

DRAFT

2010 Minnesota Water Plan



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Executive Summary

This section will be finalized after the public comment period.

This document has three main parts:

- Reflecting on the Past
- Evaluating the Status of our Resources in the Present
- Charting a Roadmap for the Future –Implementation Principles and Strategies

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Chapter 1 Introduction

The Environmental Quality Board is charged with coordinating comprehensive long-range water resources planning and policy through a *Minnesota Water Plan* every ten years. The plan also presents information on the status of the state's water resources. The *2010 Minnesota Water Plan* brings together in a single place the recent work of state water agencies, how they are working together, and articulates targeted strategies for the future. While the law requires the EQB to develop a state water plan each decade, and while the plan should guide state activities during the decade, the planning horizon of the plan should be viewed as long term and not limited to a 10-year period.

This plan does not set out to touch on every water issue challenging the state. Rather, the goal is to inform state agency programs that are responsible for addressing the multitude of water topics facing Minnesotans, and to communicate to the Legislature and public the commitment of the agencies to work toward sustainable water management. This document strives to outline the framework that will be implemented in coming years to improve water management and delivery of information. This report is not all-inclusive, but is designed to help set priorities and inform decision-making. Readers of this report are also encouraged to review the appendices for much greater detail on the status of our state's water resources and programs designed to monitor and manage them.

Audience

The primary audiences of the plan are the Governor, Legislature, and the citizens of Minnesota. The goal is to help water resource management in the state move toward sustainability. This plan was prepared to integrate the work of the state agencies, and identify ways that work can usefully guide the activities of local, regional and state agencies.

2010 represents an exciting time to work in the field of water resource management in Minnesota. While blessed with abundant water and natural resources, all must be managed as an interconnected system to achieve sustainability. Managing for water quality and quantity, while balancing the needs of natural systems with human activity and development, is complex and challenging, but critical. The passage of the 2008 Clean Water Land and Legacy Amendment signals the importance of water resources, habitat and environmental health to the state's citizens, and represents the opportunity to bring all participants and stakeholders onboard with what is best for nurturing Minnesota's economy, communities, human health, recreation and environment.

103B.151 COORDINATION OF WATER RESOURCE PLANNING.

The Environmental Quality Board shall:

(2) coordinate comprehensive long-range water resources planning in furtherance of the Environmental Quality Board's "Minnesota Water Plan," published in January 1991, by September 15, 2000, and each ten-year interval afterwards.

Values

Minnesotans truly value their water resources. Through the current University of Minnesota Water Sustainability Framework process, a survey was created to gather input from citizens in the state. Preliminary results indicate that citizens consider water's most important use to be for drinking water; and second to that is for ecological services. Even though resources vary across the state, as do industry and recreation, there is consensus about the need to be protective of drinking water and ecology above other uses. Additionally, survey results show that citizens are most concerned about chemical pollution, but close behind is recognition that nutrient pollution, non-native species and loss of wetlands threaten the quality and character of Minnesota's waters. Survey respondents said they supported equal investment in restoring impaired waters and protecting still-healthy resources; and similarly seemed equally committed to investing in ground and surface waters.

Historic Perspective

Similarly, Minnesota has long recognized the importance of water resource protection. Specific to groundwater resources, the Groundwater Protection Act of 1989 (*Minnesota Statutes* Chapter 103H.001) articulated specific protection goals, *"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."*

103A.204 GROUNDWATER POLICY.

(a) The responsibility for the protection of groundwater in Minnesota is vested in a multiagency approach to management.

(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.

"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."

The Clean Water Legacy Act of 2006 (*Minnesota Statutes* Chapter 114.10) was passed for the purpose of protecting, restoring and preserving the quality of Minnesota's surface waters. The legislature noted in findings that:

- *"there is a close link between protecting, restoring, and preserving the quality of Minnesota's surface waters and the ability to develop the state's economy, enhance its quality of life, and protect its human and natural resources;*
- *achieving the state's water quality goals will require long-term commitment and cooperation by all state and local agencies, and other public and private organizations and individuals, with responsibility and authority for water management, planning, and protection; and*

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- *all persons and organizations whose activities affect the quality of waters, including point and nonpoint sources of pollution, have a responsibility to participate in and support efforts to achieve the state's water quality goals."*

In more recent legislation, the Clean Water, Land and Legacy Constitutional Amendment (Legacy Amendment) was passed by Minnesota voters on Nov. 4, 2008. The Amendment was created to:

- *"protect our drinking water sources;*
- *protect, enhance, and restore our wetlands, prairies, forests, and fish, game, and wildlife habitat; to preserve arts and cultural heritage; to support parks and trails; and*
- *protect, enhance, and restore our lakes, rivers, streams, and groundwater."*

One component of the Legacy Amendment was the establishment of the Clean Water Fund (CWF), into which one-third of the Legacy Amendment sales tax proceeds are deposited. *Minnesota Statutes* Section 114D.50 further specifies the allowed uses of the Clean Water Fund as follows:

- supporting measures to prevent surface waters from becoming impaired, and
- supporting measures to prevent the degradation of groundwater in accordance with the groundwater degradation prevention goal under section 103H.001.

Recent Activities

State and local agencies have increased their activities associated with water monitoring, planning and aquifer resource evaluation within the last several years. Some of these recent efforts include:

- DNR's plan to Develop a Groundwater Level Monitoring Network for the 11-County Metropolitan Area,
- Metropolitan Council's seven-county Twin Cities Metropolitan Area Master Water Supply Plan and regional groundwater model,
- MDA funding to acquire additional analytical equipment, to support increased monitoring capacity, and an expanded pesticide analyte list,
- Minnesota's involvement as a pilot state for a proposed National Groundwater Monitoring Network,
- Environmental Quality Board's water availability reports *"Managing for Water Sustainability"* and *"Use of Minnesota's Renewable Water Resources: Moving toward Sustainability"*,
- Freshwater Society's report *"Water is Life – Protecting A Critical Resource For Future Generations"*,
- MPCA's redesigned ambient groundwater monitoring network,
- MDA and MDH partnership to monitor Community Water Supplies for pesticides and pesticide degradates,
- United States Geological Survey's NAWQA research conducted in this region,
- Incorporation of groundwater considerations in county water plans,
- Improved groundwater data management by the MPCA by using the EQUIS database,

- Studies by the Minnesota Geological Survey and DNR of Minnesota’s aquifer resources,
- A cooperative effort with MDA, MPCA, MDH, and the Southeast Minnesota Water Resources Board to obtain pesticide data in conjunction with long-term nitrate data collection,
- USGS low flow study on the Mississippi River as it relates to metropolitan surface water supply planning,
- University of Minnesota’s water sustainability planning efforts,
- Continued progress in the advancement of the County Geologic Atlas program,
- Second generation of water supply plans for water suppliers,
- DNR’s Groundwater Technical Work Group assessment of models and tools needed to manage water availability and sustainability, and
- MPCA’s report to the Legislature, *“Statewide Endocrine Disrupting Compound Monitoring Study 2007 – 2008”*.

This list is not exhaustive; many efforts are ongoing or have recently been completed that are not listed. Please use the Bibliography of the report as a resource for many of the other documents that detail work and findings.

Contributions from Many Groups

This plan recognizes that sustainable water resource management, monitoring and planning depend on partnerships with and participation of many groups and stakeholders. Federal, state, regional and local government partners are critical to providing effective resource management programs. Monitoring is done by regional, state and federal agencies, but also by cities, watersheds, citizen groups and others. Education and outreach activities are carried out by many public and private partnerships. Planning for an improved future is done effectively at the local level through state efforts, and by others. Research and improved tools come from academia, industry and others. While each of these contributions is essential, this plan focuses on state executive branch responsibilities and charges. Finally, for purposes of this plan, the references to “state agencies” are meant to include the activities and involvement of the Metropolitan Council, when applicable.

Chapter 2 Reflecting on the Past

The Environmental Quality Board has a long history of preparing decadal Minnesota Water Plans. Since the board's inception in 1973, each decade has been marked with a commitment to protect and restore Minnesota's water resources. Looking back over these documents one can see expression of great vision, transformational ideas and indications of progress made. There are also recurring ideas and reflections of barriers that impede our ability to realize the visions articulated. It is our challenge, and responsibility, to look to the past to learn and to move forward with a renewed commitment to enact progress. The following paragraphs highlight key issues and findings from earlier state water plans, which in turn have informed the development of the 2010 *Minnesota Water Plan*.

Minnesota Watermarks: Gauging the Flow of Progress 2000-2010

Minnesota Watermarks is the most recent state water plan, developed through the EQB Water Resources Committee in September 2000 with assistance from the Water Management Unification Task Force, river basin teams and many others. The report put forth four statewide goals and nine objectives:

- **Minnesotans will improve the quality of water resources.**
 - Protect and improve water quality in rivers, streams and other water courses.
 - Protect and improve lake water quality.
 - Protect and improve groundwater quality.

The 1991 *Minnesota Water Plan* was accompanied by a letter from then Governor, Arne Carlson. The words he wrote to the citizens of Minnesota still apply today.

Water is precious to Minnesotans. It is a symbol of our state and our people. Protecting and conserving water resources is an investment in Minnesota, not a cost.

The rich outdoor experience that we value, and that so typifies our state, centers on our lakes, wetlands, and streams. Beneath the surface, we also share the hidden treasure of abundant, pure ground water.

We have come to realize in recent years that our water resources are at risk. We cannot stand pat and maintain the quality of Minnesota's water.

We have begun to understand a very simple principle - the ecological principle of interdependence. What we do on the land affects water quality and availability. When we seek to protect our water quality, we had better understand quantity. When we think to use surface water, we need to realize that ground water may also be affected.

Minnesotans across the state have joined in a unique grassroots campaign called "comprehensive local water planning." The word "comprehensive" signals a recognition of the principle of interdependence; the word "local" means that the people involved are close to the real issues and solutions.

The Minnesota Water Plan sets an ambitious agenda for protecting and conserving our water. It is an agenda in which each of us has a part to play.

- **Minnesotans will conserve water supplies and maintain the diverse characteristics of water resources to give future generations a healthy environment and a strong economy.**
 - Maintain groundwater levels to sustain surface water bodies and provide water supplies for human development.
 - Maintain the hydrologic characteristics of surface water bodies that support beneficial uses.
- **Minnesotans will restore and maintain healthy aquatic ecosystems that support diverse plants and wildlife.**
 - Ensure that aquatic environments have conditions suitable for the maintenance of healthy self-sustaining communities of plants and animals.
 - Limit geographic range of exotic species.
- **Minnesotans will have reasonable and diverse opportunities to enjoy the state's water resources.**
 - Provide access to water-based recreation sites.
 - Improve or maintain the quality of water recreation.

The report evaluated water resources across the state's seven major basins, and concluded that while there was significant variability of resources, challenges and priorities across the state, six conditions and problems were consistent throughout:

- **Local planning and funding.** Strengthening local planning and ensuring adequate financial resources for local water management were key issues in most basins.
- **Land use.** Land use and its relationship to the condition and quality of lakes, streams and groundwater was of interest in every basin.
- **Prevention.** Most basin teams noted the high quality of water resources and the importance of keeping these resources in top condition.
- **Education and stewardship.** Water resources are greatly affected by the actions of individuals who sometimes unknowingly pollute.
- **Climate effects.** Recognizing that all aspects of the environment are interrelated, all of the basin teams noted that weather and climate change must be considered in planning for Minnesota's water resources.
- **Coordination.** A continuing, cooperative effort is needed because several groups and units of government have an interest in water or are charged with managing them.

Minnesota Water Plan: Directions for Protecting and Conserving Minnesota's Waters

In 1991 the EQB issued this report with an ambitious agenda for protecting and conserving water resources in the state. It identified the principles, policies and actions needed for managing water in the 1990s and beyond.

Minnesota’s Water Goals:

- To improve and maintain the high quality and availability of Minnesota’s water for future generations and long-term health of the environment.
- To ensure that our uses of water are sustainable, and that in meeting our needs for water, we recognize its limits and interconnections, accept its changing and variable nature, and adjust our demands upon it when necessary to safeguard it for future needs.

Minnesota’s Water Principles are that we:

- Manage water’s interconnections
- Focus on the resource
- Manage hydrologic units
- Make partnerships work for water
- Make prevention the focus
- Put public health and safety first
- Recognize the importance of information
- Understand the importance of research
- Think long-term
- Accept limits to growth
- Make those who benefit pay
- Let citizens make a difference
- Educate people to change behavior
- Make government understandable, adaptable and accountable

Understanding water’s interconnections

Water quality cannot be considered without quantity. Availability hinges upon quality, as well as quantity. Surface waters are connected to groundwater. Land use affects both quality and quantity of water. Air quality effects water quality. Clearly, the environment must be managed well to protect water, just as water must be managed well to protect the environment.

(A principle from the 1991 water plan)

The 1991 Minnesota Water Plan went on to present 28 recommendations for Minnesota’s water resources and for its programs. They were designed to help Minnesota meet the objectives for water management and were framed by the following four overarching categories:

- Integrating water management
- Focusing on the resource
- Protecting and conserving water resources
- Managing water’s interconnections

Toward Efficient Allocation and Management: A Strategy to Preserve and Protect Water and Related Land Resources

In June 1979, the Minnesota Water Planning Board, which was merged with the EQB in 1983, published “*Toward Efficient Allocation and Management: A Strategy to Preserve and Protect Water and Related Land Resources*” with funding from the Legislative Commission on Minnesota’s Resources. This report was prepared by the Water Planning Board, created by the Legislature for that purpose in 1977, in response to the drought of 1976. It called for four requirements to be met if Minnesota were to achieve its potential. These are:

- A stronger focus on effective management – a cornerstone of Minnesota policy in the past, but even more important in the future.
- Greater emphasis on the efficient allocation and use of water resources and rejection of the concept of water as a limitless, free good.
- Improved collection and dissemination of information for use in making critical water and related land resources decisions.
- Planning, research, and decision-making that deal with the interdependence of issues and places increased emphasis on the state as a unit.

Lessons Learned

Review of these historical documents confirms that Minnesotans have long known the challenges faced in protecting human and ecosystem health from the potential threats caused by Minnesotans' use of land and water. Many efforts have been employed that have led to significant progress and adoption of sound management practices. As an example, according to a recent report released by the Natural Resources Conservation Service, between 1982 and 2007 soil erosion on U.S. cropland decreased 43% with increased implementation of conservation practices. While a very laudable accomplishment, more work and new threats remain.

Looking back, many of the goals and objectives remain the same. What has changed over the last 10 years is:

- Increasing pressures on finite resources;
- Increasing level of complexity of the issues (and the trend of increasing complexity is expected to continue) through increased understandings of dynamic systems and increasing threats to them ;
- Increasing attention paid to these issues, especially impaired waters, emerging threats, and climate change;
- Improving strategies the water agencies are employing to address the goals and objectives
- Decreasing capacity of local government, upon which state agencies rely for implementing non-regulatory and land-use related management activities; and
- Increasing resources available to do this work through the Clean Water Fund, and more recently the Clean Water Land and Legacy Fund.

Transformational Milestones

Transformational milestones are events or issues that have had a significant impact on water resource management. In some cases they are events that have raised public awareness of a topic. In other cases they are problems of such concern that they have changed how programs are run. Regardless, transformational milestones help define the course the state is undertaking in the present.

The way in which water resources are viewed has evolved over time. Increased visibility of the need to protect and restore resources has arisen from attention given to issues such as climate change and hypoxia in the Gulf of Mexico. These issues, along with other events and milestones, have impacted the work of state agencies and help characterize the challenges and needs faced today.

Population Growth

The state's population has increased by almost half a million people since the last state water plan was published. That increases the pressure on finite resources. This trend is being seen across the United States, with few easy answers to address the dilemma.

Ecosystem Fragmentation

Continued development on the landscape has resulted in the fragmentation of ecosystems. This fragmentation adversely affects biology, water quality, hydrology and connectivity, and thus degrades the ecological functions that provide healthy watersheds.

Climate Change

Climate change is a recognized threat, with the potential for far-reaching impacts on land, water and habitat. Increased modeling and

Ten years ago few Minnesotans talked about impaired waters and even fewer used the TMDL acronym. But today thousands of Minnesotans have been engaged in Total Maximum Daily Load efforts and agencies have adapted their programs to new monitoring and priority efforts. No one has a crystal ball to predict what will transpire in the coming years, which is why state agencies must be ready to respond with adaptive management techniques and coordinated efforts. Looking back over the last decade the following issues and events have driven programmatic change:

-
- *Population growth and increased competition for resources*

 - *Ecosystem fragmentation*

 - *Climate change*

 - *Hypoxia in the Gulf of Mexico*

 - *Contaminants of emerging concern, including endocrine active compounds*

 - *Impaired waters and TMDLs*

 - *2006 Clean Water Legacy Act and the 2008 Clean Water Land and Legacy Amendment*

 - *Sustainability as a goal*

Looking forward there will be unforeseeable challenges, but a system can be developed to guide a strategic response. Working together, the citizens, local governments, agencies and Legislature can move successfully toward a goal of sustainability.

characterization of future scenarios has raised its visibility, while fostering development of interagency teams with federal, state, local, industry and academic members. There are inherent complexities in measuring climate changes and forecasting what the future brings, consequently response mechanisms are challenging to develop and must be easily adaptable.

Hypoxia

The media efforts surrounding the presence and challenge of hypoxia in the Gulf of Mexico have brought the focus to land use practices in the upper Mississippi River Valley. Minnesota and its Midwest neighbors recognize that farming practices, while important for feeding people and supporting our economy, not only impact water quality within the state's borders but are also transporting nitrogen downstream and that we need to continue to enhance our conservation practices.

Contaminants of Emerging Concern

The MPCA, MDA and MDH are working on efforts to characterize and respond to contaminants of emerging concern (CEC), including endocrine active compounds, pharmaceuticals and personal care products. The state has been active in assembling information about the presence, extent and potential impact of these chemicals.

Impaired Waters and TMDLs

Since the drafting of the last state water plan, thousands of Minnesotans have been engaged in Total Maximum Daily load efforts, focused on evaluating if waters are meeting their water quality and designated use standards. This process has increased understanding of the status of the state's water resources, while also helping the public to better appreciate the connection of land activities on water quality.

Clean Water Legacy Act and Legacy Amendment

Minnesota has committed important resources to tackle these challenges. Through the 2006 Clean Water Legacy Act, the 2008 Legacy Amendment and the subsequent funding for water resources, programs have been supported to increase our monitoring and management efforts and to promote enhanced understanding of the dynamic land and water system, and to implement restoration and protection activities.

Sustainability as a Goal

While water quality has garnered attention for decades, discussions of the sustainability of water resources has increased in recent years. A commonly defined goal of achieving sustainability has led to continued coordination among programs and an acceptance that "...water use is sustainable when the use does not harm ecosystems, degrade water quality, or compromise the ability of future generations to meet their own needs." (Minnesota Session Law 2009 c172) A recognized goal is better understanding of the flow through surface and groundwater so that allocations of water may be made without adverse impacts to human or ecosystem health.

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Through improved technology, data transfer programs, and online support tools, the knowledge base of local government and other support systems has increased. However, while information sharing has improved, local partners have struggled to combat decreased fiscal resources, limiting their ability to implement local protection and restoration efforts.

Early efforts based on the 1972 Clean Water Act were primarily focused on point sources. Since that time programs have addressed most point sources, successfully improving the environment. However, that means that nonpoint sources of pollution present the greatest challenges today, and effective responses will depend on the use of multiple tools, new technologies and enhanced education efforts.

Looking back, it is possible to see transformational milestones that have helped to define priorities and needs. There have been significant accomplishments, laudable advances and new challenges. Working together, citizens, agencies and the Legislature can create an improved future, where sustainability of waters and ecosystems is the common goal.

Chapter 3 Evaluating the Status of our Resources in the Present

Monitoring Dynamic Systems

State agencies conduct a number of water monitoring activities to assess quality and quantity, have regulatory and technical and financial assistance programs to aid in compliance with regulation of water resources, and coordinate activities to avoid overlap of agency responsibilities and maximize efficiency. Minnesota's landscape, weather patterns, and land and water use are continually changing, making assessments of progress in water resource management efforts challenging, but ever more important. When looking at trends in water, it may be that significant improvements in management of water quality and quantity in one part of a watershed may be offset by negative changes in another. It is important to consider changes in land and water use and demography to provide a context for monitoring and assessment of changes in water quality.

Understanding the Context of Trends

As an example, water quality monitoring of a particular stream location may indicate that the stream is impaired for its stream type, and quality has not improved significantly over the past 20 years. That might be either encouraging or discouraging, depending on what is happening upstream. If there has been a large increase in construction and impervious surfaces upstream (e.g. from home construction) but no decrease in water quality, then it may be that improvements in storm water management practices on individual sites have resulted in no net increase in impact to the water body, despite a significant potential for damage compared to historical storm water management practices.

Similarly, there may have been significant improvements in protecting groundwater within a wellhead protection area but because of the slow rate of travel, it may take years or decades before the effects of those improvements can be detected at groundwater monitoring sites. Additionally, in recent years analytical capabilities and methods have dramatically increased the ability to detect new potential contaminants in the environment. At the same time, public and stakeholder interest in previously unidentified contaminants, as well as other threats to water resources such as from invasive species and climate change, have increased the complexity of water management in Minnesota.

The key goal for management of water resources is to have enough water of the quality desired for the intended use, at the location where it is needed now and for future generations. That is, while it may not be possible or practical to protect or restore all waters of the state to the highest levels of quality (e.g. pre-settlement conditions), the state needs to be strategic in its water protection and restoration efforts to help ensure that ground and surface waters of the quality and quantity desired are available and that standards are met. Therefore, trend information is critical to defining the strategy required to address threats to water resources and to ensure effective policies and plans will direct activities that protect and restore water quality and quantity.

Context for Reporting

The Environmental Quality Board is charged in statute for consolidating the water quality, quantity and planning assessments detailed in M.S. 103A.43, 103H.175 and 473.1565. This section of the *Minnesota Water Plan* summarizes four agency reports (found in Appendices A through D) to provide current status information on surface and ground water quality, quantity and metropolitan planning activities. This context is important for understanding the relationships of land use to water quality and quantity, and most importantly, the relationship of human health to water resource and ecological health. This section of the Minnesota Water Plan has three parts:

- Status of Minnesota’s Water Quality
- Status of Minnesota’s Water Quantity
- Status of Metropolitan Area Water Supply Planning

103A.43 WATER ASSESSMENTS AND REPORTS

The Environmental Quality Board is charged in statute for consolidating the water quality, quantity and planning assessments detailed in M.S. 103A.43, 103H.175 and 473.1565.

Status of Minnesota’s Water Quality

Minnesota employs a multi-agency approach to monitoring surface and groundwater that requires a wide range of technical expertise to evaluate and assess resources. It takes the concerted effort of all the state agencies, along with local and federal partners as well as citizens, to build a comprehensive picture of the status of the state’s water quality. Two agency reports on the status of Minnesota’s water quality will be summarized in this section.

Biennial Assessment of Water Quality Degradation Trends and Prevention Efforts

Minnesota Statutes 103A.43 instructs MPCA and MDA to conduct a biennial assessment of water quality trends (which is found in Appendix A). Assessing water quality trends in both surface and groundwater is very timely as the information regarding status and trends aids in setting data collection, research and implementation priorities. Additionally, with recent communication efforts related to impaired waters, as well as threats to drinking water, it is a topic of great interest to state agencies, the Legislature and the citizens of Minnesota.

103A.43 WATER ASSESSMENTS AND REPORTS

(b) The Pollution Control Agency and the Department of Agriculture shall provide a biennial assessment and analysis of water quality, groundwater degradation trends, and efforts to reduce, prevent, minimize, and eliminate degradation of water. The assessment and analysis must include an analysis of relevant monitoring data.

Report Overview - Biennial Assessment of Water Quality Degradation Trends and Prevention Efforts

This MPCA and MDA biennial assessment provides an overview of relevant monitoring data and efforts to reduce, prevent, minimize and eliminate sources of water pollution to Minnesota's ground and surface water resources. This document draws from existing reports and information to highlight current water quality conditions and program activities.

This report summarizes relevant water quality monitoring data for both ground and surface water in Minnesota from the MPCA and MDA. The report also consolidates information from a number of individual reports, documents and databases on the status and trends of the state's water quality resources. Because of the large amount of information available on this subject this report is summary in nature and directs the reader to additional information provided through web-based links.

Information on groundwater quality is presented first, highlighting nitrates, pesticides, volatile organic compounds, chlorides and contaminants of emerging concern. The groundwater information is followed by descriptions of the efforts to prevent and eliminate groundwater degradation through program activities conducted by the two agencies.

Surface water quality information is presented next by water resources (i.e. lakes, streams and wetlands) and emphasizes the status and trends of Minnesota's surface water quality. Lake transparency data, pesticide detections, trends in water quality indicator parameters, and impaired waters listings are presented to highlight Minnesota's surface water quality conditions. As with groundwater, efforts to reduce and minimize surface water degradation include multiple program activities conducted by the MPCA and MDA.

Conclusions and Recommendations - Biennial Assessment of Water Quality Degradation Trends and Prevention Efforts

The MPCA and MDA collect water quality information in response to both broad and specific statutory mandates to explore water quality issues of current and emerging concern, and in accordance with formal interagency agreements, and through continuous cooperation and coordination.

Significant progress has been made by MPCA, MDA and stakeholders in addressing sources of groundwater contamination, particularly through remediation, permitting and BMP activities. However, concerns still exist, and continued effort is needed to fully realize the state's groundwater quality goals.

Improvements in the state surface water quality have also been significant, along with voluntary and regulatory reduction of point and nonpoint sources of pollution through MDA and MPCA programs and stakeholder support. Coupled with these gains are opportunities for continued improvements, and additional actions are needed to realize Minnesota's surface water quality goals.

For both ground and surface water resources, ongoing monitoring is required to characterize vulnerable aquifers and landscape settings. Additionally, MDA and MPCA must continue to identify and investigate contaminant problems, including the presence and extent of emerging contaminants. Ongoing monitoring provides the trend data that is critical to evaluating progress and refining management

actions. Protection strategies, whether regulatory or voluntary, must be developed to avoid the occurrence of new problems, and all strategies should be periodically re-evaluated and refined in order to adapt to changing situations in chemical and land use.

2010 Groundwater Monitoring Status Report

The 1989 Groundwater Protection Act (*Minnesota Statutes* 103H.175) requires the Minnesota Pollution Control Agency, in cooperation with other agencies participating in the monitoring of water resources, to provide a draft report on the status of groundwater monitoring to the Environmental Quality Board for review in each even-numbered year. The *2010 Groundwater Monitoring Status Report* (located in Appendix B) was written in response to this charge.

103H.175 GROUNDWATER QUALITY MONITORING

In each even-numbered year, the Pollution Control Agency, in cooperation with other agencies participating in the monitoring of water resources, shall provide a draft report on the status of groundwater monitoring 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 as part of the report in section 103A.204.

Report Overview - 2010 Groundwater Monitoring Status Report

The Appendix B report details groundwater monitoring efforts at three scales: national, statewide and regional. Monitoring of both quality and quantity is done by the USGS, MPCA, MDA, DNR, Metropolitan Council, and includes work done by consultants and through the citizen monitoring network. This multi-level team approach provides for a more comprehensive assessment of the resources.

At the state agency level, the MPCA, MDA and MDH each have important statutory responsibilities in protecting the quality of Minnesota's groundwater. The MPCA and MDA conduct statewide ambient groundwater quality monitoring. The MDH conducts groundwater monitoring for the purpose of regulating public and private water supply wells and to evaluate the risk of contaminants in groundwater to human health. In addition to these agencies, the DNR monitors groundwater quantity conditions across the state through a network of groundwater monitoring wells. The groundwater monitoring roles, as laid out in state statute, conducted by these agencies are shown in the Figure X below.

Groundwater – State Agency Roles

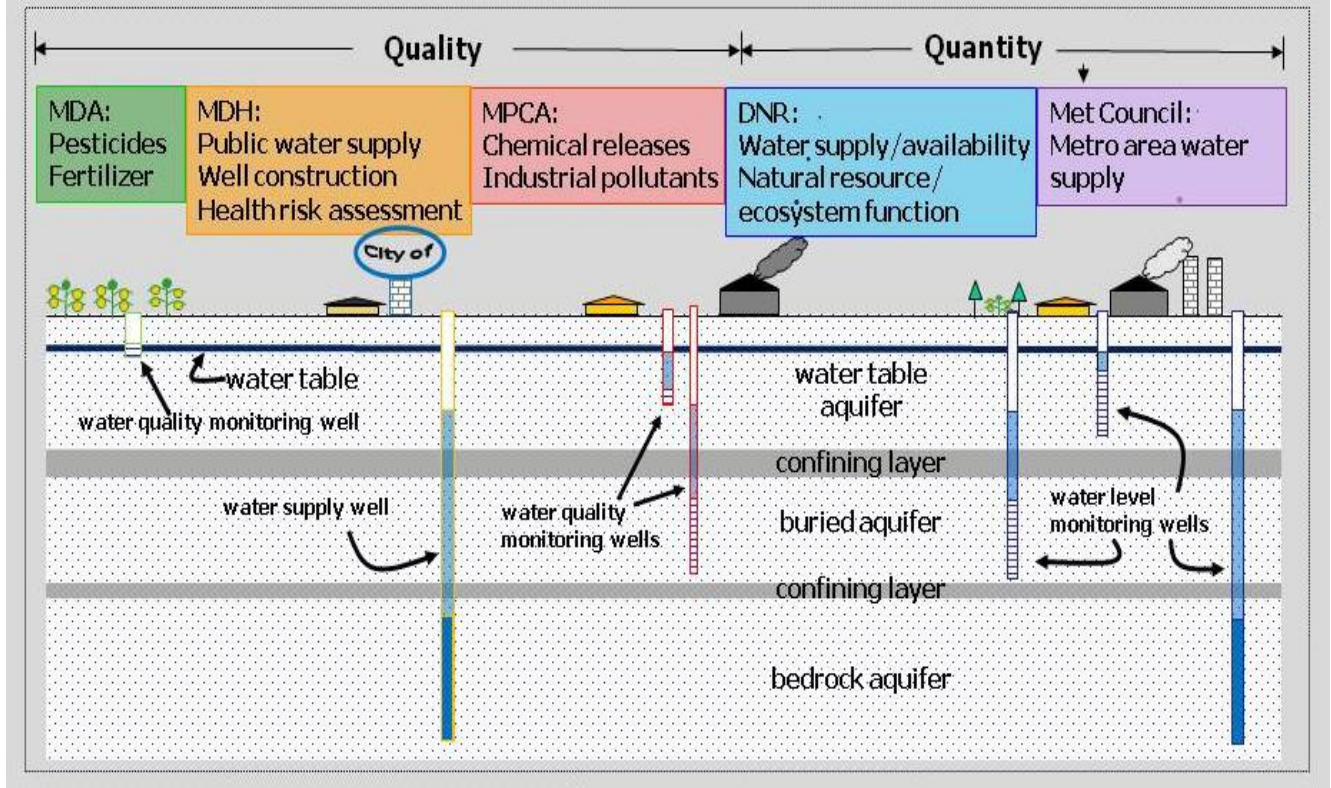


Figure X. Coordinating roles in water management.

Conclusions and Recommendations - 2010 Groundwater Monitoring Status Report

To date, groundwater monitoring efforts in Minnesota have identified that groundwater quality generally is good and in compliance with drinking water standards. However, human-caused impacts to groundwater quality are apparent in many areas of the state. Those areas of impacted groundwater correlate with land use practices known to cause the observed quality impacts. Groundwater monitoring continues to verify the presence of elevated concentrations of nitrates, low concentrations of pesticides and their degradation by-products, and chlorides in more sensitive aquifers within the state. The more recent detections of CECs and perfluorochemicals (PFCs) in groundwater require additional monitoring efforts to evaluate the extent of their presence.

The need for monitoring groundwater quality and quantity continues. A long term commitment to the collection and analysis of groundwater data is necessary to identify changes in water quality and quantity over time and provide information needed to effectively manage and protect this critical

resource. Groundwater movement is generally slow and often requires years of monitoring to assess the trends and impacts of human activities on this resource.

Long term monitoring networks coupled with adequate systems by which to share groundwater data are necessary to determine if the quality and quantity of Minnesota's groundwater resources are at risk and inform management decisions. Continued investments are needed to understand and protect groundwater systems so future generations also will have an abundant source of clean water.

Status of Minnesota's Water Quantity

2010 Water Availability Assessment Report

In *Minnesota Statutes* 103A.43 DNR is instructed to conduct an assessment of water use and availability on a five year basis, with those reports done on even years being compiled in the decadal state water plan (found in Appendix C). The goal of this charge is to provide a status update on the availability of Minnesota's water resources, as well as trends in appropriations and water resources. The last report addressing this law was done in 2007 as a joint effort of the EQB and DNR, building on a 2000 DNR report, *Minnesota's Water Supply: Natural Conditions and Human Impacts*. Recently the DNR prepared an additional report, *Long-term Protection of the State's Surface and Groundwater Resources*, to define options and funding as they relate to programs needed to provide adequate protection of the state's water resources.

The *2010 Water Availability Assessment Report* was prepared in response to the M.S. 103A.43 charge. The report discussed that the availability of water to meet the state's needs is determined by three basic factors; climate and global weather patterns, human changes to flow pathways and to water use, and human changes to water quality . Of those three, climate and

global weather patterns are challenging to directly manage, but people have great ability to affect water quality and water pathways. In order to address the long-term sustainability and availability of water and natural resources, the DNR must engage in long-term thinking and planning efforts. In this report, the agency details trend information related to precipitation, stream flows, lake levels, groundwater levels and water use.

103A.43 WATER ASSESSMENTS AND REPORTS

(c) The Department of Natural Resources shall provide an assessment and analysis of the quantity of surface and ground water in the state and the availability of water to meet the state's needs.

Report Overview - 2010 Water Availability Assessment Report

The Department of Natural Resources is charged with overseeing the state's Water Appropriation Permit Program, so that water quantity is managed wisely to protect the long-term viability of the water resource for people and the environment. *Minnesota Statutes* 103G.265 requires the DNR to manage water resources to ensure an adequate supply to meet long-range seasonal requirements for domestic, agricultural, fish and wildlife, recreational, power, navigation, and quality control purposes.

Minnesota's climate provides an ample supply of water. A relatively good network exists for understanding precipitation patterns, lake levels, and stream flow that enable management of surface water systems. However, far less is known about the groundwater system. Since 75% of Minnesotans depend on groundwater systems, and dependence is increasing, aquifer systems will need to be better defined in the future. Additionally, we will need to have a better understanding of the surface and groundwater relationships to the health of our ecosystems.

Conclusions and Recommendations - 2010 Water Availability Assessment Report

This report concluded an increasing number of places in Minnesota are experiencing water supply problems related to inadequate supplies, unacceptable quality or both. Water availability problems are more evident in places where:

- Water is being consumed faster than it can be replenished;
- Land use choices that are made without proper planning and protective practices are degrading water supplies; and
- The natural landscape has been changed so greatly that the ecosystems that remain are no longer able provide its essential cleansing and recharge functions.

Waters that become impaired by contaminants are still available for use, however the cost of removing contaminants may be so expensive that they become undesirable and not considered as available.

Well-managed industry, agriculture, housing, manufacturing, power generation, and public water supply systems are all necessary elements to nurture and sustain communities. To maintain all the natural resource features that contribute to Minnesota's attractive quality of life, including fish and wildlife habitat and recreational opportunities, each growth and development decision needs to include consideration of its effect on the water supply and associated water resources. Careful consideration of the effect each use may have on the available water supply is essential for the sustainability of the water supply and the water supply's ability to be recharged for future growth, development, and enjoyment. In order to ensure the future of our water supply, thoughtful water supply management, including conservation, restoration, study, and protection must be practiced. Only in this manner will Minnesotans continue to wisely control their water resource destiny.

Past management systems were designed around managing the consequences of an individual project to prevent it from adversely impacting the natural system. While largely successful in this endeavor, the challenge for all levels of government in Minnesota will be adapting to understand and manage the impacts from the collective actions of all land use and water supply management decisions on the public, economic and environmental health.

The report states that to begin to eliminate current problems and avoid future water availability problems we must improve our understanding and the quality of management decisions in the following areas:

- We need to significantly increase our understanding of how water moves into, through and out of the earth beneath us.
- We will need to learn how to reduce our withdrawal of water to not exceed the rate of recharge nor adversely impact local resources. As we pump groundwater of the aquifer system, withdrawals have the potential to reach a point after which they will not be sustainable and competition and conflicts will ensue.
- We will need to manage land uses to ensure that water recharge to our groundwater systems has had sufficient time or treatment to remove contaminants before entering subsurface flow pathways.
- And finally, we will need to learn more about how our surface waters are dependent on groundwater systems for supply throughout the year so we can prevent undesirable impacts in lakes and wetlands, rivers and streams, and in natural and rare plant communities that all provide important functions toward the quality of life we have enjoyed in Minnesota.

The report concludes the greatest threat to having sufficient water to assure our many and varied needs comes from how we have manipulated the landscape without due consideration of its impacts on our water quantity, water quality and the ecosystem. The ecosystem functions of natural plant communities that slow water down and remove nutrients and other compounds can reduce the problems we create, if we better plan for and make landscape management choices that retain these essential functions. Looking forward, we must become much wiser about how we are managing the lands and waters of Minnesota if we hope to have the desired availability and quality of water to provide the quality of life we desire.

Status of Metropolitan Water Supply Planning

Metropolitan Area Water Supply Planning: Report to the Legislature as part of the 2010 Minnesota State Water Plan

In *Minnesota Statutes* 473.1565 the Metropolitan Council is directed to submit findings, recommendations and planning activities to the EQB for inclusion in the *2010 State Water Plan*. This report, *Metropolitan Area Water Supply Planning*, is included in Appendix D.

The Metropolitan Council is responsible for carrying out planning activities to address the water supply needs of the metropolitan area, including development of a *Twin Cities Metropolitan Area Master Water Supply Plan*. This plan was developed in cooperation with the Metropolitan Area Water Supply Advisory committee, DNR and additional

473.1565 METROPOLITAN AREA WATER SUPPLY PLANNING ACTIVITIES

The council must submit reports to the legislature regarding its findings, recommendations, and continuing planning activities under subdivision 1. These reports shall be included in the "Minnesota Water Plan" required in section 103B.151, and five-year interim reports may be provided as necessary.

stakeholders to provide guidance, emphasize conservation, promote interjurisdictional cooperation, and inform long-term sustainability with consideration for reliability, security and cost effectiveness.

Report Overview - Metropolitan Area Water Supply Planning

The plan for the seven-county area, approved in March 2010, summarizes five years of community outreach, data collection, and technical analysis. The framework in the plan guides long-term water supply planning at the local and regional level. The plan uses an adaptive approach to water supply management, setting forth a dynamic process for the collection of new information, update of analytical tools, and improvement of guidance to address anticipated water resource issues and ensure supplies are developed sustainably.

The Council's planning activities were organized into two phases. During the first phase, culminating in a report to the 2007 Minnesota Legislature, the Council conducted a preliminary evaluation of water supply availability, examined the water supply decision-making and approval process, and explored the need for a regional role in water supply safety, security and reliability. The second phase of work refined the water resource availability assessment and culminated in the *Metropolitan Area Master Water Supply Plan*. Phase II analyses focused on the following stakeholder-identified issues that have limited water supply availability in the past and may occur in the future:

- Impact to surface water features;
- Significant aquifer drawdown;
- Well interference;
- Impact to trout streams or calcareous fens;
- Aquifer vulnerability; and,
- Presence of special well construction areas.

The analysis conducted as part of the planning effort to date indicates that, overall, the region's water resources are adequate to meet projected demands for the foreseeable future. However, local issues are predicted to continue to arise if traditional sources are developed to meet those demands. The issues include impacts to surface waters, unacceptable groundwater declines, and the potential for interference with private wells.

Definitions

Traditional groundwater sources are sources that are currently used by each community

Alternative water sources include other aquifers, surface waters and neighboring water supply systems

Conclusions and Recommendations - Metropolitan Area Water Supply Planning

The Master Plan provides a framework for long-term water supply development at the local and regional level that does not harm ecosystems, degrade water quality, or compromise the ability of future generations to meet their own needs. The plan recognizes the benefits of identifying, early in the process, issues that communities need to address.

The plan presents results of the metropolitan area water supply availability assessment at both a regional and community scale. The region-wide water supply assessment highlights potential problem

areas, so that they can be considered in the development of region-wide plans. The plan also provides enough detail on the potential local problems that water suppliers will know what needs to be addressed as part of development. This scale variability is intended to identify and coordinate water supply planning activities among utilities, local, regional and state planners and resource managers and reduce the likelihood that water supply problems will develop “under the radar”.

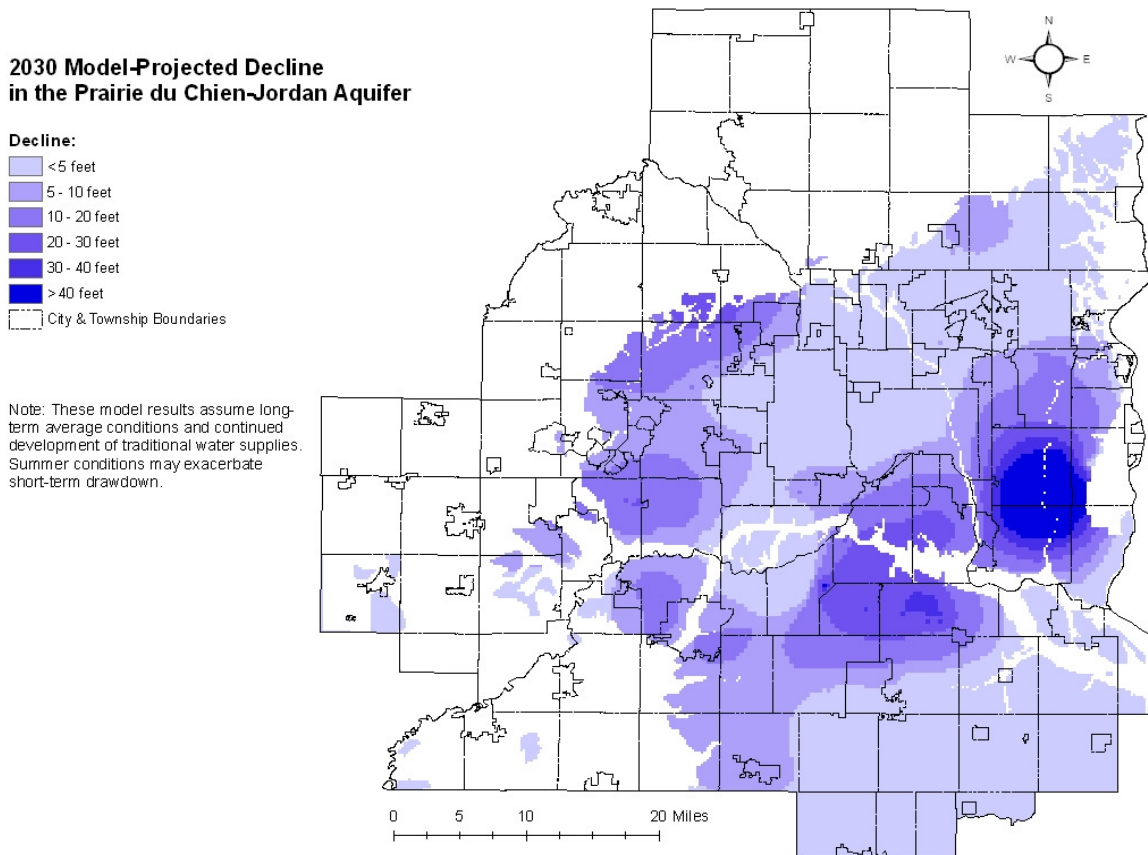


Figure X: The analysis shows potential groundwater level drawdown primarily in outer-ring suburbs that rely primarily on groundwater. Should these communities continue to use their traditional groundwater sources, aquifer water levels are expected to decline significantly in some areas. Use of alternative water sources may neutralize predicted impacts.

The plan presents local information in community-specific water supply profiles, one for each community in the region. The profiles provide information about each community’s current and projected water demand, current potential supply sources, and issues identified through the technical analysis. In addition, the plan provides guidance for communities to address the issues identified on their profiles. With the information supplied on the profiles, communities will know what potential water supply issues and range of appropriate solutions they face before investing significant time and money in infrastructure planning.

The 2010 master water supply plan expands upon recommendations identified in the 2007 legislative report, particularly those that support an adaptive management framework. The master water supply plan stresses ongoing data collection, analysis, and update of tools for water supply decisions. As the regional planning process continues, these tools will support the development and implementation of long-term sustainable water system decisions. Lessons learned through this process are expected to result in future recommendations to ensure that water supplies are developed sustainably.

DRAFT

Chapter 4 Charting a Roadmap for the Future – Implementation Principles and Strategies

In preparation of this *2010 Minnesota Water Plan*, the EQB convened an interagency team to prepare strategic directions to guide the water-related functions of the agencies over the next 10 years and beyond. While the next state water plan is to be drafted in 2020, the vision of these directions is long-term, extending well beyond 2020.

Planning, reporting and stakeholder involvement activities regarding Minnesota’s water resources management needs and challenges contributed to the foundation of this plan. In the last five years alone, agency staffs have been engaged in coordination and planning efforts that have called on the expertise of hundreds of state professionals and thousands of engaged citizens. The results of these efforts, including the needs expressed and ideas for an improved future contributed to the development of this plan.

The Legislature has charged a number of agencies with managing and protecting the state’s water resources. The agencies take this charge seriously and are committed to continuously adapting programs and direction to manage water for sustainability. However, these programmatic changes take time and often benefits are complex and thus should be thoughtfully communicated to the public, so the pace and presence of change is not easily seen. Additionally, land and water interactions are highly complex and dynamic systems, with the result that land and water improvement efforts often take years to demonstrate change, or change

may be masked by other environmental conditions. Looking forward, the EQB and its member agencies recognize the need to continue to improve coordination of efforts, adapt programs to new information, and communicate these initiatives and successes to the public. In the coming section nine **strategies guiding the work of the agencies** are outlined. As these **strategies** were developed, certain overarching **principles** were recognized that cut across boundaries and are critical to each strategy. **These principles define how the work of the strategies will be implemented.** The implementation principles are discussed first, followed by a presentation of the strategies.

Principles to Guide Implementation

The strategic directions frame the work that will be taking place while these **principles guide their implementation** and will be presented in the section immediately after the strategies:

- Optimized coordination
- Shared, long-term vision
- Comprehensive land and water management
- Adaptive management
- Goals and measures
- Education and outreach
- Prioritize resources

Implementation Principle #1 – Optimized Coordination

Coordination of efforts must be optimized across local, state and federal entities to maximize the benefits of our combined actions.

Looking forward, there is recognition that natural resource challenges are great, the implications of decision-making are significant, and the resources to address the challenges are finite. There has been a clear call for improved coordination, and a responding increased effort among state agencies, which is now expanding to include local government, the research community, federal entities and other parties.

The majority of day-to-day coordination efforts lack visibility because they are routine, but nonetheless critical to successful water management. This coordination must continue to be promoted and expanded. When coordination is administered well it leads to improved efficiencies and program adaptation. It is also important that information about coordination be communicated to the public and Legislature.

Implementation Principle #2 – Shared, Long-Term Vision

Application of the Minnesota Water Plan vision to achieve sustainable water management can unite people into cooperative action, inspiring them to work together for a common future.

The 2010 Minnesota Water Plan defines a shared vision of strategies to bring the state toward long-term water sustainability. In this document we have defined a long-term vision in which water is managed comprehensively for quantity and quality, for healthy ecosystems and citizens, and in a way that doesn't jeopardize the resources of future generations. For success, it will be important that we apply this shared vision and remember that water sustainability is our common goal, and that sustained adaptive long-term action is required to achieve this goal.

Minnesota Water Plan Defines Vision

The 2010 state water plan details a shared, long-term vision – one in which water is managed comprehensively for quantity and quality, for healthy ecosystems and citizens, and in a way that doesn't jeopardize the resources of future generations.

Implementation Principle #3 – Comprehensive Land and Water Management

Sustainable water resources can be achieved when land and water are managed as a holistic system.

Land and water must be viewed and managed holistically using a systems approach that recognizes the complex interconnections at play. A rain drop that begins as surface water may soon find itself in the groundwater, only to later be discharged back to the surface water system. Comprehensive water management recognizes this, and the way in which quantity and quality are intricately linked.

If water is not of sufficient quality for its defined use, it will not be available in the quantity needed without treatment. And both the quality and quantity are directly connected to land management practices and land use changes, including those that result in water consumption. The vegetative habitat affects the water quantity and quality in ways that directly impact the biology of the stream, all of which are indicators of ecosystem health. A degraded ecosystem can often be used as an indicator of a system whose water or fish may also be harmful for human consumption. A healthy aquatic system often indicates a system that is adequate for sustaining human health. Looking to the future, no single part of the system can effectively be managed alone, but must be evaluated and managed as a system with consideration of all the respective interactions.

Implementation Principle #4 – Adaptive Management

Adaptive management must be employed to support informed decision-making while supporting the collection of information to improve future management.

Adaptive management, also known as adaptive resource management, is a structured, iterative process of optimal decision making in the face of changing demands, environmental conditions and uncertainty, with a goal of addressing change and reducing uncertainty over time by adequately monitoring the system and its response. In this way, decision making simultaneously optimizes resource objectives and generates information needed to improve future management. Adaptive management is often characterized as "learning by doing."

Minimizing Risk through Application of Adaptive Management

Managing water resources for the goal of water sustainability requires decision-making in the face of uncertainty. Waiting for the collection of more information is a decision in itself, with risk associated in waiting to act.

Some or all of the principles of adaptive management have been used to some degree in water resources management in the state for decades. Conversely, some programs and management strategies have not adequately responded to the need for change in the face of improved understanding, while others have not been developed to collect sufficient information to assess effectiveness. Agencies involved with water management are more robustly integrating adaptive management into their respective programs and will

continue to employ this approach moving forward. State programs need to be transparent about what has worked, what hasn't, and how the modified response will address what has been learned.

Water resources need to be managed to meet a growing number of competing needs, at multiple scales, and over the long-term and in many situations where high levels of uncertainty exist. A foundational premise of adaptive management is that knowledge of water resources, and the services that they provide, is not only incomplete but elusive. However, these resources are and need to continue to be used, even in the face of uncertainty. Decision-making must take place using the best available information at the time. Adaptive management allows future decisions to improve based on new data.

The ability to act must be supported by the ability to react, quickly and with the best resources currently available, when information indicates uses are unsustainable.

Restoring water quality, hydrology and ecosystems that have been degraded by significant human alteration of natural systems over decades will be challenging, and progress may also take decades. In order to implement effective programs that will result in environmental improvements it must be recognized that some trial and error is necessary. There also must be recognition that the complexity of natural systems which are being managed is so great that despite significant scientific work and understanding, even in the most well studied systems, uncertainty will persist. However, with an appropriately designed monitoring and evaluation process, the management decisions can be periodically refined to improve effectiveness and ultimately reach management goals.

One tenet of the Great Lakes Compact (*Minnesota Statutes 103G.801*) is “to promote an adaptive management approach to the conservation and management of basin water resources, which recognizes, considers and provides adjustments for the uncertainties in, and evolution of, scientific knowledge concerning the basin's waters and water dependent natural resources”. This demonstrates the commitment of the state to utilize an adaptive management approach in water resource management.

Implementation Principle #5 – Goals and Measures

To determine if water management strategies are achieving their desired outcomes, a system must be in place to define targets and measure progress.

In recent years state agencies have begun explicitly defining targets and measures, and tracking them to gauge performance. It is critical that these measures be developed specifically for the outcomes sought. In some cases these may be water resource improvement trends, but in others they may be indicators of social change or measures of adoption of BMPs or urban conservation practices.

TMDL Implementation Plans are written to include specific targets and defined measures, such as number of conservation practices adopted, pollution reduction schedules (e.g. a 25% reduction in phosphorus loading by the year 2020), and water quality improvement trends.

Passage of the Clean Water, Land and Legacy Constitutional Amendment in 2008 sent a clear message to the Legislature and Executive branch that citizens of Minnesota strongly value natural resources, habitat, trails and parks. However, the 25 year commitment means that progress must be achieved and that resources must be distributed wisely.

Tracking measures of effectiveness demonstrates that we are improving our environment, gathering information that can support the adaptive management principle, and communicating progress to the people of Minnesota. An interagency team is working to develop measures specific to the Amendment resources, recommending long-term measures and targets to track:

- Agency performance measures, including activities and outputs;
- Financial measures, such as local efforts and leveraged funding;
- Environmental measures related to water resource trends; and
- Social measures, such as adopting new homeowner practices.

None of these efforts are easy to track, and both environmental and social changes are particularly hard to measure because they take time to mature and cause-effect relationships are hard to disentangle. Regardless, the end goal is wise use of resources and progress toward a sustainable environment.

Implementation Principle #6 – Education and Outreach

Effective water resource management efforts must bring together both science and outreach

The state agencies recognize that the desired actions to protect water resources must take place on the landscape, which often results from the actions of individual landowners, communities, local government and business community. However, these landowners and decision-makers depend on the state to provide guidance and direction based on the best available science and data. Thus, while strong water management needs good data and a sound understanding of system dynamics, there must also be a commitment to engage with landowners, stakeholders and local government.

Environmental education takes place in many different ways. Mechanisms include the traditional K-12 education, but also include community programs, summer camps, environmental organizations, community education efforts, and many others. Complimentary to the work of state agencies to communicate with their customer bases; to engage in active stakeholder efforts; to communicate through newsletters, publications and mailings; and to work with traditional educators in development of their curriculum. These efforts need to continue and to grow in the future to effect positive actions and change on the landscape. Mutually beneficial partnerships will need to be fostered so education by nongovernmental groups can compliment agency outreach and stakeholder efforts.

Implementation Principle #7 - Prioritize resources

Resources must be prioritized to most effectively target needs and maximize opportunities.

Agencies recognize a need to effectively prioritize their resources to maximize the effectiveness of their efforts by directing them to areas where the need is greatest, and the impact is expected to produce the most beneficial results. Examples include:

- Monitoring – to gather data where the need is greatest, or in ways that are better coordinated with related efforts
- Protection – to target protection measures with consideration for factors such as where the threat is most imminent, or the land and water resource is considered of highest value

- Restoration – to apply restoration in concert with other activities based on consideration of the value of the resource, the potential impact of the proposed restoration, and the engagement of the local stakeholders, along with other site specific factors
- Research– to define the questions that are most in need of answers
- Problem identification – to identify the most critical water resource problems and target actions and/or resources to address them
- Stakeholder engagement – to target stakeholder engagement in concert with monitoring, protection or restoration activities
- Outreach– to target outreach efforts in a timely manner and where they are most needed (e.g. in advance of future resource management activities so that those activities will be done by engaged and informed citizens, industry and local government)

In a time when decisions often need to be made in light of incomplete data, it is critical that agencies at all levels of government prioritize their activities and dedicate their staff and resources to areas that have the greatest need and can provide the greatest benefit.

Summary of the Implementation Principles

The seven implementation principles describe above are broad, overarching principles relevant to each of the strategies in this plan. The principles describe how the work of the agencies in carrying out the strategies should take place. In this next section, the nine strategies of the state water plan articulate critical activities that the state agencies have set out to accomplish in the coming ten years, and beyond.

Strategy #1 – Increase Protection Efforts

Goal –Ground and surface water supplies are protected from depletion and degradation, recognizing that protection is often more feasible and cost effective than restoration

Minnesota has relatively abundant surface and groundwater supplies, which are vital to human health, quality of life and economic stability. The significant value of water requires that Minnesotans protect their resources and prevent its degradation and depletion.

Value of Groundwater

It is important to have healthy and robust groundwater systems. Though the citizens of the state have a hard time visualizing groundwater or understand its complexity, they rely on services it provides every day. Three-quarters of Minnesotans rely on groundwater as their drinking water source. Groundwater also is a source of water to the majority of the state’s surface water systems, supporting sensitive ecosystems and recreational economies throughout the state. Healthy ecosystem functions help maintain the health of surface and groundwater supplies. Due to slow travel

times within most aquifers, the consequences of unwise actions taken today can be challenging to detect as they occur, and may take years to be measured by groundwater monitoring efforts. If contamination is introduced, it cannot usually be immediately detected, and once detected it may be extremely difficult and expensive to clean up. All these factors make sustainable groundwater management challenging and highlight the need to employ adaptive management.

Value of Surface Water

Many citizens in Minnesota’s major metropolitan areas depend on surface water as their drinking water source. Surface waters support ecosystems, fisheries, recreation, navigation, power generation, industrial cooling, and a multitude of other needs. Healthy surface waters help define Minnesota and support the economy. Yet, monitoring conducted by the MPCA indicates at least 40% of our surface waters don’t meet their designated uses and are considered “impaired”. Like groundwater impacts,

Summary of the Strategies

The **strategies** are ordered starting with those that are protective in nature, involve local partners, followed by a discussion of management areas and their associated data and information needs, and end with a discussion of decision-making tools.

1. Increase Protection Efforts
2. Promote Wise and Efficient Use of Water
3. Restore and Enhance Local Capacity
4. Employ Water Resource Management Units
5. Collect Information Necessary for Water Management Decisions
6. Improve Access to Environmental Data
7. Provide Up-to-Date Implementation Tools
8. Employ Targeted Approach to Identify and Protect High Risk Areas
9. Apply a Systematic Approach for Emerging Threats

restoration and quantifying associated improvement is a slow and expensive process. Both limited water resources and limited financial resources make protection a high priority.

Benefits of Protection

The importance of protection has long been recognized. Specific to groundwater resources, the Groundwater Protection Act of 1989 articulated specific protection goals. The Clean Water Legacy Act of 2006 was passed for the purpose of protecting, restoring and preserving the quality of Minnesota's surface waters. And in more recent legislation, the Clean Water, Land and Legacy Constitutional Amendment passed by Minnesota voters on Nov. 4, 2008 also contains a strong protection component.

The need for greater focus on protection is not just limited to preserving water supplies. Preventing water quality problems before they occur is also a key tenet of the 1972 Clean Water Act and state water quality laws and rules.

Minnesota state agencies, in cooperation with the Clean Water Council, have developed ground and surface water protection strategies that reflect that well managed land leads to healthy aquatic systems. Implementation of the strategies will take place in coming years, both through the *Minnesota Water Plan* strategies, as well as other efforts. Protecting water resources leads to ensuring that the state will have adequate supplies of sufficient quality both now and in the future. Many of the following recommendations recognize the steps that have been started, but that commitment to their continuation and advancement are key to their success.

Recommendations – Increase Protection and Prevention Efforts

- Continue development of protection and implementation strategies for protection of ground and surface water resources and communicate the results of these efforts to stakeholders.
- Continue to identify and proactively address potential problems by focusing on protection activities and tools for preventing degradation including pollutant source reduction, conservation and fostering sustainable practices.
- Recognize the importance of local partnerships in identifying and capitalizing on prevention opportunities. Work with local government to incorporate protection into local planning efforts.
- Employ compliance and enforcement techniques and voluntary practices as tools to prevent degradation and overuse, while supporting the ongoing refinement of our management tools and techniques (e.g. refinement of water quality standards) to more precisely protect water resources.
- Implement recommendations for long-term protection of surface and groundwater contained in the DNR January 2010 report, *Long-Term Protection of the State's Surface and Groundwater Resources*.

Strategy #2 – Promote Wise and Efficient Use of Water

Goal – Water quality degradation and water quantity conflicts are minimized through the promotion of wise and efficient use of water

Unsustainable water withdrawals and allocations can have significant adverse consequences on human and ecosystem health, as well as cause significant financial burdens. Conversely, when water is used efficiently, there are multiple environmental and cost benefits, including reducing the need for:

Per capita water use over the last ten years has increased 6%, going from 156 to 168 gallons per day in the metro, and 413 to 443 gpd outstate. This trend indicates the likelihood for increased future conflicts.

From the DNR *Water Availability Assessment Report* (Appendix C)

construction and operation of larger supply and wastewater treatment systems; reduced energy and chemical consumption to treat water and wastewater; and protection of environmentally-sensitive features, such as in-stream flows, groundwater levels, fens, wetlands and lake levels. Additionally, water quality degradation can be prevented when less water is used or more efficiently managed; meaning that the simple act of conservation benefits both quantity and quality.

It is widely recognized that some parts of the state have limited water resources while in others supplies appear to be plentiful or even excessive. Despite this

disparity, Minnesotans tend to take water for granted in planning for development; expecting to find it available everywhere in a quantity and quality that meets their demands at minimal cost.

Historically Minnesotans have spent a great deal of time and energy in attempting to rid the landscape of water as quickly as possible, which has had significant adverse environmental consequences. Additionally, this perception of excess water has affected public understanding regarding the need to conserve. Even in the relatively water-rich regions there are consequences for withdrawals, including reduced discharge to surface water features and ensuing impacts to aquatic life, impacts on neighbors, potential influences on the migration of contaminants, and the rising costs associated with constructing new wells and their associated infrastructure. While there are clear benefits that arise from efficient use, it is also true that most Minnesotans rarely experience shortages or even hear about them occurring in the state and therefore there is no sense of urgency to conserve. With growing demand for water and more limits on supplies for both quantity and quality reasons, water conservation will require much more serious attention by all users in years to come.

Metro communities use roughly 2.6 times more water on the peak summer day than an average day presumably to accommodate lawn watering. This leads to costly construction of new municipal wells, treatment and storage facilities and increases the risk of water quality degradation. More importantly, it depletes the limited reserve of water more quickly.

Minnesota's laws have long recognized the benefit associated with employing water efficiencies, and the respective savings to both users and the state. However, the challenge is continuing to communicate this message to citizens and industry when we are blessed with many resources and relatively inexpensive access to water. Tools that are being used, and will continue to be important in the future include:

- State agencies are developing programs and leading efforts for water conservation, guided by *Minnesota Statutes* 103A.205 and 103A.206.
- *Minnesota Statutes* 103G.101 requires that the commissioner of the Department of Natural Resources develop a water resources conservation program for the state that includes conservation, allocation, and development of waters for the best interests of the people.
- *Minnesota Statutes* 103G.301 also allows for consideration of alternatives to the actions proposed in permit applications, including conservation measures to improve water use efficiencies and reduce water demand.
- *Minnesota Rules* 6115.0770 state that *"in order to maintain water conservation practices ... it is necessary that existing and proposed appropriators and users of waters of the state employ the best available means and practices based on economic considerations for assuring wise use and development of the waters of the state in the most practical and feasible manner possible to promote the efficient use of waters."* The rule goes on to allow the DNR to *"require a more efficient use of water to be employed by the permittee or applicant."*
- The DNR, in review of all appropriation requests, considers efficiency of use and intended application of water conservation practices (*Minnesota Rules* 6115.0670). In addition *Minnesota Statute* 103G.291 requires that public water suppliers serving over 1,000 persons employ water use demand reduction measures including a conservation rate structure and education program prior to requesting additional appropriations.
- *Minnesota Statutes* 115.03 requires that applicants of wastewater discharge permits evaluate in their applications for the potential reuses of the discharged wastewater.
- Public water suppliers provide information on their water conservation programs as part of a water supply plan (*Minnesota Statute* 103G.291). Most have a conservation payment rate structure in place, or will by 2013, to meet statutory requirements.

Water Conservation Programs

Many suppliers have some type of watering restrictions in place over the summer. These are typically odd/even restrictions that help reduce peak day demands allowing the utility to develop systems for lower peak volumes. Communities also provide water conservation messages through bill inserts, websites, newsletters and other local media. Other conservation measures employed by water utilities include leak detection, tree or topsoil requirements and metering or monthly billing.

While it is clear that the DNR has an explicit statutory and regulatory role in ensuring wise use through the water appropriation permit requirements and review of municipal water supply plans, the remaining state agencies have a role in promoting water conservation. All are in agreement with the need to incorporate conservation and promotion of water use efficiencies in their water programs. Therefore, the agencies will look for opportunities to promote water conservation and wise use in all aspects of water management. Despite the variability across the state in water availability, a coordinated consistent message from state agencies that wise and efficient use of all the state's water is important. Similar to the previous strategy, many of the recommendations in this section recognize the important steps that have begun, but that commitment to their continuation and advancement are key to their success.

Recommendations – Promote Wise and Efficient Use of Water

- Continue to promote water efficiency and look for opportunities to further advance water conservation and wise use in all aspects of water management.
- Encourage other entities with a role in managing land and water resources to incorporate water conservation goals into local water plans, while evaluating options for incorporating water use efficiency in regulatory programs.
- Ensure a coordinated, consistent message that wise efficient use of all the state's water is important.
- Develop guidance materials on best management practices for water conservation as well as explore and support opportunities for alternative methods to efficiently use resources such as stormwater and wastewater reuse.

Strategy #3 – Restore and Enhance Local Capacity

Goal – Recognition of and support for local capacity and actions is increased

The state is highly dependent upon the day-to-day activities of local governments, nonprofits and landowners to meet its land and water management goals. State and community partnerships have achieved significant accomplishments and harkens back to the earliest organized approaches of watershed management begun by the federal Soil Conservation Service in the 1930s. The state recognizes that in order for water management to be effective, there needs to be support from local governments, non-profits and landowners. While the assessment, funding and overall goals may come from the state, implementation occurs at the local level.

In recent years, the foundation on which water resource management implementation largely depends, especially for addressing nonpoint source pollution, has eroded as local government funding reductions have limited local capacity for water resource management. For the state's efforts to be successful

existing capacity needs to be supported and lost capacity needs to be rebuilt. Increasing funding for local projects is not the only answer. While money needs to be provided for local projects, there also needs to

Aligning Self and Public Interest for Clean Water

During our study on water governance last year, I found a gem of a quote from a Citizens League report back in 1993:

“State lawmakers should embrace the view that the purpose of government is to design environments where individual citizens and institutions are systematically oriented to accomplish public purposes, and where they meet their own interests in the course of doing so.”

This is exactly what we need to do to address problems like water pollution. The biggest water quality problems we're dealing with today are not the major industrial polluters of the past; they're caused by pollution from the activities of the millions of individuals, businesses, and communities on the land across the state. Reducing pollution is going to require the public (i.e., us) to acknowledge that we're the source of the problem and to take a central role in the solutions.

Science and engineering have told us a lot about what we can do to improve our waters. The question for the rest of us is not so much what can we do, but how are we going to do it?

Most of our water pollution comes from our activities on the land. And most of the land is in private ownership. So the people who own and care for the land are the ones who need to make the changes.

The key water policy question, not asked frequently enough, is:

How does Minnesota set up the environments in which individuals, businesses, farms, and other organizations all work together with government toward the goal of clean water, because they meet their own interest in the process of doing so?

Annie Levenson-Falk, July 16, 2010

be recognition of the capacity required for the local entity to apply for, receive and make the best use of the project funds. This capacity needs to be sustained across funding cycles.

Coordination of Local Effort

The health and sustainability of surface and ground water resources are directly related to land uses within watersheds that drain to surface water features and recharge aquifers. Land use management and decision making is conducted by local governmental units in coordination with private land owners and land managers. Decisions made at the local level individually and cumulatively have the greatest effect on water resource management within the state. The local capacity to understand, access, and evaluate information as well as support and encourage good land use decisions and water resource management practices is highly variable across the state. A key aspect of state water plan strategy is to ensure local governments have access to the needed information and

Shoreland Management Act

The Shoreland Management Act is an example of recognizing the importance of local land use regulation to statewide water resources. Shoreland and riparian areas are critically important to water quality, flow regime, recharge and ecosystem function. The concept of the Shoreland Management Act is to provide statewide minimum standards for land uses in shoreland areas, which are implemented by local governments through land use ordinances. This component of riparian land use management is a critical piece of water resource management that needs additional resources for updates and implementation.

use that information as part of the decision making, education and outreach efforts. New levels of coordination with local government (cities, counties, SWCDs, watersheds) are essential for implementation of sustainable water resource management.

Local Engagement

State government tends to interact with its local partners on a program-by-program and project-by-project basis, rather than in an integrated way. Opportunities to solve root problems or address larger state and community concerns may sometimes be missed. Local capacity to manage water and related land resources is limited, and some local governments are concerned that they must navigate through a maze of multiple federal and state agency interests, perspectives and requirements. The state is currently exploring ways to engage local governments across issues and at a variety of scales, including major watersheds and groundwater management areas, and increasing program delivery through local governments to accomplish better outcomes for Minnesota communities and natural resources.

Recommendations – Restore and Enhance Local Capacity

- Implement organizational structures that enhance local contacts and coordination with local governments. Explore programmatic opportunities to attract additional funds for local implementation by using state funds to leverage federal, local, and landowner contributions.
- Deliver assessed data and trend information to local managers.

- Participate in the established 10-year planning cycles and the community level.
- Look for opportunities to have federal-state-local funds leverage each other for multiple benefit projects and activities.
- Utilize local governments to cost-effectively provide state program services when appropriate by integrating functions with other local services.
- Increase recognition of and stabilize support for local capacity and actions – local capacity cannot thrive while going from potential grant to potential grant.
- Continue to explore ways to support state and local collaboration to provide consistent messages and information to local interests.
- Build and maintain the capacity to work across projects, programs and agencies to meet local as well as state needs.
- Implement organizational structures that enhance contacts and coordination with local government.

Strategy #4 – Employ Water Resource Management Units

Goal –Water resource management activities are improved by defining water resource management units that represent a systems approach to management

One of the big challenges the state faces in effectively managing its water resources is organizing and coordinating management efforts at a scale that promotes efficiency, engagement and implementation success. Experience has shown that addressing water resources at too small a scale, such as a waterbody-by-waterbody approach can miss the opportunity to identify related problems and address them more comprehensively, and in the process realize economies of scale. Conversely, selecting a management area that is too large – such as the state as a whole, ecoregions or even river basins – can make it difficult to coordinate activities with the many federal, state and local partners in the area, and can present barriers to fostering local engagement.

Water Resource Management Units

- Surface water managed through the 81 major watersheds
- Groundwater managed using source water protection areas and groundwater management units

Surface Water Management Units

A key strategy that has emerged from the implementation of the Clean Water Legacy Act and activities supported by the Clean Water Fund is the use of the state's 81 major watersheds as the organizing framework for surface water quality management under the act (see Figure X). The major watersheds, while large enough to provide a systems approach to solving problems and gain economies of scale, are small enough to promote targeted and coordinated efforts and are hydrologically-based units. Additionally, a coordinated watershed approach enables addressing protection and restoration for multiple impairments simultaneously. This does not mean that the major watersheds are a one-size-fits-all scale to address every question. Rather, this strategy is about using the appropriate scale to achieve

resource goals. Other management scales (individual water bodies, basins, etc.)_ continue to be valuable; the employment of the major watershed scale is simply a tool for enhancing the coordination and efficiency of monitoring and management.

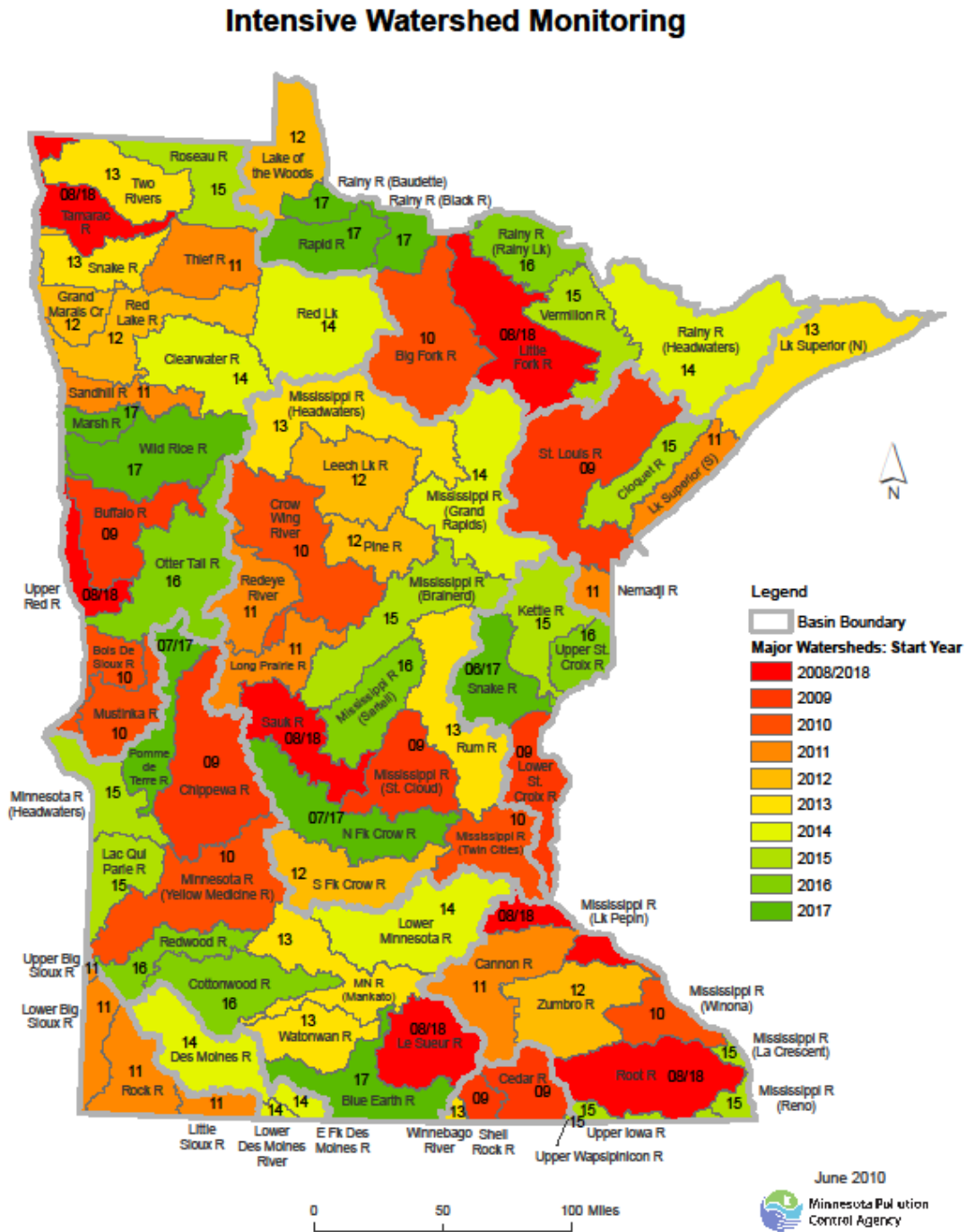


Figure X. Minnesota’s 81 major watersheds and their respective monitoring schedule.

Groundwater Management Units

Similarly, for groundwater, source water protection areas and groundwater management areas are being developed to define the boundaries and flow pathways for subsurface water movement. While it is recognized that surface watersheds and groundwater aquifer boundaries are different, both systems need to be managed in an integrated manner when possible, recognizing land use management choices will impact the sustainability of human and ecological health. Merging the understanding of surface and groundwater movement will foster increased coordination and collaboration among state agencies and with federal and local groups as we continuously improve management tools based on new information and system understanding. Additionally, characterizing the larger system will improve quantification of flow through the resource to enhance management of sustainable withdrawals.

Defining Benefits

The benefits of this “water resource management unit” approach to organizing and coordinating the work of water resource protection and restoration are many, including:

- Identifying most, if not all, the water resource problems in an area at one time. Additionally, enabling the opportunity to address the problems through a coordinated, efficient process.
- Fostering increased local understanding of how water moves through, across and beneath the landscape, which will help people identify causes and solutions to both water quality and quantity issues.
- Providing citizens, stakeholders and local government an opportunity to proactively engage in the resource management work, first through volunteer and local monitoring activities, and then through implementation efforts. This up-front engagement helps set the stage for local involvement in water resource management, and enhances the information available for good planning efforts and successful implementation of restoration and protection strategies.
- Developing effective management strategies based on hydrologic boundaries.

This approach also provides an opportunity to integrate and prioritize protection and restoration efforts at the management unit scale, relying on data to determine what actions are needed and how resources can be most effectively allocated. With this approach, protection becomes an integral part of the identified management strategies, and management and implementation efforts can then include both protection- and restoration-focused activities.

Recommendations – Employ Water Resource Management Units

- Utilize water management units to organize and communicate data, trend information and preferred strategies to local planning processes and organizations.
- Continue to employ a major watershed approach to protecting and restoring surface water quality, while enabling scaling up or down of efforts as appropriate..
- Define and employ groundwater management areas.

- Achieve the goal of a 10-year cycle for monitoring and assessment, TMDL and protection strategy development, and implementation of regulatory and nonregulatory actions to protect and restore surface water quality.
- Develop schedules collaboratively for groundwater monitoring, mapping and management activities to foster cross-agency coordination and efficiency.
- Align major watershed and source water protection or aquifer management area monitoring, planning and implementation schedules where possible to foster a better understanding of surface water–groundwater interactions, identify opportunities to concurrently meet groundwater and surface water management needs, and help avoid unintentionally transferring problems from one water resource to another.

Strategy #5 – Collect Information Necessary for Water Management Decisions

Goal – Information necessary to support sustainable water management decisions is collected efficiently and collaboratively

The state is employing a thoughtful, integrated and collaborative approach for collecting prioritized information, in targeted locations and within timeframes that will inform water management decisions. It has long been recognized that effective water resource management requires sufficient data and information about the hydrologic systems to inform sound decision-making. While a great deal of information has been collected, an understanding of status, trends, stressors and interactions (between groundwater and surface water, water and land use, climate and recharge, ecosystem components, etc.) is essential to identifying and achieving water resource goals and supporting adaptive management principles.

“Sustainable water management requires sound data to support understanding of the various elements of the hydrologic system. This includes high resolution landscape and soils information, precipitation, aquifer recharge, aquifer discharge, aquifer withdrawals, ecosystem services needs, surface water quality, ground water quality, evapotranspiration, surface water and ground water interconnections and flow pathways, among other traits.”

2008 EQB report, *Managing for Water Sustainability*

The state has made significant progress towards meeting this need in recent years, particularly in the surface water arena with the advent of the CWLA and Clean Water Fund support for monitoring and information-gathering efforts. And in the past year there has been a renewed effort to generate new critical groundwater data. While gaps still remain, the state is on a path to address many of those gaps over the next 10 years, provided that funding continues.

Each agency has a specific need for collecting information relevant to its statutory mandates and agency objectives. To gain a more complete understanding of the hydrologic system, these information sources must be

considered together. State agencies routinely coordinate ground and surface water sampling activities to eliminate redundancy and maximize efficient use of limited resources. In addition, information collected for a variety of purposes is routinely shared amongst agencies. This collaborative approach is working well, and is further enhanced by efforts to identify and employ “water resource management units” (discussed in the previous strategic direction, #3) to prioritize, schedule and communicate future data collection efforts.

While discussion of the collection of water information is often done in the context of surface and groundwater, it is important to remember that these systems are connected and also include landscape and biological systems. The following sections on surface water, groundwater-surface water interaction, and groundwater provide further discussion on existing information being collected as well as priorities for additional information collection efforts.

Surface Water

The state is on track to monitor and assess its surface waters on a 10-year cycle, and to monitor the outlets of major watersheds for flood warning, pollutant trend, and adaptive management purposes. The Clean Water Legacy Act and the Clean Water Fund have greatly accelerated data collection for surface water quality (biology, physical characteristics and chemistry). There is a need to continue that effort over the 10-year cycle, expand the effort through local partnerships, and use adaptive management concepts to measure progress and identify information gaps.

Additional efforts are needed to collect information that will assist in determining the water quality and quantity requirements of healthy ecosystem functions and drinking water. Typical approaches to address ecosystems have tended to orient around the minimum requirements (quantity and quality) of an ecosystem rather than what is needed to support a healthy ecosystem. The natural variability of flows within a year (season to season) and between years (dry to wet water years) is a factor that biota have adapted to and depend on. Understanding and addressing the variability requirements of ecosystems has been a challenge for water managers.

Five Key Components for Ecological Functions

- Hydrology
- Connectivity
- Biology
- Geomorphology
- Water quality

The relationship of surface water to the landscape or watershed is also critically important to understanding the system. For example, information about the role small headwater streams and wetlands in the overall health of the system is needed. This better understanding will be used in development of predictive tools that use information on hydrology, connectivity, biology, geomorphology and water quality to assess watershed health. Ultimately these tools will help inform land use decisions that are protective of water resources.

Ground and Surface Water Interaction

Ground and surface water have traditionally been managed separately, which has led to unintended consequences. Pumping of groundwater can reduce aquifer levels that adversely impact seeps, springs,

wetlands and discharge to streams. Conversely groundwater recharge from unsustainable land use and surface water can transport chemical constituents into the groundwater system. Additional information on site specific geology, hydrology and identification of sensitive landscape features will better inform water appropriations, best management practices and land use decisions to avoid adversely affecting the ground and surface water interactions. An improved understanding of surface and groundwater interactions will help ensure that both components of water resources are being protected, and we are not inadvertently transferring problems from one component to another (i.e. from surface water to groundwater, or vice versa).

Groundwater

There are ongoing efforts to develop information for understanding groundwater systems. Agencies are making significant progress addressing information gaps related to aquifer characteristics, water quality and water sustainability. While trend data is available for several important pollutants, it is still lacking for others, and the monitoring and information gathering efforts being implemented through recent funding initiatives are designed to address some of these gaps. Regardless, sufficient time is required for collection of data that supports rigorous trend analysis.

Continuing development of county geologic atlases and development of groundwater monitoring networks, such as the groundwater level monitoring network for the 11-county metro area are examples of ongoing efforts that will better inform land and water management decisions. However, additional information is needed to better understand aquifer characteristics such as recharge, storage and movement of water in these underground systems, and to identify areas at high-risk for depletion and/or contamination.

Ground water systems are particularly challenging as the main information source comes in the form of a single point (i.e. a well) on the landscape and requires significant interpretation between points (wells) to define the system. For these reasons it is important to maximize the information obtained from each point and prioritize those areas of investment for information collection. State agencies programs will need to increase monitoring requirements and coordinate efforts under existing authorities to ensure enough information is collected to understand and manage groundwater systems.

Concurrently, more work needs to be done to characterize the quality of private drinking water wells. Monitoring efforts exist for public water supplies (through MDH), and ambient groundwater quality (through MPCA and MDA). With the exception of testing required for newly constructed wells, Minnesota lacks a systematic effort to monitor and understand private drinking water well quality. Traditionally well owners have been encouraged to conduct annual testing of their water, but few do and the data that is generated is not aggregated in a single location for public use. There have been some recent efforts coordinated by counties with state agency support, most notably the Southeastern Minnesota Nitrate Study, but more work is needed to assure that these water supplies, which fall outside the Source Water Protection Program, are sufficiently understood and protected.

Recommendations – Collect Information Necessary for Water Management Decisions

- Continue work on collaborative and integrated systems of groundwater and surface water information collection.
- Continue recently accelerated data and information gathering efforts, such as the 10-year cycle of watershed monitoring, enhanced groundwater monitoring, and increased efforts to better understand aquifer characteristics.
- Focus on the following priority areas for additional information collection:
 - Water quality and flow requirements to sustain healthy ecosystems.
 - Ground and surface water interactions.
 - Aquifer characteristics such as recharge, use, storage, and transmissivity.
 - Resource thresholds and performance standards to inform management decisions
- Increase efforts to characterize the quality of private drinking water wells.

Strategy #6 – Improve Access to Environmental Data

Goal – Decision-makers and public have ready access to environmental data to support sound management decisions

Agencies are committed to making easy and efficient access to data a high priority of their respective programs. Many reports call for improved data collection and monitoring efforts, but it is equally important to ensure access to the data to support planning efforts. Good data have a diminished value if they are not readily accessible.

Recent Progress

Great strides in this area have been made recently, as the water monitoring agencies have focused on strengthening their water monitoring efforts and defining clear, long-term plans for data collection and communication of trends. Concurrent with enhanced data collection efforts, agencies have made significant progress in recent years enhancing access to environmental data through web portals such as the MPCA’s Environmental Data Access site (which includes MDA monitoring data) and the use of data standards such as MDH’s County Well Index unique well number.

The DNR recently received resources to implement a foundational water level monitoring program in the 11-county metropolitan area. As a part of this project, the DNR will begin development of a groundwater level data management framework that will improve storage, access and sharing of data between agencies and other levels of government. Additionally, the Metropolitan Council, DNR and MPCA are working together on defining better database tools.

The MPCA received a modest CWF allocation to begin development of a “Watershed Information Management System” that will serve as a portal connecting multiple sources of water data and information. These efforts are foundational and should be built upon to ensure that resource managers

and decision-makers have access to the information they need to support a more sustainable water resource management system.

Defining Goals

Easy access to accurate data and information is important to ensure sound management decisions and efficient use of resources. In order to make the most cost-effective use of existing information and funds, agencies will accelerate cooperative efforts to share and simplify public access to environmental and technical data. The goal will be to make the information accessible in a variety of formats to encourage adoption by citizens, interest groups, local units of government, watershed groups and other interested parties as well facilitate exchange of information amongst professionals. A well-designed data access system will improve our ability to clearly communicate trends in areas such as surface water discharge, groundwater withdrawals, water quality conditions and ecosystem health.

Recommendations – Improve Access to Environmental Data

- Establish data standards that provide a common format for accessing and sharing identified categories of water data (e.g. surface and groundwater quality, surface and groundwater quantity, biological, meteorological data, etc.).
- Identify and prioritize gaps in the current data management system. For example, state agencies are aware of the need for a place to store and share surface and groundwater flow data collected by local government and other partners, and are actively evaluating options for meeting this need.
- Develop an implementation plan for enhanced data management that includes the system requirements, prioritized list of needs, agency roles and responsibilities, and a work plan and cost for filling gaps and implementing identified improvements.
- Continue to provide more and better opportunities to share water data and information through web portals, analytical tools (such as the DNR’s Watershed Assessment Tool and the EQB’s Water Availability Information System), map interfaces and upload/download functions.
- Provide the contextual information needed to understand and use water data, such as standards and benchmarks, trend information, and supporting data about land use, climate, hydrogeology, geomorphology, soils, native plant communities, protected features and ecosystems.
- Identify water quality and quantity targets and use an improved data access system to measure progress towards them.
- Build on recent and current data access projects to identify the users of state water data and their information needs, and use that knowledge to guide future data access enhancement projects.

Strategy #7 – Provide Up-To-Date Implementation Tools

Goal – Water resource concerns are addressed through the use of an adaptive approach to updating management tools

A variety of management tools are used by state agencies, local governments and stakeholders to protect and improve water quality. These tools can take many forms – community-based outreach efforts; voluntary best management practices and guidance; incentives; and regulatory rules and standards based on scientific information that supports policy objectives. It is important to ensure that these tools are up to date and effective so that protection and restoration efforts are successful.

The selection of one or more management tools to address water quality and quantity concerns may be driven by the scope of the problem, by the water quality issue to be addressed (i.e., is it acute or chronic in nature?), or by other complexities that require development of other tools.

Best management practices (BMPs) offer guidance to users regarding the management of pollutants, processes, land and waste. BMPs and other tools offer guidance so that impacts to water quality are prevented or resource degradation is minimized to the greatest extent possible. Certain conservation practices help protect against or reverse the damage to water and adjacent land resources to ensure that ecological and resource protective functions are maintained or improved.

When BMPs and other recommended practices fail to be effective or are not adopted, despite being practical, other solutions may be necessary, such as the development of incentives or regulations based on science and stakeholder input.

Examples of Water Resource Protection Management Tools

Successful management tools can include such things as education, rules, enforcement and incentives:

- Storm water drain stenciling
- Construction site silt fencing
- Liquid waste management and recycling guidance
- Local ordinances regarding land management and impervious surfaces, including shoreland
- Best management practices for use of pesticides in agricultural and residential settings
- Rules for management of feedlots and the land application of manure
- Regulations for industrial and non-industrial discharges to waterways
- Enforcement programs for compliance with storage tank rules and containment structure requirements
- Incentives or recommendations for alternative crop rotations, production systems or land management approaches in agricultural settings
- Incentives to protect health ecosystems such as conservation design developments and transfer of development rights

Management practices, protection incentives and regulations should continue to be optimized and refined over the next 10 years. For example:

- Much progress has been made refining management practices, rules and standards to reflect new understanding of water quality and ecosystem interactions, and to address changing land-use conditions. Continued refinement is needed as new information becomes available and to reflect new issues and opportunities.
- Many water resource protection laws and rules are working well and achieving the desired results. Others are not as effective as they could be due to a myriad of factors including inconsistent adoption across the state, lack of adequate funding, or the need for more education/technical assistance. These tools should be fully optimized to enhance water resource protection and restoration.
- Efforts to avoid problems before they occur through pollution prevention, compliance activities, education and product stewardship have accelerated in recent years. Those activities should continue, to improve our ability to address potential threats to water resources before they become a costly restoration problem.

Ultimately, recommended practices, guidance and law, supported by adequate education and outreach should create a set of very flexible, robust and diverse tools that are periodically reevaluated to ensure their effectiveness and practicality and incorporate new information/learning.

Practices to protect land and water systems are detailed in the following two sections. However, these tools apply to all of Minnesota's landscapes. Examples will be given related to agriculture, but the same practices are relevant to any activity across the state that modifies the landscape including forestry, mining, urban development and industry.

Water Quality Best Management and Conservation Practices

For many contaminants of ground and surface water, recommended management practices (e.g., Best Management Practices) and conservation practices are the primary tool for protecting and restoring water quality. However the cost and effectiveness of many practices can vary considerably depending on multiple variables. One size does not fit all, and what may be beneficial for one part of the state, one municipality or one business may not be appropriate in another. Some practices may be difficult or expensive to implement or may have undesired effects on non-targeted contaminants. In some situations the practices and technologies promoted may be less effective in certain settings, may change over time, or our understanding of these practices may improve since the practice was last revised. For these reasons, and to ensure that limited funding is wisely spent, it is important to periodically review and quantify, to the extent practical, the costs, benefits, limitations and environmental outcomes, both intended and unintended, from specific management and conservation practices.

In a similar manner, there are a number of BMPs that can be applied for enhancing water quantity. These water quantity conservation practices have been detailed more explicitly in strategy #2, to promote wise and efficient use of water.

Agricultural Best Management Practices

BMPs for agricultural contaminants often need to be developed or updated to address environmental concerns and to keep pace with evolving technologies and crop production practices. New plant hybrids or new methods for the precise application of fertilizer are examples of innovations that may require new BMPs. Because agricultural BMP development depends on understanding and incorporating multiple variables, and for reasons outlined above, it is important to develop and implement a step-wise systematic process to review BMPs.

There are three steps to this process. The first step is to establish a systematic process to screen existing BMPs and identify which ones require a more detailed review, gaps in current BMPs, and new practices or technologies which may require a BMP. There should be an easily understood transparent process for the systematic review of BMPs and the identification of issues or concerns regarding their implementation. This process should determine if there are sufficient technical data to develop a BMP and, if not, recommend additional required projects to acquire such data. The process should also include a feedback loop where growers and crop advisors can provide input into the review process on the obstacles for their successful implementation.

The second step in the process is to undertake BMP evaluation projects to fully understand and to quantify their costs, benefits, limitations and environmental impacts. BMPs may vary from extremely simple practices that are easy to implement to potentially complex and expensive practices that might require considerable funding and knowledge to implement. For many agricultural BMPs, to fully understand and optimize their implementation will require plot or field scale evaluation supported by water monitoring and computer modeling.

The third step in the process is to support local BMP demonstration sites that facilitate their successful adoption. Demonstration sites for BMPs will help fine tune the BMPs to address potential variability in conditions that frequently exists on a regional or local scale. For example, a local demonstration site would help educate farmers on how a specific practice will fit into their own cropping system. Demonstration sites also help address the human dimension of BMP adoption where an individual will be much more likely to adopt a practice if one of their friends or neighbors can personally explain and demonstrate that it works. Demonstration sites should be integrated into local and regional efforts to promote BMPs.

Research used for agricultural BMP development should be easily available to the public on-line. The BMPs should be compiled in an easily accessible format which identifies where, when and how they might be used and the potential tradeoffs between different contaminants or practices that might be impacted by the BMP.

Agricultural BMPs are an important tool for protecting water quality and a fundamental building block for other actions, including regulations, to protect groundwater and surface water. If they are not effective, the state is at risk of expending considerable resources without achieving the desired improvements in water quality.

Recommendations – Prioritize Development, Evaluation and Implementation of Water Quality Protection Management Tools

- Develop a summary of existing laws and rules that are not yet fully implemented and identify the barriers (whether they be financial, policy or administrative) that are preventing their effective implementation.
- Provide appropriate guidance to landowners and local government to ensure all management and conservation practices are adopted in the most effective manner for their site specific application.
- Support efforts to evaluate, develop and advance management and conservation practices.
- Develop a systematic process to screen existing management practices, further refine existing practices when appropriate and develop new practices. Part of this process is to understand and quantify the costs, benefits, and limitations of formal BMPs and other management and conservation practices.
- Support local demonstration sites to facilitate the successful adoption of BMPs and other practices. Share findings of research studies used for BMP and conservation practice development through easily available online access point.
- Continue to refine standards and rules as needed to reflect new information and issues.
- Identify connections between regulation, education, incentives and protection activities, and continue to optimize the use of these tools, in combination, to achieve water quality goals.

Strategy #8 – Employ Targeted Approach to Identify and Protect High Risk Areas

Goal – Land management projects are targeted to high risk areas to protect and restore water resources

The state applies a targeted approach to implement protection and restoration projects to ensure that limited resources are spent in a manner that provides the greatest possible return on investment. Effective deployment of implementation tools begins with a tailored understanding of where on the landscape activities are impacting water resources. Targeting is being undertaken at two levels in Minnesota: broad targeting is done at the state program level while refined, smaller scale targeting is employed at the local. This two tier approach works to increase the effectiveness of the strategy.

In some situations a relatively small portion of the landscape may be contributing a disproportionately high percentage of contaminants to surface water and groundwater. Identifying these vulnerable areas, also known as priority management zones, is a necessary first step in implementation. Once these priority management zones are identified, determining the degree of change needed to protect or restore water resources is also necessary.

It is important to note using a targeted approach does not mean that best management practices or other implementation tools are ignored in less vulnerable areas on the land. A certain percentage of funding and effort should be allocated to promoting BMPs in all areas where their adoption will provide increased protection of ecosystem functions and water resources. However, it is intended that increased resources should be expended in those locations that pose the greatest risk as sources for contaminants or will have the most benefit.

Tools to Identify High Risk Areas

For a targeted approach to work, the tools must exist for identifying high risk areas on the land. For example, recent developments in the use of LiDAR technology as well as enhancements in modeling and stressor identification capabilities are enabling a new level of risk identification. The detailed topographic maps provided by LiDAR can be combined with soil, wildlife, floodplain and other data to create GIS layers that, when used in conjunction with computer models and field evaluation sites, form the basis for a much more precise method for targeting than has previously been available. These and other landscape-based methods will have applications for both urban and agricultural settings.

Similar tools for targeting high risk areas are also available for potential sources of groundwater and drinking water contamination. The capture zones, times of travel and hydrogeologic vulnerability of aquifers are already defined in Source Water Protection Areas (SWPAs) for municipal water supply wells. More detailed hydrogeologic vulnerability maps could be created possibly incorporating crop or other source-specific GIS layers in areas outside of SWPAs.

Risk Inventory

Identification of ecologically intact locations on the landscape will allow targeting of areas that are providing high quality ecological services (water quality, infiltration, flood retention, habitat, etc.) within the watershed. These areas are high risk in the sense that allowing degradation of these functions would result in degradation of water resources in the area as well. There is an important correlation between intact ecological function and sustainable water resources. Information from the Watershed Assessment Tool combined with Minnesota County Biological Survey data can be used to identify areas that need to be maintained to prevent ecological degradation.

Broader Application of Targeting

The strategy of “targeting” is important to apply in a variety of areas. Targeting allows the best application of resources to the areas in which they are most needed or effective, including monitoring, protection and restoration efforts.

State agencies already use targeting to set priorities for water quality sampling; monitoring of flows in rivers and streams; enrollment of conservation easements; and to inform installation of wells for groundwater level assessments. Local plans then refine targets for local conditions.

In addition to targeting intact ecological areas, the state needs to target areas of degraded ecological function that provide the best restoration opportunities. The National Wetland Inventory Update project will eventually allow coarse evaluation of wetland functions that can be used to target restoration of ecological functions that are limited within a watershed. These information sources should also be used in combination with other information such as soils, hydrology, and land cover type to target sites that are providing some ecological services, but have stressors that are limiting the function of the system.

Risk Evaluation

Once high risk areas are identified, a systematic approach should be used for selecting and funding the appropriate management and conservation practices given the unique landscape, land use and specific contaminants of concern in the watershed or area. Two considerations are especially important in the selection of recommended practices. First, it should be recognized that for many land uses there may be a significant cost and complexity to changing land use practices. For example if a farmer has been using the same crop rotation or has a significant investment such as in an irrigation system, it might be very difficult, expensive and risky to implement a major change in practices. Conversely there might be some practices that are relatively easy to adopt. Priority should generally be given to those practices that have the greatest probability of success and environmental benefit with consideration for cost.

Second, in some watersheds or aquifer recharge areas there may be more than one contaminant of concern and practices that may help minimize adverse impacts of one contaminant may increase negative impacts of another. For example, soil incorporation may be a desired practice to reduce runoff of nutrients or pesticides, but it may also increase the runoff of sediment, which may be the more significant concern in the watershed. This potential for tradeoffs and unintended consequences is very real and is likely to increase over time as more waters are listed as impaired for multiple contaminants. To help address this concern the state should develop and make accessible lists of contaminants of concern for specific water resource management units. The state should also develop lists of practices for specific contaminants and resource protection goals, and the potential contaminant and resource tradeoffs with other practices. Local land use managers and LGUs, with the assistance of state technical staff, should select appropriate practices in consideration of the contaminants of concern, land use, land characteristics and potential tradeoffs.

It may be expensive to implement major changes in land use practices. For example, changes in an agricultural setting may include implementing an alternative crop rotation or removing land from production. For some contaminants such as nitrogen in groundwater, the state should explore options for creating sustainable markets including, if necessary, subsidies for low nitrogen input crop rotations in high risk areas. A sustainable market-driven alternative crop rotation option such as alfalfa may be a highly desirable solution to local contamination problems. This might be linked to alternative energy crops. The significant cost of implementing major changes in land use practices reinforces the need for careful targeting of land use changes to optimize the use of limited resources.

The state has made significant progress in employ targeted strategies, including progress in adopting BMPs, but we still have water quality and quantity concerns that persist. Some of the easier solutions have been employed, leaving us with a need to rely more heavily on targeting to efficiently and soundly dedicate our limited resources in as efficient a manner as possible. A targeted approach can be applied in coordination with new tools that have been and are being developed to help with that targeting, including LiDAR and resource models.

Recommendations – Employ Targeted Approach to Identify and Protect High Risk Areas

- Use a targeting approach to optimize locations for monitoring and sampling.
- Use a targeted approach to identify high risk areas on the landscape in greatest need of specific BMPs and ecosystem protection.
- Employ targeting methods to determine the optimal places on the landscape to achieve the maximum benefit from the use of limited resources for protection and restoration efforts.

Strategy #9 – Apply a Systematic Approach for Emerging Threats

Goal –A Systematic approach is developed for identifying, assessing and responding to emerging threats

Minnesota’s water resources, while abundant, face a variety of recently recognized threats, such as aquatic invasive species, possible changes in climate, PFCs, and endocrine-active compounds, just to name a few. A state strategy for identifying, assessing and responding to new threats to water quality, quantity and ecosystem health is needed to provide a coordinated plan for federal and state agencies, working with local government and citizens in response.

State agencies are working hard to identify emerging issues and threats to water resources, gather relevant information and establish strategies for addressing emerging issues. Many of these efforts have followed an “ad hoc” approach with the lead state agency identifying and investigating the threat, bringing in the other water agencies as needed based on their expertise and authorities regarding the specific issue at hand. This approach has generally worked well, in part because of the concerted efforts of the state water agencies to work together to establish strong communication and coordination and to clarify roles and responsibilities.

While this ad hoc approach has produced effective results (for example, in addressing contaminants such as PFCs), the continued increase in complexity and new concerns suggests that a more systematic approach across agencies for identifying and understanding new threats is warranted. It is important to note that it will not always be possible to identify threats prospectively, and at times state agencies will still find themselves in a reactive mode. While this more systematic approach cannot prevent that from occurring, it can help ensure continued strong coordination of agency investigations and responses as new threats emerge.

Recommendations – Systematic Approach for Emerging Threats

- Develop a systematic approach for identifying, assessing and responding to emerging threats considering the following steps:
 - Identify and evaluate emerging threats to water resources on a regular basis.
 - Prioritize efforts to investigate and address potential threats, and determine an approach to funding high-priority efforts.
 - Clarify and further coordinate roles and responsibilities for investigating threats including presence and extent, impacts (human, aquatic and ecosystem health), stressors and sources.
 - Establish diverse teams, including staff from federal agencies, state government, local government, academia, industry, environmental organizations or other relevant parties, specific to the threat under consideration.
 - Identify management tools, both available as well as needed, for addressing the stressors and sources, and coordinate management efforts.
 - Share information with interested stakeholders and the public as it becomes available.
- Convene interagency teams as needed to address emerging threats to mitigate their potential adverse environmental and health impacts.

Contaminants of Emerging Concern

Progress is being made to better characterize surface and groundwater systems. With that said, there are gaps to be addressed during the next 10 years. One area of need involves contaminants of emerging concern, including endocrine-active chemicals, pharmaceuticals and personal care products, where the state is continuing to assemble information about the presence, extent and potential impact of these chemicals. A limiting factor can be the lack of available analytical methods for analyzing these chemicals at appropriate detection levels. Also lacking are benchmarks for many of the chemicals, which are needed to help interpret the potential impact of what is found in the environment. As analytical methods improve and new studies (from academia, state, federal, and other sources) are published about CECs, state agencies will need to regularly re-evaluate data collection efforts to ensure we are gathering the information needed to adequately inform decision-making about these chemicals.

Summary of the Strategies

These nine **strategies define what** the state agencies have set out to accomplish in the coming ten years, and beyond. The previous seven **implementation principles describe how** the strategies will be implemented. The principles are broad in nature and are meant to be applicable to each of the strategies discussed above.

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Chapter 5 Conclusions and Next Steps

This section will be finalized after the public comment period.

Minnesota has a long history of managing its water resources through state agencies and programs. Because of these efforts, great success has been achieved, but a great deal of work remains to achieve a common goal of protecting and restoring surface and groundwater and ecosystem health in the Land of 10,000 lakes. Working in coordination with federal and local entities, as well as academia and citizen groups, the *2010 Minnesota Water Plan* puts forth a series of nine strategies to apply and seven implementation principles to guide the work. The strategies frame the work that will be taking place while the principles guide their implementation. The future is one in which sustainable and holistic water management is the unifying goal. Each agency must move forward providing leadership and creating collaborative partnerships. Agencies must continue to maximize efficiencies and look for ways to deliver improved products together, with engagement of citizens and local government.

The next steps continue to be challenging. But, for Minnesota to protect its resources for future generations and while continuing to provide goods and resources for the world, it will be critical to both protect human health and well-being and preserve ecosystem health and services.

In the words of Willard Munger, former State Representative :

“It will take some tough policies over the next 100 years to protect our environment and all life it sustains... The next 100 years call for a change in course involving human restraint, international cooperation, and the money to keep our planet livable.”

This document will be revisited in five years to be assessed, adapted and improved and to serve as a guide to achieve Minnesota’s vision of sustainable water resource management.

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***Appendix A – Biennial Assessment of Water Quality Degradation Trends
and Prevention Efforts***

Appendix B – 2010 Groundwater Monitoring Status Report

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Appendix C – 2010 Water Availability Assessment Report

Appendix D – Metropolitan Area Water Supply Planning: Report to the Legislature as part of the 2010 Minnesota State Water Plan

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