Minnesota Environmental Quality Board

2010 Minnesota Water Plan

Working together to ensure clean water and healthy ecosystems for future generations

November 2010

The Environmental Quality Board (EQB) brings together the Governor's Office, five citizens and the leaders of nine state agencies in order to develop policy, create long-range plans and review proposed projects that would significantly influence Minnesota's environment and development. *Minnesota Statutes* (see Chapters 103A, 103B, 116C, 116D, and 116G) directs the EQB to:

- Ensure compliance with state environmental policy
- Oversee the environmental review process
- Develop the state water plan and coordinate state water activities
- Coordinate environmental agencies and programs
- Study environmental issues
- Convene environmental congresses
- Advise the Governor and the Legislature

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Upon request, the *2010 Minnesota Water Plan* will be made available in alternate format, such as Braille, large print or audio tape. For TTY, contact Minnesota Relay Service at 800-627-3529 and ask for the Environmental Quality Board. For more information or for paper copies of *2010 Minnesota Water Plan*, contact the Environmental Quality Board at:

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Photographs by Princesa VanBuren Hansen.

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Executive Summary

The *2010 Minnesota Water Plan* defines a vision for Minnesota's water resources that ensures healthy ecosystems and meets the needs of future generations. It recognizes that Minnesota is a leader in managing land and water resources, but that there are opportunities for these programs to improve and adapt.

In 2008, the citizens of Minnesota voted to dedicate special tax revenue to protect and restore the state's land, water, habitat, trails and cultural resources. These valued resources define our identity as Minnesotans, and with this special revenue comes a responsibility to set priorities wisely and in a manner that can most effectively make a difference. We have been given a 25-year timeframe in which to make the investments needed to help Minnesota secure a sustainable future.

In recent years, state agency activities have grown in response to increased needs and associated funding. The state water plan gathers together information regarding these efforts in a single document, while also recognizing contributions from numerous additional concurrent efforts. The goal of this report is to define a broad framework that can be adapted and applied to specific land and water activities.

The water plan has three main parts:

- *Reflecting on the Past* summarizes key points from past decadal planning efforts and presents significant issues and events that have influenced our understanding of natural resource priorities.
- *Evaluating the Status of Minnesota's Water Resources in the Present* provides an overview of the status of the state's ground and surface water resources, as well as monitoring efforts and trends.
- *Charting a Roadmap for the Future – Implementation Principles and Strategies* is the foundation of the water plan, identifying key strategies and principles for achieving the vision of sustainable water resource management.

Implementation Principles

The following principles define how state agencies must work together with local and federal partners to ensure effective progress.

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

2. Prioritized resources – Priorities must be set to most effectively target resources and maximize opportunities.

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

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

5. Goals and measures – A system to define targets and measure progress must be in place to determine whether water management strategies are achieving desired outcomes.

6. Education and outreach – Effective water resource management efforts must bring together both science education and outreach.

7. 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.

Strategies

These strategies identify critical activities that state agencies have set out to accomplish in the coming 10 years, and beyond.

1. Increase protection efforts – Groundwater and surface water supplies are protected from depletion and degradation, recognizing that protection is often more feasible and cost effective than restoration.

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

3. Restore and enhance local capacity – Recognition and support for local capacity and actions is increased.

4. Employ water resource management units – State-level water resource management activities are improved by defining water resource management units for coordinating a systems approach to management.

5. Collect information necessary for water management decisions – Information necessary to support sustainable water management decisions is collected efficiently and collaboratively.

6. Improve access to environmental data – Decision-makers and the public have ready access to environmental data to support sound management decisions.

7. Provide current implementation tools – Water resource concerns are addressed through the use of an adaptive approach to updating management tools.

8. Employ a targeted approach for protection and restoration – Land management projects are targeted to high risk areas to protect and restore water resources.

9. Apply a systematic approach for emerging threats – A systematic approach is developed for identifying, assessing and responding to emerging threats.

State agencies are mandated to manage and protect the state's water resources and are committed to continuously adapting programs and direction to achieve water sustainably. The Environmental Quality Board and its member agencies recognize the need to continue to improve coordination of efforts, adapt programs to new information, present clear quantity and quality targets, and communicate these initiatives and progress to the public in the days and years ahead. These implementation principles and strategies define a plan, building upon today's foundation, to set Minnesota on a course to an improved and sustainable future.

The challenges and obstacles are significant, and overcoming them depends on all partners working together to realize sustainability. State agencies provide a framework for collecting information and delivering technical support and funding, but rely extensively on local government, stakeholders and landowners to apply conservation practices and restoration efforts. Equally important is the support from and open communication with elected officials. Only by working together as local, state and legislative partners can Minnesota effectively protect and improve its natural resources.

Chapter 1 Introduction

The *2010 Minnesota Water Plan* defines a vision for Minnesota's water resources that ensures healthy ecosystems and meets the needs of future generations. Minnesota is a leader in managing land and water resources, but recognizes that there are opportunities for these programs to improve and adapt. The *2010 Minnesota Water Plan* brings together in a single document recent work of state water agencies and articulates targeted strategies for the future.

The Environmental Quality Board is charged with coordinating comprehensive long-range water resources planning and policy through a *Minnesota Water Plan* every 10 years. The plan also presents information on the status of the state's water resources. Although the law requires the EQB to develop a state water plan each decade, and while the plan should guide state activities through the decade, the planning horizon should be viewed as long term.

This plan does not set out to touch on every water issue challenging the state. Rather, the goal of the plan is to inform state agency programs that are responsible for addressing the multitude of water challenges facing Minnesotans, and to communicate to the Legislature and public the commitment of the agencies toward working on sustainable water management. This document strives to outline the framework that will be implemented over the coming years to improve water management and the 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 Minnesota's water resources and programs for monitoring and managing them.

Purpose

This plan seeks to integrate the work of state agencies and identify ways that work can usefully guide the activities of local, regional and state agencies. 2010 represents an exciting time for water resource management in Minnesota. While the state is blessed with abundant water and natural resources, these 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 it is critical.

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.

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 together to achieve what is best for nurturing Minnesota's economy, communities, human health, recreation and environment.

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. Results indicate that citizens consider drinking water as the most important use of water, followed by ecological services. Although resources vary across the state, 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.

Historical Perspective

Similarly, Minnesotans have long recognized the importance of water resource protection. Specific to groundwater resources, the Groundwater Protection Act of 1989 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*" (*Minnesota Statutes* section 103H.001).

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.

The Clean Water Legacy Act of 2006 (*Minnesota Statutes* Chapter 114.10) calls for protecting, restoring and preserving the quality of Minnesota's surface waters. The Legislature, in passing the law, 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*

- *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 Amendment (Legacy Amendment), passed by Minnesota voters on November 4, 2008, 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*.

In response to the Legacy Amendment, the Legislature established 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:

- 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:

- A Department of Natural Resources (DNR) plan to "*Develop a Groundwater Level Monitoring Network for the 11-County Metropolitan Area*"
- The Metropolitan Council's seven-county Twin Cities Metropolitan Area Master Water Supply Plan and regional groundwater model
- Minnesota Department of Agriculture (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
- The Environmental Quality Board's water availability reports, "*Managing for Water Sustainability: Report of the EQB Water Availability Project,*" and "*Use of Minnesota's Renewable Water Resources: Moving toward Sustainability*"
- The Freshwater Society's report, "*Water is Life – Protecting A Critical Resource For Future Generations"*
- The Minnesota Pollution Control Agency's (MPCA) redesigned ambient groundwater monitoring network
- MDA and Minnesota Department of Health (MDH) partnership for monitoring community water supplies for pesticides and pesticide degradates
- United States Geological Survey's National Water Quality Assessment research

- The incorporation of groundwater considerations in county water plans
- Improved groundwater data management by MPCA through the EQuIS database
- Studies by the Minnesota Geological Survey and DNR on 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
- United States Geological Survey's low-flow study on the Mississippi River as it relates to metropolitan surface water supply planning
- The University of Minnesota's water sustainability framework planning efforts
- Continued progress in the advancement of the County Geologic Atlas program
- Second-generation water supply plans for water suppliers
- DNR's Groundwater Technical Work Group assessment of models and tools needed to manage water availability and sustainability
- MPCA's report to the Legislature, "*Statewide Endocrine Disrupting Compound Monitoring Study 2007 – 2008*"

This list is far from exhaustive; many efforts are ongoing or have been completed recently; the bibliography in this report serves 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. In addition to these partners, cities, watershed districts, citizen groups and others monitor Minnesota's resources. Many public and private partnerships conduct education and outreach activities. Local and state entities and many other groups and organizations effectively plan for an improved future. Academia, industry and other fields provide research and improvement tools.

While each of these contributions is essential, this plan focuses on state executive branch responsibilities and charges, including, when applicable, the activities and involvement of the Metropolitan Council.



Chapter 2 Reflecting on the Past

The Environmental Quality Board has a long history of preparing decennial 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. Separately and collectively, these documents express great vision, transformational ideas and indications of progress. There are also recurring thoughts and reflections of barriers that impede Minnesota's ability to realize the articulated visions. 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 passages highlight key issues and findings from earlier state water plans, which in turn have informed the development of the *2010 Minnesota Water Plan*.

"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."

Governor Arne Carlson
1991 Minnesota Water Plan
Letter of introduction

Minnesota Watermarks: Gauging the Flow of Progress 2000-2010

Minnesota Watermarks, 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, puts 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

- **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 resources, challenges and priorities varied significantly 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 were of interest in every basin.

- **Prevention.** Most basin teams noted the high quality of water resources and the importance of maintaining these resources in top condition.

- **Education and stewardship.** Water resources are greatly affected by the actions of individuals, who sometimes unknowingly pollute.

- **Climate effects.** All basin teams, recognizing the interrelationship of all aspects of the environment, noted that weather and climate change must be considered in planning for Minnesota's water resources.

- **Coordination.** A continuing, cooperative effort is needed because multiple 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

Minnesota Water Plan: Directions for Protecting and Conserving Minnesota's Waters, issued by the EQB in 1991, set an ambitious agenda for protecting and conserving water resources in the state. It identified the principles, policies and actions required 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 included 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. The report was prepared in response to the previous year's drought. The report set forth four requirements to meet if Minnesota were to achieve its potential:

- 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 they face in protecting human and ecosystem health from the potential threats caused by using land and water. Nationwide, many efforts 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, soil erosion on U.S. cropland decreased 43 percent between 1982 and 2007 through increased implementation of conservation practices. While a very laudable accomplishment, more work remains to address both longstanding issues and emerging threats.

Looking back, many of the goals and objectives are essentially unchanged. However, over the past decade, we see a series of challenges and opportunities that uniquely define the environmental, economic and social considerations of today. Challenges to resource management include:

- Increasing pressures on finite resources due to population and economic growth;
- Increasing level of complexity of the issues (a trend that is expected to continue) through increased understandings of dynamic systems and growing threats to them ; and
- Decreasing state funding for local government that has led to inadequate resources in much of the state to support the capacity of local government, upon which state agencies rely for implementing non-regulatory and land-use related management activities.

Similarly there are unique opportunities upon which to build a plan for the future, including:

- Increasing attention paid to these issues, especially impaired waters, emerging threats and climate change;
- Increasing resources available to do this work through the Clean Water Legacy Act, and more recently the Clean Water Land and Legacy Fund; and
- Improving strategies that water agencies are employing to address the goals and objectives.

Transformational Milestones

Transformational milestones are events or issues that significantly impact water resource management. They can be events that raise public awareness of a topic or problems of such concern that they affect fundamental change in a program's operations. Regardless, transformational milestones help define the state's course in water resource management.

The way in which water resources are viewed continues to evolve. Increased visibility of the need to protect and restore resources has arisen from attention to such issues as climate change and hypoxia in the Gulf of Mexico. These issues, along with other events and milestones, impact the work of state agencies and help characterize today's challenges and needs.

Population Growth

The state's population has grown by almost 500,000 people since publication of the 2000 state water plan. That growth increases the pressure on finite resources and reflects a nationwide trend that offers few if any easy answers.

Ecosystem Fragmentation

Continued development on the landscape is further fragments ecosystems. This fragmentation adversely affects biology, water quality, hydrology and connectivity, degrading the ecological functions that support 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 characterization of future scenarios has raised its visibility while fostering development of

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 the2008 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.

interagency teams with federal, state, local, industry and academic members. There are, however, inherent complexities in measuring climate changes and forecasting likely impacts. Consequently, developing response mechanisms that must also be easily adaptable is a significant challenge.

Hypoxia

Recent media attention regarding hypoxia (oxygen deprivation in the Gulf of Mexico caused by excess nutrients discharging to the Mississippi River) has increased scrutiny of land-use practices in the Upper Mississippi River Valley.. This is a complex issue, with many sources contributing nutrients to the river, including runoff from urban areas, wastewater discharges and industrial discharges, as well as others. Minnesota and its Midwest neighbors recognize that farming practices, while critical for feeding people and supporting the economy, impact water quality within and beyond the state's borders and that there is a continuing need to enhance conservation practices.

Contaminants of Emerging Concern

The Minnesota Pollution Control Agency and departments of Agriculture and Health 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 continues to be active in assembling information about the presence, extent and potential impact of these chemicals.

Impaired Waters and TMDLs

Since the drafting of the 2000 state water plan, thousands of Minnesotans have been engaged in Total Maximum Daily Load (TMDL) efforts, which focus on evaluating whether waters are meeting 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 with water quality.

Clean Water Legacy Act and Legacy Amendment

Minnesota is dedicating important resources to tackle these challenges. The 2006 Clean Water Legacy Act, the 2008 Legacy Amendment and subsequent water resource funding support programs are increasing monitoring and reporting, promoting the understanding of a dynamic land and water system, and enhancing water restoration and protection activities.

Sustainability as a Goal

Water quality has been a significant public policy topic for decades, but more recent discussion is focused on sustainability. 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 water and groundwater so that allocations of water may be made without adverse impacts on human or ecosystem health.

Improved technology, data transfer programs and online support tools have increased the knowledge base of local governments and other support systems. While information sharing has improved, local partners have struggled with diminished financial resources, limiting their ability to implement local protection and restoration efforts.

Early efforts based on the Federal Clean Water Act focused primarily on point sources. Programs since then have addressed most point sources, successfully improving the environment. Today, nonpoint sources of pollution present the greatest challenge. Effective responses will depend on the use of multiple tools, new technologies and enhanced education efforts.

Looking back, transformational milestones have helped define priorities and needs. There have been significant accomplishments, laudable advances and new challenges. Working together, citizens, local governments, 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 Minnesota's Water Resources in the Present

Monitoring Dynamic Systems

State agencies conduct a variety 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. Significant improvements in management of water quality and quantity in one area of a watershed, for example, 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 assessing changes in water quality.

Understanding the Context of Trends

As an example, water quality monitoring may indicate that a particular stream impaired for its 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 development 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 water resource management 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 practicable to protect or restore all waters of the state to the highest levels of quality (e.g. pre-settlement conditions), the state must 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 a strategy that will address threats to water resources and ensure effective policies and plans that direct activities toward protecting and restoring water quality and quantity.

Context for Reporting

The Environmental Quality Board (EQB) 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 (Appendices A through D) to provide current status information on surface and ground water quality and 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 requires the concerted effort of all responsible 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 are summarized in this section.

Biennial Assessment of Water Quality Degradation Trends and Prevention Efforts

Minnesota Statutes 103A.43 instructs the Minnesota Pollution Control Agency (MPCA) and Minnesota Department of Agriculture (MDA) to conduct a biennial assessment of water quality trends (Appendix A). Assessing water quality trends in both surface and groundwater is very timely because the information regarding status and trends aids in setting priorities for data collection, research and implementation. 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.

The 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, this report is summary in nature and directs the reader to additional information 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 water 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, 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 best management practices. However, concerns still exist, and continued effort is needed, to fully realize the state's groundwater quality goals.

Improvements in 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, along with additional actions that 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 are critical to evaluating progress and refining management actions. Protection strategies, whether regulatory or voluntary, must be developed to avoid the occurrence of new problems. Furthermore, 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 (MPCA), in cooperation with other agencies participating in the monitoring of water resources, to 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* (Appendix B) fulfills this requirement.

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 *Groundwater Monitoring Status Report* details groundwater monitoring efforts at three scales: national, statewide and regional. Monitoring of both quality and quantity is performed by the U.S. Geological Survey, MPCA, Minnesota Department of Agriculture (MDA), Minnesota Department of Natural Resources (DNR) and Metropolitan Council and includes work by consultants and 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 Minnesota Department of Health (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 evaluating 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 monitoring wells. The groundwater monitoring roles conducted by these agencies, as stipulated by state statute, are shown in Figure 1.

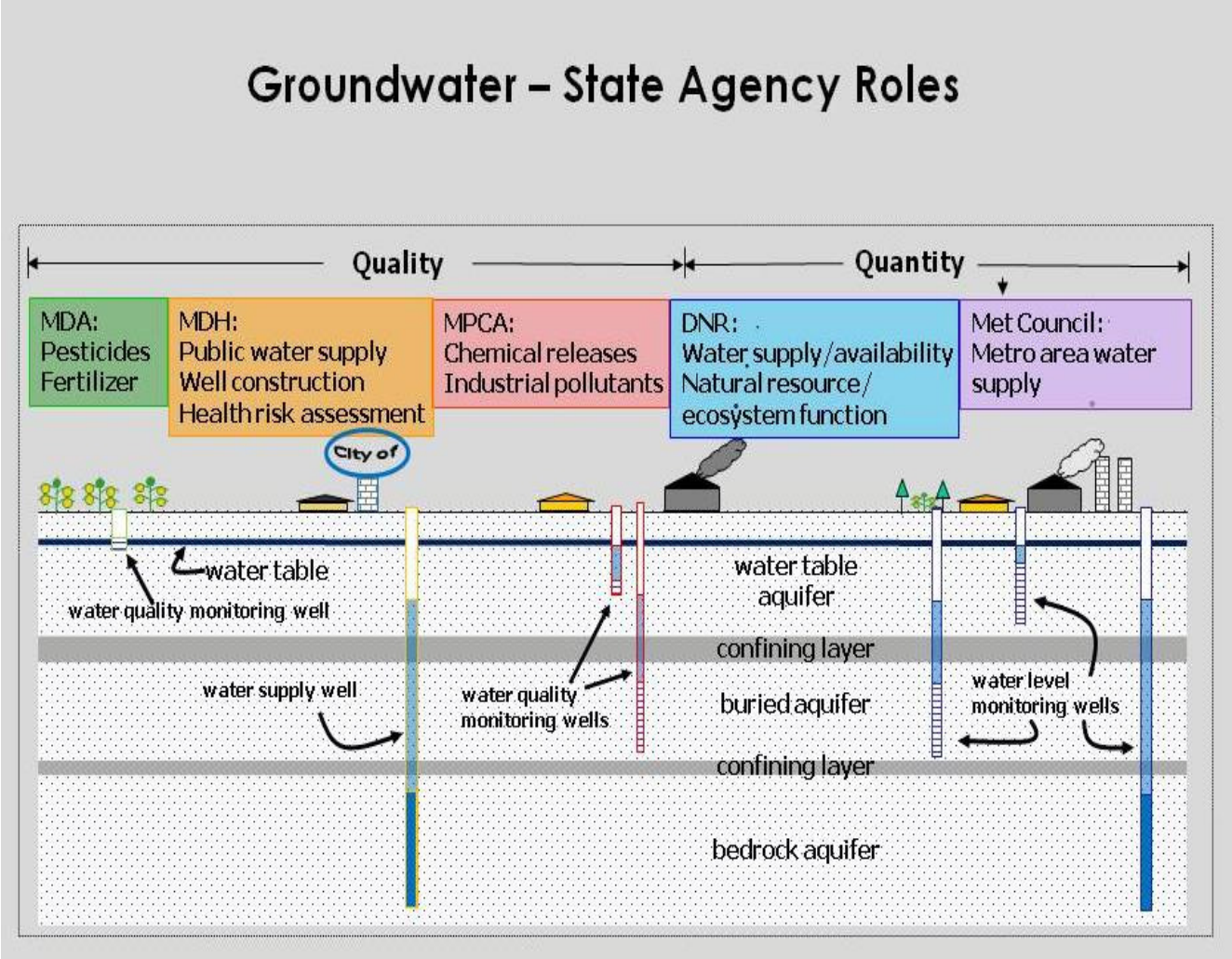

Figure 1. Coordinating roles in water management.

Conclusions and Recommendations - 2010 Groundwater Monitoring Status Report

Monitoring efforts to date 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 contaminants of emerging concern 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 to provide information that is necessary 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 whether the quality and quantity of Minnesota's groundwater resources are at risk and to inform management decisions. Continued investments are required to understand and protect groundwater systems to ensure that future generations will also have an abundant source of clean water.

Status of Minnesota's Water Quantity

2010 Water Availability Assessment Report

Minnesota Statutes section 103A.43 instructs the Department of Natural Resources (DNR) to conduct an assessment of water use and availability on a five-year basis, with reports from even years compiled in the decadal state water plan (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 latest report, completed in 2007 jointly by the EQB and DNR builds on a 2000 DNR report, *Minnesota's Water Supply: Natural Conditions and Human Impacts*. The DNR more recently 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 necessary for providing adequate protection of the state's water resources.

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.

The *2010 Water Availability Assessment Report* was prepared in response to M.S. 103A.43. 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 these, climate and global weather patterns are challenging to manage directly. Conversely, 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.

Report Overview - 2010 Water Availability Assessment Report

The DNR is charged with overseeing the state's Water Appropriation Permit Program to ensure 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 percent of Minnesotans depend on groundwater systems, and because dependence is increasing, aquifer systems will need to be better defined in the future. Additionally, the state will require a better understanding of the relationships between surface and groundwater and the health of Minnesota's ecosystems.

Conclusions and Recommendations - 2010 Water Availability Assessment Report

In conclusion, the report states that an increasing number of Minnesota locations 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 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 the resource becomes undesirable and is not considered available.

Well-managed industry, agriculture, housing, manufacturing, power generation and public water supply systems are all necessary elements for nurturing and sustaining 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 must 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. Ensuring the future of Minnesota's water supply will require practicing thoughtful water supply management, including conservation, restoration, study and protection. 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 an adverse impact on 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 on public, economic and environmental health from the collective actions of all land use and water supply management decisions.

The report states that to begin to eliminate current problems and avoid future water availability problems, Minnesota must improve both 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 water quantity, water quality and the ecosystem. The ecosystem functions of natural plant communities that slow water flow and remove nutrients and other compounds can reduce problems through better landscape planning and management choices that retain these essential functions. Looking forward, Minnesota must become much wiser about how it is managing the lands and waters of the state if there is hope for 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

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

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.

The Metropolitan Council is responsible for carrying out planning activities that address the water supply needs of the metropolitan area. Planning activities include the 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, the Minnesota Department of Natural Resources and additional stakeholders to provide guidance,

emphasize conservation, promote inter-jurisdictional 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, updating analytical tools, and improving guidance to address anticipated water resource issues and to 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 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
- Presence of special well construction areas

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.

The analysis conducted as part of the planning effort 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.

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 needs. The plan recognizes the benefits of identifying, early in the process, issues that communities need to address.

The plan presents the 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 to ensure that water suppliers will be aware of what must 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, reducing the likelihood that water supply problems will develop "under the radar."

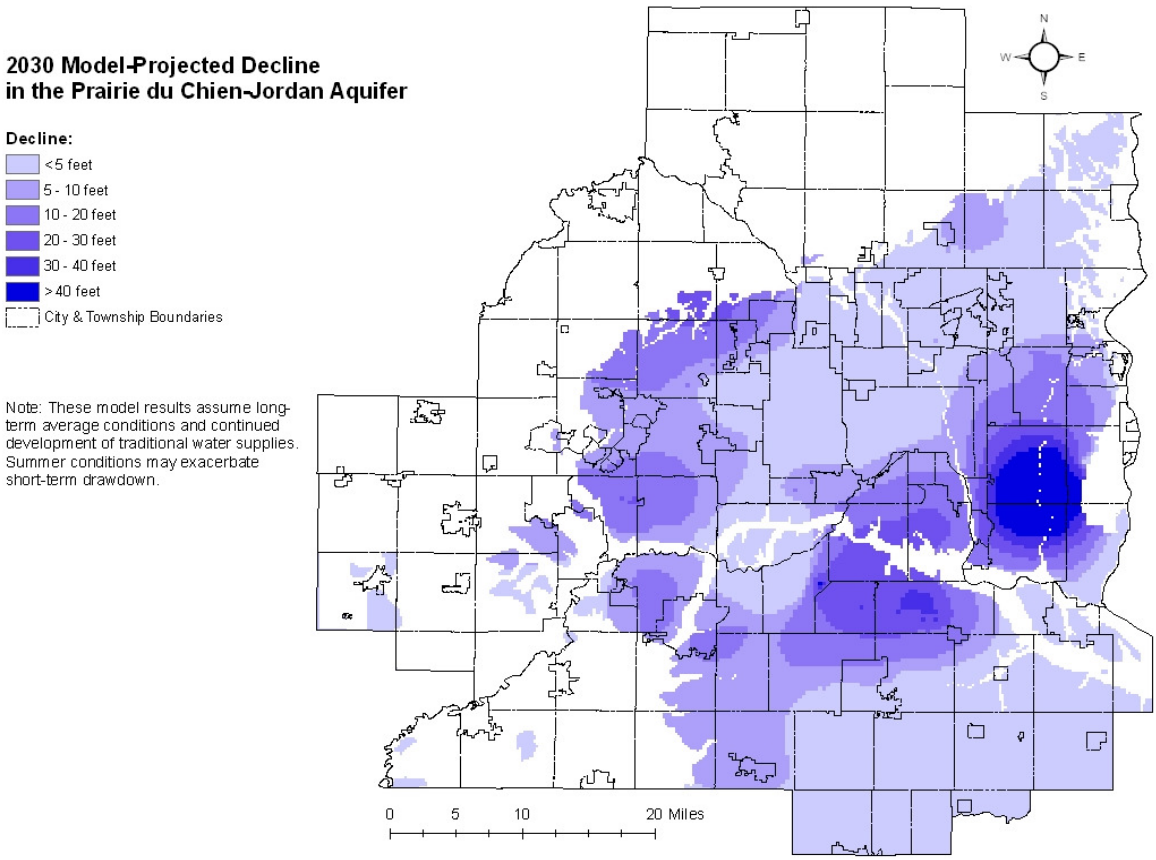

Figure 2: The analysis shows potential groundwater level drawdown primarily in outer-ring suburbs that rely primarily on groundwater. Should these communities continue to use their traditional groundwater sources, aquifer water levels are expected to decline significantly in some areas. Use of alternative water sources may neutralize predicted impacts.

The plan presents local information in community-specific water supply profiles. 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 to communities for addressing the issues identified in their profiles. With this information, communities will be aware of potential water supply issues and the range of appropriate solutions 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 tool updates 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 the sustainable development of water supplies.