EPA's review incorporates aqueous concentration/exposure time relationships, use of models in the development and field evaluation of aquatic herbicides, and modeling of the dispersion of aquatic herbicides.

Still, the basic understanding of the behavior of pesticides in water, including their dispersion, breakdown, and uptake by non-target organisms, is sufficient to apply water-use restrictions to many pesticides labeled for aquatic use. Those use restrictions limit how water in the treatment areas can be used (e.g., fishing, lawn watering, swimming, or consumption by livestock). The DNR does not allow pesticides labeled for aquatic use to be applied to public waters in Minnesota if their associated water-use restrictions would unreasonably limit the use of those public resources.

Chapter 4: Coordination and Stakeholder Involvement

Introduction

Minnesota statutes and rules related to water resource protection provide for various types of state agency coordination and public involvement. In some cases, specific roles and responsibilities are prescribed.

Coordination of Pesticide Management Plan Development, Implementation, and Related Reporting

As directed in MINN. STAT. 18B.045, the PMP was coordinated and developed with other state agency plans and with other state agencies through the Environmental Quality Board (EQB). In addition, the University of Minnesota Extension (UMN Extension), farm organizations, farmers, environmental organizations, and industry groups were involved in plan development, consistent with MINN. STAT. 18B.045.

The Pesticide Control Law requires the commissioner of agriculture to submit a biennial status report on the plan to the EQB for review and then to the house of representatives and senate committees with jurisdiction over the environment, natural resources, and agriculture. Separately, the EQB is charged with writing a report based on the work of different state agencies and submitting a single report to the house of representatives and senate committees with jurisdiction over the environment, natural resources, and agriculture and the Legislative-Citizen Commission on Minnesota Resources by September 15, 2010, and every five years thereafter (MINN. STAT. 103A.43).

MINN. STAT. 103B.151 defines a broad coordinating role for EQB in development and implementation of state water planning and directs EQB to coordinate development of state water policy recommendations and priorities.

PMP implementation is also coordinated with the Minnesota Nonpoint Source Management Plan developed approximately every five years by the MPCA and its cooperators under Section 319 of the Clean Water Act. The Nonpoint Source Management Plan is a comprehensive plan for controlling nonpoint source pollution and includes pesticide management. Actions recommended in the plan are intended to be carried out through extensive coordination of a number of state and local resource agencies. For example, the MDA works with counties through the One Watershed, One Plan program to develop comprehensive watershed management plans that align local water planning purposes and procedures on watershed boundaries to create a systematic, watershed-wide, science-based approach to watershed management.

Groundwater Protection: Roles and Responsibilities

MINN. STAT. 103A.204 clarifies state agency roles to address groundwater pollution from non-point sources. The roles laid out are supplemental to other authorities to control point sources of pollution and to regulate pesticide registration and sales. For the MDA, MINN. STAT. 103A.204 defines responsibilities for a variety of voluntary and regulatory mechanisms for protection of groundwater from agricultural chemical contaminants.

Several state agencies have defined roles in the management of groundwater resources. MINN. STAT. 103A.204 describes the following:

> *(a) The responsibility for the protection of groundwater in Minnesota is vested in a multiagency approach to management. The following is a list of agencies and the groundwater protection areas for which the agencies are primarily responsible; the list is not intended to restrict the areas of responsibility to only those specified:*
>
> > *(1) Environmental Quality Board: coordination of state groundwater protection programs;*
> >
> > *(2) Pollution Control Agency: water quality monitoring and reporting and the development of best management practices and regulatory mechanisms for protection of groundwater from nonagricultural chemical contaminants;*
> >
> > *(3) Department of Agriculture: sustainable agriculture, integrated pest management, water quality monitoring, and the development of best management practices and regulatory mechanisms for protection of groundwater from agricultural chemical contaminants;*
> >
> > *(4) Board of Water and Soil Resources: reporting on groundwater education and outreach with local government officials, local water planning and management, and local cost share programs;*
> >
> > *(5) Department of Natural Resources: water quantity monitoring and regulation, sensitivity mapping, and development of a plan for the use of integrated pest management and sustainable agriculture on state-owned lands; and*
> >
> > *(6) Department of Health: regulation of wells and borings, and the development of health risk limits under section 103H.201.*
>
> *(b) The Environmental Quality Board shall prepare a report on policy issues related to its responsibilities listed in paragraph (a), and include these reports with the assessments in section 103A.43 and the "Minnesota Water Plan" in section 103B.151.*

In addition to broad, statutorily defined roles and responsibilities outlined above, the Groundwater Protection Act (MINN. STAT. 103H) outlines specific roles and responsibilities for participation of state and local governments and the public in best management practice development, education, and promotion. These roles and responsibilities are further described in Chapters 8, 9, and 10.

Surface Water Protection: Roles and Responsibilities

Chapter 2 of the PMP outlines the philosophy, goals, and approaches for preventing surface water degradation, including references to Minn. Rules Chapter 7050 governing Minnesota's surface water quality standards and resource management. In addition, for pollutants that cause a water body to fail to meet state water quality standards (i.e., cause an impairment), Section 303(d) of the federal Clean Water Act requires the MPCA to conduct a total maximum daily load (TMDL) study. The regulations that govern the TMDL program (40 CFR 130A) require the study to identify both point and non-point sources of each pollutant that fail to meet water quality

standards. Water quality sampling and computer modeling, for example, can be used to help determine how much each pollutant source must reduce its contribution to assure the water quality standard is met. Rivers and streams may have several TMDLs, each one determining the limit for a different pollutant. The MDA's specific statutory roles and responsibilities for surface water protection are generally limited to those outlined in the Pesticide Control Law (MINN. STAT. 18B).

The MDA coordinates with the MPCA to review pesticide water quality data for the determination of impaired waters. Based on the MDA pesticide water monitoring data, the MPCA determines which waterbodies do not meet Minnesota water quality standards and proposes them to the EPA for the impaired waters list. The MPCA also evaluates potential delisting of impairments based on the latest water monitoring data. The MPCA releases a bi-annual Impaired Water List (303(d)) which lists all changes from the previous list. The MPCA and the MDA work cooperatively responding to pesticide impairments. Currently, as part of that process, the MDA develops a Response Plan for the specific pesticide that caused the identified impairment(s) and submits it to the MPCA for review.

Coordination of surface water contamination prevention, evaluation, and mitigation is outlined in Chapters 8, 9, and 10, respectively.

Additional MDA Groundwater and Surface Water Protection Activities

In addition to PMP activities directed at prevention of non-point source contamination of water resources by pesticides, the MDA conducts many other activities that protect groundwater and surface water by reducing the amounts of pesticides entering water resources. A number of programs and responsibilities of the MDA that relate directly or indirectly to ground and surface water protection are described below. While this section focuses on MDA activities, it is important to note that pesticide pollution prevention activities are not limited to the MDA. The University of Minnesota, other state agencies, local agencies, federal agencies, Tribal governments, pesticide manufacturers and dealers, and other organizations may also conduct pesticide pollution prevention activities.

Pesticide Registration

Before a pesticide product can be offered for sale in Minnesota, the manufacturer must apply for and receive registration from the EPA, and then from the MDA. Federal registration requires that registrants complete a variety of studies to evaluate potential impacts on human health and the environment. The federal label includes legal rates of application, various environmental hazards and compliance requirements, and enforceable standards for worker protection. Each pesticide must be annually registered in Minnesota, accompanied by the payment of fees based on annual gross sales and submission of labels of current pesticide products. The MDA can prohibit the sale of products by refusing to register the pesticide or may restrict use to certain crops or geographic areas by imposing use restrictions when the product is registered (MINN. STAT. 18B.26). In addition, the commissioner of agriculture has broad authority, both within and separate from the PMP, to take actions necessary to protect public health and the environment from harmful exposure to pesticides, and to prevent unreasonable risk to humans or the environment.

The MDA may conduct a more detailed special registration review of pesticides that have the potential to contaminate groundwater or surface water resources at levels that might exceed relevant standards or guidelines, or at levels that might present unreasonable adverse effects on the environment. The criteria for which federal pesticide registrations will receive further state review for water quality concerns will focus on new pesticide active ingredients, new uses of previously registered products, active ingredients included in EPA's annual registration workplan, and active ingredients that have been identified as common detection in groundwater or as surface water pesticides of concern. Because federal registration data contains information about anticipated water resource impacts, such data will be reviewed for accuracy with respect to Minnesota conditions that may differ from conditions evaluated in the federal registration package. Registration reviews will be prioritized based on the degree of an active ingredient's environmental or human health risk concern and will include consultation with the MPCA, MDH or other state agencies as appropriate. Factors considered in prioritization will include related ongoing research on pesticide chemistry, toxicology, and environmental fate, as well as the anticipated or known level of use in each pest-control setting. Summaries of registration reviews will be publicly available.

Pesticide Applicator Training

The MDA has an ongoing licensing/certification program for applicators who commercially apply pesticides in Minnesota, or for applicators of certain classes of pesticides. State mechanisms for certification include examinations, training sessions, and other materials for self-study as part of the ongoing process to maintain accurate, up-to-date training for pesticide applicators. Study manuals and materials will be updated as needed to provide current, relevant information. The licensing and certification program represents the cooperative efforts of the MDA, UMN Extension, and various industry associations and groups.

Licensing and Permitting of Facilities

The potential for contamination from agricultural chemical storage and distribution sites has been considerably diminished through inspection and permitting programs. The MDA expends considerable time and effort in inspecting bulk pesticide storage sites that it has permitted. The MDA has also assisted the agricultural chemical storage industry in the permitting and subsequent safeguarding of large bulk fertilizer storage sites. Storage and distribution of non-agricultural and urban pesticides are monitored under a separate program that conducts marketplace inspections to ensure prevention of water resource contamination through proper storage and handling.

Incident Response

The Groundwater Protection Act (MINN. STAT. 103H) extended existing MDA statutory authority to require and oversee investigation and clean-up of agricultural chemical incidents. Authorization to develop an Incident Response Program for point source contamination was also part of that legislation. In the Incident Response Program, MDA staff receives reports of incidents from MDA inspections, property transfer investigations, MDH public water supply well sampling, and other sources. All new incident reports go to the MDA spills team who determine if the incident is an immediate threat to human health or the environment. If the incident is a high priority, MDA personnel first request responsible parties to voluntarily perform necessary incident or site

investigations and clean-ups. The spills team directs the cleanup at those sites. All other incidents are then prioritized.

Agricultural Chemical Response and Reimbursement Account

The Minnesota Groundwater Protection Act of 1989 (MINN. STAT. 103H) established the Agricultural Chemical Response and Reimbursement Account (ACRRA). ACRRA is an account created to reimburse persons for costs incurred in cleaning up agricultural chemical incidents resulting from the use, handling, storage, transportation, and distribution of agricultural chemicals. Money from the ACRRA can be used to reimburse for costs of cleaning up both emergency and long-term spills involving agricultural chemicals. The ACRRA is funded by a surcharge on pesticide and fertilizer sales.

Routine Pesticide and Fertilizer Inspections and Misuse Investigations

Routine pesticide and fertilizer inspections are conducted by the MDA's Inspection and Enforcement Section with regulated clientele to determine compliance with pesticide and fertilizer regulations, issue compliance orders when necessary, and provide compliance assistance. Pesticide misuse investigations are completed in response to complaints of alleged pesticide and fertilizer misuse activities. Inspections and investigations are evaluated by the respective program units for potential violations and regulatory follow-up of documented violations.

Enforcement

The MDA has administrative, civil, and criminal authority to enforce program regulations within the Pesticide and Fertilizer Management Division. Violations are addressed through the use of non-penalty or penalty enforcement documents and may include additional remedies applicable to case circumstances. Non-penalty Actions are routinely issued, either in the field or office, to address noncompliance issues. Penalty enforcement Actions are completed for violations of a more serious or repeat nature and are reviewed through senior Pesticide and Fertilizer Management Division management. Significant cases are additionally reviewed by the commissioner's office.

Environmental and Water Analysis

The laboratory has two sections that perform analysis of environmental samples for pesticides and other contaminants. The Water Analysis Unit analyzes ground and surface water samples for pesticides at trace levels (parts per trillion). Three primary methods are employed for the extraction and analysis of over 175 pesticides and metabolites. Methodology includes automated extractions, liquid chromatography with tandem mass spectrometry (LC-MS/MS), and gas chromatography with tandem mass spectrometry (GC-MS/MS).

The Environmental Analysis Unit tests for other matrices, such as highly contaminated soils, as a result of incidents and vegetation samples from drift complaints. This unit completes all sample extraction, chromatographic analysis, and chromatogram review and interpretation when analyzing for pesticides. Services include unique or high-level water residues analysis, methods development, soils and vegetation analysis,

formulation analysis and food analysis. Methodology includes liquid and gas chromatography, and mass spectrometry.

Funding from the federal Clean Water Act has supported purchasing equipment for pesticide analysis.

Agricultural Water Quality Certification Program

The Minnesota Agricultural Water Quality Certification Program (MAWQCP) is a voluntary program that uses a whole farm risk assessment process to identify threats to water quality on farms. Farmers and agricultural landowners are then presented with options to mitigate risks so they can achieve certification. Those who implement and/or maintain approved farm management practices can be certified and, in turn, receive recognition and obtain regulatory certainty for a period of ten years. Special funding pools are available to certified producers and those seeking certification. The MAWQCP is a comprehensive partnership that includes federal, state, and local public sector entities, as well as private sector collaborations providing certification services to Minnesota's farms.

The MAWQCP whole farm assessment includes a review of pest management practices and ways agricultural producers minimize potential for pesticide leaching, solution runoff, soil adsorbed runoff and drift. Farmers and agricultural landowners can also receive additional recognition for excellence in use IPM techniques with an IPM endorsement. Each IPM endorsement review includes a discussion of the MDA pesticide BMPs.

Chapter 5: Introduction to the Pesticide Management Process

Process Overview

Based on the direction provided in MINN. STAT. 18B.045, the pesticide management process starts with efforts to prevent occurrences of pesticides and pesticide breakdown products in groundwaters and surface waters of the state. The process continues with water quality monitoring and evaluation of prevention efforts. Then, if necessary, voluntary measures for potential problem pesticides are developed and promoted, and further monitoring occurs prior to consideration of regulatory actions by the MDA. This process is summarized in this chapter and described in detail throughout the PMP. Figure 4 and Figure 5 outline the process for groundwater and surface water, respectively. The commissioner of the MDA has authority to deviate from this process and impose use and distribution restrictions on a pesticide, if necessary, to prevent unreasonable risk to humans and the environment.

Prevention – Chapter 8

The foundation of the PMP is promotion of pesticide use, handling, and management practices which are protective of water resources. Prevention of contamination is an underlying theme behind the MDA's pesticide registration and certified applicator programs, and it is also a key factor in the development of generic or pesticide-specific best management practices (BMPs). These and other prevention activities are ongoing and may occur even if contamination is not detected in groundwater or surface water.

Within the prevention component of the PMP, many activities take place including the establishment of an Education and Promotion Team to assist the MDA with development and implementation of its education and promotion activities focused on preventing degradation of water resources. BMPs may be promoted both before pesticides are detected and in response to common detection determinations in groundwater or surface water pesticide of concern determinations.

Evaluation – Chapter 9

Evaluation of prevention efforts is coupled with statewide water quality monitoring, including monitoring of groundwater, drinking water supplies, and surface water. A variety of reference values are considered for the different monitoring efforts. These include the application of MDH's Health Risk Limits (HRL), Health Based Values (HBV), Rapid Assessments, and surface water standards, criterion, or advisory values established by the MPCA. Reference values established by the EPA are also considered (e.g., aquatic life benchmarks, human health benchmarks for pesticides). Monitoring of pesticide use practices is also conducted. The data gathered is analyzed and summarized to support MDA prevention, evaluation, and mitigation decisions. A PMPC is convened to review water monitoring data and to support MDA's evaluation activities. The PMPC meets to provide informed and diverse comment to the commissioner for major evaluation activities and decisions. In addition to MDA-led activities, the MDA provides technical support to the MPCA with its process for determination of impaired surface waters.

Mitigation – Chapter 10

Voluntary pesticide-specific BMPs are developed and promoted as part of the MDA's actions to mitigate the deleterious effects of specific pesticides in common detection status for groundwater or that are determined to be surface water pesticides of concern. The commissioner, based on this status and other information, may also determine whether it is in the best interest of the state of Minnesota to take other actions in response to water resource contamination by pesticides. Various regulatory and non-regulatory options are available to the commissioner ranging from statewide prohibition of use to specific pesticide or crop management strategies.

Once initial mitigation steps are taken, continued evaluation and monitoring of water resources occurs, as does evaluation of BMP use and effectiveness. If BMPs are proven to be ineffective, Water Resource Protection Requirements (WRPRs) or other enforceable actions are considered for groundwater. Evaluation of the need for groundwater WRPRs follows guidance based on statutory requirements. To mitigate or regulate pesticides in surface water, the MDA cooperates with the MPCA in its implementation of the federal Clean Water Act; however, the MDA also has authority under the state Pesticide Control Law to take independent action to prevent unreasonable adverse effects on the environment. An analysis of the benefit of the continued registration of a pesticide may also be conducted as part of mitigation actions.

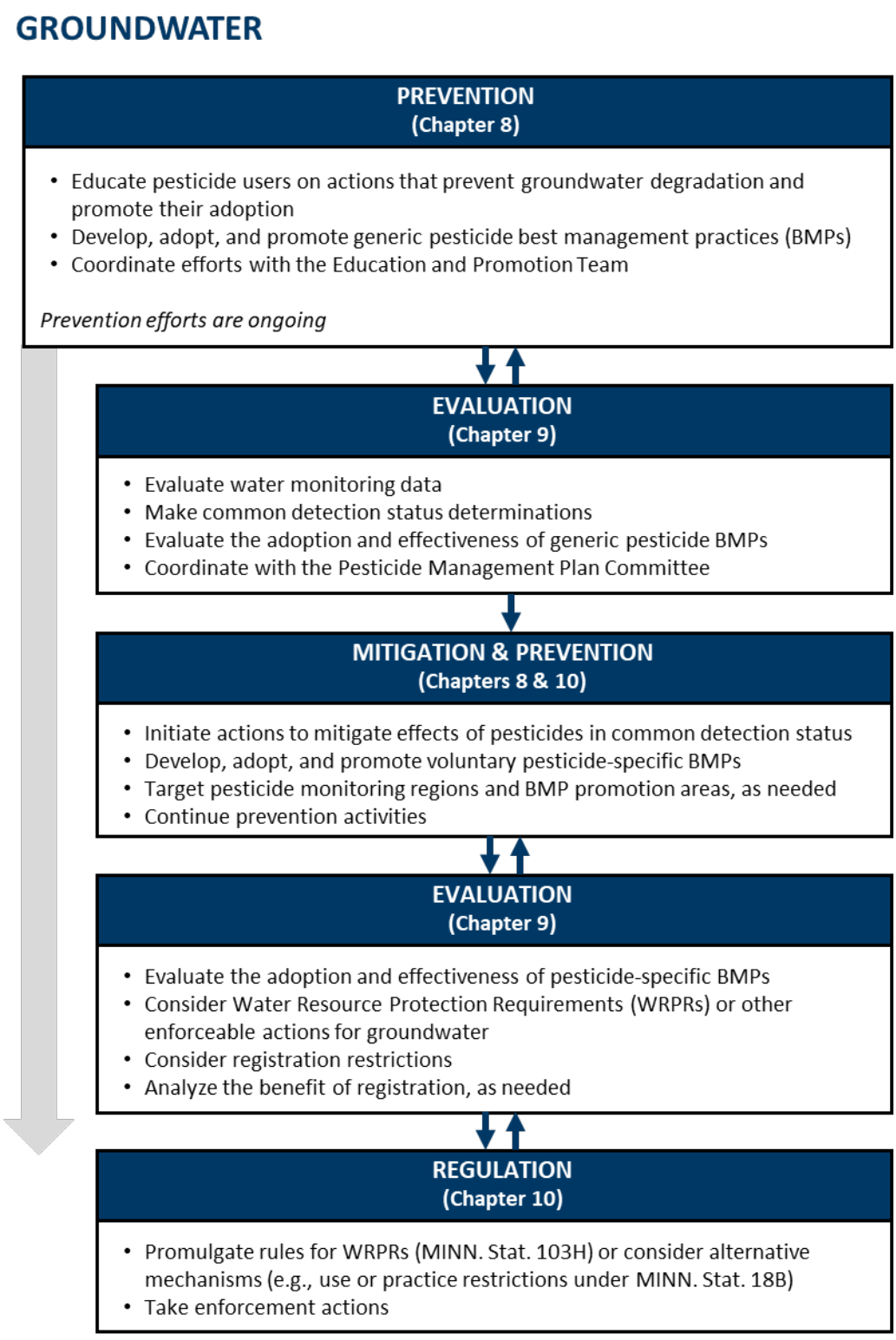

Figure 4. Minnesota Pesticide Management Plan general process for groundwater decisions

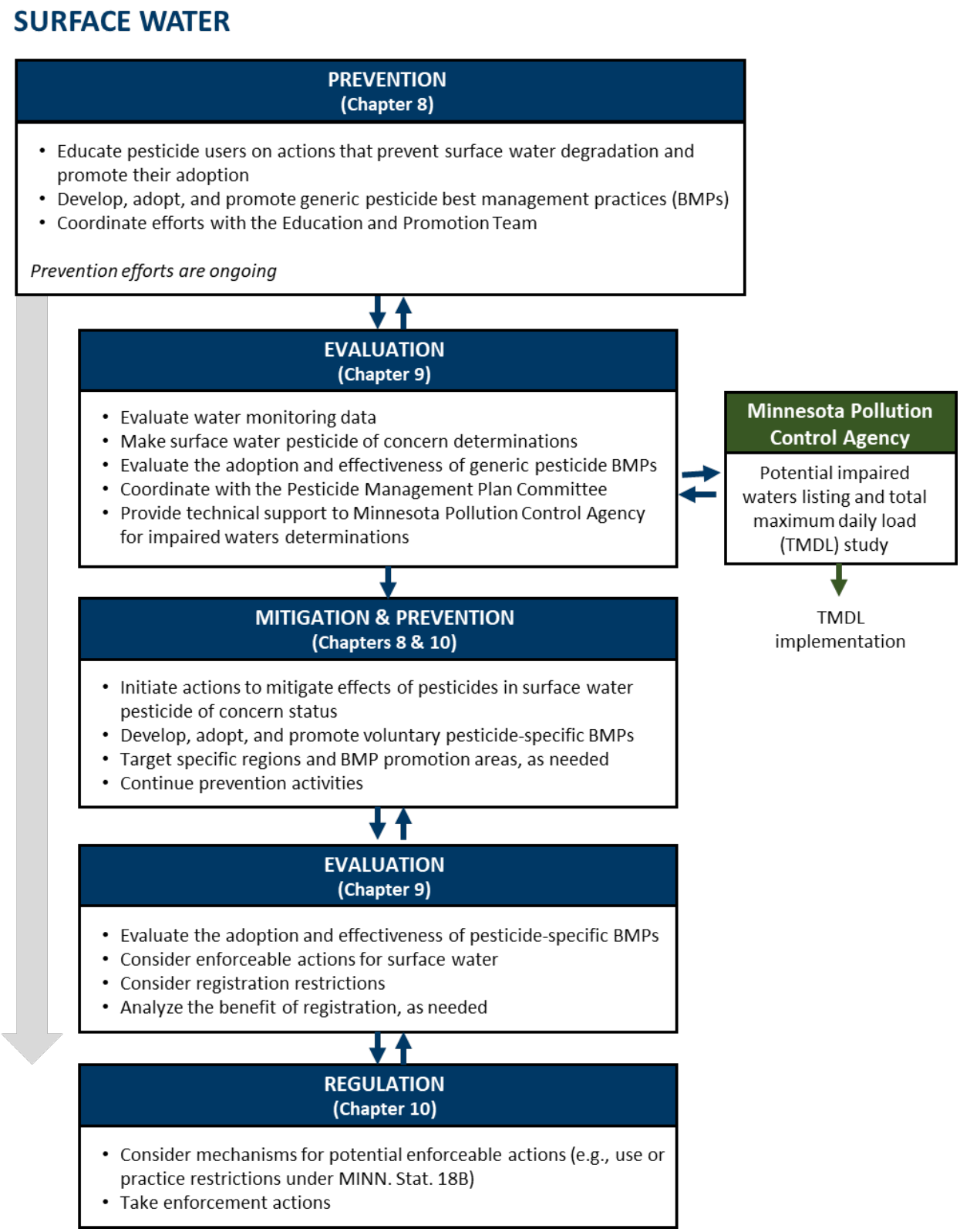

Figure 5. Minnesota Pesticide Management Plan general process for surface water decisions

Chapter 6: Statewide Water Quality Monitoring

MDA Water Quality Monitoring Overview

Water quality monitoring is considered a key component of the Minnesota PMP. Water quality monitoring consists of the collection and analysis of water samples to determine the identity, concentration, and frequency of pesticide compounds in the state's water resources. Ambient water quality monitoring is conducted by the MDA's Monitoring and Assessment Unit for the purpose of evaluating the impact from the routine application of agricultural chemicals on groundwater and surface water in Minnesota. The data collected is used to identify compounds and/or places where concentration may exceed established water quality benchmarks, guidance values, and/or standards, collectively referred to as reference values. These data are also used to identify trends related to the detection frequency and concentration of specific pesticides found in the waters of Minnesota. The data can also prompt the development of BMPs, aid in evaluating the effectiveness of BMPS for those specific compound(s) and determine if additional actions are necessary to protect the environment as defined in this plan. This information is also made available to policy makers, interested diverse stakeholders, and the public to help guide policy and management decisions that will mitigate impacts from the routine use of pesticides.

In the mid-1980s, prior to and separate from the PMP, the MDA conducted groundwater surveys throughout the state. The MDA developed a formal groundwater monitoring program in 1987 and a surface water monitoring program in 1990 in response to changes to the Minnesota Pesticide Control Law (MINN. STAT. 18B.04 subd. a). The monitoring programs have undergone substantial redesigns since they were initially established. In the early 2000s, the MDA redesigned the groundwater network in the Central Sand Plain and expanded to other regions of the state through the 2000s. By 2010, the groundwater network had reached its current configuration. The surface water network was initially developed in cooperation with the Minnesota Pollution Control Agency (MPCA), and the current tiered sampling network was implemented in 2007. The MDA will continue to coordinate the monitoring program with the implementation of the PMP and may adjust the program to meet additional needs of the PMP.

In addition to the ambient water monitoring networks, the MDA may also conduct water monitoring through other special projects. To optimize limited resources, the MDA seeks development of cooperative relationships with existing monitoring programs at the local, state, Tribal, or national level whenever possible.

This chapter describes the overall goals and objectives of the MDA's water quality monitoring program. Pesticide water quality results and pesticide use are outside the scope of this document. Reports and raw data from the monitoring program are available on the MDA's Water Monitoring Reports and Resources webpage.

Statutory Authority

The MDA's water quality monitoring program for pesticides was originally mandated in 1987 through the Minnesota Pesticide Control Law. MINN. STAT. 18B.04 states:

> *The commissioner [of agriculture] shall: (1) determine the impact of pesticides on the environment, including the impacts on surface water and groundwater in this state;...*

The scope of the MDA water quality monitoring program for pesticides was further expanded in 1989 through the Groundwater Protection Act (MINN. STAT. 103H), which called for increased monitoring of the state's groundwaters.

Purpose

The purpose of the MDA's water quality monitoring program is the protection of Minnesota's water resources from the routine use of pesticides. The data is used to protect human health and the environment by identifying contaminants that may be present in Minnesota's water resources. Protection necessitates collection, analysis, and distribution of pesticide water quality data.

Monitoring Goal

The goal of the MDA's water quality monitoring program is to provide information on the impacts of the routine use of pesticides on groundwater and surface water in Minnesota so that pesticide use may be managed to prevent or minimize degradation of the state's water resources.

Monitoring Objectives

The MDA's water quality monitoring program is designed to collect and analyze groundwater and surface water samples throughout the state to provide information on which pesticides are occurring in Minnesota's water resources, where they are occurring, and at what levels (i.e., concentrations) they are present. The specific objectives for groundwater and surface water monitoring are detailed below.

The objectives of groundwater monitoring are to:

1. Determine pesticide concentration and occurrence in representative groundwater systems where the routine use of pesticides may pose a risk to human health or the environment
2. Determine statewide and regional differences in pesticide concentrations and occurrences
3. Assess long-term trends and significant changes in pesticide concentrations over time
4. Analyze how land use, hydrologic and geologic attributes, and pesticide management may result in water resource degradation, as needed
5. Provide the basic information from which the efficacy of pesticide management strategies may be determined
6. Disseminate the water quality information extracted from the monitoring data to inform pesticide users, policy makers, scientists, and other interested parties

The objectives of surface water monitoring are to:

1. Determine pesticide concentration and occurrence in representative streams, rivers and lakes

2. Determine statewide spatial differences in pesticide concentrations and occurrences
3. Assess long-term trends and significant changes in pesticide concentration and occurrence over time
4. Collect pesticide water quality data that supports the assessment of results as compared to water quality reference values (standards and benchmarks)
5. Analyze how land use, hydrologic attributes, and pesticide management may result in water resource degradation
6. Provide the basic information from which the efficacy of pesticide management strategies may be determined
7. Disseminate the water quality information extracted from the monitoring data to pesticide users, policy makers, scientists, and other interested parties

MDA Water Quality Monitoring Program Design

The MDA recognizes that groundwater and surface water are not separable. For the purpose of prevention, evaluation, and mitigation, and given existing legal authority, references, and resources, groundwater and surface water may need to be considered separately in certain circumstances. Separate monitoring networks exist for groundwater and surface water. These networks have been designed to determine specific aspects of the impacts of pesticides on water quality.

Pesticide Monitoring Regions

In 2004, to facilitate water quality monitoring and fulfill the program goals, the MDA, with assistance from the University of Minnesota, divided the state into 10 Pesticide Monitoring Regions, or PMRs, as shown in Figure 6. PMRs are based on areas with similar cropping practices, soil characteristics, hydrogeologic conditions, climate, and agro-ecosystem classifications. PMRs are delineated on county lines to facilitate the evaluation of the results by farmers, the public, and others. Table 1 provides detailed descriptions and characteristics of each PMR.

PMRs are used in both the groundwater and surface water network designs. Neither groundwater nor surface water is currently monitored in PMR 2 (North Central Minnesota) because of the relatively low use of agricultural chemicals in this region. Likewise, groundwater in PMR 3 (Northeast Minnesota) is not monitored because of the low use of agricultural chemicals. However, limited surface water monitoring in PMR 3 is included as a background monitoring location. Within PMR 10 (Twin Cities Metro), the MDA has historically emphasized monitoring for non-agricultural pesticides.

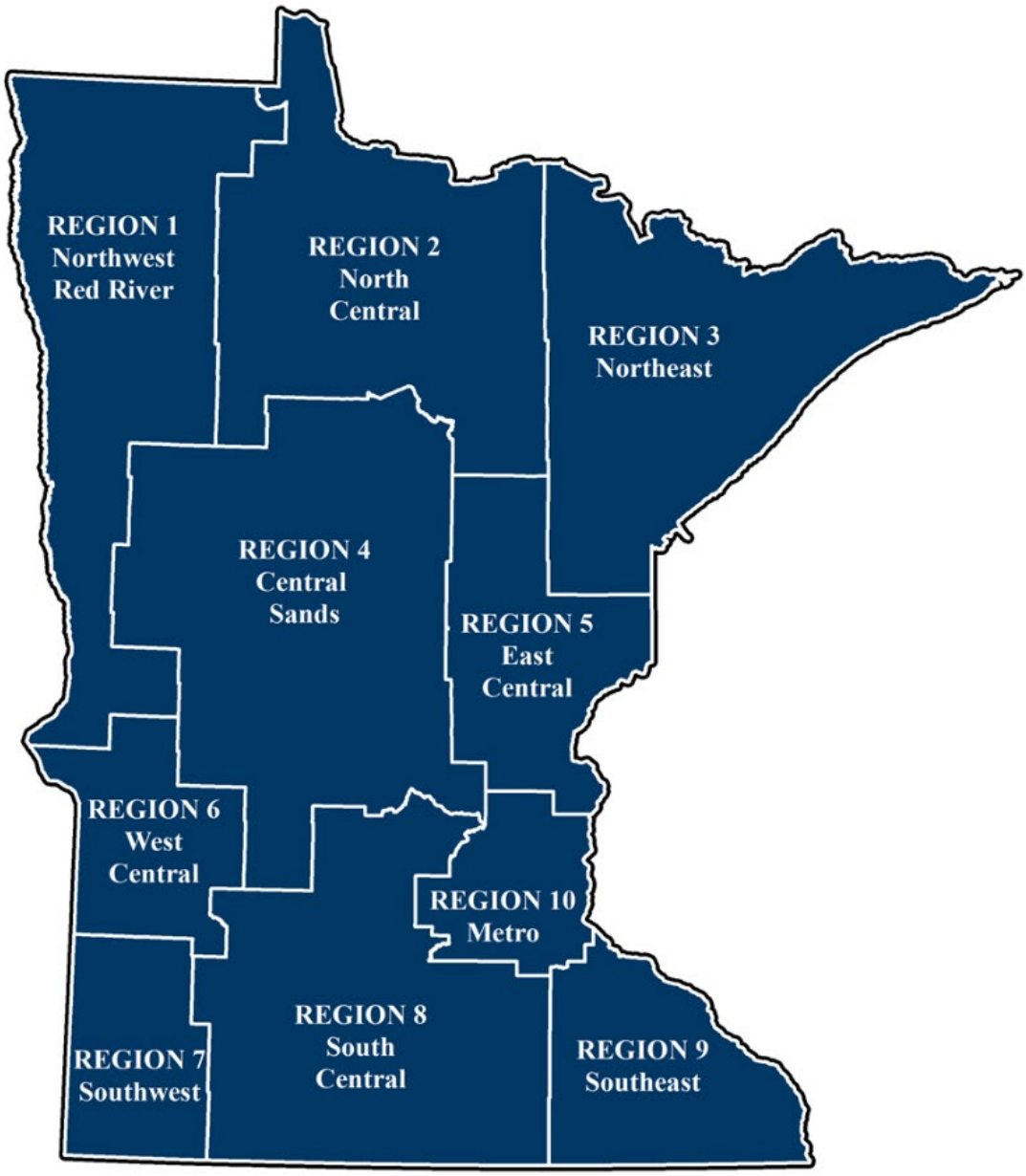

Figure 6. Map of the MDA's Pesticide Monitoring Regions

Table 1. Pesticide Monitoring Region (PMR) descriptions and characteristics

PMR	Region	Counties Included	Physical Characteristics
1	Northwest Red River	Kittson, Roseau, Marshall, Pennington, Red Lake, Polk, Norman, Mahnomen, Clay, Wilkin, Traverse, Grant	Glacial lakebed w/ high clay content soils 150 to 250 ft thick; gravel aquifers buried under clay; beach ridge deposits of sand and gravel; high value agriculture of sugar beets and small grains
2	North Central	Lake of the Woods, Koochiching, Beltrami, Clearwater, Itasca	Mostly forested and bog; little agriculture in discontinuous areas; groundwater resources quite variable
3	Northeast	St. Louis, Lake, Cook, Carlton	Forested with shallow bedrock; agriculture nearly nonexistent
4	Central Sands	Becker, Hubbard, Cass, Crow Wing, Morrison, Wadena, Otter Tail, Todd, Douglas, Pope, Stearns, Benton, Sherburne, Kandiyohi	Large glacial outwash sand plains that are highly sensitive to surface activities; high value potatoes and other crops; irrigated fields are common
5	East Central	Aitkin, Pine, Mille Lacs, Kanabec, Chisago, Isanti	Glacial outwash and lacustrine sands; low pH soils; generally poor cropping conditions; some irrigation; some potato production
6	West Central	Stevens, Big Stone, Swift, Chippewa, Lac Qui Parle, Yellow Medicine	Some areas of glacial outwash sand; thin and narrow alluvial aquifers; many buried sand aquifers; mix of corn and soybeans; thick glacial tills in some areas
7	Southwest	Lincoln, Lyon, Pipestone, Murray, Rock, Nobles	Aquifers consist of highly sensitive alluvial river valley deposits; fractured quartzite formations and well protected deep cretaceous sediments; sufficient water supply is hard to come by; rural water systems are large and growing

PMR	Region	Counties Included	Physical Characteristics
8	South Central	Wright, Meeker, Renville, McLeod, Sibley, Nicollet, Le Sueur, Rice, Steele, Waseca, Blue Earth, Brown, Redwood, Cottonwood, Watonwan, Jackson, Martin, Faribault, Freeborn	A mix of glacial outwash sands; deep glacial tills, glacial lacustrine deposits; windblown silts, river valley deposits; and deep bedrock aquifers; sensitivity varies accordingly; corn and soybeans; intensive ag production with extensive sub-surface tile drainage
9	Southeast Karst	Goodhue, Wabasha, Winona, Olmsted, Dodge, Mower, Fillmore, Houston	Karst geology that is highly sensitive to surface activities; shallow windblown silt and glacial till soils; springs, sinkholes and disappearing streams; high value trout streams; extremely shallow to very deep bedrock aquifers; some river valley alluvial deposits
10	Metro	Anoka, Ramsey, Washington, Dakota, Scott, Carver, Hennepin	Urban, suburban and transitional areas; some irrigated farming; hobby farms; outwash sand and gravel to deep bedrock aquifers

Groundwater Monitoring Network Design

The MDA began monitoring groundwater in November 1985 and redesigned the program in 1998. New wells were installed in 1999, and the MDA began sampling the redesigned monitoring network in January 2000. This network has continued to evolve over time and is designed to provide long term data about pesticides in groundwater. Data collected from the network can be used to determine trends in pesticide concentrations and detection frequencies, to track changes within and between the various MDA monitoring regions, and to provide information useful for implementing and assessing BMPs.

The current network is summarized below. Additional information about the network design can be found in the MDA's Groundwater Monitoring Network Design document or in the annual work plans.

Groundwater Monitoring Network

The current network began in the Central Sands region (PMR 4) and has expanded throughout the state targeting areas with vulnerable groundwater that is considered sensitive to contamination from activities at the land surface. Areas with a large percentage of acreage in row crops, sandy soils, surficial sand and gravel aquifers, and relatively large amounts of irrigation are given the highest priority for monitoring groundwater. Minnesota's sand plain regions (primarily in the central part of state) are high priority because of the value of these aquifers for shallow rural wells, the limited adsorption capacity of the soils, the high water transmission rates of the soil and vadose zone material, and the results of previous monitoring that showed relatively high frequency of pesticide detections in groundwater of the area. Karst bedrock areas have the next highest priority due to the rapid recharge of water to the aquifers through sinkholes and solution channels, shallow soil with

little adsorptive capacity, and the widespread use of the aquifers as domestic drinking water supplies. Alluvial river valley aquifers with finer textured geologic materials, fractured crystalline bedrock aquifers, and buried sand aquifers are also of particular interest to the program.

The groundwater monitoring network is a combination of shallow monitoring wells, springs, and domestic wells. Most of the network consists of the monitoring wells (86% of the current network) that are installed with the following criteria:

- Completed in the water table aquifer
- Adjacent or close (within ¼ mile) to, and downgradient of active row crop agriculture
- Available well log or construction information
- Easily accessible for sampling
- Remote from potential point sources of pesticides
- Capable of producing sufficient volumes of water for sampling

PMR 4 was the first region in the state to be monitored as part of the redesigned network in 2000, and it contains the majority of the sites in the program. Sampling began in PMRs 1, 6, and 7 in 2004, in PMR 8 in 2006, and in PMR 5 in 2007. Southeastern Minnesota (PMR 9) groundwater is sampled via naturally occurring springs and domestic drinking water wells. Three Minnesota DNR fish hatchery springs were first sampled in 2000, and regional spring sampling began in 2006. Private drinking water wells in PMR 9 were first sampled in 2009 and were selected to represent the upper-most aquifer in the area. Private wells were targeted for monitoring due to the high cost of monitoring well installation in the bedrock aquifers of PMR 9. In 2020, a DNR observation well was also added to the PMR 9 network.

In 2004, the MDA began a cooperative effort with the MPCA to sample wells within urban/suburban land use areas or developing urban settings. Historically, sampling for urban use pesticides was conducted in urban areas within the geographic bounds of several PMRs. Beginning in 2017, all urban groundwater samples were collected from monitoring wells within PMR 10.

Other groundwater networks maybe sampled by the MDA for pesticides as a part of other projects. These networks may include, but are not limited to, public water supplies, domestic wells, or other local, state, Tribal, or federal monitoring networks. Often this sampling is conducted in cooperation with other local, state, Tribal, or federal agencies. These networks are not detailed here as each is distinct, with different purposes and goals. These projects tend to be shorter in duration, compared to the current groundwater network, and may be very localized or statewide.

Currently every location within the network is sampled at least once a year. Locations within PMR 4 are sampled once a year while locations in the other PMRs are sampled twice a year, once in the spring and once in the fall. Sampling frequency has changed over time to continue providing the quality data needed to implement the PMP while efficiently using the available resources. Sampling frequency may continue to change based on the data and resources available for sampling and analysis.

Drinking water well surveys were conducted during the initial development of the MDA's groundwater monitoring network. Data from drinking water well surveys was used to evaluate the general quality of

groundwater used as drinking water and to focus expansion of the more scientifically rigorous groundwater monitoring well network. In 2014, the MDA began sampling private drinking water wells in areas of vulnerable groundwater with row crop production. Between 2016 and 2020 the MDA sampled approximately 5,700 wells in 50 counties for low-level pesticide analysis.

With the development of the MDA's groundwater monitoring network, ongoing use of drinking water wells has not been necessary except for those domestic wells which are a part of the monitoring network in PMR 9. However, the MDA will continue to sample drinking water wells to provide data for areas of the state or aquifers which are not covered by the groundwater monitoring network. The MDA will cooperate with Tribes, other state agencies (e.g., Minnesota Department of Health), and organizations to sample and test drinking water wells. This sampling will be short-term in nature and related to a specific project or investigation. The MDA's surface water monitoring data is also used to evaluate surface water as a drinking water source.

Surface Water Monitoring Network Design

The MDA's water quality monitoring program strategically collects surface water samples at different times of the year from locations throughout the state. For example, samples are collected during spring runoff when peak pesticide concentrations may occur, as well as in late summer when fungicide and insecticide applications are occurring without large runoff events. Targeting the "worst case scenario" maximizes resources and allows for the most valuable information in terms of assessing possible pesticide impacts to aquatic life.

In 2007, the MDA began monitoring surface water from agricultural and urban watersheds utilizing a tiered structure defined and described in the 2007 MDA Surface Water Quality Monitoring Design Document. Within the tier structure, there are three levels of monitoring intensity:

- **Tier 1 - Statewide Pesticide Survey Sampling**

  Tier 1 locations are distributed across the state and are sampled eight times from May 1 through August 31, targeting storm flow conditions if they occur. The objective is to provide a general assessment of water quality during peak pesticide runoff and detection periods from watersheds throughout the state. Sampling consists of grab samples (i.e., samples taken at a single point in time) collected from rivers and streams.

- **Tier 2 - Duration Assessment Sampling**

  Tier 2 locations are distributed across the state and follow the same sampling regime as Tier 1 with the addition of a second "follow-up" grab sample if the first sample is collected during storm flow conditions. This level of monitoring provides better information for duration assessment (the length of time pesticide concentrations persists).

- **Tier 3 - Enhanced Duration Assessment Sampling**

  Tier 3 locations are located in south central, southeast, and northwest Minnesota and are sampled using an equal-time increment autosampler to collect the sample over several days during storm flow

conditions. This sampling regime provides a duration component to the pesticide concentration data collected during storm flow conditions.

The MDA's surface water monitoring network includes both agricultural and non-agricultural watersheds. The current monitoring locations are detailed in the annual surface water work plan which can be found on the MDA's Water Monitoring Reports and Resources webpage.

Rainfall

Rainfall monitoring allows the MDA to assess atmospheric deposition of pesticide compounds in rainfall in Minnesota. The current rainfall monitoring network for pesticides and nutrients began in 2008. There are currently four stations, one each in PMR 1, PMR 8, PMR 9 and at an urban location (St. Paul). Rainfall samples are collected from April through October.

National Aquatic Resource Surveys

The MDA conducts periodic sampling of lakes, wetlands, and rivers and streams in cooperation with the EPA National Aquatic Resource Surveys (NARS) when analytical capacity is available. The NARS surveys offer an opportunity to collect additional pesticide water quality samples from randomly selected locations throughout Minnesota.

The MDA monitors pesticide water quality in randomly selected lakes in association with the National Lake Assessment that occurs approximately every five years. Pesticide water quality monitoring of wetlands is conducted approximately every five years in association with the National Wetland Condition Assessment. The MDA monitors randomly selected locations on rivers and streams with the National River and Stream Assessment.

Pesticide Analyte Selection

The MDA carefully selects which pesticides and pesticide breakdown products (i.e., degradates) are targeted for analysis in its monitoring program based on several factors including:

- The extent of use or planned use in Minnesota or neighboring states
- Environmental fate characteristics or use patterns that could potentially result in adverse water resource impacts
- Data from non-MDA water quality monitoring reports of relevance to Minnesota
- Reference values or risk guidance available for human health and aquatic life toxicity from the MPCA, MDH, and/or the EPA
- The MDA Laboratory Services Division's ability to analyze for the compound

The water quality monitoring program targets pesticides largely based on the resources available, practicality, and the appropriateness of analysis. The target analyte list includes many of the most commonly used pesticide active ingredients and their associated degradates.

The MDA has formed an advisory committee with the MDH and the MPCA to coordinate efforts to identify pesticides and their degradates that are a priority for monitoring. The goal is to prioritize chemicals that are most likely to reach ground and surface water, as well as those that may pose a risk to human health or other non-target organisms.

Non-MDA Water Quality Data Collection

It is the responsibility of the commissioner of agriculture to collect information on the occurrences, concentration, and use of pesticides in Minnesota. Several other governments and organizations also monitor for pesticides in water. Each government or organization has different program goals and procedures. These organizations include but are not limited to:

- Minnesota Department of Health (public water supplies)
- Minnesota Pollution Control Agency (surface water, groundwater)
- Minnesota Department of Natural Resources (surface water)
- Tribal Nations
- United States Geological Survey (surface water, groundwater, precipitation)
- United States Fish and Wildlife Service
- National Parks Service
- Other States
- Local Units of Government
- Pesticide Registrants

The MDA evaluates water quality data collected from other organizations, public or private, and determines if it is applicable and meets MDA quality control standards. The MDA will consider data from other states but will not use that data as the primary criteria for making a determination that a pesticide is commonly detected in groundwater or a surface water pesticide of concern.

The commissioners of the MDA, MPCA, and MDH have signed an interagency cooperative groundwater and surface water monitoring agreements. These agreements define roles and assist in the coordination of monitoring and data management activities among the three agencies.

Water Quality Data Collection as a Decision-making Tool

The MDA's philosophy is that water quality data is a tool to aid in decision-making. Water quality data will be reviewed on an annual basis by the MDA and a report will be prepared that covers data from the previous year's monitoring efforts. The report will discuss the compounds detected in Minnesota, concentrations, geographic locations, criteria and benchmarks for evaluation, and long-term statistical trend analysis of the results. The MDA will continually modify and evaluate the monitoring program so that it provides the flexibility needed to implement and assess the PMP.

For the purposes of the PMP, water monitoring data from all readily available sources will be analyzed to determine if pesticide detections (including parent compounds and/or breakdown products) are a result of

normal applications or a unique or unusual circumstance. Detections and respective concentrations of a pesticide which are determined after investigation and analysis to be the result of routine use will be evaluated for common detection status in groundwater or for designation as a surface water pesticide of concern (Chapter 9 - Evaluation). Detections determined to be the result of an unusual or unique situation will be further evaluated to develop an appropriate response.

Focused pesticide management activities may be appropriate in regions where use of the pesticide is more frequent. Additional resources may be necessary to expand the water quality monitoring program to include monitoring networks for specific pesticides placed in common detection status or determined to be a surface water pesticide of concern. Chemical-specific monitoring may be focused in special BMP promotion areas to help determine the effectiveness of specific BMPs.

Chapter 7: Water Quality Standards and Rules

Health Risk Limits for Groundwater

The 1989 Minnesota Groundwater Protection Act directs the MDH to develop human health-based groundwater standards. These standards, known as Health Risk Limits, or HRLs, are defined in MINN. STAT. 103H.005, subd. 3. as:

> *A concentration of a substance or chemical adopted by rule of the commissioner of health that is a potential drinking water contaminant because of a systemic or carcinogenic toxicological result from consumption.*

An HRL is the concentration of a contaminant, or a mixture of contaminants, that can be present in water and pose little or no health risk to a person drinking that water. HRLs are developed to protect sensitive or highly exposed populations. If groundwater quality monitoring results show that there is a degradation of groundwater, the commissioner of health may promulgate HRLs for substances degrading the groundwater. The rules under which HRLs are developed and adopted can be found in MINN R. 4717.7810 to 4717.7900.

The MDH calculates HRLs using methods based on EPA risk assessment guidelines. HRLs are based on health effects data alone. They do not incorporate economic or technological factors, as do federal drinking water standards called Maximum Contaminant Levels.

Mandatory Uses of HRLs for Implementation of the PMP

There are specific situations, mandated by statute, where the MDA considers HRLs when making PMP decisions.

Determination of Common Detection

"Common Detection" is defined in MINN. STAT. 103H.005, subd. 5. as:

> *The detection of a pollutant that is not due to misuse or unusual circumstances, but is likely to be the result of normal use of a product or practice.*

A "pollutant" is defined in MINN. STAT. 103H.005, subd. 11. as:

> *A chemical or substance for which a health risk limit has been adopted.*

Therefore, current law requires that an HRL must be established for a pesticide (pollutant) prior to a determination of common detection by the MDA. This requirement, however, does not preclude the MDA from taking necessary action to prevent contamination under other statutory authorities.

Water Resource Protection Requirements

MINN. STAT. 103H.275, subd. 1. states that in areas where groundwater pollution is detected:

(a) If groundwater pollution is detected, a state agency or political subdivision that regulates an activity causing or potentially causing a contribution to the pollution identified shall promote implementation of best management practices to prevent or minimize the source of pollution to the extent practicable.

(b) The Pollution Control Agency, or for agricultural chemicals and practices, the commissioner of agriculture may adopt water resource protection requirements under subdivision 2 that are consistent with the goal of section 103H.001 and are commensurate with the groundwater pollution if the implementation of best management practices has proven to be ineffective.

(c) The water resource protection requirements must be:

(1) designed to prevent and minimize the pollution to the extent practicable;

(2) designed to prevent the pollution from exceeding the health risk limits; and

(3) submitted to the house of representatives and senate committees with jurisdiction over the environment, natural resources and agriculture.

The MDA will request that the Pesticide Management Plan Committee (see Chapter 9 – Evaluation), after reviewing available data, provide comment to the MDA on the implementation of BMPs, development of WRPRs, or other appropriate actions. The MDA will consider mandatory requirements as outlined in MINN. STAT. 103H.275 based on the effectiveness of BMPs, the product use and practices contributing to the pollution detected, economic factors, availability, technical feasibility, implementability, and effectiveness.

Emergency HRLs, Health-Based Values, and Other Guidance Values

In emergency situations, where an established HRL does not exist for a specific pesticide or breakdown product that is being found in groundwater, the MDH commissioner may adopt an emergency HRL for that compound, effective for one year, under authorities in MINN. STAT. 103H.201, subd. 2 (b).

The MDH may also develop a Health-Based Value, or HBV, for a groundwater contaminant, or a mixture of contaminants. Similar to an HRL, an HBV is the concentration of a chemical, or a mixture of chemicals, that is likely to pose little or no risk to human health. HBVs are calculated using the methodology adopted in the HRLs rules and meet the same data requirements as HRLs. HBVs, however, have not been promulgated as rules. If a chemical has been detected in water, MDH anticipates that HBVs for Minnesota's groundwater will become HRLs (i.e., be promulgated) at the time that MDH next amends the Health Risk Limits for Groundwater rule.

The MDA will submit requests with supportive documentation for human health-based guidance values to the MDH in accordance with MDH procedures. If the MDH is unable to adopt an HRL, an emergency HRL, or develop an HBV, the MDA will consider taking necessary action to prevent groundwater contamination under other statutory authorities. In such situations, the MDA may review relevant literature, and compare and consider use of other guidance values such as Maximum Contaminant Levels (MCL), Maximum Contaminant Level Goals (MCLGs), Human Health Benchmarks for Pesticides, Risk Assessment Advice (RAA), and Pesticide Rapid Assessments. The MDA will consult with the MDH before using human health-based guidance values under other statutory authorities.

Minnesota Rules Chapter 7060 for Groundwater

Minn. Rules Chapter 7060 are rules promulgated by the MPCA for the control and prevention of pollution of the natural quality of groundwater. This rule provides that groundwater is classified according to its highest potential use; therefore, for groundwaters of suitable natural quality, it is their use now or in the future as a source of drinking, culinary, or food processing water.

Minnesota Rules Chapter 6280 for Aquatic Plant Management

The Minnesota DNR is responsible for the implementation of Minn. Rules Chapter 6280. These rules govern the control and management of aquatic plants and animals that can adversely impact aquatic habitats or interfere with the public's ability to use Minnesota's public water resources. Pesticide applications are one of the control options addressed in MINN. R. 6280.

The DNR regulates aquatic plants growing in public waters owned by the state. These plants can interfere with riparian property owners' access to lakes. The Aquatic Plant Management Program of the DNR protects aquatic plant habitat from unnecessary harm while allowing lakeshore homeowners to control some aquatic vegetation for water access. Permits are issued to control aquatic plants at the bay-wide or lake-wide level to alter the composition of the plant community. The DNR also regulates aquatic animals living in public waters that may cause nuisance conditions (e.g., mosquitoes, blackflies, and leeches) and are intermediate hosts of nuisance-causing organisms (e.g., snails), or disrupt aquatic ecosystems (e.g., European carp).

Any use of pesticides in protected lakes, rivers, or wetlands to control aquatic plants or animals requires a DNR permit. Permits are issued by Regional Fisheries Managers or the Ecological and Water Resources Division. The DNR uses aquatic use pesticides as part of its management activities consistent with the requirements outlined in MINN. R. 6280.

Implementation of MINN. R. 6280 requires staff that are responsible for a variety of tasks. Staff are needed for: developing and providing educational and informational materials for permit applicants; providing technical advice to the public; coordinating with the MDA on pesticide regulations; updating and revising the aquatic plant management rules; working with commercial aquatic plant harvesters and pesticide applicators; and coordinating statewide efforts with the regional fisheries aquatic plant management specialists. The DNR's Aquatic Plant Management Program also includes an aquatic plant botanist responsible for focusing research on native aquatic plant communities and an aquatic pesticide enforcement specialist who supervises pesticide treatments and investigates reports of the misuse of pesticides in lakes (an effort directed at pesticide enforcement).

Minnesota Rules Chapter 7050 and the Federal Clean Water Act for Surface Water

When making PMP decisions for surface water, the MDA will consider Minn. Rules Chapter 7050 adopted by the MPCA for the control and prevention of pollution of surface waters. This rule provides both chronic and acute standards for surface waters and applies those standards through a use classification system. Water bodies within the state are given specific use classifications and each classification has associated water quality

standards. Water bodies that have not been classified through rule are given a default classification of 2B (which are protected for aquatic life and recreation but are not protected as drinking water sources).

The MPCA uses a three-fold process in developing the criteria for these water quality standards. The first protects aquatic life from the direct toxic effects of contaminants. The second protects humans from the adverse effects of eating contaminated fish and other edible aquatic organisms as well as consumption of drinking water from those waters protected as potential sources of drinking water. The third component protects wildlife that eats freshwater organisms from the adverse effects of contaminants. The most restrictive of the three chronic criteria (aquatic life-based, human health-based, or the wildlife-based) becomes the rule-based chronic standard used by the MPCA. Between rule-making efforts, the MPCA may develop interim surface water chronic criterion or, in the absence of complete toxicological information, advisory values (guidelines).

If a water body fails to meet water quality standards adopted by MPCA, it is considered "impaired." Section 303(d) of the federal Clean Water Act requires the MPCA to develop a list of impaired waters in the state that is updated biennially and conduct Total Maximum Daily Load, or TMDL, studies for the impaired waters. The regulations that govern the TMDL program (40 CFR 130.7) require the studies to identify both point and non-point sources of each pollutant that fails to meet water quality standards. Rivers, streams, and lakes may have several TMDLs, each one determining the limit for a different pollutant. The MDA monitors and reports annually on pesticide compound detections in Minnesota surface water and meets with the MPCA to discuss the data. These data and conversations help inform the MPCA's decisions about listing water bodies as impaired for pesticide compounds. The MDA will continue to coordinate with the MPCA annually on reviewing and discussing the pesticide monitoring data and developing response plans for specific pesticides for impaired waters.

In situations where an adopted surface water quality standard does not exist for a specific pesticide or breakdown product detected in surface water, the MDA will submit a written request that the MPCA adopt a standard or develop a criterion or advisory value for the compound(s). The request will include supportive documentation. If the MPCA is unable to adopt a standard, or develop a criterion or advisory value, the MDA will consider using alternate guidance values, such as EPA developed aquatic life benchmarks, and taking necessary action to prevent contamination under other statutory authorities.

Breakdown Products and Combined Impacts

Groundwater or surface water monitoring programs may detect the presence of pesticide breakdown products. When a pesticide breakdown product is detected in groundwater, the MDA may request that the MDH adopt an HRL, an emergency HRL, or develop an HBV, RAA value, or other guidance value for that breakdown product. For the detection of a breakdown product in surface water, the MDA may request that the MPCA adopt a standard or develop a criterion or advisory value for that breakdown product. Supporting data may be considered from all readily available sources, including registrants. In the absence of specific guidance values for breakdown products, the MDA will use values for the parent compound.

In assessing the potential for combined impacts to water resources from chemicals and/or their breakdown products, or from multiple chemicals with similar toxic endpoints, the MDH and MPCA currently employ specific approaches adopted by rule or established by policy. The MDH, for example, when assessing risk in the absence

of a HRL or HBV for breakdown products, has a policy of treating breakdown products and their parent compounds as though they cause the same toxic effect and have the same potency. The MPCA, in MINN. R. 7050.0222 subpart 7.B., may apply an additive model to determine the toxicity of chemical mixtures for chemicals having the same mode of toxic action and to prevent acutely toxic conditions; a similar model may be applied for mixtures of carcinogenic chemicals.

Chapter 8: Prevention

Introduction

Prevention activities within the PMP are meant to protect Minnesota's water resources from non-point source pesticide pollution. These activities are ongoing and independent of the status of pesticides or their breakdown products as common detection in groundwater or as surface water pesticides of concern. As described in Chapter 2, Minnesota recognizes that prevention is the best strategy for protecting water quality and is key to maintaining groundwater in its natural condition and maintaining the highest possible water quality in surface water.

Goal, Approach, and Recommended Actions

Prevention Goal

The prevention goal of the PMP is to prevent occurrences of pesticides or pesticide breakdown products in groundwater and surface waters of the state through education and the promotion of practices that protect water quality.

Prevention Approach

It is intended that this prevention goal be accomplished by promoting practices based on the criteria outlined in the Groundwater Protection Act (i.e., economic factors, availability, technical feasibility, implementability, effectiveness, environmental effects, and the beneficial uses of pesticides and applicable water quality standards), label instructions, and other factors. The prevention goal will be accomplished through education and the promotion of science-based actions that prevent the degradation of water resources (i.e., "prevention actions"). The MDA's approach will involve:

1. Utilizing available data, such as geologic atlases, to focus resources in scientifically defensible ways and in high-risk areas
2. Establishing an Education and Promotion Team, or EPT, to assist in coordinating prevention activities and programs
3. Working with various groups to develop, adopt, and promote BMPs
4. Encouraging the adoption of integrated pest management, or IPM, which includes a wide range of pest management strategies and includes and the judicious use of pesticides
5. Implementing a range of educational and promotional strategies through programs and activities such as applicator training and certification and demonstration projects

The prevention approach includes two main objectives.

Objective 1: Educate key target groups on pesticide water quality issues in Minnesota, risks versus benefits of pesticide use as it impacts water quality, and strategies to prevent contamination of water resources. Education

topics may include voluntary actions as well as restrictions and regulations. Target groups may include pesticide users, crop advisors, retailers, policymakers, landowners, organizations, institutions, agencies, residents, and other interested parties.

Objective 2: Promote effective prevention strategies including the adoption of BMPs by pesticide users that consider all management tools available and support the proper distribution, storage, handling, use, and disposal of pesticides.

Recommended Actions

The following actions are recommended to accomplish the prevention goal and are described in this chapter.

1. Utilize available databases, maps, and analytical procedures to evaluate potential pesticide loss from application sites and water resource impacts based on hydrogeology, soil, and pesticide properties.
2. Establish an EPT to assist the MDA in coordinating prevention activities and programs.
3. Develop and adopt:
    a. BMPs to address general pesticide distribution, storage, handling, use, and disposal;
    b. generic BMPs to serve as core practices to address potential water resource impacts or concerns for specific classes of pesticides (e.g., insecticides, herbicides, fungicides, or for certain use applications in non-agricultural settings, including lakes); and,
    c. chemical-specific BMPs for pesticides (or their breakdown products) determined to be common detection in groundwater or to be surface water pesticides of concern (see Chapter 9).
4. Educate pesticide users on BMPs and promote the adoption of BMPs for pesticide distribution, storage, handling, use, disposal, and crop-specific strategies.
5. Develop, coordinate, and extend BMP educational programs to include training for dealers, crop consultants, agronomists, Soil and Water Conservation District (SWCD) and NRCS staff and other agricultural, non-agricultural, urban, and aquatic pesticide users. Assistance with these educational programs will be sought from UMN Extension, registrants, dealers, and others.
6. Incorporate BMPs and the various prevention activities and strategies developed and recommended by the EPT into pesticide applicator certification and training. BMPs may be developed as part of the MDA's general prevention activities or in response to common detection pesticides in groundwater or to surface water pesticides of concern (see Chapter 9).
7. Conduct periodic literature reviews of available pesticide groundwater and surface water research data to facilitate the development of scientifically based prevention activities and programs, including BMPs. Such reviews can also be used to determine opportunities for research, demonstration projects, and education.
8. Incorporate the results of BMP research into ongoing MDA/UMN Extension applicator training and certification/licensure programs.

9. Promote and coordinate IPM activities related to water quality protection with the University of Minnesota and registrants/dealers.
10. Encourage state agencies and universities (e.g., Minnesota Department of Natural Resources, Minnesota Department of Transportation, University of Minnesota) to use IPM to protect water resources.
11. Identify the range of pest management options and determine efficacy by working with the University of Minnesota, registrants, and other interested parties.
12. Develop demonstration projects to exhibit and evaluate BMPs.
13. Utilize the available data collection activities of the USDA NASS, UMN Extension, and other organizations to develop and target prevention strategies, and encourage coordination of state task forces, working groups, and agencies in gathering and issuing data.

Groundwater and Surface Water Vulnerability Assessment

Prevention of water resource contamination is a major component of wise resource management. Several approaches, described in the following sections, will be combined to identify areas vulnerable to pesticide contamination. Available databases, maps, and analytical procedures can be used to estimate the likelihood of pesticide contamination. Pesticide pollution prevention efforts can be prioritized according to the relative risk of pesticide contamination of groundwater and surface water.

For groundwater, the Minnesota DNR is required to provide maps and other materials that show where sensitive areas are located and indicate the type of risk of groundwater degradation that may occur from activities at or near the surface (MINN. STAT. 103H.101, subd. 3). The MDA, in turn, is required to consider the type of risk identified by the DNR when adopting BMPs, water resource protection plans, and water resource protection requirements in sensitive areas. According to MINN. STAT. 103H.101, subd. 5:

> *(a) The commissioner of agriculture for pollution resulting from agricultural chemicals and practices ... must consider the type of risk identified under subdivision 3 when adopting best management practices, water resource protection plans, and water resource protection requirements to prevent and minimize groundwater degradation in sensitive areas.*
>
> *(b) To prevent and minimize groundwater degradation, state agencies must consider the type of risk identified under subdivision 3 when undertaking an activity within a sensitive area.*

MINN. STAT. 103H.005, subd. 13 defines a *"sensitive area"* as:

> *a geographic area defined by natural features where there is a significant risk of groundwater degradation from activities conducted at or near the land surface.*

For surface water, the vulnerability of different areas to degradation is also an important consideration by the MPCA in the development of basin plans. The MPCA has established a framework for developing approaches to prevent the impairment of surface waters within the 10 major water basins of the state (Chapter 3, Figure 2).

Various tools are used to assess land use and management practices within each basin and the potential for water quality impairments.

Additional information on Minnesota's philosophy, goals, and approaches for preventing water resource degradation is provided in Chapter 2. Minnesota's soil and water resources are described in greater detail in Chapter 3.

Groundwater Vulnerability

The vulnerability of groundwater to pesticide contamination can generally be evaluated separately from that of surface water, although in some areas of the state (e.g., southeast Minnesota's fractured limestone bedrock region), groundwater vulnerability may be strongly linked to surface water vulnerability. Groundwater can be evaluated by combining the geologic sensitivity with soils sensitivity to designate areas of greater relative risk in Minnesota. Maps generated as result of such evaluations can then be combined with the pesticide leaching ratings for specific pesticides.

Geologic and Groundwater Sensitivity Criteria

MINN. STAT. 103H.101, subd. 3 requires that:

> *…the commissioner of Natural Resources shall (1) notify political subdivisions with planning and zoning authority and provide maps and other materials that show where sensitive areas are located and indicate the type of risk of groundwater degradation that may occur from activities at or near the surface.*

The DNR administers the Groundwater Atlas Program which prepares map-based reports of counties (County Geologic Atlases), statewide hydrogeologic maps (Minnesota Hydrogeology Atlas), and multicounty regions (Regional Hydrogeologic Assessments) to convey geologic and hydrogeologic information and interpretations to governmental units at all levels, but particularly to local governments. This information and these interpretations contribute to sound planning and management of the state's land and water resources. The geologic sensitivity criteria are based on the known or estimated time of travel for a waterborne contaminant to travel vertically from its source at or near the land surface to an aquifer. The DNR has developed two types of pollution sensitivity maps through the County Geologic Atlas Program- one for near-surface pollution sensitivity (Chapter 3, Figure 1) and one for pollution sensitivity of buried aquifers. Geologic sensitivity ratings are either very high, high, moderate, low, or very low. The most sensitive groundwater areas (very high, high) have the shortest estimated time of travel and the least potential to retard the vertical movement of contaminants into an aquifer.

The criteria are limited in that they are only a first step. They are a screening tool, not a detailed technical approach and are not intended for specific sites or specific chemicals. Not all areas of the state have been fully mapped.

Soils Sensitivity Criteria

The Natural Resources Conservation Service (NRCS) has developed the Windows Pesticide Screening Tool, or WIN-PST, to evaluate the potential for pesticides to move with water and eroded soil/organic matter and affect non-target organisms. WIN-PST considers soil characteristics and pesticide properties, among other factors (e.g., water table depth, rainfall probability, pesticide application method), in its evaluation of potential off-site movement. Ratings of high, intermediate, low, or very low are used to characterize the soil sensitivity to pesticide loss through leaching and runoff (both solution and adsorbed runoff potential). Similar ratings for runoff and leaching potential are assigned to pesticide active ingredients and can be combined with soil sensitivity ratings to evaluate the loss potential for a specified soil/pesticide interaction.

NRCS pesticide loss ratings can be used in the promotion of voluntary BMPs and aid in the development of maps illustrating the vulnerability of water resources to pesticide use/application. Minnesota soils data can be downloaded directly from the Web Soil Survey for use in WIN-PST or accessed through the Minnesota Geospatial Information Office. Soils data can be used for localized solutions to pesticide leaching and runoff concerns, and on a larger scale, geologic sensitivity assessments can be combined with soil pesticide leaching ratings. Areas or soil map units with both high leaching potentials and high or very high geologic sensitivity can be assessed for possible designation as high-risk areas for pesticide leaching.

Detailed methods for screening and evaluating pesticide leaching to groundwater in non-agricultural and urban settings are less well-developed than methods available for agricultural settings. Nevertheless, DNR County Geologic and Hydrogeology Atlases and the Regional Hydrogeologic Assessments and information gathered and maintained by local watershed groups will be very helpful to the MDA and its partners for BMP education and promotion in conjunction with sound planning and management of land and water resources.

Surface Water Vulnerability

Surface water vulnerability criteria can be used to design generic or specific BMPs. Agricultural soils sensitivity criteria can be used to evaluate the runoff potential for specific soil series. Criteria can include surface water features from U.S. Geologic Service topography maps and state surface water resource classifications from MPCA. BMPs to address impacts of non-agricultural and urban uses of pesticides to vulnerable surface waters may best be developed using criteria such as application timing and rate, management of losses from pervious and impervious surfaces, and alternative pest control practices. BMPs to minimize aquatic use pesticide impacts to vulnerable lakes and other targeted water bodies will necessarily be governed by similar and additional criteria in consultation with the MPCA and DNR. Generic and specific BMPs can be designed in consideration of these and other pertinent and applicable factors. This information can also be utilized to identify issues for further research.

Methods for screening and evaluating pesticide runoff to surface waters in non-agricultural and urban settings are less well-developed than methods available for agricultural settings. The vulnerability of lakes to aquatic use pesticides is considered during the DNR's aquatic pesticide permitting process. Information gathered and

maintained by other cooperators will be very helpful to the MDA and its partners for BMP education and promotion in conjunction with sound planning and management of land and water resources.

Education and Promotion Team

As a first step in developing general education and promotion strategies to prevent water resource degradation, the MDA will establish an Education and Promotion Team, or EPT. The EPT will assist the MDA with the coordination of prevention activities and programs. In addition to providing assistance with the review and design of educational and promotional activities for water resource protection, the EPT will be tasked with fulfilling the requirements of MINN. STAT. 103H.151, subd. 3, which states that:

> *The commissioners of the Pollution Control Agency and Agriculture, in conjunction with the Board of Water and Soil Resources, Soil and Water Conservation Districts, and the Minnesota Extension Service must promote best management practices and provide education about how the use of best management practices will prevent, minimize, reduce, and eliminate the source of groundwater degradation. The promotion and education shall include demonstration projects.*

The EPT should include the following organizations as listed in statute: the MDA (as convener and lead agency), the MPCA, the Board of Water and Soil Resources (BWSR), the Minnesota Association of Soil and Water Conservation Districts, and UMN Extension. Additional interested parties will be welcome to attend EPT meetings and contribute to discussions and planning activities. EPT meetings will be informal and will be facilitated by the MDA. Stakeholders will be given sufficient advance notification of these meetings and will be encouraged to attend. The MDA will work with historically underserved groups (e.g., Tribes, emerging farmer organizations) around pesticide education and water quality.

The EPT will meet at least once annually to review and design educational and promotional prevention activities for water resource protection, including related activities associated with generic or specific BMPs required as part of MINN. STAT. 103H or as part of MDA's activities in response to common detection or surface water pesticide of concern designations. It is anticipated that frequent, informal communications and interactions will occur to plan and implement outreach activities.

EPT suggestions for educational and promotional activities to prevent water resource degradation will be considered subject to available resources. Opportunities for cooperation among Tribes, state agencies, representative EPT organizations, pesticide registrants, and other interested parties will be explored, as will opportunities for joint grant-writing.

Pesticide Best Management Practices Development and Adoption

Definition and Responsibility

The Groundwater Protection Act (MINN. STAT. 103H) provides a useful definition for BMPs developed for groundwater. MINN. STAT. 103H.005, subd. 4, defines BMPs as:

> *…practicable voluntary practices that are capable of preventing and minimizing degradation of groundwater, considering economic factors, availability, technical feasibility, implementability, effectiveness, and environmental effects. Best management practices apply to schedules of activities; design and operation standards; restrictions of practices; maintenance procedures; management plans; practices to prevent site releases, spillage, or leaks; application and use of chemicals; drainage from raw material storage; operating procedures; treatment requirements; and other activities causing groundwater degradation.*

Additionally, MINN. STAT. 103H.151, subd. 2 states that:

> *The commissioner of agriculture, in consultation with local water planning authorities, shall develop best management practices for agricultural chemicals and practices. The commissioner shall give public notice and contact and solicit comment from affected persons and businesses interested in developing best management practices.*

The MDA will use the Groundwater Protection Act's definition of BMPs and its consultative requirements in the development of BMPs for both groundwater and surface water. Under the Groundwater Protection Act, the MDA is responsible for coordinating the development and implementation of groundwater BMPs for pesticides and pesticide breakdown products defined as pollutants, while under the Pesticide Control Law (MINN. STAT. 18B), the MDA is responsible for prevention, evaluation, and mitigation efforts (all of which could include BMPs) related to occurrences of pesticide and pesticide breakdown products in both groundwater and surface water.

As a preventative measure, the MDA will coordinate the development, promotion, and maintenance of generic pesticide BMPs for pesticide distribution, storage, handling, use, and disposal. Possible categories for generic BMPs include: general farm or urban BMPs, training and development, pesticide selection, record keeping, surface runoff and leaching prevention, container management, mixing and loading, protecting sensitive areas, proper application techniques, drift control, response to spills, and chemigation.

The MDA may develop and adopt additional generic BMPs that serve as core practices to address potential water resource impacts or concerns for specific classes of pesticides (e.g., insecticides, herbicides, fungicides) or for certain use applications (e.g., on crops, lawns, gardens or lakes). Additionally, when pesticides are determined by the commissioner to be common detection in groundwater or surface water pesticides of concern (see Chapter 9 – Evaluation), specific BMPs will be developed to address those pesticides.

BMP development efforts will include consultation with local water planning authorities (as required in MINN. STAT. 103H.151 subd. 2). As part of their development, the MDA will solicit and consider input from farm organizations, park and recreation groups, lake associations, conservation groups, other interested groups, and the public.

The University of Minnesota will be asked to assist the MDA with periodic literature reviews of pesticide research that can be used as the basis for generic or specific pesticide BMPs in Minnesota. Such reviews should address the issues of pesticides in Minnesota water resources, both surface waters and groundwaters. Such reviews should include, but not be limited to, a literature review of pertinent pest management research, evaluation of the research, and recommendations for future action.

Generic Best Management Practices

The MDA will coordinate development of generic BMPs using available databases, maps, and analytical procedures that characterize relevant hydrogeologic, soil, and pesticide properties. NRCS national standards can be the starting point for development of generic BMPs. BMPs developed may go beyond conservation compliance plans (expanding on NRCS technical standards). These practices in turn may be considered for use by NRCS. Efforts will be coordinated between MDA and NRCS programs.

The MDA may prioritize development and implementation of generic BMPs according to the potential of a geographic area for contamination. The priority focus of promotion will be high risk or BMP promotion in targeted areas.

The MDA may also consider the development, adoption, and promotion of crop-specific management strategies in addition to pesticide-specific BMPs (described below). For example, if a common detection pesticide is a member of a class of pesticides that generally have the same use pattern and are applied to the same crop, a crop-specific strategy could be developed in addition to individual pesticide-specific BMPs. Supplemental pesticide-specific BMPs could be added to the basic crop-specific strategy.

Generic pesticide BMPs can be used in agricultural, non-agricultural, urban, and aquatic settings (lawns, turf, gardens, lakes, forests, rights-of-way, etc.).

Development Process for Generic BMPs

1. The MDA will work with Tribes, local water planning authorities, UMN Extension pest/weed scientists, crop specialists, turf and lawn specialists, and aquatic pest control specialists, to prepare draft BMPs based upon literature reviews and other pertinent factors defined under MINN. STAT. 103H.
2. Draft BMPs and any pertinent data will be distributed for comment to interested parties via the MDA's pesticide non-point source email list.
3. After a minimum comment period of 60 days, the MDA will review comments received. Where appropriate, the BMPs will be revised by the MDA, and a second draft of the BMPs will be prepared.
4. The MDA will distribute revised draft BMPs for comment by publishing the revised BMPs in the State Register, by notifying local water planning authorities, and through the MDA's pesticide non-point source listserv.
5. After a minimum comment period of 60 days, the MDA will review comments received. Where appropriate, the BMPs will be revised by the MDA.
6. Final BMPs will then be submitted to the commissioner of agriculture for adoption and notice will be published in the State Register.

Following the adoption of BMPs, the MDA may assess the benefit of translating the BMPs into non-English languages.

Pesticide-Specific Best Management Practices

BMPs for specific pesticides which are determined by the commissioner of agriculture to be common detection in groundwater or surface water pesticides of concern, or which may be targeted by EPA in the implementation of its pesticide or water quality programs, will be developed using the same process as generic BMP development (described above), with the following modifications:

The MDA can initially provide the registrant(s) and the respective commodity and user group(s) with the opportunity to propose product- or pesticide-specific BMPs for the product(s) or pesticide(s) that are determined by the commissioner of agriculture to be common detection in groundwater or surface water pesticide(s) of concern.

The MDA will seek comments on the proposed BMPs from primary companies that register or manufacture the pesticide for use in Minnesota.

Best Management Practices Education and Promotion Program

Development and Coordination

After BMP development, the MDA will utilize the EPT to guide the coordination of prevention activities and programs associated with BMP education and promotion. This is consistent with MINN. STAT. 103H.151, subd. 3.

The MDA will act as the lead agency in coordinating pesticide BMP promotional efforts and will request the assistance of the EPT and its members' extended networks to support those efforts. The MDA will seek assistance from organizations that can provide resources to promote the BMPs. SWCDs can provide a local coordination role, especially in areas where ground or surface water are significantly impacted by contamination.

The promotion of BMPs, whether generic or pesticide-specific, will use existing delivery mechanisms whenever possible. It is understood that different individuals and user groups are more receptive to certain information sources than others. By providing a number of channels for education and information dissemination, there is an increased likelihood that most pesticide users will be reached.

In addition to pesticide applicator training sessions, the MDA will seek assistance in promoting BMPs from pesticide dealers, the University of Minnesota, pesticide registrants, SWCDs, NRCS, BWSR, crop consultants, DNR, industry trade associations, user groups, and environmental groups. To effectively promote BMPs to the urban landowner/manager, or to lakeshore homeowners or managers, the MDA will encourage participation from a variety of stakeholders, including local units of government, garden centers, block clubs, the master gardener program, park and recreation boards, lake associations, conservation groups, and commercial and non-commercial applicators.

The adoption of a pesticide-specific BMP by the commissioner does not preclude the promotion of the BMP in conjunction with generic BMPs or other pest management strategies. Pesticide-specific BMPs will be promoted

through a variety of cooperators and methods, such as through commodity and specific user groups, or in conjunction with other management practices adopted by organizations or commodity and user groups.

BMP promotion can be divided into distinct levels, depending upon the nature of the BMPs, the extent of the audience to be reached, and the geographic area included. These levels include promotion on a pesticide management area level, a township level, a special BMP promotion area level, and a soils or watershed level. Currently, pesticide management areas in the state follow the same outlines as the pesticide monitoring regions (Chapter 6, Figure 6). To reach the intended audience, the MDA may work strategically with organizations at the different levels.

Statewide/Pesticide Management Area BMP Promotion

Generic BMPs and certain pesticide-specific BMPs are likely to be applicable to the majority of the state, or to large regions of the state, depending on the class or type of pesticide being used (e.g., agricultural, non-agricultural, urban, aquatic). Through the MDA's EPT, campaigns can be designed to promote BMPs through a variety of groups or mechanisms including the following:

1. Pesticide dealers and registrants

   Pesticide dealers and registrants are often a primary source of information for pesticide applicators in agricultural settings. For non-agricultural, urban, and aquatic use settings, registrants and dealers can also be a source of information to pesticide users. Promotional information can be developed for generic and pesticide-specific BMPs. Under the direction of the MDA, pesticide-specific BMP promotional packets can be developed by the registrants and distributed to the dealers. Registrants can work with dealers to encourage distribution of BMP promotional information.

2. University of Minnesota

   The University of Minnesota's researchers, Extension specialists, and Extension educators can inform pesticide users of pertinent BMP information. BMPs can be promoted by researchers, specialists, and educators working in a variety of areas including IPM, water quality, and pesticide impact analysis (e.g., basic research and modeling on pesticide-soil-water-site interactions). Agricultural experiment stations can also be used to promote BMPs.

3. Pesticide applicator training

   The MDA and UMN Extension will cooperate in the development of training materials for BMPs which are applicable on a statewide level. These will be distributed at pesticide applicator training sessions for private applicators by county extension educators. Information will be delivered at commercial and non-commercial applicator recertification workshops. BMP information will also be included in MDA newsletter mailings to private and commercial/non-commercial applicators.

   In situations where WRPRs are adopted (see Chapter 10 – Mitigation), or where MDA authorities have been exercised to prevent unreasonable adverse effects on the environment, relevant training materials will become mandatory in addition to any EPA-required materials. Questions on WRPRs or

other use restrictions will be included in the appropriate certification tests and recertification workshops.

4. Groups working with urban audiences

   The MDA will encourage cooperative relationships with a variety of groups/organizations who work with urban audiences to promote BMP educational information more effectively to the urban landowner/manager. These may include local units of government, garden centers, block clubs, the UMN Extension Master Gardener Program, park and recreation boards, and commercial and non-commercial applicators.

   In addition, when conducting inspections, the MDA can distribute BMP promotional materials through urban pesticide commercial retailers such as garden centers, hardware stores, and department stores.

5. Department of Natural Resources, lake associations, and conservation groups

   Many applications of aquatic use pesticides, such as those used to control aquatic plants or other animal pests, are permitted by the DNR. Aquatic use BMPs can be distributed and promoted in conjunction with permit application and issuance. Lake associations and conservation groups can work with lakeshore homeowners and landholders to promote healthy lakes and multiple uses for lake resources and can be particularly good vehicles through which to promote aquatic use pesticide BMPs. The DNR also uses aquatic use pesticides as part of its management activities and can insure that developed BMPs are incorporated into those management applications.

6. Groups representing or working with emerging farmers

   Emerging farmers are integral to Minnesota's agriculture and have unique needs and challenges, such as speaking non-English languages. Organizations that support emerging farmers can be strong partners when working with diverse farmers. Additionally, the MDA has established an Emerging Farmer Office to strengthen the commitment to this group of farmers.

7. Additional BMP promotional opportunities

   Additional BMP promotional opportunities can be developed with environmental organizations, the pesticide industry, and state and local agencies. The MDA's EPT will consider other efforts and will cooperate with other groups to ensure that the most effective methods to deliver and promote BMP implementation are achieved. These may include public service announcements, demonstration plots, brochures, displays, and events. The EPT will strive to coordinate these efforts to ensure that the message delivered to producers is consistent with the BMPs.

Local BMP Promotion

The MDA will seek assistance in promoting BMPs from organizations that reach pesticide applicators on a local level. These groups include commodity and user groups, township boards, local citizens and associations, the

UMN Extension, NRCS, SWCDs, BWSR, pesticide dealers, registrants and UMN Agricultural Experiment Stations. The MDA will provide appropriate translations of BMPs to better reach all Minnesotans.

BMP Promotion Areas

Special attention and efforts may be focused within areas where significant pesticide contamination of groundwater or surface water exists or in geographically contiguous areas where it could potentially exist from normal (labeled) use of pesticides.

These areas may be identified as warranting concern for several possible reasons including:

1. Existing monitoring data, either collected by or provided to the MDA, indicates a water quality problem due to pesticide use.
2. Vulnerability assessments indicate the area as being highly sensitive to contamination, whether documented or not.
3. The area is designated as a Wellhead Protection Area by the Minnesota Department of Health.

The MDA will evaluate areas in consultation with the local SWCD and the appropriate water planning authorities and, where necessary, will designate a special BMP promotion area.

Integrated Pest Management (IPM)

According to U.S. Code at 7 U.S.C. 136r-1:

> *Integrated Pest Management is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health and environmental risks.*

IPM emphasizes prevention of pests, using a variety of management options, and using pesticides only when justified (e.g., based on scouting, economic thresholds) to minimize risks associated with pesticides.

Opportunities exist for the EPT to incorporate various IPM strategies that directly relate to water quality protection into prevention activities. Additionally, MINN. STAT. 18B.063 requires the state to use IPM techniques in its management of public lands, including roadside rights-of-way, parks, and forests; and use planting regimes that minimize the need for pesticides. Such techniques might be used to protect water resources from pesticides used in crop production, the management of lawns and turf, or other areas.

Various programs at the MDA, University of Minnesota, and within local, state, and national commodity and industry groups promote the development and implementation of IPM. Several MDA programs have been established to respond to a variety of statutory directives, including: the provision of funds for demonstration grants; a low-interest loan program to support farmer transition to more environmentally sound, profitable practices; whole farm planning decision-making assistance; on-farm research in practical farming alternatives; a Conservation Reserve Program Project to identify the Conservation Reserve Program lands most critical to preserving Minnesota's soil and water quality; an IPM program concerned with developing and implementing state-wide strategies for the increased use of IPM on private and state managed lands; and organic farming technical assistance and advice on conversion to organic methods, certification, and marketing of crops and

livestock; and the Minnesota Agricultural Water Quality Certification IPM endorsement. In addition, the MDA conducts field days, workshops, and assembles speakers on diverse topics related to IPM with farmer, agency, academic, non-profit, and local partners.

These programs and related activities can be considered by the EPT as it assists the MDA with review and design of educational and promotional strategies for the prevention of water resource impacts from pesticides. The MDA will work with the groups and mechanisms outlined in this chapter to promote water quality BMPs that incorporate the techniques and concepts of IPM in agriculture as well as in non-agricultural, urban, and aquatic settings where pesticide impacts to water quality are a concern.

Chapter 9: Evaluation

Introduction

Evaluation is a necessary component of the PMP to ensure that technically and legally defensible decisions are made and are based on accurate data. Evaluation actions are necessary to identify potential water quality problems, determine whether pesticide BMPs are effective in addressing problems (and that they don't cause other problems), and to verify that pesticide users are following the BMPs. The MDA is the lead state agency for pesticide environmental and regulatory functions, including the evaluation of monitoring data and BMP effectiveness related to water resource protection decisions. These authorities are described in Minnesota Statutes Chapters 18B, 18C, 18D and 103H. Through its evaluation of water monitoring data, the MDA also provides technical support to the MPCA in its impaired waters determination process.

Goal, Approaches and Recommended Actions

Evaluation Goal

The evaluation goal of the PMP is to: (1) evaluate detections of pesticides and breakdown products in groundwater and surface water resources from monitoring data; and (2) evaluate the adoption and effectiveness of prevention and management strategies, including pesticide BMPs.

Evaluation Approach

The evaluation goal will largely be accomplished through the review and analysis of water monitoring data. Additional evaluation strategies, such as surveys, may also be implemented, depending on available resources. The MDA's approach will involve:

1. Establishing a Pesticide Management Plan Committee, or PMPC, to support the MDA's evaluation activities
2. Annually reviewing detections of pesticides and pesticide breakdown products in groundwater and surface water monitoring data
3. Assessing changes in management practices, water resource impacts and trends, information delivery systems, and factors that affect implementation

Findings from the MDA's evaluations will be used to refine prevention practices and management strategies and guide future mitigation efforts.

Recommended Actions

Establish a PMPC to review the collection and analysis of information on detections of pesticides and pesticide breakdown products for potential common detection determinations in groundwater and surface water pesticide of concern determinations in surface water.

1. Develop potential pesticide management and monitoring areas based on landform units, agro-ecoregions, watersheds, and other factors.
2. Conduct water monitoring in each monitoring region with considerable pesticide use.
3. Provide assistance to the Minnesota Pollution Control Agency impaired waters determination process.
4. Delineate areas based on landform units or watersheds for use in evaluating the adoption and effectiveness of BMPs. These may correspond to BMP promotion areas established as part of prevention efforts or new areas based on monitoring data.
5. Utilize water monitoring data and other available strategies (e.g., surveys), as appropriate, to evaluate the adoption and effectiveness of pesticide management efforts in BMP promotion areas.

Pesticide Management Plan Committee

The PMPC will be created by the commissioner and will serve at the commissioner's discretion. The PMPC's purpose is to provide informed and diverse comment to the commissioner for major evaluation activities and decisions. The PMPC is one element of ensuring open and equitable comment into PMP decisions for all stakeholder groups. These decisions may address, but are not limited to, the following topics: adoption and effectiveness of generic (core) pesticide BMPs; common detection determination for pesticides in groundwater; surface water pesticide of concern determination for pesticides in surface water; evaluation of pesticide use data and data collection options; and adoption and effectiveness of pesticide-specific BMPs and other mitigation decisions.

It is envisioned that the PMPC will meet at least once annually following completion of an annual MDA water monitoring report. Additional meetings or consultations may be conducted as needed to evaluate PMP activities. Formal notes will be taken of the PMPC meetings and reviewed by members to document the positions and concerns of all the members of the committee. Supplemental letters or materials may also be submitted by PMPC members for the commissioner's consideration as part of the PMPC process. The commissioner shall assign MDA staff to manage and direct the PMPC.

The committee, convened and staffed by the MDA, will include organizations referenced in MINN. STAT. 18B.045 on PMP development and coordination, with representation from: the MPCA, the MDH, the Minnesota DNR, UMN Extension, farm organizations, farmers, environmental organizations, and industry. The MDA will also include a Tribal representative. The commissioner may also expand PMPC representation by including additional University of Minnesota or other college faculty with relevant expertise in pesticides, cropping systems in Minnesota, or environmental science. Other technical experts also may serve on the PMPC. The PMPC serves at the discretion of the commissioner, who will establish the final composition of the committee.

Members will be selected by the commissioner following the open appointment process outlined in MINN. STAT. 15.0597, with preference given to candidates with relevant scientific credentials, broad representation of their interest group, and experience in Minnesota. Members of the committee should, but are not required to, have scientific expertise in areas such as hydrology, natural resources, pesticide chemistry, pesticide use, public

health, soil chemistry, or toxicology. Members will serve for two-year terms and are expected to actively participate in PMPC activities. Members may be replaced if they are unable to do so.

To ensure the opportunity for participation from all stakeholders, a public notice and a minimum 60-day open public comment period will be provided for significant proposed PMP decisions. This notice will be provided via an MDA listserv and through a formal State Register notice for final proposed BMPs and any proposed changes to pesticides determined to be common detection in groundwater or surface water pesticides of concern. Information reviewed by the PMPC or submitted to the commissioner by individual PMPC members prior to the commissioner's preliminary decisions on pesticides in water resources, will be made available to the public as part of the comment process.

Additional guidance for specific evaluation decisions and related process activities is provided in the following sections.

Common Detection in Groundwater

Information on pesticide detections in Minnesota's groundwater resources will be collected and analyzed by the MDA's monitoring program with assistance from other state agencies and cooperators. Those detections determined to be the result of non-point source contamination will be evaluated for common detection status. According to MINN. STAT. 103H.005:

> *"Common detection" means detection of a pollutant that is not due to misuse or unusual or unique circumstances, but it likely to be the result of normal use of a product or practice.*
>
> and
>
> *"Pollutant" means a chemical or substance for which a health risk limit has been adopted.*

"Common detection status" refers to an MDA designation assigned by the commissioner to a pesticide detected in groundwater not due to misuse or unusual circumstances, but likely to be the result of normal use of a product or practice.

Common detection status, as determined through the analysis of scientifically valid information, allows the state and all involved parties to take a proactive approach to focus limited resources on pesticides which may adversely impact Minnesota's water resources. Groundwater common detection status is a useful tool to communicate to all involved parties that the normal use of a product or practice has resulted in its presence in groundwater. Common detection status does not regulate the use of a pesticide in Minnesota; rather, it triggers development of voluntary BMPs for those pesticides.

Voluntary BMPs and Mandatory Regulations

Voluntary BMPs will be developed for pesticides in common detection status. MINN. STAT. 103H.251, subd. 1 (b) states:

> *If conditions indicate a likelihood of the detection of the pollutant or pollutant breakdown product to be a common detection, the commissioner of agriculture must begin development of BMPs and continue to monitor for the pollutant or pollutant breakdown products.*

Voluntary BMPs are defined in MINN. STAT. 103H.005, subd. 4:

> *"Best management practices" means practicable voluntary practices that are capable of preventing and minimizing degradation of groundwater, considering economic factors, availability, technical feasibility, implementability, effectiveness, and environmental effects. Best management practices apply to schedules of activities; design and operation standards; restrictions of practices; maintenance procedures; management plans; practices to prevent site releases; spillage; or leaks; application and use of chemicals; drainage from raw material storage; operating procedures; treatment requirements; and other activities causing groundwater degradation.*

Common detection status allows the use of a focused voluntary approach to address pesticides detected in groundwater that are of concern. The Minnesota legislature promotes the voluntary approach and directs that mandatory regulations occur through adoption of WRPRs or, in cases of unreasonable adverse effects, through other statutory authorities as described in MINN. STAT. 18B.10:

> *The commissioner may, by rule, special order, or delegation through written regulatory agreement with officials of other approved agencies, take action necessary to prevent the contamination of groundwater resulting from leaching of pesticides through the soil, from the backsiphoning or backflowing of pesticides through water wells, or from the direct flowage of pesticide to groundwater.*

With regard to pesticides in surface or groundwater, regulatory authority is provided through the Pesticide Control Law as stated in MINN. STAT. 18B.26 subd. 5,

> *(b) The commissioner shall review each application and may approve, deny or cancel the registration of any pesticide. The commissioner may impose state use and distribution restrictions on a pesticide as part of the registration to prevent unreasonable adverse effects on the environment.*
>
> *(c) The commissioner must notify the applicant of the approval, denial, cancellation, state use or distribution restrictions.*
>
> *(d) The applicant may request a hearing on any adverse action of the commissioner within 30 days after being notified.*

Determination of Common Detection Status

The MDA's process for the designating pesticides as common detection in groundwater is outlined in Figure 7. The determination of common detection status for a pesticide is made by the commissioner and will consider comments from both the PMPC and the public.

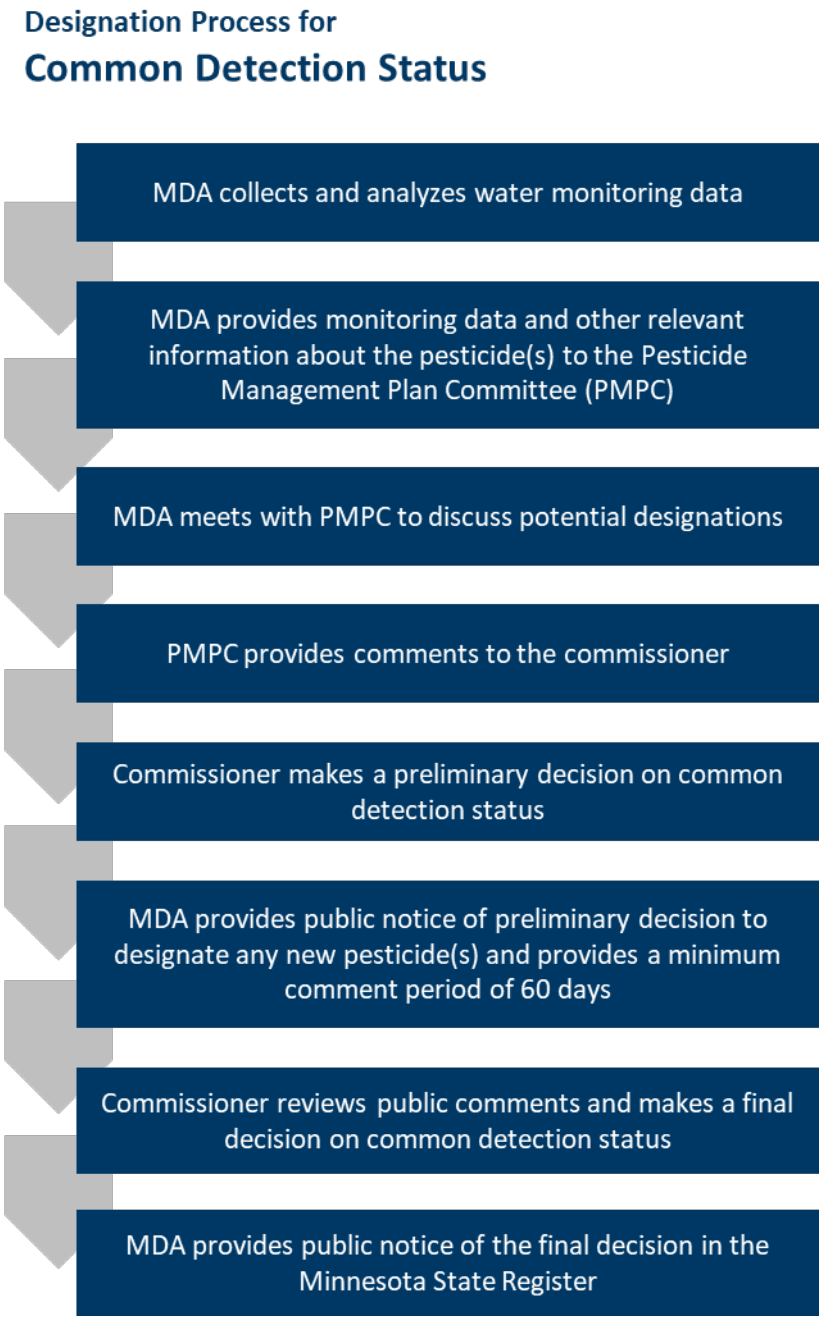

Figure 7. Overview of the process for designating pesticides as common detection in groundwater.

Prior to meeting with the PMPC to discuss potential common detection designations, the MDA will provide monitoring data and other relevant information on the pesticide(s) being considered to the committee. This should include monitoring data from the MDA's annual report and other available, relevant sources, as well as readily available information from within Minnesota. Information provided to PMPC members may also include pesticide use information; physical, chemical, and toxicological properties of the pesticide; hydrogeologic

information; and a review of information and data from other local, state, or federal monitoring databases. Monitoring data collected from outside Minnesota may be used as supporting information.

The PMPC will provide comment to the commissioner on which pesticides should be considered common detection prior to the commissioner's preliminary decision. The following guidelines will serve as the general basis for evaluation to determine whether a particular pesticide should be considered for common detection status.

Guidelines for Evaluation

Consider the following:

1. The scientific validity of the data upon which the evaluation is based
2. The frequency of detections and concentrations reported in the groundwater monitoring data and any associated trends over time
3. The extent of use and general use profile of the pesticide
4. The existence of a Health Risk Limit, or HRL, for the pesticide or breakdown product set by the MDH
5. Events which may be considered unique or unusual such as agronomic, meteorological, or hydrologic events
6. If conditions indicate a likelihood of the detections of the pollutant or pollutant breakdown product to be a common detection as defined in MINN. STAT. 103H.005 (i.e., detections are not due to misuse or unusual or unique circumstances)
7. If detections of a pesticide or breakdown product found in groundwater which is not a pollutant (i.e., it does not have an HRL) would be determined to be a common detection if an HRL existed

Note that in the absence of an HRL, an analysis will be conducted by the MDA to determine whether to request an HRL, if one has not already been requested. When an HRL does not exist for a pesticide or its breakdown product(s), the MDA will submit a written request to the MDH that the MDH commissioner adopt an HRL, an emergency HRL, or develop an HBV for the compound(s). If the MDH is unable to adopt an HRL, an emergency HRL, or develop an HBV, the MDA will consider using other guidance values after consulting with the MDH. The absence of an HRL does not preclude the MDA from taking necessary action to prevent groundwater contamination under other statutory authorities.

Members of the PMPC, after conducting a thorough analysis and evaluation of the available information and options, will outline concerns and considerations related to the common detection decision for consideration by the commissioner. These will be summarized in notes from the PMPC meeting(s). Additional supplemental materials may be submitted for the commissioner's consideration by any PMPC member. All notes and submittals will be available for PMPC and public review. The committee may also provide to the commissioner a list of reports used, evaluations of the scientific validity of data, and, if applicable, recommendations for future information needs.

The commissioner will consider the comments and materials submitted by PMPC members prior to making a preliminary determination of common detection status. Any proposed change in common detection status by the commissioner will be published in the state register and distributed via the MDA pesticide non-point source e-mail list for a minimum public comment period of 60 days. Once the commissioner determines that a pesticide is or is no longer in common detection status, that determination shall be published in the State Register.

Common detection status may not be appropriate in a number of cases where a pesticide has been detected in groundwater in Minnesota. Detections which are sporadic and not indicative of widespread presence as a result of use in accordance with label directions will need to be evaluated by the committee and the commissioner. The commissioner may promote core (generic) BMPs, and the MDA and the registrant may coordinate additional prevention efforts.

Removal from Common Detection Status

The MDA's process for removing pesticides from common detection status is described separately for pesticides which have been cancelled and those that remain registered.

Pesticides for which registration has been cancelled by the EPA or the MDA will be removed from common detection status when the pesticides can no longer be legally used. The EPA may allow a product to be used for a period of three years after its cancellation. According to MINN. STAT. 18B.26 subd. 1(c).:

> *An unregistered pesticide that was previously registered with the commissioner may be used for a period of two years following the cancellation of the registration of the pesticide, unless the commissioner determines that the continued use of the pesticide would cause unreasonable adverse effects on the environment, or with the written permission of the commissioner.*

The commissioner will publish the decision to remove the pesticide from common detection status in the State Register and BMPs for the cancelled pesticide will be removed from the MDA website, as these will no longer be relevant. The MDA will continue to monitor and analyze data for the cancelled pesticide in groundwater. Should the cancelled pesticide be reregistered in the future, the commissioner may directly reinstate its common detection status, bypassing the designation process outlined in Figure 7.

Pesticides registered for use by the EPA or the MDA that have been designated common detection in groundwater may be removed from common detection status by the following process.

1. The MDA will identify a pesticide as a potential candidate for removal.
2. The MDA will present the proposed pesticide and justification for its removal to PMPC members for review and comment.
3. The Commissioner will make a preliminary decision whether to remove the pesticide from common detection status, and any proposed changes will be published in the State Register with a minimum comment period of 60 days.
4. The commissioner will make a final decision regarding the status of the pesticide and notice of the decision will be published in the State Register.

If a registered pesticide is removed from common detection status, pesticide-specific BMPs will remain available on the MDA website; however, efforts to promote these will be scaled back. The specific pesticide will no longer be a focus of education and outreach, and targeted efforts will cease or be reduced. The MDA will continue to collect and analyze monitoring data for the pesticide, and general education and outreach efforts will also continue to prevent the degradation of groundwater quality.

The following guidelines will serve as the general basis for the evaluation to determine whether a pesticide may be removed from common detection status.

Consider the following:

1. Initial reasons for designating common detection status
2. The registration status of the pesticide
3. Use trends and substantial changes in the pesticide use profile (e.g., changes in application methods, rates, sites) or pesticide formulation since its initial designation as a common detection pesticide
4. Trends in detection frequency and concentration throughout the state, the timeframe over which these trends have been observed, and how detected concentrations compare to relevant reference values
5. The risk of a potential increase in detection frequency or concentration following removal from common detection status

Surface Water Pesticide of Concern

Information on pesticide detections in Minnesota's surface water resources will be collected and analyzed by the MDA's monitoring program with the assistance of other state agencies and cooperators. Those detections determined to be the result of non-point source contamination will be evaluated relative to a surface water standard or other relevant surface water reference value for designation as a surface water pesticide of concern.

"Surface water pesticide of concern" status, as it is used in the PMP, refers to an official designation assigned by the commissioner to a pesticide detected in surface water at concentrations of concern relative to a water quality standard, water quality criterion or water quality advisory value (i.e., a "reference value"), not due to misuse or unusual or unique circumstances, but likely to be the result of normal use of product or practice.

Surface water pesticide of concern status, as determined through the analysis of scientifically valid information, allows the state and all involved parties to take a proactive approach to focus limited resources on pesticides which are adversely impacting Minnesota's water resources. Surface water pesticide of concern status is a useful tool to communicate to all involved parties that there is a scientific basis for concern about the use of a specific pesticide and its impact on water quality. Surface water pesticide of concern status does not regulate the use of a pesticide in Minnesota; rather, it triggers development of voluntary BMPs for those pesticides.

With regard to pesticides in surface water, regulatory authority for the MDA is provided through the Pesticide Control Law as stated in MINN. STAT. 18B.26, subd. 5,

(b) The commissioner shall review each application and may approve, deny or cancel the registration of any pesticide. The commissioner may impose state use and distribution restrictions on a pesticide as part of the registration to prevent unreasonable adverse effects on the environment.

(c) The commissioner must notify the applicant of the approval, denial, cancellation, state use or distribution restrictions.

(d) The applicant may request a hearing on any adverse action of the commissioner within 30 days after being notified.

A determination that a pesticide is a surface water pesticide of concern will initiate the development of preventive actions including voluntary pesticide-specific BMPs to protect surface waters from further contamination. Such actions will be taken prior to, and in an effort to prevent, the impairment of a surface water body (see "MPCA Impaired Waters Determination").

The MDA has broad authority to take action to prevent any unreasonable adverse effects on the environment (as defined in Minn. Stat. 18B, 18C, 18D and Minn. Rules Chapters 7050) including impacts to surface waters. The MDA also has the authority and responsibility to develop and promote pesticide voluntary best management practices.

Determination of Surface Water Pesticide of Concern Status

Following review of surface water monitoring data, the commissioner may determine that a pesticide has been found at a concentration of concern relative to a water quality standard, water quality criterion or water quality advisory value (i.e., a "reference value"), and that the concentration of concern is not the result of misuse or unusual or unique circumstances. Unusual or unique circumstances might include specific product use in response to an unusual pest outbreak, climatic anomalies or other factors that can contribute to unexpected or abnormally high concentrations of limited duration. For the purposes of the PMP, the source of surface water quality reference values in Minnesota is the MPCA. Note that the absence of an MPCA reference value does not preclude the MDA from taking necessary action to prevent surface water contamination under its statutory authorities. If a pesticide does not have an MPCA reference value, then reference values from the EPA or other sources will be considered (see Chapter 7 - Water Quality Standards and Rules).

To provide flexibility in evaluating and responding to concentrations that might lead to future impairment listings of water bodies, and in recognition of the complex variables that can contribute to peak concentrations, there is no single value or percentage of a reference value that will trigger the development of preventive actions such as voluntary pesticide-specific BMPs or educational campaigns. Instead, preventive actions will be considered when surface water monitoring results for a pesticide exceed 10-50% of its reference value. The commissioner will consider a number of factors in determining if an exceedance means that the pesticide is a surface water pesticide of concern requiring initiation of specific preventive actions. The most important factors will be monitoring and use trends. For example, if the use of a pesticide is stable or increasing, and the concentration is at 10-50% of its reference value and exhibits an increasing trend, then preventive actions may be taken to ensure that the water body does not become impaired. Trends in detection frequency will also be

considered along with other factors including how well the monitoring dataset characterizes the observed exceedance.

The MDA's process for the designating pesticides as a surface water pesticide of concern is similar to that for common detection status in groundwater and is outlined in Figure 8. The PMPC will provide input to the commissioner prior to the commissioner's preliminary decisions on a determination of surface water pesticide of concern. Public notice and a minimum comment period of 60 days will then be provided prior to any changes in surface water pesticide of concern status for a pesticide. The types of information provided to the PMPC and the decision-making and public notice process used for surface water decisions will be the same as those used for groundwater.

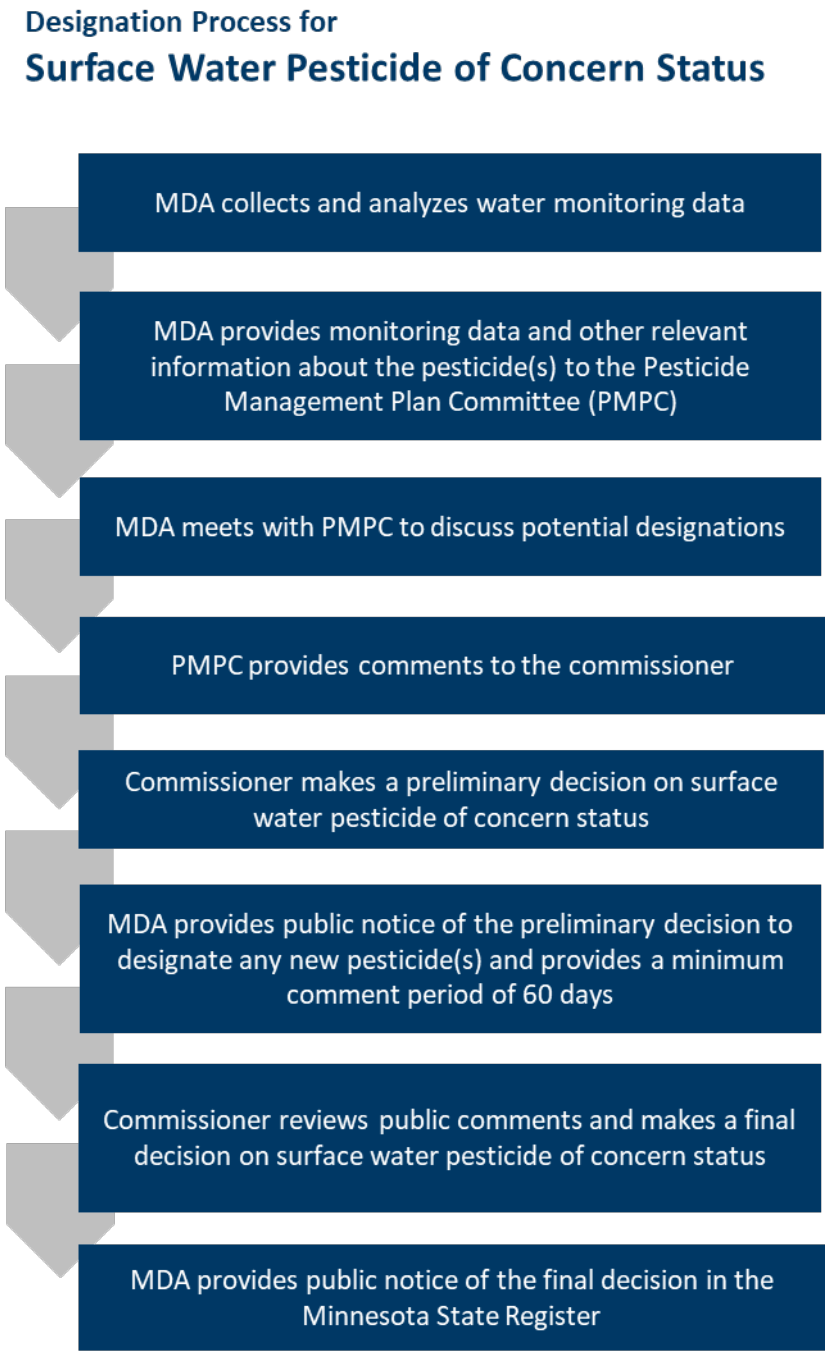

Figure 8. Overview of the process for designating pesticides as surface water pesticides of concern.

The PMPC will provide comment to the commissioner on which pesticides should be considered surface water pesticides of concern. The following guidelines will serve as the general basis for evaluation to determine whether a particular pesticide should be considered for surface water pesticide of concern status.

Guidelines for Evaluation

Consider the following:

1. The scientific validity of the data upon which the recommendation is based
2. The extent of use and general use profile of the pesticide as well as its anticipated status of registration
3. The existence of a water quality standard, water quality criterion, or water quality guideline for the pesticide or breakdown product set by the MPCA (In the absence of a standard, an analysis will be conducted to determine whether to request a standard, if one has not already been requested.)
4. Trends and concentrations of the pesticide in surface waters and the relationship of the detected concentrations relative to a water quality standard, water quality criterion, or water quality guideline
5. Other associated events which may be considered unique or unusual such as agronomic, meteorologic, or hydrologic events

Surface water pesticide of concern status may not be appropriate in a number of cases where a pesticide has been detected in surface water in Minnesota. Detections which are low relative to a surface water reference value or which are sporadic and not indicative of widespread presence as a result of use in accordance with label directions will need to be evaluated by the committee and the commissioner. It may not be appropriate for determining a surface water pesticide of concern and developing BMPs for a product which is being phased out or likely will have its use significantly reduced. The commissioner may promote generic (core) BMPs, and the MDA and the registrant may coordinate additional prevention efforts.

Removal from Surface Water Pesticide of Concern Status

The MDA's process for removing pesticides from surface water pesticide of concern status mirrors the process for removing pesticides from common detection status (see "Removal from Common Detection Status"). The process for both cancelled pesticides and registered pesticides is summarized below.

Pesticides for which EPA or MDA registration has been cancelled will be removed from surface water pesticide of concern status when the pesticide can no longer be legally used, typically three years after cancellation, and pesticide-specific BMPs will no longer be promoted or posted on the MDA website. The MDA will continue to monitor and analyze data for the cancelled pesticide, and the commissioner may directly reinstate a cancelled pesticide's surface water pesticide of concern status should it be reregistered.

Pesticides registered for use by the EPA or the MDA that have been designated surface water pesticides of concern may be removed from this status as follows. First the MDA will identify a potential candidate for removal and present it, along with justification for its removal, to the PMPC for review and comment. The commissioner will then make a preliminary decision regarding its status, and any proposed change in status will be published in the State Register. Following a comment period of at least 60 days, the commissioner will make a final determination whether a pesticide will remain a surface water pesticide of concern. The final decision will again be published in the State Register.

If a registered pesticide is removed from surface water pesticide of concern status, targeted efforts to educate on and promote pesticide-specific BMPs will cease or be reduced. Pesticide-specific BMPs will, however, remain available on the MDA website, and monitoring and analysis of the pesticide will continue. General education and outreach efforts to protect surface waters will likewise continue.

The following guidelines will serve as the general basis for the evaluation to determine whether a pesticide can be removed from surface water pesticide of concern status.

Consider the following:

1. Initial reasons for designating surface water pesticide of concern status
2. The registration status of the pesticide
3. Use trends and substantial changes in the pesticide use profile (e.g., changes in application methods, rates, sites) or pesticide formulation since its initial designation as a surface water pesticide of concern
4. Trends in detection frequency and concentrations throughout the state, the timeframe over which these trends have been observed, and how detected concentrations compare to relevant reference values (water quality standards etc.)
5. The risk of a potential increase in detection frequency or concentration following removal from surface water pesticide of concern status

MPCA Impaired Waters Determination

If the concentration of a pesticide in a surface water body exceeds a numerical standard or if a pesticide is a cause for exceeding a biological or narrative standard, the water body may be subject to formal listing as "impaired" on the Clean Water Act's 303(d) list assembled by the MPCA. An impaired listing may result in the initiation of a Total Maximum Daily Load, or TMDL, study under the federal Clean Water Act section 303(d). The MPCA has a formal process for making determinations of water body impairment (see the MPCA's Water Quality webpage for additional information on water quality standards and the impaired waters process).

While the MDA is the lead state agency for pesticide environmental and regulatory functions, it works closely with the MPCA in its role as the lead agency for regulating the TMDL process and for managing pollution in surface water bodies under Minn. Rules Chapters 7050. Information on pesticide detections in Minnesota's surface water resources will be collected and analyzed by the MDA monitoring program with the assistance of other state agencies and cooperators. The MDA will forward this information to the MPCA and provide technical assistance to support the MPCA process for evaluating surface waters for impairment.

The MDA has broad authority to take action to prevent any unreasonable adverse effects on the environment (as defined in statute) including impacts to surface waters, and the authority and responsibility to develop and promote pesticide voluntary best management practices. The MDA also is directly involved in pesticide applicator training and many other grower outreach activities that may be useful in support of the TMDL implementation process.

If a water body becomes impaired due to a currently registered pesticide, the MDA will consult and coordinate with the MPCA on how best to approach the issue and maximize the use of both agencies' available resources.

Evaluation of the Adoption and Effectiveness of Pesticide BMPs

There are a range of options available to evaluate the adoption (i.e., use) and effectiveness of pesticide BMPs. Rates of BMP adoption can be measured through surveys and other means. BMP effectiveness can be measured through plot and small watershed scale projects where specific pesticide use practices can be correlated with water monitoring and pest control data. Many of these options carry a relatively high cost if they are to be conducted in a meaningful manner. This section outlines a variety of BMP evaluation options. The actual implementation of options will be tied directly to the availability of funding and other resources. At a minimum, it is anticipated that a sufficient level of groundwater and surface water monitoring will be conducted at key locations in Minnesota to determine concentration trends over time sufficiently to evaluate, at a broad level, the need for additional protective actions. Other BMP evaluation activities outlined in this section will be conducted to the extent that resources allow.

Pesticide Management Areas and BMP Promotion Areas

The MDA will evaluate the adoption and effectiveness of pesticide BMPs statewide and/or through the use of pesticide management areas and BMP promotion areas, depending on the applicability of a specific BMP and the availability of resources. At present, pesticide management areas in the state are identical to pesticide monitoring regions (Chapter 6, Figure 6). Small scale BMP promotion areas may also be established for use in evaluating BMPs if sufficient monitoring data and resources allow. BMP promotion areas may encompass several townships in a county or a small urban or rural watershed.

To accurately assess the effectiveness of promotion and pesticide management efforts, it is desirable to focus monitoring efforts on a discrete watershed or landform unit. Concentrating on specific areas can help in the quantification of cause-and-effect relationships between management efforts and water quality. It also aids in focusing limited resources. While BMPs will be promoted widely, the effectiveness of promotion activities will best be determined in discrete BMP promotion areas by comparing BMP implementation rates to water quality.

Evaluation of BMP Adoption

Evaluating BMP adoption is an important part of the pesticide management process. It is important that these activities be conducted in a technically defensible manner. The results of implementing BMPs may not be discernible as changes in pesticide concentration in groundwater or surface water for a long period of time. Furthermore, a change in pesticide concentration observed over the course of a single year may or may not be related to the adoption of BMPs. Because direct water quality monitoring has such limitations for evaluating the adoption of BMPs, it is important to evaluate other indicators of the degree to which BMPs have been put into practice (i.e., adopted) by landowners.

Conceptual models are often used to describe and study the adoption of agricultural innovations and can be useful in evaluating the adoption of BMPs. One such model by Rogers (2003) describes the adoption process as having five key stages:

1. **Awareness** - An individual is first exposed to a new practice.
2. **Interest** - An individual is motivated by curiosity and interest to seek information about a new practice.
3. **Evaluation** - An individual considers applying the practice to their present or predicted future situation.
4. **Trial** - An individual tries out the practice on a small scale to determine its usefulness in their own situation.
5. **Adoption** - An individual evaluates the trial and decides whether to adopt the practice (i.e., continue using the practice in the future).

The adoption of a new pesticide management practice or technique is essentially a decision-making process which occurs over specific stages in time, and there is a lag time between the awareness phase and the adoption phase. The underlying assumption in the process is that rational decisions guide an individual to adopt a new idea or technique. Individuals may try a new practice on a relatively small scale before adoption. For example, pesticide applicators may seek to reduce economic risk before the final decision to adopt a BMP.

One advantage to "stage identification" in the adoption of new practices is the possibility of detecting the "drop-out" rate during the adoption process. This refers to pesticide applicators or users who leave the process somewhere between the stages of awareness and final adoption. If sufficient resources allow, the MDA will attempt to monitor and quantify the transition from awareness to adoption of BMPs.

The overall "drop-out" rate can be estimated by finding the difference in percentages between those pesticide applicators who reported being aware of the existence of the practice and those who adopted it. This would be accomplished by comparing the number of pesticide applicators who are aware of specific BMPs with the number who have used a practice for two consecutive years.

It is the responsibility of the MDA, in cooperation with other groups, to determine the rate at which BMPs are being adopted. The MDA should measure the rate of adoption after a promotional campaign has been underway for at least two years. An increase in the percentage of awareness and adoption and a decrease in the drop-out rate are indicators that the BMPs are being adopted.

BMP adoption should be evaluated on an ongoing basis so that promotional methods can be modified as necessary. Measuring the rate of awareness will indicate the effectiveness of a promotional campaign. If a low rate of adoption or a high rate of "drop out" is found, the BMP should be evaluated to determine the difficulty of adoption or if the cost of adoption is too high in relation to the potential return. If one or both of these reasons are found to be the cause, then the BMP may need to be modified so that it is more adoptable by applicators.

The following methods for evaluation of BMP adoption rates can be used statewide, regionally, or locally. Movement from one level of adoption to another depends upon the scale and severity of the problem that is identified through evaluation. The following methods can be used individually or in concert.

Field Audit

The MDA is mandated to conduct field audits. MINN. STAT. 103H.151 subd. 4 [Evaluation] reads:

> *The commissioners of Agriculture and the Pollution Control Agency shall, through field audits and other appropriate means, monitor the use and effectiveness of best management practices developed and promoted under this section. The information collected must be submitted to the Environmental Quality Board.*

The MDA can conduct field audits through a variety of means including direct communications by phone, mail, or email, or documents of land management practices through the Minnesota Agricultural Water Quality Certification Program. The MDA has previously conducted field-by-field analysis for nutrient management.

Farmer Surveys

A statistically designed, BMP adoption survey can be used prior to the initiation of BMP promotion and again at the end of a designated time period. Such a survey would indicate a change in adoption rate over time and the percent of pesticide users using BMPs both before and after implementation.

It is recommended that pesticide use surveys be designed to ask questions regarding rate, timing, form of pesticide applications, and current BMP use. The answers would be translated to reflect whether BMPs are being adopted. This design ensures greater accuracy than asking questions directly on adoption of specific BMPs.

Applicator and Dealer Surveys

Private applicators, commercial applicators, dealers, and other pesticide applicators could be surveyed on awareness and implementation of BMPs. For licensed and certified applicators, surveys could occur at certification and licensing training programs administered by the MDA and the UMN Extension. Testing, which is required as a condition for certification for applicators of Restricted Use Pesticides, can also be used as an opportunity to survey this segment of pesticide applicators. Statistically defensible surveys may also be conducted through the USDA NASS. Other pesticide applicators might be surveyed in cooperation with retail outlets that sell pesticides, lake or landowner associations, conservation groups, parks and recreation personnel, or through other means. Aquatic pesticide users might be surveyed through the DNR permitting process.

Direct Interviews Including FANMAP

Extension educators, pesticide applicators, and pesticide dealers, that are randomly selected as being representative of a region or local area can be interviewed on adoption of BMPs. This information would supplement the survey data and would be more readily available. Results could be extrapolated to represent a specific region or the entire state. The current MDA Farm Nutrient Management Assessment Program (FANMAP) is an effective method to evaluate nutrient and pesticide management practices in great detail over a small area and is particularly well suited for evaluating pesticide BMPs. Similar direct interviews can be conducted for pesticide applicators in non-agricultural and urban settings.

Focus Groups

Focus groups, led by professionals, can be conducted periodically to assess the degree of BMP adoption and to detect any changes in use trends. Focus groups may not be very effective in measuring rate of adoption but would be effective in looking at promotional delivery systems.

Evaluation of BMP Effectiveness

For groundwater, MINN. STAT. 103H requires that BMPs must be proven ineffective prior to adoption of WRPRs; therefore, the approach to evaluating BMP effectiveness must be scientifically rigorous and technically and legally defensible. Determining the effectiveness of BMPs will be based primarily on a statistical analysis of groundwater monitoring and water quality trends from the MDA monitoring network. Pesticide sales and use data, data on precipitation rates, and climatic, agronomic, or other considerations that might influence rates of pesticide leaching to groundwater will also be considered. In addition, field or plot scale studies and computer modeling of pesticide leaching patterns may be used as a tool to evaluate BMP effectiveness and observed groundwater quality trends. Actual monitoring results – the frequency and concentrations of detections – provide the best foundation for BMP effectiveness evaluation.

It is inappropriate to adopt specific quantitative performance measures or goals for a specific timeframe as a determinant of BMP effectiveness unless there is a scientific justification for that goal. A natural system such as a local or regional groundwater flow system is highly complex with multiple variables. It may be exceedingly difficult to understand or predict a specific response to one or several changed variables unless a detailed study is performed. An achievable goal might differ in different parts of the state. In addition, there can be significant annual variability in the weather and in pest infestations, either of which could confound a goal or prediction. The MDA would consider the use of modeling tools as a defensible means of determining performance goals for evaluating BMP effectiveness if the tools are supported by actual monitoring data from Minnesota. However, to use a specific performance measure without this type of data may be arbitrary and could not easily be defended or used to justify the development of regulations under MINN. STAT. 103H.

For surface water, the MDA will evaluate the effectiveness of BMPs using the same high standard of scientific rigor and a generally similar approach as previously described for groundwater. When evaluating pesticide BMPs for surface waters, the emphasis should be on small watershed scale surface water monitoring linked to field surveys of pesticide use and BMP adoption. The MDA is well qualified for this type of evaluation; however, it is highly resource intensive. The MDA will conduct surface water BMP evaluations to the extent that resources allow. The MDA also will seek opportunities to evaluate surface water BMPs through field studies, modeling and other cooperative efforts through the University of Minnesota, pesticide registrants and other interested groups in agricultural, non-agricultural, urban, and aquatic settings. Scientifically valid data will be considered from all sources including universities, registrants, and other government agencies. As with groundwater, actual monitoring results will provide the best foundation for BMP effectiveness evaluation.

Evaluation of the effectiveness of pesticide management strategies will be the responsibility of the MDA with input from the PMPC. The MDA should develop methods to evaluate the effectiveness of specific pesticide management activities. BMP promotion areas should receive more intensive promotional efforts. If the

promotional campaign is effective, the subsequent implementation of BMPs should result in a measurable improvement in water quality. An evaluation strategy should be designed to evaluate the rate of BMP adoption, effectiveness of promotional activities, and water quality. This will include the field audit process.

The MDA has the responsibility to determine BMP effectiveness. Based upon the results of monitoring, the MDA will develop and recommend changes and additional promotional activities with assistance from the PMPC. Should data submitted to the MDA indicate that a change in BMPs is necessary, the MDA will present the information to the PMPC for comment and, if necessary, re-initiate the BMP development process.

Pesticide Use Data

Under MINN. STAT. 18B.064, the MDA is required to monitor urban and rural pesticide use on a biennial basis. Pesticide use data is useful when reviewing and evaluating water monitoring trends. MDA's approach to collecting this data will be reviewed by the PMPC. Current activities and methods for evaluating pesticide use are outlined in PMP (Chapter 3 – Minnesota's Natural Setting, Pesticide Use Patterns, and Information Sources).

Chapter 10: Mitigation

Introduction

The purpose of mitigation is to implement practices to reduce or eliminate the movement of pesticides to Minnesota's water resources. Mitigation of the contamination of groundwater or surface water from the normal use of pesticides will be comprised of several activities. If the implementation of voluntary practices is ineffective over time, the MDA may implement mandatory practices through rule development, product label changes, or state restrictions on registration.

Mitigation activities of the PMP will be initiated by the MDA for a specific pesticide upon the determination of common detection status in groundwater or designation as a surface water pesticide of concern. These activities will be ongoing until the status of the pesticide is formally changed. Management efforts for pesticides with similar characteristics such as similar modes of action or which are applied to the same crops may be coordinated.

Management of the pesticide will be conducted in accordance with this chapter of the PMP by the MDA. The decision-making process provides for formal comment from the PMPC (see Chapter 9 – Evaluation) and the participation of other subject matter experts as requested by the MDA. Technical assistance from knowledgeable individuals representing involved constituencies is imperative for success.

This chapter outlines specific mitigation steps including: the mitigation goal; mitigation approach; recommended actions to accomplish the mitigation goal; descriptions of responses to pesticide detections in water; and the process for determining the need and process developing water resource protection requirements or other mandatory and enforceable restrictions on pesticide use.

Goal, Approach, and Recommended Actions

Mitigation Goal

The mitigation goal of the PMP is to reduce or eliminate movement of pesticides or pesticide breakdown products in areas or for specific active ingredients where there are elevated concentrations in groundwater or surface water.

Mitigation Approach

The mitigation goal will be accomplished first through targeted voluntary efforts and, if necessary, regulatory actions. The MDA's approach will involve:

1. Intensifying and targeting education and outreach (preventative) efforts
2. Refining or developing BMPs, incentives, or regulatory options
3. Considering the cost versus benefit and technical feasibility of mitigation measures
4. Exercising regulatory authority through mandatory use changes by adoption of water resource protection requirements or the restriction or cancellation of product registration, if necessary

Recommended Actions

Mitigation activities begin when the pesticide is determined by the commissioner of agriculture to be common detection status in groundwater or a surface water pesticide of concern (see Chapter 9 – Evaluation). Recommended actions to accomplish the mitigation goal for common detection pesticides and surface water pesticides of concern include the following.

1. Develop pesticide-specific BMPs (see Chapter 8 – Prevention).
2. Consider whether a change in use instructions on product labels as a condition of registration is needed.
3. Develop educational materials and promote materials through the BMP Education and Promotion Team (see Chapter 8 – Prevention).
4. Evaluate groundwater and surface water monitoring data to determine BMP effectiveness, review BMP adoption data, and refine BMPs, if needed.
5. Consider WRPRs or other enforceable actions for common detection pesticides in groundwater, if BMPs are proven ineffective and further refinement of the BMPs is determined not to be feasible or appropriate.
6. Consider enforceable actions for surface water pesticides of concern, if BMPs are proven ineffective and further refinement of the BMPs is determined not to be feasible or appropriate.
7. Support the MPCA's process for determining impaired waters and development of total maximum daily loads.
8. Conduct an analysis of the benefit of registration of the pesticide in relation to measured or predicted environmental impacts in Minnesota, as needed.
9. Promulgate rules for WRPRs for common detection pesticides in groundwater.
10. Take enforceable actions (e.g., impose restrictions on product registration) for common detection pesticides in groundwater or surface water pesticides of concern in surface water.
11. Enforcement as required.

Pesticide-specific BMPs

Mitigation activities begin when a pesticide is determined by the commissioner of agriculture to be common detection in groundwater or a surface water pesticide of concern, as described in Chapter 9 - Evaluation. Following this determination, pesticide-specific BMPs and educational materials are developed, and the BMPs are promoted in accordance with guidance outlined in Chapter 8 - Prevention. BMP rates of adoption and effectiveness are evaluated on a regular basis through National Agricultural Statistics Service surveys, water monitoring, and other means outlined in this document. The MDA may also do additional targeted evaluations for pesticides in common detection status and surface water pesticides of concern. Evaluating BMP adoption and effectiveness is described in Chapter 9 - Evaluation.

Regulatory Options for Groundwater

Statutory Authority for Water Resource Protection Requirements

The MDA will initiate a prevention, evaluation, and mitigation program to protect Minnesota water resources through voluntary action and may utilize a regulatory approach in the event that voluntary action is ineffective (for prevention and evaluation components, see Chapters 8 and 9, respectively). The framework for this philosophy was established by the Groundwater Protection Act of 1989, which directed that WRPRs may be promulgated by rule of the MDA if voluntary BMPs are proven to be ineffective.

MINN. STAT. 103H.005, subd. 15 states that Water Resource Protection Requirements, or WRPRs, are:

> *requirements adopted by rule for one or more pollutants intended to prevent and minimize pollution of groundwater. Water resource protection requirements include design criteria, standards, operation and maintenance procedures, practices to prevent releases, spills, leaks, and incidents, restrictions on use and practices, and treatment requirements.*

MINN. STAT. 103H.275, subd. 1 states that for areas where groundwater pollution is detected:

> *(a) If groundwater pollution is detected, a state agency or political subdivision that regulates an activity causing or potentially causing a contribution to the pollution identified shall promote implementation of best management practices to prevent or minimize the source of pollution to the extent practicable.*
>
> *(b) The Pollution Control Agency, or for agricultural chemicals and practices, the commissioner of agriculture may adopt water source protection requirements under subdivision 2 that are consistent with the goal of section 103H.001 and are commensurate with the groundwater pollution if the implementation of best management practices has proven to be ineffective.*
>
> *(c) The water resources protection requirements must be:*
>
> > *(1) designed to prevent and minimize the pollution to the extent practicable;*
> > *(2) designed to prevent the pollution from exceeding the health risk limits; and*
> > *(3) submitted to the House of Representatives and Senate committees with jurisdiction over the environment, natural resources, and agriculture.*

MINN. STAT. 103H.275, subd. 2 states that:

> *(a) The Pollution Control Agency, or for agricultural chemicals and practices, the commissioner of agriculture shall adopt by rule water resource protection requirements that are consistent with the goal of section 103H.001 to prevent and minimize the pollution to the extent practicable. The proposed rule must be submitted to the house of representatives and senate committees with jurisdiction over the environment, natural resources, and agriculture before adoption. The water resource protection requirements must be based on the use and effectiveness of best management practices, the product use and practices contributing to the pollution detected, economic factors, availability, technical feasibility,*

implementability, and effectiveness. The water resource protection requirements may be adopted for one or more pollutants or a similar class of pollutants…

(b) Before the water resource protection requirements are adopted, the Pollution Control Agency or the commissioner of agriculture for agricultural chemicals and practices must notify affected persons and businesses for comments and input in developing the water resource protection requirements.

(c) Unless water resource protection requirements are to cover the entire state, the water resource protection requirements are only effective in areas designated by the commissioner of the Pollution Control Agency by order or for agricultural chemicals and practices in areas designated by the commissioner of agriculture by order. The procedures for issuing the order and the effective date of the order must be included in the water resource protection requirements rule.

(d) The water resource protection requirements rule must contain procedures for notice to be given to persons affected by the rule and order of the commissioner. The procedures may include notice by publication, personal service, and other appropriate methods to inform affected persons of the rule and commissioner's order.

(e) A person who is subject to a water resource protection requirement may apply to the Pollution Control Agency, or for agricultural chemicals and practices the commissioner of agriculture, and suggest an alternative protection requirement. Within 60 days after receipt, the agency or commissioner of agriculture must approve or deny the request. If the Pollution Control Agency or commissioner of agriculture approves the request, an order must be issued approving the alternative protection requirement.

(f) A person who violates a water resource protection requirement relating to pollutants, other than agricultural chemicals, is subject to the penalties for violating a rule adopted under chapter 116. A person who violates a water resource protection requirement relating to agricultural chemicals and practices is subject to the penalties for violating a rule adopted under chapter 18D.

Need for Water Resource Protection Requirements

The MDA will follow an approach to regulation of the use of pesticides to protect groundwater that conforms to the Minnesota Groundwater Protection Act and the Minnesota Pesticide Control Law. This section of the PMP will outline the circumstances under which regulations may be adopted. The approach to evaluating BMP adoption and effectiveness is outlined in PMP Chapter 9 - Evaluation.

The following are the key elements from MINN. STAT. 103H.275 regarding the adoption by rule of WRPRs to protect groundwater:

1. WRPRs may only be adopted if BMPs are proven to be ineffective.
2. WRPRs must be commensurate (proportional) with the groundwater pollution.

3. WRPRs must be consistent with the degradation prevention goal of the Groundwater Protection Act and be designed to prevent and minimize the pollution to the extent practicable.
4. WRPRs must be designed to prevent the pollution from exceeding health risk limits.
5. WRPRs must be based on:
    a. use and effectiveness of BMPs;
    b. the product use and practices contributing to the pollution detected;
    c. economic factors;
    d. availability;
    e. technical feasibility;
    f. implementability; and,
    g. effectiveness.

Based on these statutory requirements, the following is general guidance that will be used by the MDA when evaluating the need for proposed adoption of WRPRs by rule:

1. WRPRs cannot be adopted unless BMPs are proven to be ineffective.
2. WRPRs may be adopted by the commissioner if:
    a. BMPs are proven to be ineffective;
    b. the BMPs are not widely used;
    c. there is significant or widespread elevated concentration or exceedances of the HRL; and,
    d. the WRPRs would be commensurate with the groundwater pollution.
3. WRPRs may not be required if another suitable regulatory option, such as a comparable and enforceable label use requirements, is in place or is adopted.
4. If the BMPs are, or appear to be, ineffective, and BMP adoption data supports that the BMPs are being adopted, then the revisions to the BMPs should be considered prior to adopting WRPRs.
5. If successful, the BMPs will provide for the minimum amount of pesticide to be used for the pesticide to be effective, though at a rate sufficient to suppress the development of pesticide resistance in weeds or other target organisms, with consideration for methods of use, other products, integrated pest and weed management, and non-chemical means of control. It is possible that some contamination of groundwater at concentrations below the HRLs, will occur. Under the Groundwater Protection Act, it is recognized that for some human activities the degradation prevention goal cannot be practicably achieved; however, pollution should be prevented and minimized to the extent practicable.
6. The Groundwater Protection Act directs similar goals and considerations for the development of both BMPs and WRPRs. Both are intended to prevent and minimize pollution to the extent practicable in consideration of several specific and similar criteria. Therefore, if required, WRPRs should be similar to the BMPs. A WRPR may provide more detailed guidance than that described in a voluntary BMP, and include, when appropriate, minor uses of a pesticide and uses for rescue treatments.

Regulatory Options for Surface Water

The MDA has general authority to take regulatory actions to prevent unreasonable adverse effects on the environment which includes protection of surface waters. However, the lead agency responsible for regulation to protect surface waters is the MPCA. The MPCA's primary mechanism to address non-point source contamination in surface waters is declaring waters impaired under section 303(d) of the federal Clean Water Act due to the exceedance of a numerical standard, narrative standard, or due to a concern with a water body's biological integrity.

The Minnesota DNR is responsible for the implementation of Minn. Rules Chapter 6280 relating to management of aquatic plants growing in public waters and aquatic animals that cause nuisance or health concerns. The DNR's Aquatic Plant Management Program protects aquatic plant habitat from unnecessary harm while allowing lakeshore homeowners to control some aquatic vegetation for water access. Bay-wide or lake-wide permits for aquatic use pesticides are issued to improve the quality of the aquatic environment. The use of pesticides in protected lakes, rivers or wetlands requires a DNR permit. The DNR's program also includes an effort directed at pesticide enforcement, with aquatic pesticide enforcement specialists supervising herbicide treatments and investigating reports of the misuse of pesticides in lakes or the unlawful destruction of aquatic vegetation. Additional regulatory actions could include limiting or refusing issuance of permits, modifications to aquatic pesticide use labels, or referral of water bodies to the MPCA to address impairments under the Clean Water Act.

As noted in Chapter 9 – Evaluation, the MDA will monitor surface waters in Minnesota, and will develop and promote pesticide voluntary BMPs with the goal of preventing water bodies from becoming impaired from currently registered pesticides. The MDA will make a determination that a pesticide is a surface water pesticide of concern as a preliminary step leading to developing pesticide-specific BMPs to protect surface waters. The MDA also will actively support the MPCA's process for determining impaired waters and development of TMDLs.

The MDA is not authorized by law to take regulatory action to protect surface waters under MINN. STAT. 18B unless the action is needed to prevent an unreasonable adverse effect on the environment. Using the process outlined in Chapter 4 ("Pesticide Registration") of this plan, the MDA will annually review pesticides that have been determined to be surface water pesticides of concern for their potential to cause unreasonable adverse effects on the environment and, if necessary, will consider regulatory options under MINN. STAT. 18B.

Registration and the Authority to Prevent Unreasonable Adverse Effects

In addition to the development of WRPRs as a tool to mitigate adverse effects on groundwater resources, the commissioner of agriculture can also exercise authority under MINN. STAT. 18B.26 regarding restrictions on registration to protect the quality of groundwater and surface water. All pesticides sold in Minnesota are required to be registered by the MDA. The MDA can prohibit the sale of products by refusing to register the pesticide.

In addition to the previously mentioned groundwater and surface water protection activities, MINN. STAT. 18B.26 subd. 5 addresses review and registration of pesticides:

(a) The commissioner may not deny the registration of a pesticide because the commissioner determines the pesticide is not essential.

(b) The commissioner shall review each application and may approve, deny, or cancel the registration of any pesticide. The commissioner may impose state use and distribution restrictions on a pesticide as part of the registration to prevent unreasonable adverse effects on the environment.

(c) The commissioner must notify the applicant of the approval, denial, cancellation, state use or distribution restrictions.

(d) The applicant may request a hearing on any adverse action of the commissioner within 30 days after being notified.

(e) The commissioner may exempt pesticides that have been deregulated or classified as minimum risk by the United States Environmental Protection Agency from the requirement of registration.

Unreasonable adverse effects on the environment are defined in MINN. STAT. 18B.01, subd. 31:

"Unreasonable adverse effects on the environment" means any unreasonable risk to humans or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide.

The commissioner of agriculture may impose restrictions on product registration anytime there is a determination that a restriction is necessary to prevent unreasonable adverse effects on the environment. A registrant may also voluntarily propose label changes or restrictions if they feel they are needed.

During its annual review of monitoring data, the MDA will consider restrictions on products as a condition for registration.

The following considerations will guide decisions on how the annual review of monitoring data might be used to restrict pesticide use in conjunction with product registration using the authorities of MINN. STAT. 18B.26 to prevent unreasonable adverse effects on the environment.

1. Use restrictions may be imposed on "common detection" pesticides in groundwater and on surface water pesticides of concern.
2. Use restrictions may be imposed on pesticides that, based on other factors, might require MDA action to prevent unreasonable adverse effects on the environment (e.g., a significant change in the drinking water or surface water standards resulting in an immediate need for registration review and possible use restrictions).
3. MDA staff would conduct any initial registration reviews on products for which use restrictions are being considered. Relevant information on water quality risk, benefit of use, and alternative pest management practices may be sought by the MDA through consultations with various stakeholders, including:
    a. The EPA
    b. Tribes

c. The MDH
d. The MPCA
e. The DNR
f. University of Minnesota Extension
g. Pesticide registrants
h. Farmers
i. Farm Organizations
j. Environmental Organizations
k. The Board of Soil and Water Resources
l. Soil and Water Conservation Districts
m. Watershed Districts
n. Other interested parties

4. The MDA may impose, as a condition of registration, restrictions on the use of a pesticide (e.g., restrictions on timing, rate, crop, landscape setting, lake management concerns, depth to groundwater, or other use criteria).

In situations where the MDA takes action to restrict the use of a pesticide because it has been determined to pose an unreasonable adverse effect on the environment, the commissioner will notify the pesticide registrant(s) of the action. The registrant(s) will then have 30 days to request a hearing as provided for in MINN> STAT. 18B.26 subd. 5 (d).

Analysis of the Benefit of Registration

Prior to implementing an enforceable option such as WRPRs to protect groundwater, or restrictions under MDA's general authorities to prevent unreasonable adverse effects on the environment to groundwater or surface water, the commissioner of agriculture may determine that an analysis of the benefit of registration of the pesticide to Minnesota agriculture in relation to measured or predicted human health or environmental impacts is necessary. The purpose of this analysis is to determine whether the product should be registered for use in Minnesota. That is, whether continued use of the pesticide provides sufficient balance between the benefits to Minnesota and the risks to human health and the environment due to water quality impacts.

If the analysis reveals that the potential water quality risks outweigh the benefits of use, the commissioner may choose not to register a pesticide.

Mitigation Decision Process

Mitigation-related decisions will use the same process for decision-making as outlined in the evaluation chapter. This process includes consultation with the PMPC prior to major preliminary decisions by the commissioner and public notice, by means of both the MDA pesticide non-point listserv and through the state register, prior to final decisions.

Enforcement

The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) expressly authorizes the state to regulate the sale or use of pesticides, so long as the State regulation does not permit any sale or use prohibited by FIFRA. In addition, FIFRA gives the state primary enforcement authority for pesticide use violations if the EPA determines that the state has adopted adequate laws and has adequate enforcement procedures. Minnesota has such authority.

The legislature, in 1987 amended Minn. Stat. Chapter 18B, authorizing additional procedures and authorities to the MDA for pesticide enforcement, including authority to proceed civilly. The MDA has extensive authority and experience in issuing various kinds of orders to remedy violations. State regulation of pesticides is accomplished under Minn. Stat. Chapters 18B and 18D.

Minn. Stat. Chapter 18B sets forth state requirements for pesticide registration, pesticide use and misuse, applicator licensing, and record keeping. Minn. Stat. Chapter 18D provides for the cleanup of sites contaminated by pesticides, the ability to administer civil and criminal penalties, and the assignment of liability for contaminated sites. Minn. Stat. Chapter 18E provides for reimbursement of costs associated with the cleanup of agricultural chemical incidents.

The MDA typically uses written warnings and remedial or corrective action orders to administratively enforce its regulations. A stepped approach is utilized to determine the appropriate level of enforcement action and remedy. The following is a brief description of the most commonly used administrative remedies:

1. Advisory Notices or Notices of Violation are issued to persons when evidence indicates that documented deficiencies represent minor non-compliance with regulatory requirements.
2. Remedial or Corrective Action Orders with schedules of compliance and potential administrative penalties.
3. Civil enforcement authority for serious or repeated violations of Minn. Stat. Chapters 18B & 18D, or rules adopted thereunder.

The MDA has developed a procedure preceding civil action: the Notice of Intent-Enforcement Action. This action is essentially a Notice of Violation, with an introduction of authority, a recitation of facts, a listing of alleged violations, a description of the MDA's intent to file a civil suit within a fixed period of time, an offered settlement opportunity with specified proposed penalty, proposed remedies and effect of settlement, and an opportunity for submission of additional information. If a person wishes to close the matter in the manner described, an acknowledgment of violation is requested and necessary.

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Appendix A: Roles and Responsibilities

The State of Minnesota has resources and technical staff that allow it to implement much of the Pesticide Management Plan (PMP). This appendix details the roles, responsibilities, and resources of state agencies available for implementation of the PMP. For additional information, see also Chapter 4 – Coordination and Stakeholder Involvement.

I. Minnesota Department of Agriculture (MDA)
   a. Roles and Responsibilities
      i. Develop a PMP in coordination with other state agencies, interest groups and the public.
      ii. Develop generic (core) Best Management Practices (BMPs).
      iii. Conduct water resource monitoring.
      iv. Establish pesticide management areas and monitoring regions to help promote and evaluate BMPs.
      v. Track monitoring well locations, pesticides detected, and concentration data in a comprehensive database.
      vi. Manage and facilitate the Pesticide Management Plan Committee.
      vii. Manage and facilitate the Education and Promotion Team.
      viii. Assign staff to implement the PMP.
      ix. Develop pesticide-specific BMPs based on determinations of common detection in groundwater and surface water pesticides of concern in surface water.
      x. If BMPs are proven ineffective, consider adopting rules or other regulatory restrictions on pesticide use or management.
      xi. Measure BMP adoption rates.
      xii. Help develop, support, and promote integrated pest and weed management.
      xiii. Coordinate with other agencies about water quality in Minnesota.
   b. Resources
      i. The MDA funds the PMP through multiple sources. The major sources are listed below.
      ii. State pesticide revenues including:
         1. Registration fees on products (pesticides)
         2. Certification and licensing fees
         3. Permit programs
         4. Surcharges
         5. Environmental Protection Agency (EPA) annual grants
         6. Clean Water Funds to support pesticide water monitoring
         7. Other program revenues such as grants and general funds
   c. Technical Expertise
      Through its various divisions and associated professional staff, the MDA is capable of implementing the PMP.
      i. Personnel classifications include:
         1. Research Scientists

2. Entomologists
3. Soil Scientists, Agronomists, Weed Scientists, and other Agricultural Scientists
4. Hydrogeologists
5. Analytical Laboratory Analysts
6. Environmental Chemists
7. Agricultural Advisors and Consultants

ii. Laboratory capabilities include:

1. Analysis of groundwater and surface water for pesticides, nutrients, and metals that pose an environmental concern.
2. Analysis of soils for high level contamination as a result of spills and poor pesticide management.
3. Sample extraction, concentration and analysis, and liquid and gas chromatography when analyzing for pesticides in water at trace levels.
4. Analysis of samples, including the development of unique analytical methods for variable sample (e.g., cloth, vegetation, bees) matrices and unique chemical compositions, to support enforcement of pesticide misuse cases.

II. Minnesota Department of Health (MDH)

a. Roles and Responsibilities

i. Participate in development of the PMP.
ii. Participate in the Pesticide Management Plan Committee in the review of information related to the prevention, evaluation, and mitigation of occurrences of pesticides and pesticide breakdown products in water resources.
iii. Participate in the MDA's Education and Promotion Team.
iv. Adopt, through rulemaking, Health Risk Limits (HRLs) for groundwater pollutants.
v. Establish a Wellhead Protection program to protect public drinking water supplies and incorporate pesticide management strategies into protection programs.
vi. Implement EPA Safe Drinking Water Act rules pertaining to pesticide monitoring and maximum contaminant levels and share related information with the MDA.

b. Technical Expertise

i. The MDH employs toxicologists, hydrogeologists, and planners to support its roles and responsibilities.

III. Minnesota Pollution Control Agency (MPCA)

a. Roles and Responsibilities

i. Participate in development of the PMP.
ii. Participate in the Pesticide Management Plan Committee in the review of information related to the prevention, evaluation, and mitigation of occurrences of pesticides and pesticide breakdown products in water resources.
iii. Participate in the MDA's Education and Promotion Team.
iv. Develop relationships and procedures needed to generate indicators for the Non-point Source Management Plan [federal Clean Water Act Section 305 (b)] report.

v. Develop procedures and standards to assess water bodies for impairment and total maximum daily load (TMDL) assessment under federal Clean Water Act Section 303 (d).

b. Technical Expertise
    i. The MPCA employs toxicologists, hydrogeologists, and pollution control specialists to support its roles and responsibilities.

IV. Board of Water and Soil Resources (BWSR)
a. Roles and Responsibilities
    i. Participate in the development of the PMP.
    ii. Participate in the MDA's Education and Promotion Team.
    iii. Provide grant funding to implement BMPs and other recommended practices to protect water quality.

V. Minnesota Department of Natural Resources (DNR)
a. Roles and Responsibilities
    i. Participate in development of the PMP.
    ii. Participate in the Pesticide Management Plan Committee in the review of information related to the prevention, evaluation, and mitigation of occurrences of pesticides and pesticide breakdown products in water resources.
    iii. Participate in the MDA's Education and Promotion Team.
    iv. Develop groundwater sensitivity assessments.
    v. Monitor water withdrawal and water level change.
    vi. Conduct hydrogeologic studies.
    vii. Systematic mapping of counties in collaboration with the Minnesota Geological Survey and publish County Geologic Atlases.
    viii. Continue mapping of regional areas and publication of the Regional Hydrogeologic Assessments.
    ix. Monitor and report precipitation amounts across the state and interpret their statistical frequency.
    x. Manage water resources development consistent with resource capabilities.
    xi. Delegated lead agency for aquatic pesticide management.

VI. University of Minnesota (UMN)

Research and extension staff at the UMN provide important technical expertise in the development of educational programs specifically dealing with water quality and BMP issues. The UMN can support PMP activities and BMP development, in keeping with the University's mission, while assisting with funding and staff when available and appropriate. Research at the UMN can overlap with the developing needs of the MDA and water quality protection and collaborations are pursued appropriately.

a. Roles and Responsibilities
    i. Participate in development of the PMP.

ii. Participate in the Pesticide Management Plan Committee in the review of information related to the prevention, evaluation and mitigation of occurrences of pesticides and pesticide breakdown products in water resources.
iii. Participate in the MDA's Education and Promotion Team.

b. Technical Expertise
   i. University of Minnesota Extension has extensive scientific and education expertise. They have established diverse educational and technical expertise with programs addressing issues such as pesticides and water quality, integrated pest and weed management, the environment, environmental health, agricultural education, pesticide applicator training, and water quality.

Appendix B: Records and Reporting

Documentation of Minnesota's Pesticide Management Plan (PMP) activities not only provides a source of data to share with the U.S. Environmental Protection Agency (EPA), other involved federal and state agencies, and the many stakeholders of the Minnesota Department of Agriculture (MDA), but also provides a basis with which to assess the implementation and effectiveness of Minnesota's prevention, evaluation, and mitigation response activities.

The MDA will maintain all records relating to the development and implementation of the PMP for a period of at least six years. This information will include, but is not limited to, records on any monitoring or sampling collected, results of analyses, issuance of permits, types and numbers of enforcement actions taken, records of any site-specific regulatory actions, and administrative actions.

The MDA either produces or receives PMP-related reports, and will compile appropriate reports and provide them to the legislature, EPA, and other interested parties on a periodic basis. Related reports include, but are not limited to, the following:

1. A biennial PMP report required under Minn. Stat. § 18B.045.
2. Annual and mid-year MDA reports to EPA under the "Consolidated Pesticide Cooperative Agreement."
3. MDA's contribution to the state Groundwater Monitoring Status Report, assembled by the Minnesota Pollution Control Agency.
4. Pesticide-related chapters from the Minnesota's Non-Point Source Management Plan to EPA (a requirement for continued state receipt of Clean Water Act funding), assembled by the Minnesota Pollution Control Agency.
5. The MDA annual groundwater and surface water monitoring report.
6. Occasional relevant reporting conducted outside of the above-referenced reports, covering issues such as: state, regional or local pesticide use, pesticide practices, watershed monitoring, etc.

Appendix C: Figure Descriptions

Figure 4

Figure 4 is a flow chart outlining the Minnesota Department of Agriculture's (MDA's) process for decisions related to groundwater. The text in the figure is divided into a series of boxes with arrows between indicating how the process can move both forward and backward at different stages as opposed to being strictly sequential.

Box 1 Title: Prevention (Chapter 8)

Box 1 Text:

- Educate pesticide users on actions that prevent groundwater degradation and promote their adoption
- Develop, adopt, and promote generic pesticide best management practices (BMPs)
- Coordinate efforts with the Education and Promotion Team
- Prevention efforts are ongoing

Box 1 Arrows: A long arrow continues down to the last box in the figure to indicate the prevention efforts are ongoing and continue throughout the entire process. Two short arrows pointing opposite directions connect to Box 1 to Box 2 indicating the possibility to move either from Box 1 to Box 2 or from Box 2 to Box 1 in the process.

Box 2 Title: Evaluation (Chapter 9)

Box 2 Text:

- Evaluate water monitoring data
- Make common detection status determinations
- Evaluate the adoption and effectiveness of generic pesticide BMPs
- Coordinate with the Pesticide Management Plan Committee

Box 2 Arrows: One arrow points from Box 2 to Box 3.

Box 3 Title: Mitigation & Prevention (Chapters 8 & 10)

Box 3 Text:

- Initiate actions to mitigate effects of pesticides in common detection status
- Develop, adopt, and promote voluntary pesticide-specific BMPs
- Target pesticide monitoring regions and BMP promotion areas, as needed
- Continue prevention activities

Box 3 Arrows: Two short arrows pointing opposite directions connect to Box 3 to Box 4 indicating the possibility to move either from Box 3 to Box 4 or from Box 4 to Box 3 in the process.

Box 4 Title: Evaluation (Chapter 9)

Box 4 Text:

- Evaluate the adoption and effectiveness of pesticide-specific BMPs
- Consider Water Resource Protection Requirements (WRPRs) or other enforceable actions for groundwater
- Consider registration restrictions
- Analyze the benefit of registration, as needed

Box 4 Arrows: Two short arrows pointing opposite directions connect to Box 4 to Box 5 indicating the possibility to move either from Box 4 to Box 5 or from Box 5 to Box 4 in the process.

Box 5 Title: Regulation (Chapter 10)

Box 5 Text:

- Promulgate rules for WRPRs (MINN. Stat. 103H) or consider alternative mechanisms (e.g., use or practice restrictions under MINN. Stat. 18B)
- Take enforcement actions

Box 5 is the last in the process.

Figure 5

Figure 5 is a flow chart outlining the MDA's process for decisions related to surface water. The text in the figure is divided into a series of boxes with arrows between indicating how the process can move both forward and backward at different stages as opposed to being strictly sequential.

Box 1 Title: Prevention (Chapter 8)

Box 1 Text:

- Educate pesticide users on actions that prevent surface water degradation and promote their adoption
- Develop, adopt, and promote generic pesticide best management practices (BMPs)
- Coordinate efforts with the Education and Promotion Team
- Prevention efforts are ongoing

Box 1 Arrows: A long arrow continues down to the last box in the figure to indicate the prevention efforts are ongoing and continue throughout the entire process. Two short arrows pointing opposite directions connect to Box 1 to Box 2 indicating the possibility to move either from Box 1 to Box 2 or from Box 2 to Box 1 in the process.

Box 2 Title: Evaluation (Chapter 9)

Box 2 Text:

- Evaluate water monitoring data
- Make surface water pesticide of concern determinations

- Evaluate the adoption and effectiveness of generic pesticide BMPs
- Coordinate with the Pesticide Management Plan Committee
- Provide technical support to Minnesota Pollution Control Agency for impaired waters determinations

Box 2 Arrows: One arrow points from Box 2 to Box 3. Two short arrows pointing opposite directions connect to Box 2 to Box 2A. Box 2A is titled, "Minnesota Pollution Control Agency" and contains the following text: "Potential impaired waters listing and total maximum daily load (TMDL) study." An arrow points from Box 2A to the words "TMDL implantation." The offshoot in the process to Box 2A indicates the direct involvement of another agency and does not continue beyond TMDL implementation. Box 3 continues with the MDA's process.

Box 3 Title: Mitigation & Prevention (Chapters 8 & 10)

Box 3 Text:

- Initiate actions to mitigate effects of pesticides in surface water pesticide of concern status
- Develop, adopt, and promote voluntary pesticide-specific BMPs
- Target specific regions and BMP promotion areas, as needed
- Continue prevention activities

Box 3 Arrows: Two short arrows pointing opposite directions connect to Box 3 to Box 4 indicating the possibility to move either from Box 3 to Box 4 or from Box 4 to Box 3 in the process.

Box 4 Title: Evaluation (Chapter 9)

Box 4 Text:

- Evaluate the adoption and effectiveness of pesticide-specific BMPs
- Consider enforceable actions for surface water
- Consider registration restrictions
- Analyze the benefit of registration, as needed

Box 4 Arrows: Two short arrows pointing opposite directions connect to Box 4 to Box 5 indicating the possibility to move either from Box 4 to Box 5 or from Box 5 to Box 4 in the process.

Box 5 Title: Regulation (Chapter 10)

Box 5 Text:

- Consider mechanisms for potential enforceable actions (e.g., use or practice restrictions under MINN. Stat. 18B)
- Take enforcement actions

Box 5 is the last in the process.

Figure 7

Figure 7 is a flow chart outlining the MDA's designation process for common detection status. The figure lists the following sequential steps in boxes connected with arrows.

1. MDA collects and analyzes water monitoring data
2. MDA provides monitoring data and other relevant information about the pesticide(s) to the Pesticide Management Plan Committee (PMPC)
3. MDA meets with PMPC to discuss potential designations
4. PMPC provides comments to the commissioner
5. Commissioner makes a preliminary decision on common detection status
6. MDA provides public notice of preliminary decision to designate any new pesticide(s) and provides a minimum comment period of 60 days
7. Commissioner reviews public comments and makes a final decision on common detection status
8. MDA provides public notice of the final decision in the Minnesota State Register

Figure 8

Figure 8 is a flow chart outlining the Minnesota Department of Agriculture's (MDA's) designation process for surface water pesticide of concern status. The figure lists the following sequential steps in boxes connected with arrows.

1. MDA collects and analyzes water monitoring data
2. MDA provides monitoring data and other relevant information about the pesticide(s) to the Pesticide Management Plan Committee (PMPC)
3. MDA meets with PMPC to discuss potential designations
4. PMPC provides comments to the commissioner
5. Commissioner makes a preliminary decision on surface water pesticide of concern status
6. MDA provides public notice of preliminary decision to designate any new pesticide(s) and provides a minimum comment period of 60 days
7. Commissioner reviews public comments and makes a final decision on surface water pesticide of concern status
8. MDA provides public notice of the final decision in the Minnesota State Register