Acknowledgments

The Minnesota River Basin Plan represents the work of many people, both inside and outside the Minnesota Pollution Control Agency. Many agencies and organizations contributed to this plan: Minnesota Board of Water and Soil Resources, Metropolitan Council, Minnesota Department of Health, Minnesota River Basin Joint Powers Board, Minnesota Department of Natural Resources, Natural Resources Conservation Service, Minnesota Department of Agriculture, University of Minnesota, and local government.

Many people played an integral part in the development of this plan. Citizens throughout the Basin attended the public review meetings resulting in more than 30 organizations and individuals providing comments during the public review process. Comments were received via the Internet, email, letter, and in person. They had an impact on developing the goals and strategies, layout, and the plan's overall direction. For example, first drafts of the plan included the goals up front followed by the strategies. Readers suggested incorporating the goals into the strategies (e.g. including the sediment goals along with the sediment strategy). Suggestions such as this changed and improved the document.

We say 'thank you' to those who are making changes to improve the river: Farms, cities, industry, and many citizens. It is up to all of us to do our part to improve the Minnesota River and the network of streams that flow to it. This plan and others set a general direction in which to proceed. It is now up to the people of Minnesota to take the next steps.

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Executive Summary

Over the past decade, the Minnesota River attracted a lot of attention. Algal blooms, murky waters filled with sediment, and unhealthy fish populations were just a few of its troubles. In 1992 Governor Arne Carlson issued his famous proclamation of “making the Minnesota River fishable and swimmable in ten years.” Consequently, scientists from agencies and organizations examined the issues. They identified many of the problems that prevented the waters in this Basin from supporting two activities of great importance: Aquatic life and recreation.

The past ten years has allowed scientists time to define the problems, time for citizens' groups such as the Minnesota River Citizen's Advisory Committee and the Minnesota River Agriculture Team to put forth visions, and time for local efforts to develop an infrastructure and coordinate implementation around high priority projects. But these efforts alone have not produced a river safe for recreation or diverse fish populations. Because of the breadth of impacts in the Basin, ten years is simply not enough time to solve an environmental issue as complex as the Minnesota River.

This plan is intended to be another step in the process to improve the river. Based on the past ten years of effort including scientific research, citizen recommendations, and the work of many agencies and organizations this plan sets goals and strategies to improve the river.

OVERALL GOAL OF THE PLAN

To restore, protect and maintain the water quality, bio-diversity and the natural beauty of the Minnesota River. Or, to make the Minnesota River “fishable and swimmable” once again.

OBJECTIVES

**Dissolved oxygen** - Ensure that dissolved oxygen concentrations in surface waters throughout the Basin are adequate to fully support designated beneficial uses.

**Nutrients**

- **Phosphorus** - Ensure phosphorus concentrations are low enough to fully support aesthetic (recreational use) and aquatic life goals in the lakes and waterways of the Minnesota River Basin and downstream waterways.

- **Nitrogen** - Protect human health and the environment from the effects of excessive concentrations of nitrate-nitrogen.

**Sediment** - Ensure that turbidity and total suspended solids levels are low enough to fully support aesthetic (recreational use) and aquatic life goals in the waterways of the Minnesota River Basin and downstream waterways.
**Toxics** - Protect human health and aquatic life within the Minnesota River Basin from the effects of toxic substances.

**Bacteria** - Reduce the potential for water-borne disease transmission in the Minnesota River and its tributaries.

**Biology** - Improve the health of aquatic communities in the Minnesota River Basin. Increase biodiversity in natural systems.

**ACTION STRATEGIES**

1. **Recognize Threats to Minnesota’s Environment**
   Develop and implement Total Maximum Daily Loads (TMDL) - Work on completing TMDLs for stream reaches or lakes in the Minnesota River Basin as identified in the 1998 and future 303(d) list(s); continue assessments to identify impairments; complete current and future TMDLs in the Basin, and assist in the development of rules for the determination of impairments for future 303(d) lists.

   **Develop pollutant reduction plans**
   - **Phosphorus** - Reduce phosphorus loads to the Minnesota River, its tributaries, and lakes in the Basin.
   - **Sediment** - Reduce sediment concentrations and loads to levels that provide for the attainment of aesthetic (recreational use) and aquatic life (habitat) needs, using methods that are economically and technologically achievable.
   - **Nitrogen** - Protect human health and the environment from the effects of excessive concentrations of nitrate-nitrogen.
   - **Hydrologic storage** - Increase riparian water storage and the ecological integrity of the Minnesota River Basin riparian corridors.

2. **Monitoring** - Provide an adequate level of monitoring in the Minnesota River Basin. Provide the water quality information needed to identify and assess water quality problems, provide focus to the environmental outcomes set in the Basin Plan, make resource management decisions, and evaluate changes in the water quality of the Minnesota River Basin as Basin and watershed management efforts continue.

3. **Ground Water** - Protect, maintain, and restore the quality and quantity of ground water in the Minnesota River Basin.

4. **Modeling** - Develop and use computer models to characterize and predict pollutant loads and water quality responses in the Minnesota River and its tributaries, given the complex water quality, land use, and pollutant source issues in the Basin.
2. Prevent, Limit and Clean Up Pollution

**Livestock/feedlots** – Implement regulations for a clean environment while maintaining a viable livestock industry. Several organizations worked on proposed new rules through the Feedlot and Manure Management Advisory Committee including producer groups, environmental groups, county staff, and other agencies.

**Individual Sewage Treatment Systems** - Work with local government to implement Minnesota Individual Sewage Treatment System (ISTS) rules, Chapter 7080. Local governments in the Minnesota River Basin have documented that 60 percent of ISTS are not in compliance. Non-complying septic systems can contribute bacteria and nutrients into tributaries that eventually reach the Minnesota River.

**Compliance** - Implement programs to ensure compliance with Minnesota laws that have been established to protect water quality. These programs are necessary to maintain fairness, credibility and increase motivation. Use various enforcement tools to lead those who are in violation of a law back into compliance.

**Storm water** - Lessen impact of urban storm water on the Minnesota River by implementing principles of the Phase II Storm Water Program.

3. Improve Government Services and Collaboration

**Integrate planning** – Integrate the Minnesota River Basin Plan with other water planning efforts in Minnesota including, but not limited to, comprehensive local water plans and the Water Management Unification Initiative. The MPCA will use the elements of the Basin Plan, along with other state policy, when reviewing local water plans.

**Support education** – Education creates greater public awareness and understanding of Basin water quality issues. It gives people tools and encourages personal responsibility to help clean up the Minnesota River.

**Pursue sustainable development** - Build understanding for sustainable quality of life decision-making. Evaluate interrelated community, environmental and economic factors within the watershed and use this knowledge to inform decision-makers on water quality problems. Local water plans should guide communities to mitigate and minimize the impacts of growth. Water quality funding should be directed to demonstrate innovative solutions that promote sustainable growth.

**Support watershed management/funding** - Support watershed planning and implementation efforts by providing financial and technical assistance to watershed partnership teams. The MPCA supports developing inclusive watershed partnership teams for each of the major watersheds in the Minnesota River Basin.
Coordination of overall cleanup effort - Support coordination of overall cleanup effort to avoid duplication and minimize cost. Work closely with the Minnesota River Basin Joint Powers Board, which helps provide overall coordination among local, state, and federal agencies.

4. Provide Responsive Services to Citizens and Stakeholders

Improve access to agency services - Minimize number of entries people need to get the information they need from MPCA. Coordinate programs, where appropriate, to reduce the number of contacts people must make (phone calls, visits, or letters) to find an answer, obtain a permit, or get funding.

Basin Plan evaluation - Evaluate the effectiveness of the Basin planning process itself—especially the success of efforts to integrate internal MPCA programs—to learn from this experience and improve future Basin planning efforts.

THE NEXT TEN YEARS

The path to a cleaner Minnesota River does not end with the completion of this plan. By implementing this plan, we will find some of the subgoals and strategies were appropriate while others need to be improved. In the coming years, attention in the Minnesota River Basin will move more and more toward implementation. Local planning and changes in practices will set the pace. State government will continue to provide assistance but will be looking toward local government and watershed teams for leadership.
**The Minnesota River Story**

Minnesota’s namesake river marks the state map like a backward checkmark. From its source at Big Stone Lake on the South Dakota border, the Minnesota River flows 335 miles southeast to Mankato and then northeast to join the Mississippi at Fort Snelling. Native prairie and pothole wetlands once covered most of the 16,770-square-mile Basin. Today it's a patchwork of farms sprinkled with areas of urban and industrial development with its outlet in a growing metropolitan area.

The name Minnesota means "sky-tinted water." Pollution and sediment in the river make it more like "soil-tainted water." Minnesotans expect and depend on safe and clean waters for drinking, swimming, industrial and agricultural uses and the support of aquatic life. The Minnesota River fails to meet these expectations. The Basin’s waters are contaminated by excessive amounts of numerous pollutants. Streambank, gully and sheet erosion problems scour the Basin landscape.

The Minnesota River Basin Plan presents specific goals and actions toward improving water quality in the Minnesota River Basin. It suggests ways to measure results. It builds upon the efforts of dozens of public and private agencies, and many individuals. They have done much work already. The Minnesota Pollution Control Agency hopes this plan inspires even greater effort and cooperation toward the overall goal:

*To restore, protect and maintain the water quality, bio-diversity and the natural beauty of the Minnesota River. Or, to make the Minnesota River “fishable and swimmable” once again.*

Much of this effort can be traced back to the low dissolved oxygen problem identified in the mid-1980s. Scientists projected that without pollutant reductions, metropolitan growth combined with headwater loading into the lower 25 miles of the Minnesota River would not meet dissolved oxygen standards during periods of low flow due to high oxygen demand requirements.

In addition to water quality problems within the Basin, the Minnesota River also impacts downstream areas. The sedimentation and eutrophication of Lake Pepin is one example. Much research has been devoted to determining individual and cumulative impacts from metropolitan area dischargers and loads of sediment and phosphorus from the Minnesota River and Upper Mississippi River Basins.

To solve the dissolved oxygen problem, the MPCA placed restrictive effluent standards on metropolitan point sources and established an upstream oxygen demand reduction of 40 percent.
This led to intensive research into the pollutant sources, transport mechanisms, and impacts on the river. Grants from the Legislative Commission on Minnesota Resources supported the Minnesota River Assessment Project (MRAP) from 1989-1994. The MPCA led a MRAP team of more than 30 agencies from federal, state and local governments to investigate the physical, chemical and biological condition of the river and its major tributaries. The study concluded with a series of Basin management recommendations mainly aimed at reducing the loads of sediment and phosphorus.

The recommendations include:

- Increased adoption of soil erosion practices and nutrient management in all land uses;
- County adoption of the state feedlot program;
- Wetland restoration and riparian buffer establishment;
- Establish a water quality standard for phosphorus; and
- Urban and agricultural storm water and drainage should be better planned.

In September 1992, in the midst of the MRAP study, former Governor Arne Carlson issued a challenge to make the Minnesota River swimmable and fishable within ten years. A Minnesota River Citizens’ Advisory Committee (CAC) established shortly thereafter made recommendations to guide agencies and other collaborators in achieving goals for the Basin.

The CAC recommendations included: restore floodplains and riparian areas, restore wetlands, manage drainage ditches and storm sewers as tributaries, improve land management practices; monitor water quality throughout the Minnesota River Basin, establish a “Minnesota River Commission” to oversee cleanup effort, establish local joint powers agreements, improve technical assistance to local governments, engage the general public and enforce existing laws.

In 1993 the Minnesota River Agriculture Team (MnRAT) was established through the Minnesota Department of Agriculture in cooperation with farm groups and organizations. Its purpose was to inform producers of non-point source problems being identified by natural resources agencies, and to involve them in a dialogue on developing responses.

MnRAT drafted the following strategic directions in 1996: establish and focus partnerships, involve agriculture and local governments in watershed planning, answer producers' questions, establish goals and action plans, identify sources and monitor impacts, implement cost effective Best Management Practices, engage the general public, and educate the public. Significant ongoing research at the University of Minnesota and other research universities contribute to information and education goals in the Basin.

The Minnesota River Basin Information Document, published in 1997 by the MPCA, summarizes additional information on these and other activities. Information from the Basin Information Document is available on the MPCA’s web site at:

http://www.pca.state.mn.us/water/basins/mnriver/

In response to the Governor’s challenge, the MRAP study and the CAC recommendations, more and more local and regional government and non-government organizations from throughout the Basin started getting involved in the river’s
restoration. These include Clean Up our River Environment (CURE) in the upper Basin, Citizens for a Clean Minnesota River (CCMR) headquartered in New Ulm, and a growing number of county joint powers boards, including the largest such organization in the state: the 37-county Minnesota River Basin Joint Powers Board.

As a result of increased involvement by local organizations, the focus of restoration efforts started to shift from a single focus on the lower reach of the Minnesota and downstream impacts on Lake Pepin to include the condition of individual tributaries and lakes. While certain activities such as the development and promotion of Best Management Practices and pollutant-specific initiatives were undertaken at the Basin-wide level, more and more activity in assessment and implementation began shifting to the major watershed level (13 major watersheds comprise the Minnesota River Basin).

In 1995 the MPCA formally adopted Basin Management as its water quality planning approach. This Basin Plan attempts to build on previous planning efforts for the Minnesota River and its Basin by laying out a broad framework for directing environmental programs toward improving water quality in the Minnesota River, its tributaries and other water bodies. This broad framework is the Basin Management approach. Ideally, through this approach, the MPCA can plan its activities in coordination with those of other agencies to work toward the restoration of downstream resources in a manner that also benefits local resources that matter to citizens and local governments engaged in watershed management.

**MINNESOTA RIVER BASIN PLAN PRIORITIES**

1. **Maintain progress achieved in improving water quality.**
   Significant strides have been made in improving water quality since the 1970s. Most pollution problems concerning leaking storage tanks, leaking landfills, and sewage in rivers have been cleaned up. The MPCA intends to maintain this progress through efficient delivery of existing programs in these areas.

2. **Focus efforts on streams not meeting the designated uses of aquatic life and recreation.**
   Most of the strategies of this plan are directed here. Although water quality has improved since the 1970s, in many locations it still does not support the uses of aquatic life and recreation. Evidence of this “non-support” comes from the 303(d) list, which the MPCA submits to Congress every two years. Efforts will be focused on these non-supporting streams and lakes in the Minnesota River Basin, attempting to move them toward supporting their uses.

3. **Assist local organizations in solving water quality problems important in their watershed.**
   Watershed projects, local water plans, and other efforts often identify issues important to local communities. In addition to the two priorities emphasized above, the MPCA also considers the concerns of local organizations important.
How does this plan relate to other plans?

This plan is not meant to duplicate other plans, but to deal with issues on a different scale. This plan’s scale is the Basin. For detail on other programs, refer to their plans.

Statewide issues and programs → Program plans Nonpoint Source Management Program Plan

Basin issues Waters not meeting standards → Minnesota River Basin Plan

Local priorities → Local plans such as comprehensive local water plans

More detail on statewide programs or issues can be found in their individual program plans or in the Nonpoint Source Management Program Plan. It is a similar situation with local priorities in that this plan does not mean to duplicate them. Local priorities can be found in comprehensive local water plans and other documents.
Minnesota River Basin Watershed
Map: Minnesota River Basin Data Center, Minnesota State University, Mankato

MINNESOTA RIVER BASIN FACTS AT A GLANCE

Length of river .................. 335 miles
Source .............................. Big Stone Lake
Average gradient .............. 0.8 feet per mile
Basin total area ............... 16,770 square miles
Area in state ..................... 14,840 square miles
Major watersheds .......... 13
Minor watersheds .......... 1,208
Minnesota counties ...... 37
Crop land usage .......... 70 percent
The Basin Management Approach

Basin Management is a geographically-based approach to water quality protection and restoration built around the focus on water. Rather than starting from categories of pollution sources or specific facilities, Basin Management focuses on the relationship of water resources with land management and its communities. The MPCA is using this approach to focus on the state’s major river basins to help it: 1) Better identify water quality problems; 2) Work with communities to establish shared goals and priorities; and 3) Develop effective pollutant-reduction strategies. The Basin Management approach is meant to complement the programs that exist. It is an extension and combination of the many efforts in identifying and correcting the various pollution problems that affect the Minnesota River.

BASIN MANAGEMENT PRINCIPLES

1. **Focus on water resources.** Basin Management starts with a focus on the water resources themselves and the extent to which they are threatened or impaired by pollution sources of all types. For the Minnesota River Basin, this focus encompasses problems ranging from low dissolved oxygen during low flow to high concentrations of sediment, nutrients and fecal coliform bacteria at normal and higher flows.

2. **Emphasis on achieving environmental objectives.** Basin Management emphasizes measuring success by progress made toward achieving specific water quality improvements rather than simply in terms of meeting the objectives of pollution control or resource management programs. The MPCA is attempting to define measurable goals and objectives for the Basin as a whole, while providing technical support to work with local units of government in developing measurable goals and implementation strategies in each of the 13 major watersheds.

3. **Hydrologically defined management units.** The Minnesota River Basin includes 13 major watersheds and 1,208 minor watersheds within state boundaries. A central part of the MPCA’s Basin Management strategy is to support water quality assessment and implementation projects in each of the Basin’s 13 major watersheds. Additional MPCA staff are being located in subdistrict offices to support activities ranging from water quality monitoring and assessment to watershed project management and Basin planning, as well as regulatory and enforcement support.

4. **Integrated management strategies.** The Basin Plan attempts to encompass all major point and non-point sources of pollution. While the emphasis is on those sources for which the MPCA has significant program responsibilities, other important sources also are included in the plan. The MPCA’s main watershed program, the Clean Water Partnership (CWP) program, assists non-point source projects with water quality restoration efforts. The MPCA will be encouraging local watershed sponsors to include point sources in their efforts. At the Basin level, significant progress has been made in adding point source issues, phosphorus in particular, to the non-point source issues being considered. In two instances, industries have used pollutant trading to offset part of the pollutant-reduction requirements for their wastewater treatment facilities with non-point source pollutant reductions obtained elsewhere in the Basin. Efforts are underway to ensure that point
sources, such as towns and industries, are also included in major watershed management efforts throughout the Basin.

5. **Stakeholder involvement.** This process needs to recognize and build on water quality-related plans and activities already under way by various organizations, such as the comprehensive local water plans developed by local governments.

The CWP program explicitly requires stakeholder involvement in the watershed management process. This typically covers a wide range of non-point sources. The MPCA is beginning to find ways to systematically include point source stakeholders (towns, cities and industries) in major watershed projects as well. At the Basin scale, Basin Management is being carried out in close cooperation with the Minnesota River Basin Joint Powers Board, whose 37 county members cover the entire Basin within state borders.
Purpose and Scope of the Basin Plan

The purpose of this Basin Plan is to guide and coordinate the activities of the MPCA, in conjunction with other agencies and organizations, in restoring or protecting the water resources of the Minnesota River Basin. The material presented here is meant to provide a general direction for water quality improvement and not a final answer. Later plans will evaluate this Plan and refine the goals and strategies to improve the river. While the primary focus of the Basin Plan is on rivers and streams, it also addresses lakes and ground water.

For this Minnesota River Basin Plan, the tasks emphasize MPCA authorities and activities focused on water quality. This is not to say it is the MPCA’s plan. People representing several other organizations have helped to shape the Basin Plan’s objectives and action strategies. Some have added what their agency or organization will do. In addition public notice and public information meetings have generated citizen ideas and input. Many of the tasks do focus on MPCA programs but it will take the efforts of many organizations to get the job done.

A more comprehensive plan will be completed as part of the Water Management Unification Initiative being organized statewide by the Minnesota Planning Agency and Environmental Quality Board (EQB). This initiative will coordinate water plans Basin-wide. This Basin Plan is a part of that process…a spoke in the wheel. The Water Management Unification Initiative is a much more extensive plan. In addition to including water quality, the larger plan includes goals to conserve the diverse characteristics of Minnesota’s waters, restore and maintain healthy aquatic ecosystems, and provide diverse recreational opportunities. Some of these goals are well beyond the scope of this Basin Plan and will need to be developed by other organizations.

DEVELOPMENT OF THE BASIN PLAN

The Basin Plan is part of a 10-year process based on the efforts of many people. Over the past decade citizens, government, and the private sector have been working to identify the river’s problems. Watershed improvement projects have formed to implement land use change. To develop this Basin Plan, MPCA staff used:

- Results from the Minnesota River Assessment Project
- Studies from other agencies and organizations
- Recommendations from the Minnesota River Citizen’s Advisory Committee
- Recommendations from the Minnesota River Agriculture Team
- Input from stakeholders and citizens at public meetings
- Written comments on draft of plan
- Input from basin planning meetings

GOALS, OBJECTIVES, TARGETS, AND MEASURES

The goals, subgoals, objectives, targets and measures in this plan focus on measurable environmental outcomes. They are intended to help guide the activities of the MPCA as well as
other agencies, stakeholders and partners. They are also meant to support and provide structure to the coordinating role of the Minnesota River Basin Joint Powers Board in integrating the activities of individual watershed organizations as well as regional, state and federal agencies active in Basin restoration activities.

The goals, objectives, and measures were developed using an environmental outcomes-based approach based on the Environmental Performance Partnership Agreement (EnPPA) between the MPCA and the U.S. Environmental Protection Agency (EPA). The purpose of this agreement is to solidify the understanding of the roles and responsibilities of the MPCA and the EPA in protecting Minnesota's environment. It calls for the development of environmental protection strategies and programs based on a consistent process for various pollutants dealt with by the MPCA and EPA.

Future targets for some objectives are presented without specifying which agency or program should be directed toward achieving them. This can only be determined through discussions with agencies that exercise authority and responsibility over the specific land uses in question. Residue management is an example.

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**Goals:** Broad environmental statements that derive from the MPCA’s authorizing legislation. The overall goal of this plan is “To restore, protect and maintain the water quality, biodiversity and the natural beauty of the Minnesota River,” or, to make the Minnesota River “fishable and swimmable” once again.”

**Environmental Objectives:** Specific targets that agencies intend to achieve. An attempt has been made to ensure that the objectives are measurable and based on either state water quality standards (Minnesota Rules ch. 7050) or on scientific water quality assessment.

**Objective Targets:** Ultimate targets for objectives are based on water quality standards or scientific assessments. Ultimate targets are presented here as given, subject to modification based on improved assessments or changes in standards. In addition to these ultimate targets, five and ten-year **planning targets** will be identified to indicate the speed at which the MPCA and others will attempt to achieve these targets through Basin Management, the TMDL process and related policies and programs. Planning targets, together with a list of priority water bodies, need to be developed in close collaboration with those responsible for implementation of the specific programs or activities. Five-year planning targets can be included in the EnPPA, while 10-year planning targets can be considered for Minnesota the Water Management Unification Initiative.

**Environmental Measures:** Indicators used to evaluate progress toward achieving environmental objectives. Measures must be clearly connected to an objective and goal to be useful.

**Strategies/Tasks:** Strategies will direct activities, that in turn will help guide individual tasks to be performed in order to achieve the objectives of this plan.
It is important to note that, in time, the goals and objectives listed in this plan will need to be changed as they are attained or as better information becomes available. Many of the goals and objectives will become more specific. An example of providing better information is the Agency’s modeling study of the Minnesota River upstream from Jordan. The study is part of this plan. Results from the study will add more precision to the dissolved oxygen, phosphorus, and sediment goals and associated strategies.
ACTION STRATEGIES

Recognize and Address Threats to Minnesota's Environment

1. Water quality impairments

A. TMDL ACTION STRATEGY

Work on completing Total Maximum Daily Loads for stream reaches or lakes in the Minnesota River Basin as identified in the 1998 and future 303(d) list(s); continue assessments to identify impairments; complete current and future TMDLs in the Basin, and assist in the development of rules for the determination of impairments for future 303(d) lists.

TASKS


2. Complete TMDLs for the stream reaches in the Minnesota River Basin included on the 1998 303(d) List (see Table 1 in the Background section of this action strategy).
   a) Complete monitoring and data analysis for initial fecal coliform and turbidity TMDL projects. These projects include reaches in the Chippewa River, Redwood River, Cottonwood River, Yellow Medicine River, Blue Earth River, High Island Creek, Rush River, Hawk Creek, and Watonwan River watersheds.
   b) Initiate and/or continue the other components of the TMDL process (citizen involvement, load allocations, and implementation plan).
   c) Ensure that the TMDL processes at each scale include adequate local government, stakeholder, and citizen involvement.
   d) Complete and submit individual stream-reach TMDL reports to EPA as scheduled.

3. Estimate the geographic scope of fecal coliform and turbidity impairments using data from the initial fecal coliform TMDL projects in combination with other available data.

4. Because of the extent of unassessed water in the Basin, coordinate TMDL development and implementation with other watershed and Basin pollutant reduction plans. Develop and implement watershed and Basin pollutant reduction strategies at appropriate spatial (place-based) scales. Implementation will involve various Basin-wide, major watershed-wide, and minor watershed efforts depending on the extent of the problems and the funding, organization, and staff resources available.

5. Develop monitoring strategies to evaluate progress toward reaching the TMDL goals and objectives at each spatial scale.
6. Evaluate and revise the procedures used to assess water bodies for water quality impairment to better reflect the type and extent of impairments in the Basin. Incorporate these procedures in Minnesota Rules.

7. Coordinate with North Dakota and South Dakota and Iowa on developing and addressing TMDLs that impact the border reaches of Minnesota.

**MILESTONES**

1. Maintain the TMDL schedule as submitted to EPA.

2. Determine how to approach widespread impairments such as fecal coliform and turbidity by 2005.

3. Coordinate the above tasks at the Basin, major watershed, and minor watershed scales with the TMDL planning process and schedule.

4. Meet with North Dakota and South Dakota by January 2002 to develop interstate strategies for managing TMDLs in mutual geographic areas of concern.

**BACKGROUND**

Section 303(d) of the Clean Water Act requires the identification of impaired waters and the development of TMDLs to: 1) determine the maximum amount of a pollutant that the water bodies can receive and still meet water quality standards and 2) allocate that load among point and nonpoint sources. Minnesota’s 1998 303(d) list includes water bodies that have water quality data indicating that they have exceeded one or more water quality standards. Specifically, stream reaches are listed for dissolved oxygen, ammonia, fecal coliform bacteria, and turbidity. A number of lakes are listed for mercury.

A study must be completed for each water body and pollutant on the 303(d) list, identifying both point and nonpoint sources that contribute to the water body’s failure to meet water quality standards. Water quality sampling and computer modeling is then used to determine how much each pollutant source must reduce its contribution to assure the water quality standard is met. Then a plan is written to bring the water body back to meeting water quality standards. The plan takes into account a margin of safety and a foreseeable increase in pollutant loads (allowing for reasonable expansion of nonpoint or point sources).

The MPCA and others have been actively involved in TMDL work through the Lower Minnesota River dissolved oxygen TMDL first established in the 1980s. It provided the basis for the Minnesota River Assessment Project and ensuing efforts, which showed that phosphorus was a large part of the problem. Since the TMDL was established, scientific evidence has demonstrated that in order to meet dissolved oxygen standards at low flow, pollutant reductions must also occur upstream of the Lower Minnesota River Watershed.

Efforts to complete TMDLs for the other stream reaches listed on the 1998 303(d) list have begun over the past two years. Table 1 lists the water bodies in the Minnesota River Basin that are included on 1998 303(d) list. The table also contains the schedule for each TMDL.

Water quality monitoring specific to the TMDLs has begun on several projects, largely through the efforts of CWP projects and project managers. A 12-step process developed for completing TMDLs
is shown in Table 2. Although monitoring is well under way in some areas, other important activities such as local government and citizen involvement are just starting.

In addition to working on individual impaired stream reaches, work is needed to evaluate the spatial extent of water quality impairments so that the 303(d) list would better encompass all of the water quality problems in the state (i.e., nutrients, temperature, sediment). Work is also needed to better identify and/or link the biological, chemical, and physical water quality impairments in the Basin with the state’s water quality standards. The MPCA Commissioner has determined that the process for revising the 303(d) list will be defined through the development of state rules. The number of water bodies listed as impaired in future 303(d) lists is expected to increase.

MPCA staff believe that a basin or watershed approach to the TMDL process should be taken. While Clean Water Act Section 303(d) regulations call for the completion of individual TMDLs for each stream reach included on the list, the regulations do identify the possibility of linking common impairments in similar water bodies into a combined TMDL. Water quality impairments associated with fecal coliform and turbidity standards are expected to fit into this regional or place-based approach in the Minnesota River Basin. This type of approach would provide a more accurate description of the state’s water quality, as well as greater efficiencies in completing the required TMDLs. Use of a place-based approach best represents the goals and purposes of Basin management.

A regional or place-based TMDL process can be used at the basin, major watershed, and minor watershed scales. It could also be applied at the ecoregion scale. By carefully considering those aspects of the TMDL process that are best accomplished at each of these scales and then designing specific TMDL processes accordingly, the task of conducting TMDLs can be made considerably more manageable than the current approach. Development of such a process will require discussions within the Agency, as well as between the Agency and a number of stakeholders and partners, including the EPA. This approach may be appropriate for those impaired watersheds or stream reaches that border other states, as the solutions may not be dependent on Minnesota residents alone.
### Table 1: 1998 303(d) List of Impaired Waters in the Minnesota River Basin

<table>
<thead>
<tr>
<th>Major Watershed</th>
<th>Reach Name</th>
<th>Pollutants and Schedule for Start and Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fecal Coliform</td>
</tr>
<tr>
<td>MN R. (Granite Falls)</td>
<td>Yellow Medicine R., Spring Cr. to MN R.</td>
<td>1999//2003</td>
</tr>
<tr>
<td>Watonwan R.</td>
<td>Watonwan R., Perch Cr. to Blue Earth R.</td>
<td>2000//2004</td>
</tr>
<tr>
<td>Redwood R.</td>
<td>Redwood R., Coon Cr. to Three Mile Cr.</td>
<td>2000//2005</td>
</tr>
<tr>
<td>MN R. (Granite Falls)</td>
<td>MN R., Chippewa R. to Stoney Run Cr.</td>
<td>2002//2006</td>
</tr>
<tr>
<td>Cottonwood R.</td>
<td>Cottonwood R., JD#30 to MN R.</td>
<td>2003//2007</td>
</tr>
<tr>
<td>MN R. (Shakopee)</td>
<td>MN R., Forest Prairie Cr. to Bevens Cr. (3 reaches)</td>
<td>2004//2008</td>
</tr>
<tr>
<td>MN R. (Mankato)</td>
<td>MN R., Blue Earth R. to MN R. near Ottawa (3 reaches)</td>
<td>2006//2010</td>
</tr>
<tr>
<td>MN R. (Shakopee)</td>
<td>MN R., Bevens Cr. to Miss. R. (4 reaches)</td>
<td>1992//2001</td>
</tr>
<tr>
<td>Redwood R.</td>
<td>Redwood River, JD#3 to Three Mile Cr.</td>
<td>1999//2003</td>
</tr>
<tr>
<td>Blue Earth R.</td>
<td>JD#3, Martin County, source DT to JD#3</td>
<td>2000//2005</td>
</tr>
<tr>
<td>Blue Earth R.</td>
<td>Center Run Creek, Headwaters to Elm Cr.</td>
<td>2002//2007</td>
</tr>
<tr>
<td>MN R. (Shakopee)</td>
<td>MN R., Bevens Cr. to Sand Cr.</td>
<td>2004//2008</td>
</tr>
<tr>
<td>MN R. (Shakopee)</td>
<td>MN R., Carver Cr. to Miss. R. (2 reaches)</td>
<td>2004//2008</td>
</tr>
</tbody>
</table>
Minnesota, Missouri, Cedar and Des Moines River Basins
1998 Impaired Waters List
(per Section 303(d) Clean Water Act)
Table 2: Steps in the TMDL Process

1. **Stakeholder involvement**
   - Outline water quality problem; answer questions, in regional meetings/presentations.
   - Establish local team (or use existing one) to stay with the project.
   - Invite local ideas on approaches to solving the problem.
   - Involve local people in data collection, plan development and review.

2. **Data collection**
   - Develop source inventories.
   - Conduct water quality monitoring to identify contributing areas.
   - Other data – geologic, land use, etc.

3. **Analyze and interpret data**
   - Identify sub-watersheds contributing disproportionately to problem.
   - Estimate “loads” or relative contributions by sector.

4. **Show initial results to local team**

5. **Show high-loading watersheds/sectors**
   - Discuss broad load-reduction scenarios.
   - Discuss specific site issues (unsewered communities, unpermitted feedlots, poor manure management sites, etc.).

6. **Run scenarios on different approaches to achieving designated uses**

7. **Show scenario results to team**
   - Show scenario results/discuss alternatives.

8. **Develop implementation strategy**
   - State load-reduction goals by sector.
   - Describe strategies for reaching goals.

9. **Send TMDL and implementation strategy to EPA**
   - EPA review.
   - Revisions, if any.
   - EPA approval.

10. **Implement strategy**
    - Focus MPCA programs on target areas/sites.
    - Seek funding.

11. **Monitor Progress**
    - Track progress on the land (BMP implementation, permits, etc.).
    - Monitor water quality to determine when goals are achieved.
    - If not achieved on schedule, return to #2 and repeat process.

12. **Declare victory, de-list the impaired reach**
Recognize Threats to Minnesota's Environment
Water Quality Impairments

B. DISSOLVED OXYGEN AND PHOSPHORUS

The dissolved oxygen and phosphorus goals and objectives are included together because of the strong linkage between phosphorus levels in the Minnesota River and dissolved oxygen concentrations in the lower reaches of the Minnesota River. Almost all efforts toward reducing the biochemical oxygen demand and, therefore, maintaining dissolved oxygen concentrations in the river involve the reduction of phosphorus levels. This is especially true of the reduction efforts above the lower reaches of the river.

DISSOLVED OXYGEN GOAL

Ensure that dissolved oxygen concentrations in surface waters throughout the Basin are adequate to fully support designated beneficial uses.

Objective 1: Maintain dissolved oxygen concentrations above 7.0 mg/l, as a daily minimum in Class 2A waters (Aquatic life and recreational waters – cold water fish; there are 22 designated trout waters in the Basin).

Targets: Currently these are not monitored routinely. They get appropriate effluent limits for point source discharges and implementation of nonpoint source programs. Special emphasis will be given to smart growth areas.

Measures: Dissolved oxygen in trout waters will be measured on a special case basis. Data will be maintained in STORET and will be reported as needed.

Objective 2: Maintain dissolved oxygen concentrations above 5.0 mg/l, as a daily minimum in Class 2B, 2C waters (Aquatic life and recreational waters – cool and warm water fish; the majority of the waters in the Basin).

Targets: Maintain by establishing appropriate wastewater treatment facility effluent limits for point sources and implementing nonpoint source programs. For water reaches threatened or not meeting dissolved oxygen requirements, identify for 303(d) list, schedule and complete TMDLs (see implementation schedule for specific reach impairments).

Measures: Dissolved oxygen in recreational and aquatic life waters will be monitored at strategic monitoring sites, at five-year intervals. Additional monitoring will be conducted during critical seasons and critical low streamflow conditions. If indications of hypoxia occur, such as unexplained fish kills, additional monitoring will be conducted to assess the problem and direct solutions.
Objective 3: Maintain a daily average dissolved oxygen concentration above 5.0 mg/l for the lower 22-mile reach of the Minnesota River (Class 2C - healthy communities of indigenous fish and associated aquatic life and their habitats).

Targets: A TMDL for dissolved oxygen was completed for this reach. Specific biochemical oxygen demand load allocations for point sources discharging directly into this reach along with headwater load and benthic sediment oxygen demanding loads have been established. A TMDL-assigned 40 percent reduction of the median summer $\text{BOD}_5$ (5-day biochemical oxygen demand) concentrations in the headwater to this reach will be achieved by reducing dissolved and suspended organic material, primarily through decreased algal production resulting from reductions in nutrient (phosphorus) load to the river. A Minnesota River TMDL will be completed using a computer model of the Basin and a stakeholder involvement process to further allocate the 40 percent headwater reduction objective.

Measures: For the lower Minnesota TMDL reach, weekly monitoring is conducted by the Metropolitan Council Environmental Services during the June-September summer period at Shakopee for $\text{BOD}_5$ and chlorophyll-a. Less frequent sampling for complementary parameters of Carbonaceous Oxygen Demand, Total Suspended Solids and Carbonaceous Biochemical Oxygen Demand is also conducted.

Objective 4: Maintain dissolved oxygen at measurable concentrations at all times and not less than 1.0 mg/l daily average in Class 7 waters (Limited resource value waters).

Targets: Class seven waters are not routinely monitored.

Measures: Assessments will be made under special cases.

**PHOSPHORUS GOAL**

Ensure phosphorus concentrations are low enough to fully support aesthetic (recreational use) and aquatic life goals in the lakes and waterways of the Minnesota River Basin and downstream waterways.

Objective 5: Reduce phosphorus loads throughout the Basin above Jordan to address the TMDL for low dissolved oxygen established for the 25-mile reach above Fort Snelling by 2010.

Targets: **Low Flow Year:** Reduce annual phosphorus loading above Jordan by 200 tons (approximately 60 percent of the total load, 350 tons per year, observed in the low flow years of 1988 and 1989) in a low flow year.
Targets: **Low Flow Year (Continued):**

- **2005:** 20% (percent reduction in annual load in a low flow year)
- **2010:** 40% (percent reduction in annual load in a low flow year)
- **Ultimate:** 60% (compared to 1988-1989)

**High Flow Year:** Reduce the annual phosphorus loading above Jordan by 1,200 tons (approximately 40 percent of the total load, 2,900 tons, observed in the high flow year of 1991) in a high flow year.

- **2005:** 10% (percent reduction in annual load in a high flow year)
- **2010:** 25% (percent reduction in annual load in a high flow year)
- **Ultimate:** 40% (compared to 1991)

**Long-term Average Flow Year:** Reduce the ten-year average annual phosphorus loading above Jordan by 600 tons (approximately 40 percent of the long-term average load of 1,500 tons).

- **2005:** 10% (percent reduction in the 10-year average annual load)
- **2010:** 25% (percent reduction in the 10-year average annual load)
- **Ultimate:** 40% (compared to the long-term average)

**Measures:** Annual and running ten-year average annual phosphorus load calculations from the river-monitoring site at Jordan. Point and nonpoint source load calculations and estimates based on available databases.

**Objective 6:** Establish nutrient criteria to meet beneficial use designations in tributaries and subwatersheds of the Basin. Adopt stream-specific nutrient criteria for the Minnesota River and its major tributaries for use in identifying and clarifying through policy decisions when and how phosphorus is an important factor in the water quality of the river and streams.

**Targets:**

- **2005 – Nutrient criteria for the rivers and streams of two major watersheds; data compilation in four major watersheds**
- **2010 – Nutrient criteria for the rivers and streams of five major tributaries; data compilation in nine major watersheds**
- **Ultimate – Nutrient criteria on all major tributaries and reaches of the Minnesota River**

**Measures:** Number of major watersheds with individual stream nutrient criteria developed and number with data compiled.

**Objective 7:** Reduce phosphorus loading to lakes throughout the Basin via a program approach requiring the use of best available technology for point source phosphorus control and promoting the implementation of various best management practices. These include on-site sewage treatment system upgrades, nutrient management on crop
land, and erosion control practices as described in the action strategies of this Basin Plan and in Minnesota’s Nonpoint Source Management Program Plan.

**Targets:** See targets and measures for the objectives in the sediment and bacteria goals (c. and e.).

**Objective 8:** Reduce phosphorus loads to lakes in the Basin via an individual project approach through the development and implementation of “comprehensive Lake Management Plans” using various grant and technical assistance resources (Lake Assessment Project, CWP, 319, Minnesota Lakes Association’s sustainable lake planning strategy, and others).

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2010</th>
<th>Ultimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Support</td>
<td>5</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Partial Support</td>
<td>5</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Non-Support</td>
<td>3</td>
<td>6</td>
<td>15</td>
</tr>
</tbody>
</table>

**Measures:** Number of lakes with active comprehensive Lake Management Plans.

**Objective 9:** Continue to evaluate lakes for swimmable and aquatic life use support for use in identifying their need for protection or restoration.

<table>
<thead>
<tr>
<th>Target</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2005:</td>
<td>25 lakes</td>
</tr>
<tr>
<td>2010:</td>
<td>50 lakes</td>
</tr>
<tr>
<td>Ultimate:</td>
<td>100 lakes</td>
</tr>
</tbody>
</table>

**Measures:** Number of additional lakes evaluated for use support (176 assessed as of 2000).

---

**PHOSPHORUS ACTION STRATEGY**

**Reduce phosphorus loads to the Minnesota River, its tributaries, and lakes in the Basin.**

**Tasks**

The tasks and milestones of this action strategy are intended to address the Lower Minnesota River TMDL for dissolved oxygen or the eutrophication of lakes as described below. The tasks and milestones related to the Lower Minnesota River TMDL reflect the need for a phosphorus protection strategy. The tasks will also go a long way toward addressing the Minnesota River’s share of the phosphorus problems in the Mississippi River. The tasks and milestones for
lakes are somewhat more specific given the smaller watersheds usually associated with the lakes in the Basin. The tasks for each often interrelate. The phosphorus source reduction strategies for the lower Minnesota River can be developed in a way that also addresses local water quality problems, including the restoration of lakes. Clean Water Partnership and other watershed management programs active in the Basin’s 13 major watersheds are appropriate venues for developing such strategies.

**Lower Minnesota River TMDL**

1. Quantify the phosphorus loads from different sources and major watersheds through additional Basin monitoring and modeling. A key to this quantification is the Hydrologic Simulation Program Fortran modeling effort described in the modeling action strategy.

2. Complete an expansion of the Lower Minnesota River TMDL for dissolved oxygen to determine the load allocations and implementation plan necessary for the Basin above Jordan to meet the Basin Plan objectives. This will involve Basin modeling analyses and stakeholder involvement efforts in identifying source contributions, implementation options and projected loadings. The final result of the TMDL will be an approved wasteload and load allocation for point and nonpoint sources, respectively.

3. Evaluate the adequacy of the initial load reduction goals for the pollution sources listed in the action strategy. Revise the load reduction goals, as necessary.

4. Apply the MPCA Phosphorus Strategy for NPDES permits in the Basin to identify the need for a phosphorus management plan and/or phosphorus limits for all point sources discharging in the Minnesota River Basin. Do so until more specific implementation measures are identified in a completed TMDL for the phosphorus loading from the Basin above Jordan to the lower reaches of the river.

   a) Require phosphorus monitoring and the development of a Phosphorus Management Plan. Include a provision for a phosphorus limit during the next facility expansion or upgrade based on an individual limit review process for each facility, as NPDES permits are reissued to facilities that are not expanding or undergoing significant upgrades.

   b) Apply a phosphorus limit to new and expanding facilities and facilities undergoing significant upgrades based on an individual limit review process for each facility, as NPDES permits are issued.

5. Incorporate the Waste Load Allocations (WLA) and implementation schedule of the Lower Minnesota River TMDL into NPDES permits, when it is completed.

6. Encourage the incorporation of the load allocations and implementation schedule of the Lower Minnesota River TMDL into watershed project implementation plans, when it is completed.

7. Support the Minnesota Technical Assistance Program (MnTAP) as it works with industries and publicly owned treatment works in conducting preliminary phosphorus evaluations and then developing Phosphorus Management Plans.
8. Evaluate the need for establishing an annual average effluent phosphorus limit of one mg/l or a load cap for all municipal and industrial point sources in a Basin-wide permit via a revision of Minnesota Rules.

9. Assess the needs of smaller facilities for incorporating biological phosphorus removal as a treatment technology to control phosphorus discharges.

10. Develop stream nutrient criteria as called for in the National Strategy for Development of Nutrient Criteria.

11. Encourage greater coordination between point source facilities’ planning (development of Phosphorus Management Plans and effluent limits) and Clean Water Partnership projects’ implementation planning.

12. Encourage the use of point and nonpoint source pollutant trading in NPDES permits. Streamline pollutant-trading policy to accommodate higher volume of trades.

13. Support local Soil and Water Conservation Districts, Board of Water and Soil Resources, and Natural Resource Conservation Service in the implementation of cropland Best Management Practices for erosion control and nutrient management. Identify additional resources needed to attain the pollutant reduction objectives.

14. Implement the EPA Phase II Storm Water Program in the applicable urban areas of the Basin. Continue the industrial and construction components of the Storm Water Program.

**Lakes**

15. As monitoring data becomes available, evaluate the level of swimmable and aquatic life use support for additional lakes in the Basin using the lake ecoregion phosphorus criteria.

16. Work with local units of government, citizens, and organizations in characterizing the quality of lakes in their area, setting appropriate water quality goals, and developing appropriate Lake Management Plans for the lakes. A small part of this work may be accomplished through grants and/or technical assistance of the CWP Program and Lake Assessment Program. Making observable changes in the quality of lakes that do not support swimmable uses will usually be much more difficult to accomplish than in lakes that are fully or partially supporting of swimmable uses.

17. Provide assistance to local units of government in developing and using adequate watershed assessment information for identifying land use changes needed to reduce phosphorus loading to lakes. Watershed information likely to include pollution sources such as feedlots, municipal and industrial point sources, individual sewage treatment systems, unsewered and undersewered communities, cropland, and riparian erosion areas.

18. Work to get more participants in the Citizens’ Lake Monitoring Program to provide broader coverage for the lakes in the Basin.

**MILESTONES**

1. Initiate Task # 4 as presented above to continue the process of reducing phosphorus loads from point sources of pollution through the NPDES permitting process – 2001 – 2002.
a) Develop a list of facilities that may be started, expanded, or upgraded for use identifying their need for a phosphorus limit.
b) Develop and prioritize a list of facilities/industries that will need to do phosphorus management planning in the next five years.

2. Develop a list of facilities that may be able to use MnTAP assistance in conducting evaluations of the potential for making phosphorus reduction - 2003.


4. Develop list of cities subject to Phase II Storm Water Program and begin working with them to demonstrate the importance of the program in controlling phosphorus loads in storm water – 2001 – 2003.

5. Improve the quantification of phosphorus load estimates and load reduction goals from the various sources in the Basin through the completion of HSPF modeling for the Basin – 2002.


9. Evaluate monitoring data in 2002 and 2004 to identify the swimmable use support (fully, partially, and non-) for newly assessed lakes and lakes with additional data.

10. Identify schedule for selecting and completing Lake Assessment Program studies on selected lakes in the Basin. Also, allocate staff resources to manage any lake projects selected for funding through the CWP – 2001 – 2005.

11. Increase the number of lakes monitored through the Citizens' Lake Monitoring Program from 80 in 2000 to 115 in 2004.

**BACKGROUND**

The Minnesota River is sensitive to the amount of phosphorus present in the river. Phosphorus significantly affects dissolved oxygen concentrations in water by causing increased algal growths. This results in a high carbonaceous biochemical oxygen demand as the algae decompose in the Lower Minnesota River during low flow periods. The high oxygen demand can then result in dissolved oxygen concentrations too low to support aquatic life in the river, violating Minnesota’s water quality standards.

Low dissolved oxygen levels were identified in a TMDL that was established for the lower 25 miles of the Minnesota River to address the presence of low dissolved oxygen concentrations. The impact of high oxygen demand was identified in a 1985 Waste Load Allocation for the Lower Minnesota River and a following TMDL in 1988. The linkage between the oxygen demand and phosphorus in the Minnesota River was established in a 1995 MPCA report titled, “Phosphorus reduction goals for the Minnesota
Eutrophication problems are most readily identified in the Basin’s lakes and reservoirs as excess phosphorus levels provide for accelerated growth of algae in the water. Eutrophication is also an issue in the river and its tributaries as high levels of phosphorus and chlorophyll have been measured in these waters. The Minnesota River plays an important role as a contributor of phosphorus to the Mississippi River, where eutrophication occurs periodically in Lake Pepin and Spring Lake.

**Phosphorus, Dissolved Oxygen, and the Lower Minnesota River TMDL**

The TMDL established for the lower 25 miles of the Minnesota River is based on a 1985 WLA study that addressed recurring dissolved oxygen and ammonia toxicity impairments in the metro reach of the river. Approved in 1985 by the EPA, the WLA concluded that both point source controls and nonpoint source reductions were needed to achieve water quality objectives.

To address the point sources, the MPCA issued permits to the Blue Lake and Seneca wastewater treatment facilities in 1987 that required these major dischargers to upgrade their facilities and provide advanced wastewater treatment with stringent CBOD and ammonia effluent limitations. In addition to these point source controls, the WLA recognized the need for an estimated 40 percent reduction in background levels of oxygen-demanding materials carried by the Minnesota River into the metro reach from other sources in the watershed.

The WLA was incorporated into Minnesota’s Water Quality Management Plan as a TMDL for the Lower Minnesota River in 1988. The load allocations for the various sources of oxygen demanding materials, as ultimate CBOD, are shown in the following table:

<table>
<thead>
<tr>
<th>Source</th>
<th>Oxygen Demand (#/d)</th>
<th>Percent of TMDL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue Lake WWTP, CBOD\textsubscript{ult}</td>
<td>14,600</td>
<td>27.3</td>
</tr>
<tr>
<td>Seneca WWTP, CBOD\textsubscript{ult}</td>
<td>15,100</td>
<td>28.3</td>
</tr>
<tr>
<td>* Headwaters, CBOD\textsubscript{ult}</td>
<td>13,600</td>
<td>25.5</td>
</tr>
<tr>
<td>Metro Tributaries CBOD\textsubscript{ult}</td>
<td>1,200</td>
<td>2.2</td>
</tr>
<tr>
<td>* Sediment O\textsubscript{2} Demand</td>
<td>6,700</td>
<td>12.6</td>
</tr>
<tr>
<td>Nitrogenous O\textsubscript{2} Demand</td>
<td>2,200</td>
<td>4.1</td>
</tr>
<tr>
<td>TMDL (Total)</td>
<td>53,400</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Following the TMDL, CBOD and phosphorus discharges from the Metropolitan Council’s wastewater treatment facilities at Blue Lake and Seneca were greatly reduced following the facilities’ upgrades to meet the CBOD\textsubscript{5} effluent limit of 10 mg/l. Average CBOD\textsubscript{5} effluent concentrations have decreased from 10 mg/l to three to four mg/l, while phosphorus discharges have been reduced by 50 percent.

In June 1997, the Metropolitan Council adopted a phosphorus reduction strategy. In implementing the strategy for its nine wastewater treatment plants, the Council set a goal to provide phosphorus removal to 1 mg/l in conjunction with significant plant expansions or by 2015,

River at Jordan,” by Dr. Erwin Van Nieuwenhuyse.
whichever is sooner. The Metropolitan Plant, which treats 80 percent of the wastewater generated in the metropolitan area, is scheduled to achieve this goal by 2003. In addition, the Council developed a grant program, funded at $7.5 million through 2003, to encourage and achieve nonpoint source reductions. The remaining load reductions needed to satisfy the requirements of the TMDL for dissolved oxygen will largely have to come from upstream point and nonpoint sources of phosphorus.

**Sources of phosphorus**

Phosphorus originates from several sources in the Minnesota River Basin. Point-source phosphorus comes mainly from municipal and industrial dischargers to surface waters. Non-point source phosphorus comes from agricultural fields, urban runoff, construction sites, feedlots, and onsite septic systems. The load of total phosphorus in the Minnesota River, and the relative proportions of point and non-point source phosphorus and internal load that comprise the total load, vary greatly with the river’s flow.

As would be expected, total phosphorus loads are the lowest during low flow conditions and highest during high flow conditions. The following load calculations are based on river monitoring data from the U.S. Geological Service gauge and Metropolitan Council sampling site near Jordan, Minn., and a combination of point source flow and phosphorus monitoring data, when available, and point source design flow and estimated phosphorus concentrations, when actual data were not available:

- **Low Flow:** In the low-flow years of 1988-89, the average total annual load of phosphorus measured at Jordan was 350 tons (English). The point and nonpoint source components of this load is difficult to identify because the sum of point load inputs and nonpoint source inputs is greater than the measured load at Jordan. This difference reflects the complex and uneven transport of phosphorus through the Basin during low flow conditions. Based on an assumption that the proportion of point and non-point loads are similar to the estimated loads (table 4), the point source component was estimated to be up to 55 percent of the total phosphorus load measured at Jordan. The remainder was attributed to nonpoint sources and internal load.

- **Average Flow:** The long-term (1979 – 1992) average annual phosphorus load at Jordan is 1,500 tons. Approximately 20 percent of this total (300 tons) is estimated to come from point sources. Non-point sources contributed approximately 80 percent of the Minnesota River’s total phosphorus loading.

- **High Flow:** In the high flow year of 1991, the total load of phosphorus measured at Jordan was 2,900 tons. Nonpoint sources contributed approximately nine-tenths of the Minnesota River’s total phosphorus loading with the remaining 10 percent, or 300 tons, being contributed by point sources.

The wide variation in the phosphorus loads from point and nonpoint sources during different flow conditions demonstrates the need to manage both point and nonpoint sources of pollution. During low flow conditions, phosphorus from point sources is a major component of the annual load to the Minnesota River, and, as such, needs to be reduced. On the other hand, the phosphorus
being delivered to the river during high flow years is almost all from nonpoint sources, the reduction in contribution being a result of greatly increased nonpoint loads rather than any decrease in point source load. The need and ability to achieve load reductions varies with flow regime.

Tables 4, 5, and 6 provide a comparison of phosphorus loads and potential load reductions from various sources in the Basin. At this time, the source load and reduction estimates are based on very limited data and rough assumptions. The numbers will be revised as more and better information is obtained through monitoring and modeling. The tables assume that all loads generated are transported through the system in any given year; whereas, in reality, there can be a lot of intermediate deposition or trapping and resuspension within and between years. This is especially evident in the loading estimates for a low flow year where the estimated total load equals 540 tons compared to a measured load at Jordan of 350 tons.

Recent work by Mulla (personal communication, 2001) indicates that inadequate nutrient management of both manure and chemical fertilizers results in about 60 percent of the phosphorus load to the Minnesota River on average. Relative contributions and the potential for reductions of manure and chemical fertilizer vary by geographic location in the Basin. On average, 50 to 60 pounds of phosphate per acre are over applied to cropland in the Basin. While the contribution of phosphorus from runoff and spills from feedlots is only about one percent of the total load to the Minnesota River, it can be critical at a local and specific time scale.

Relative proportions of total phosphorus at different flows:
<table>
<thead>
<tr>
<th>Phosphorus Load Estimates (tons (Eng.)/yr)</th>
<th>Flow Level&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td><strong>Point Sources</strong>&lt;sup&gt;2&lt;/sup&gt;</td>
<td>300</td>
</tr>
<tr>
<td>Septic tanks/systems&lt;sup&gt;3&lt;/sup&gt;</td>
<td>80</td>
</tr>
<tr>
<td>Improperly managed animal manure&lt;sup&gt;4&lt;/sup&gt;</td>
<td>70</td>
</tr>
<tr>
<td>Crop land (inorganic fertilizer &amp; sediment)&lt;sup&gt;5&lt;/sup&gt;</td>
<td>50</td>
</tr>
<tr>
<td>Riparian areas and stream banks&lt;sup&gt;6&lt;/sup&gt;</td>
<td>20</td>
</tr>
<tr>
<td>Urban storm water runoff&lt;sup&gt;6&lt;/sup&gt;</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total of Nonpoint Sources:</strong></td>
<td>240</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td>540</td>
</tr>
<tr>
<td>Difference between Estimated and Measured&lt;sup&gt;8&lt;/sup&gt;:</td>
<td>190</td>
</tr>
<tr>
<td><strong>Total Load Measured at Jordan</strong>&lt;sup&gt;9&lt;/sup&gt;:</td>
<td>350</td>
</tr>
</tbody>
</table>

<sup>2</sup> Estimated point source load calculated to be 300 tons/year based on effluent monitoring and treatment facility design standards.
<sup>3</sup> Personal communication with D. Mulla, University of Minnesota, 2001.
<sup>4</sup> Personal communication with D. Mulla, University of Minnesota, 2001.
<sup>5</sup> Calculated as the difference between the total load and the other source estimates.
<sup>6</sup> Assume 7% of total nonpoint source load under average conditions based on personal communication with D. Mulla, University of Minnesota, 2001.
<sup>8</sup> Difference reflects a small portion of the uncertainty present in the estimated loads given the complex transport processes present in the Basin’s rivers, streams, and ditches.
<sup>9</sup> Metropolitan Council Environmental Services data and calculations using FLUX.
Table 5. Gross Estimates of Potential Phosphorus Load Reductions in the Minnesota River Basin.

<table>
<thead>
<tr>
<th>Phosphorus Load Reduction Estimates (tons (Eng.)/yr)</th>
<th>Flow Level¹</th>
<th>Low</th>
<th>Average</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point sources²</td>
<td>170</td>
<td>170</td>
<td>170</td>
<td></td>
</tr>
<tr>
<td>ISTS³</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Agricultural sources (sum of 3 below):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crop land (CREP)⁴</td>
<td>40</td>
<td>160</td>
<td>160</td>
<td></td>
</tr>
<tr>
<td>Conservation tillage⁵</td>
<td>20</td>
<td>120</td>
<td>270</td>
<td></td>
</tr>
<tr>
<td>Nutrient (manure) management⁶</td>
<td>10</td>
<td>70</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Stream banks⁷</td>
<td>5</td>
<td>10</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Urban storm water runoff⁸</td>
<td>5</td>
<td>20</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Sum of Source Reduction Estimates:</td>
<td>290</td>
<td>590</td>
<td>970</td>
<td></td>
</tr>
</tbody>
</table>

¹ Low – mean of 1988 & 1989 values; Average – mean of 1979 – 1992 values; High – 1991 values
² Assumes a 57% reduction in loading due to point source controls (draft revision of Phosphorus Reduction Needs in the Minnesota River Basin, MPCA).
³ Assumes a 50% reduction in the number of septic systems discharging to surface water.
⁴ Estimate of reduction based on the following assumptions: full enrollment of a total of 100,000 acres in CREP (33,000 acres allocated to riparian area crop land with an average erosion rate of 5 tons/acre, a treatment efficiency of 80 percent and delivery rate of 100 percent; 33,000 acres allocated to wetland restoration with no phosphorus treatment; and 33,000 acres allocated to floodplain cropland with an average scour erosion rate of 5 tons/acre, a treatment efficiency of 80 percent, and 100 percent delivery). Sediment yield would be 264,000 tons. Assuming 1 ton P per 1,600 tons sediment provides a phosphorus reduction estimate of 160 tons/year.
⁵ Estimate based on the adoption of conservation tillage on 75 percent of the row crop land in the Basin. Number estimated from Hydrologic Simulation Program Fortran (HSPF) modeling of the Le Sueur River watershed by the MPCA.
⁶ Assumed a 25% reduction in loading due to improved nutrient management at average conditions.
⁷ Assumed a 10% reduction in loading due to stream bank erosion controls at average conditions.
⁸ Assumed a 20% reduction in loading due to urban storm water controls at average conditions.
Table 6. Comparison of Total Loads, Interim Reduction Goals, and Estimated Source Reductions of Phosphorus in the Minnesota River Basin.

<table>
<thead>
<tr>
<th>Phosphorus Load Estimates (tons (Eng.)/year)</th>
<th>Flow Level¹</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Average</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td><strong>Total Estimated Load</strong>²</td>
<td>540</td>
<td>1,500</td>
<td>2,900</td>
<td></td>
</tr>
<tr>
<td><strong>Sum of Source Reduction Estimates</strong>³</td>
<td>290</td>
<td>590</td>
<td>970</td>
<td></td>
</tr>
<tr>
<td>Total Load after Source Reductions:</td>
<td>150</td>
<td>910</td>
<td>1,930</td>
<td></td>
</tr>
<tr>
<td><strong>Interim Reduction Goal</strong>⁴</td>
<td>210</td>
<td>600</td>
<td>1,200</td>
<td></td>
</tr>
<tr>
<td>Total Load after Interim Goal Reductions:</td>
<td>140</td>
<td>900</td>
<td>1,700</td>
<td></td>
</tr>
</tbody>
</table>

² See Table 4.
³ See Table 5.
⁴ Intermediate reduction goals set via the Lower Minnesota River Waste Load Allocation and following Minnesota River assessment work were 60, 40, and 40% of estimated total loads for low, average and high flow levels, respectively.
Phosphorus Reduction Plan

Considerable work has gone into the development of the information present in this action strategy. The phosphorus strategy for the Minnesota River Basin builds on, and is consistent with, the MPCA’s statewide Phosphorus Strategy and the 1985 Wasteload Allocation for the lower Minnesota River. The reduction goals for the river, point sources, and nonpoint sources are provisional estimates based on the information described in an MPCA technical memorandum titled, “Phosphorus Reduction Goals for the Minnesota River at Jordan.”

The adequacy of the phosphorus strategy will be re-evaluated as additional data and better analytical techniques become available. Additional monitoring and modeling are needed to quantify the phosphorus loads, transport processes, and load reduction goals for the Basin and individual pollution sources. A Basin modeling effort using the model, Hydrologic Simulation Program Fortran, is to be completed in 2002. The Lower Minnesota River TMDL will then be expanded to specify load allocations for the headwater sources of phosphorus. The process for completing the TMDL will include stakeholder involvement as load allocations and the mechanisms to attain the allocations are developed for both point and nonpoint sources.

Phosphorus, Lakes, and Eutrophication

As noted above, phosphorus is closely associated with the eutrophication of lakes in Minnesota. The extent to which algal blooms are a problem in lakes depends on several factors. Factors that affect the water quality of lakes include their size and shape, watershed size, residence time of water and their location in the state. Water quality criteria have been developed based on aquatic ecoregions and phosphorus concentrations in the least impacted lakes of each ecoregion. Individual ecoregions describe areas that are similar based on a number of physical and hydrologic factors. The Minnesota River Basin contains the following three ecoregions: North Central Hardwood Forests, Western Corn Belt Plains, and Northern Great Plains.

The lake phosphorus criteria developed for these ecoregions can be used as initial goals to guide lake protection and restoration efforts. The ecoregion-based criteria are now being used as the primary basis for evaluating the degree of “swimmable” use support in lakes that have a maximum depth of 10 feet or greater. Criteria for lakes less than 10 feet deep are based on secondary contact phosphorus (partial support) levels and aquatic life protection. As such, they may be used to identify lakes that are not supporting their designated uses for inclusion on the Clean Water Act Section 303(d) List. It is anticipated that the criteria will eventually be promulgated into water quality standards as per the EPA Clean Water Action Plan.

The degree of “swimmable” use support has been assessed for 176 lakes in the Minnesota River Basin. This represents 39 percent of the lake surface area in the Basin. Use support for swimming based on phosphorus concentration in the water is characterized as fully supporting, partially supporting, or not supporting (Table 7). Of the lakes assessed, 38, 22, and 40 percent of the lakes are fully, partially, or not supporting of swimmable use, respectively. Given these results, attaining or maintaining “partial” support for swimmable use may be a goal for many of the lakes in the Minnesota River Basin.
Table 7: Summary of Swimmable Use Support for Assessed Lakes in the Minnesota River Basin.

<table>
<thead>
<tr>
<th>Ecoregion</th>
<th>Number of lakes assessed</th>
<th>Phosphorus criteria for swimmable use</th>
<th>Percent of assessed lakes with given level of use support</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Full Support</td>
<td>Partial support</td>
</tr>
<tr>
<td>North Central Hardwood Forests</td>
<td>110</td>
<td>&lt; 40 ( \mu g/l )</td>
<td>40 - 60 ( \mu g/l )</td>
</tr>
<tr>
<td>Western Corn Belt Plains</td>
<td>42</td>
<td>&lt; 70 ( \mu g/l )</td>
<td>70 - 90 ( \mu g/l )</td>
</tr>
<tr>
<td>Northern Glaciated Plains</td>
<td>24</td>
<td>&lt; 70 ( \mu g/l )</td>
<td>70 - 90 ( \mu g/l )</td>
</tr>
<tr>
<td>Whole Basin</td>
<td>176</td>
<td>38</td>
<td>22</td>
</tr>
</tbody>
</table>

Studies indicate that lakes fully or partially supporting swimming are more likely to respond to water quality improvement efforts than lakes that do not. Small to moderate pollutant reductions to lakes in relatively good condition are likely to result in some water quality improvement, while similar reductions to a highly impaired lake are likely to show minimal improvement in water quality from a swimmable use perspective. However, care must be taken to set goals appropriate to individual lakes. Specific goals should be based on individual lake and watershed monitoring studies.

Many of the non-supporting swimmable use lakes in the Basin likely will never fully support swimmable uses based on the state’s ecoregion phosphorus criteria, because their phosphorus concentrations are very high (much greater than 90 \( \mu g/l \)). However, improvements in water quality that provide a slight to moderate reduction in the number and/or extent of nuisance algal blooms in a lake may be a desirable and attainable goal. MPCA staff will work with local units of government and organizations in the Minnesota River Basin in setting appropriate lake goals and pursuing restoration activities.
C. **SEDIMENT AND TURBIDITY**

The goal, objectives, and action strategy dealing with sediment and turbidity in the waters of the Minnesota River Basin and its downstream waters are listed below. Sediment in water can cause water quality problems in various ways as described in the background section of this action strategy. The goal and objectives are intended to address both the water column (turbidity and/or suspended solids concentrations) and the sediment loading problems in the Minnesota River Basin. They are also meant to help address the sediment loading problems present in the Lower Mississippi River, especially in Spring Lake and Lake Pepin. The objectives identify both water quality measures and source reduction estimates believed necessary to make progress toward attaining the sediment goal. The tasks of the action strategy will help reach the objectives, develop methods for better understanding the sediment delivery system, and identify the most appropriate targets and measures for the objectives.

The development and linkage of sediment reduction goals to the Lower Mississippi River Basin, as well as to the Minnesota River Basin, are very important. The Hydrologic Simulation Program Fortran modeling for the Lower Minnesota River dissolved oxygen TMDL will also be important in the development of the sediment goals. This integration is needed since a TMDL will be required for turbidity in the lower reaches of the Minnesota River and since sedimentation in the Lower Mississippi River is a big concern. The situation is complicated by the need for an evaluation of the turbidity standard compared with the attainability of the turbidity standard and issues dealing with the transport and deposition of sediment in the river.

**SEDIMENT GOAL**

Ensure that turbidity and total suspended solids levels are low enough to fully support aesthetic (recreational use) and aquatic life goals in the waterways of the Minnesota River Basin and downstream waterways.

**Objective 1:** Reduce sediment loading from recent (average annual load for the period, 1989 – 1992) levels to the Minnesota River and its tributaries by the target percentages:
 Targets: 2005 – 10% reduction
          2010 – 20% reduction
          Long term goal – 40% reduction*

 Measures: Annual sediment loading calculations from long-term monitoring sites.
           Annual sediment loading calculations from major watershed projects’ monitoring sites.
           Sediment load estimates from turbidity TMDL study areas.
           Use of sediment load estimates from validated models.
           *Note – May be changed based on future research.

 Objective 2: Achieve turbidity levels of 25 Nephelometric Turbidity Units (NTU) or less in streams and rivers during base flow conditions throughout the Basin.

 Targets: Targets will be set following an assessment of existing data and an evaluation of the use of the water quality standard for turbidity as an appropriate measure of water quality impairment.

 Measure: Percent of monitored streams and rivers with annual mean turbidity levels during base flow conditions that are less than or equal to 25 NTU.

 Objective 3: Determine the amount of sediment loading that needs to be reduced to ultimately attain the resource goals for the Minnesota River and the Lower Mississippi River, especially Lake Pepin.

 Target: Complete Minnesota River modeling and assessment by 2005.
        Link reduction goals with Lower Mississippi River Basin Plan goals and action strategies.

 Measures: Completion of the modeling and assessment study.
           Referencing of goals with the Lower Mississippi River Basin Plan.

 Objective 4: Increase the percentage of row-crop acres under conservation tillage.

 Targets: 2005 – 55%
          2010 – 65%
          Ultimate – 75%

 Measure: Percentage of row-crop land (Basin-wide) under conservation tillage or equivalent erosion protection based on a five-year rolling average using the annual BWSR tillage transect survey completed by counties.

 Objective 5: Increase the number of stream miles in the Basin that are protected by riparian buffers according to the following schedule:

 Targets: 2005 – 50 %
Minnesota River Basin Plan

2010 – 75 %
Ultimate – 100 %

**Measures:** Percentage of stream miles protected by riparian buffers as tracked by the Minnesota State University Geographic Information System database, NRCS efforts, or similar efforts. Incorporate Conservation Reserve Enhancement Program (CREP) tracking, as available.

**Note:** Gross estimates of riparian land use/cover made by BWSR staff using information from the 100–100 Study by MSU indicate that about half of the stream length in the Basin is in vegetative cover, while the other half is cropped (i.e., unprotected). Approximately 15 percent of the unprotected riparian areas have now been protected through programs such as CREP and Reinvest In Minnesota (RIM).

**Objective 6:** Increase the percentage of floodplain with protected vegetative cover, according to the following schedule:

**Targets:**
- 2005 – 75 %
- 2010 – 85 %

**Measures:** Percentage of floodplain area in the Basin with permanent vegetative cover buffers as tracked by the MSU GIS database, CREP tracking, NRCS efforts, or similar efforts.

**Note:** Gross estimates of floodplain land use/cover made by BWSR staff using information from the 100–100 Study by MSU indicate that about half of the 100-year floodplain in the Basin is in vegetative cover, while the other half has been in other land uses (i.e., unprotected). Approximately 15 percent of the unprotected floodplain areas have now been converted back to protective vegetative cover through programs such as CREP and RIM. Therefore, protective vegetative cover is already present in nearly 60 percent of the 100-year floodplain of the Minnesota River and its tributaries.

**Objective 7:** Implement the Phase II Storm Water NPDES Permit Program and work with communities (cities and counties) in developing their storm water programs to reduce sediment loading from urbanized areas to the waters of the Minnesota River Basin.

**Targets:**
- 2002 – Develop list of cities subject to the Phase II Storm Water Program
- 2003 – Phase II community applications due
- 2008 – Fully Implement the Phase II Storm Water Program, as required by the EPA

**Measures:** Number of general and individual community permits issued.
Number of implementation plans completed.
SEDIMENT ACTION STRATEGY

Reduce sediment concentrations and loads to levels that provide for the attainment of aesthetic (recreational use) and aquatic life (habitat) needs, using methods that are economically and technologically achievable.

TASKS

1. Complete modeling and assessment of the Minnesota River Basin to adequately identify the sediment loading reductions needed for the Lower Minnesota River and the Lower Mississippi River. Current effort involves the completion of Minnesota River modeling. Efforts are also needed to incorporate other models as they become available. Adjust the sediment reduction strategy, as necessary.

2. Develop a better understanding of sediment in water and its effects on the physical and ecological integrity of the aquatic system. Research using monitoring and modeling is needed to better quantify the movement of sediment into the water from various sources, the magnitude and duration of turbid stream conditions, the influence of weather, and the nature and extent of aquatic life impairments associated with the different levels of turbidity and sediment loading. Characterize turbidity and TSS levels in different ecoregions, at different stream orders, and at different flow levels, and relate the levels to water quality goals and standards. This information then needs to be used to confirm the adequacy of the interim sediment delivery reduction recommendation of 40 percent from in the Minnesota River Assessment Project (MRAP) or in determining a more appropriate sediment loading reduction goal for the Basin. The relevance of the current turbidity standard should also be reviewed in light of this information, and new benchmarks developed, if appropriate.

3. Measure the change in sediment delivery in terms of load and concentration due to implementation activities. This task will be completed via the monitoring action strategy. The change measured will then be evaluated against the reduction goals to be established or confirmed in the task above.

4. Develop stream criteria for turbidity and suspended sediment concentrations throughout the Basin for high, medium and low flows. Use these criteria in conjunction with load reduction goals to develop major watershed goals that contribute to the attainment of local and Basin-wide water quality goals.

5. Restore and protect riparian corridors and flood plain areas from excessive erosion. The Wetland Reserve Program, the Reinvest in Minnesota Reserve Program, the Conservation Reserve Program, and the Conservation Reserve Enhancement Program will be promoted to restore these sensitive areas to protected vegetative cover.
6. Communicate the need for national legislation that ties farm income supports to conservation compliance measures and reauthorizes the Conservation Reserve Program and Conservation Reserve Enhancement Program.

7. Track the implementation of riparian corridors and flood plain area practices completed in the above programs.

8. Promote the use of crop residue management for reducing soil erosion on cropland. MRAP recommended a three-phase approach to bring row crop land to a rotation average of at least 30 percent residue after planting, or provide equivalent soil protection:
   - Treat crop land currently exceeding soil loss tolerance levels;
   - Treat crop land in riparian areas and other areas where sediment delivery is highest;
   - Treat the remaining crop land acres.

Pursue opportunities for enhancing current efforts in cooperation with the Minnesota Board of Water and Soil Resources, Minnesota Department of Agriculture, USDA Natural Resources Conservation Service, Minnesota Extension Service, and other organizations. Promote additional research and extension efforts on tillage alternatives.

9. Evaluate and/or revise targets for conservation tillage and other BMPs by resource goal or impairment. Targets will likely differ by the resource and impairment in question (i.e., Lower Minnesota River versus the major and minor tributaries versus individual TMDL reaches). Work with BWSR and individual counties to develop county and/or watershed specific targets.

10. Promote research on the effects of surface tile intake management on water quality. Research and demonstration initiatives are needed to identify economical and effective tiling practices that will reduce sediment delivery through surface tile intakes. These practices may include slotted or controlled standpipes, grass buffer strips, rock filters, crop residue management, or the removal of surface inlets with increased densities of subsurface drainage in low-lying areas. Research is also needed to provide better estimates of total sediment load delivered through open tile intakes from various geographical settings.

11. Promote and document the implementation of tile intake management practices through educational efforts and incentives as appropriate management practices are developed. Focus implementation efforts on areas susceptible to the greatest sedimentation via the surface tile inlets.

12. Promote research for improved assessment including measurement or estimation of sediment loads coming from stream bluff and bank erosion in the Minnesota River main stem and its major tributaries. Research should also investigate how both overland and artificial drainage, hydrology and stream morphology interact to affect erosion of stream bluffs and banks. Develop improved predictive techniques relating to this source of sediment as well as revisit current prioritization processes for mitigation and treatment. This knowledge can be used to design effective remediation measures, ranging from increased water storage in the uplands to bank and bluff stabilization measures.

13. Assemble inter-agency committee to monitor the effect and enforcement of mandatory vegetative buffer strips on protected waters (Shoreland Management) and public drainage ditch projects. Utilize the results of the study and a survey of how buffer strips have been used in other areas to develop recommendations on how their use can be improved. Implement recommended changes (changes may include enhanced enforcement of existing controls, rule changes, or other mechanisms identified by the committee). Monitor the effectiveness of the changes. (This task is included in the Rivers and Streams chapter of the 319 Management Plan.)
14. Address urban storm water sediment issues through the storm water chapter of the Basin Plan.

**MILESTONES**


2. Complete an evaluation of the adequacy of the interim 40 percent sediment delivery reduction recommendation for the Minnesota River Basin, revise the reduction goal, if necessary, and provide an evaluation of how to incorporate the turbidity standard to nonpoint sources of pollution – 2001-2005.

3. Document receipt of additional state funding for CREP to take advantage of this opportunity to reduce sediment and nutrient loads. Enter into a Phase 2 CREP agreement with USDA to provide for the enrollment of an additional 90,000 acres for the program – 2001-2002.


**BACKGROUND**

The Minnesota River Assessment Project identified sediment as a pollutant of concern in the Minnesota River. Sediment causes turbidity or cloudiness in the water that can limit light penetration and inhibit healthy plant growth on the river bottom. Sediment on the river bottom can destroy the habitat of fish, macroinvertebrates, and other aquatic life. Sediment is a significant carrier of other critical pollutants, including phosphorus and heavy metals. It can play a role in decreasing dissolved oxygen levels in the river via a direct sediment oxygen demand and increases in the biochemical oxygen demand due to warmer water temperatures resulting from increased adsorption of solar energy by the sediment in the water. Excessive turbidity is also an aesthetic impairment.

Sediment settling at the bottom of a water body will fill it in over time. These impacts are felt not only in the Minnesota River, but also downstream in the Mississippi River. The Minnesota River accounted for over 90 percent of the sediment loading to Lake Pepin in the 1990s. While its sediment contribution prior to European settlement was still over 70 percent of the total, the actual load was dramatically less (Engstrom and Almendinger, 2000).

The amount of sediment that enters and is transported through the streams and rivers of the Minnesota River Basin varies greatly from year to year. The average annual sediment transport of the Minnesota River at Mankato is about one million tons, but it can range from 200,000 to 3.5 million tons per year. A sediment reduction recommendation of 40 percent was developed following the MRAP work. This has served as an interim reduction goal while further monitoring and modeling efforts are being completed to better quantify the reduction needed in the Basin. The 2005 and 2010 reduction targets are set at 10 percent and 20 percent as steps toward attaining the ultimate sediment reductions needed.

Upper Mississippi River: Mass-balance Reconstructions from the Sediments of Lake Pepin. Final research report prepared by the St. Croix Watershed Research Station, Science Museum of Minnesota for the Metropolitan Council Environmental Services, St. Paul, MN. 48 pp.)

Many Sources of Sediment

Although specific estimates of the total sediment contribution from agricultural land have not been made, based on the fact that agriculture comprises over 80 percent of the Basin’s land use, it is likely the dominant land use contributor of sediment to the Minnesota River. Urban and suburban land uses, while comprising only about 2 percent of the Basin, have been estimated to contribute about 30,000 tons of suspended sediment to the river per year.

The banks and beds of streams and rivers are another source of sediment in the Minnesota River. The extent to which streambank erosion and streambed scouring account for the sediment load varies. At particular times and locations it can be very significant. Recent studies of the Blue Earth River by the University of Minnesota estimated that 30 percent to 45 percent of suspended sediment originated from the bluffs and banks of this highly incised river, while highly erosive farm fields contributed about 40 percent of the sediment.

The composition of sediment in the river is about 90 percent silt and clay, which can be transported long distances. Sand typically settles back to the streambed quickly. Sand comprises about 50 percent of bank and bed erosion. The degree to which stream bank and bed erosion is natural and unavoidable is not known. It is known that extensive artificial drainage has resulted in higher peak flows on some of the smaller tributary streams, which can lead to greater stream bank erosion. In addition, it is likely that a certain percentage of the sediments in the streambed and along the bank originated from upland sources. Thus, it is hard to clearly separate upland and near or in-stream sediment sources.

TSS Concentrations, Loads Vary With Flow

Total suspended sediment concentrations and yields vary with flow, as noted above. Data compiled from the long term USGS monitoring site on the Minnesota River near Mankato show these changes over various flows and time. A number of observations can be made from this data. The observations include:

- The amount of sediment delivered downstream was much greater in the period, 1990 – 1999, than in the decade, 1971 – 1980. The total loads were 20 million tons and 8 million tons per decade, respectively.
- Daily flows were lower in the 1970s than in the 1990s:
  - 45 percent of the mean daily flows between 1971 – 1980 were less than 1,000 cfs; whereas,
  - only 12 percent of the mean daily flows were less than 1,000 cfs between 1990 – 1999. See Figure A.
- Likewise, out of bank flows were much higher in the 1990s than in the 1970s:
  - mean daily flows exceeded 16,000 cfs (out of bank or flood flow conditions at Mankato) 415 times in the 1990s and only 95 times in the 1970s (11 percent and 3 percent of the total number of days, respectively);
  - several of the highest mean daily flows between 1990 and 1999 exceeded the maximum
mean daily flow observed in the 1970s. See Figure A.

- With the greater proportion of low flows in the 1971-1980 decade, the proportion of the sediment load occurring during the lower flow periods was also greater. Fifty-seven (57) percent of the total sediment load between 1971 and 1980 occurred during flows less than 10,000 cfs; while only 23 percent of the total load occurred during these flow levels in the 1990s. See Figure C.
- On an average per event basis, the sediment load at flows less than 8,000 cubic feet per second decreased an average of 24 percent from the 1970s to the 1990s. The sediment load from flows greater than 8,000 cfs was much more variable with an
  average increase in loads of 11 percent. See Figure B.
- The sediment load for lower level flow events (less than 8,000 cfs) in the 1990s was not significantly greater than in the 1970s even though the number of lower level flows in the 1990s was much higher than in the 1970s. See Figure C.
- The flood level flows of the 1990s accounted for the delivery of 77 percent of the total sediment load; whereas, only 43 percent of the total sediment load occurred during the flood level flows of the 1970s.
- The mean daily flows in the 1990s that exceeded the maximum daily flow in the 1970s accounted for 17 percent of the total sediment load.

**Figure A**

![Number of Days per Flow Category](image)
Figure B

MN River at Mankato Average Tons/Day

1990-1999
Tons/Day
1971-1980
Tons/Day
Figure C

**BMPs Help Reduce Sediment at Low Flow**

In summary, these observations suggest that conservation efforts implemented between these periods have been effective in reducing the sediment concentrations and loads at the lower flow ranges. Whereas, the implemented BMPs do not appear to have affected the sediment concentrations and loads at the higher flows prevalent in the 1990s. This suggests that BMPs that can deal with larger storm events and related flows are still needed in the Basin. BMPs that may do this include streambank restoration, increased upland water storage, and the Conservation Reserve Enhancement Program. Some progress has been made with these practices and/or programs, but more work is needed in incorporating them into the landscape, evaluating their effectiveness, and then increasing their presence through current or new programs.

**Strong Link Between TSS, Turbidity**

Turbidity is a measure of the extent to which the intensity of light passing through water is reduced by suspended matter. The water quality standard for turbidity in the Minnesota River is 25 Nephelometric Turbidity Units (NTU). The correlation between the concentration of suspended sediment in the water and its turbidity is strong. As such, a link between the turbidity standard and TSS concentration can be made. In so doing we find that the turbidity standard is likely exceeded whenever the flow in the Minnesota River at Jordan exceeds 2,000 cfs. The development of suspended sediment goals for the Minnesota River must, in some way,
accommodate both the actual conditions in the river and the water quality standard for turbidity. Attaining a turbidity of 25 NTU or less at any elevated storm event flow is apt to be very difficult. While this was not a significant problem for controlling industrial and municipal point sources where establishing a discharge limit for low flow conditions was considered adequate, it becomes a problem if point or nonpoint discharges are to be managed to meet this outcome at medium and high flows.

Straw bales staked around this open intake provide a temporary barrier to prevent sediment runoff in this Renville County field. MPCA photo
Recognize Threats to Minnesota's Environment
Water Quality Impairments

D. TOXICS GOAL

Protect human health and aquatic life within the
Minnesota River Basin from the effects of toxic
substances.

Objective 1: Reduce ambient water un-ionized ammonia
concentrations according to the following
schedule (2000 baseline is 5 un-ionized ammonia
impaired reaches on 303 (d) list):

Targets: 2005 – 40 ug/L.
2010 – 40 ug/L. – complete TMDL studies on these
reaches

Measures: Ambient water concentrations of un-ionized ammonia.

Objective 2: Reduce, according to the following schedule, ambient water mercury
concentrations in the Lower Minnesota River:

Targets: Ultimate: 0.0069 ug/L. Eliminate mercury-caused fish consumption advisories.

Measures: Ambient water concentrations of mercury in northern pike tissues.

Objective 3: Reduce, according to the following schedule, Polychlorinated Biphenyl (PCB)
concentrations in fish tissue:

Targets: Eliminate PCB-caused fish consumption advisories

Measure: PCB concentrations in channel carp tissues.

Note: Meeting environmental objectives for mercury and PCBs may require inter-
state work on airborne transport of these pollutants.

Objective 4: Achieve and maintain the compliance rate, according to the following schedule,
for permitted dischargers with ammonia effluent limits:

Targets: 2005 – 98%
2010 – 98%
Ultimate – 98%
**Measures:** Compliance rate for permitted dischargers with un-ionized ammonia effluent limits.

**Objective 5:** Reduce the number of salvage and storage yards located in flood plains and areas subject to flooding or ponding to the targets according to the following schedule:

**Targets:**
- 2005 – Reduce by half
- Ultimate – 0

**Measures:** Number of salvage and storage yards located in flood plains and areas subject to flooding or ponding.

**Objective 6:** Reduce, according to the following schedule, the number of salvage yards and recyclers that have not removed mercury from devices and equipment:

**Targets:**
- 2005 - Educate all salvage yards on the need to remove mercury
- 2010 – 90 percent have removed mercury from devices and equipment
- Ultimate – 90 percent

**Measures:** Number of salvage yards and recyclers that have removed mercury from devices and equipment.

**Objective 7:** Reduce, according to the following schedule, the number of devices and equipment containing PCBs (e.g., transformers on poles):

**Targets:**
- 2005 - Half of devices have been disposed of.
- 2010 - All have been disposed of.
- Ultimate - 0

**Measures:** Number of devices and equipment containing PCBs (e.g., transformers on poles).
Recognize Threats to Minnesota's Environment
Water Quality Impairments

**E. BACTERIA GOAL**

Reduce the potential for water-borne disease transmission in the Minnesota River and its tributaries.

**Objective 1:** Between April 1 and October 31, work toward achieving both parts of the standard for fecal coliform bacteria (Minnesota Rules Part 7050.0222)

- 200 organisms per 100 milliliters (geometric mean of five samples/month) or
- 2,000 organisms per 100 milliliters in no more than ten percent of the samples per calendar month.

**Measures:** Number of fecal coliform organisms per 100 milliliters. Monitoring locations and frequency will be determined. Initial sites will be in association with CWPs and TMDLs.

**Objective 2:** Develop, according to the following schedule, TMDL plans to address use impairments caused by fecal coliform concentrations. (There are 20 stream reaches in the Minnesota River Basin on the 1998 303(d) List due to fecal coliform levels.)

**Targets:**
- 2005 – 9
- 2010 – 20

**Measures:** Completed and EPA accepted TMDL plans.

**Objective 3:** Decrease, according to the following schedule, the number of incorporated communities that do not have adequate wastewater treatment. There are currently 34 incorporated communities in the Minnesota River Basin that do not have adequate wastewater treatment services.

**Targets:**
- 2005 – 20 communities
- 2010 – 10 communities
- Ultimate – 0 communities
**Objective 4:** Increase, according to the following schedule, the percentage of ISTSs that are compliant with state rules.

**Targets:**
- 2005 – 25 percent
- 2010 – 50 percent
- Ultimate – 100 percent

**Measures:** Percentage of ISTSs in compliance.

**Objective 5:** Increase the percentage of 1,000+ animal unit feedlots that have proper MPCA permits and Manure Management Plans to 100 percent by 2005.

**Measures:** Percentage of 1,000+ animal unit feedlots that have proper MPCA/NPDES permits and Manure Management Plans on record with MPCA.

**Objective 6:** For 300 - 1,000 animal unit feedlots that have pollution problems, as defined in Minnesota Rules Chapter 7050, increase, according to the following schedule, the percentage of feedlots with interim county/MPCA permits.

**Targets:**
- 2005 – 75 percent
- 2010 – 100 percent

**Measures:** Percentage of 300 – 1,000 animal unit feedlots that have taken necessary measures to be in compliance with the feedlot rule.

**Objective 7:** The percentage of 0-300 animal unit feedlots that have open lot runoff problems, that have either taken interim measures as defined in a 2005-2010 open lot agreement or have fully resolved their pollution problems.

**Targets:**
- 2005 – 90 percent
- 2010 – 100 percent
- Ultimate – 100 percent of feedlots have eliminated pollution problems

**Measures:** Percentage of 0 – 300 animal unit feedlots that have either taken interim measures or have fully resolved their pollution problems.

**Open lot runoff** - The feedlot rule provides a unique opportunity to farmers with fewer than 300 animal units that have pollution hazards related to open lot runoff. If registered by January 1, 2002, the owner can sign an agreement to phase in corrective
measures over several years. As part of this agreement, lower cost interim measures need to be installed by 2005 to reduce runoff through specified BMPs or by using other means to reduce pollutant levels by 50 percent. By 2010, all measures must be completed. If an open lot agreement is not signed by 2005, an interim permit is required and the pollution problems must be fixed within 24 months.

**Objective 8:** For 0-300 animal unit feedlots with pollution problems, correct pollution problems in accordance with Minnesota Rules Chapter 7050 (25 mg/l BOD runoff from open lot).

**Targets:**
- 2005 – 30 percent
- 2010 – 100 percent

**Measures:** Percentage of 0 – 300 animal unit feedlots with pollution problems that have corrected the pollution problems in accordance with Minnesota Rules Chapter 7050.
F. NITROGEN GOAL

Protect human health and the environment from the effects of excessive concentrations of nitrate-nitrogen.

Objective 1: Change currently increasing trend of nitrate-nitrogen concentrations in surface water.


Measures: Nitrate and nitrite-nitrogen concentrations at MPCA Minnesota Milestone Program sites on the Minnesota River and several of its tributaries. Samples will be collected monthly, 10 months per year in 2001, 2004, 2006, and 2009.

Objective 2: Reduce nitrate-nitrogen concentrations in ground water.

Target: Ultimate: Trend of decreasing nitrate-nitrogen concentrations in aquifers.

Measures: Mean annual nitrate-nitrogen concentrations sampled by state and local staff.

NITROGEN ACTION STRATEGY

TASKS

1. Establish a Basin team through the Minnesota River Basin Joint Powers Board to deal with the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force Hypoxia Action Plan in the Minnesota River Basin.

2. Develop strategies for nitrogen reduction in surface water as additional state and federal funds are provided. The strategies may include setting reduction targets for nitrogen losses to surface waters, establishing a baseline of existing efforts for nutrient management, identifying opportunities to restore flood plain wetlands, detailing needs for additional assistance to meet the team goals, and promoting additional funding. There are many options for nitrate reductions in the Minnesota River Basin. A few examples include: point source controls, a third crop in the corn/soybean rotation (pasture grasses or alfalfa), riparian wetlands, end of tile wetlands, and nutrient management.

3. In concert with the assessment of the Mississippi River’s nutrient reduction needs, and changes in the size of the hypoxic zone, assess the Minnesota River’s nutrient reduction needs. Determine appropriate actions in Minnesota River Basin.
4. Begin measuring nitrate-nitrogen concentrations in point source effluent. Work with dischargers to add nitrate-nitrogen to their sample analysis.

5. Assist other agencies in nitrogen reduction efforts directed primarily to ground water. Integrate efforts to coordinate between ground and surface water resources.

6. Develop the Statewide Nitrate Assessment Program (SNAP). The study will provide long-term information on the distribution of nitrate in Minnesota's ground water.

    *See ground water action strategy on page 73 for other tasks related to ground water.*

**MILESTONES**

1. Establish Basin hypoxia team by November 1, 2002.


**BACKGROUND**

Nitrogen exists in the environment in many forms and is far more soluble than phosphorus. Nitrite, nitrate, ammonia, organic nitrogen, and nitrogen gas are common forms that cycle through the air, water and soils in Minnesota. Nitrogen is most persistent in rivers and streams when in the form of nitrate-nitrogen. Nitrogen in the forms of nitrate and ammonia are of the greatest concern to water quality. Un-ionized ammonia can be toxic to fish and other aquatic life. Nitrate can cause human health problems, primarily methemoglobinemia in infants. While nitrite is also toxic in the environment, it is readily converted to other forms of nitrogen so that it is usually not a pollutant of concern.

Water quality standards have been set for ammonia and nitrate-nitrogen to address these concerns. The 10 mg nitrate-nitrogen (NO₃-N)/l standard applies to drinking water to protect infants from methemoglobinemia. The un-ionized ammonia standard is based on levels that are toxic to fish over long periods of time (chronic toxicity). The standard for Class 2B waters is 0.040 mg un-ionized ammonia nitrogen (NH₃-N)/l.

Considerable work has been done in the area of nitrate contamination of ground water. The Minnesota Departments of Agriculture and Health have developed nutrient management recommendations and a wellhead protection program to address ground water contamination concerns, respectively. Ammonia limits are primarily an issue to point source discharges and are dealt with through the NPDES permit program. Nitrate-nitrogen concentrations in surface waters have been increasing in recent decades. This increase parallels a national trend towards increased use of fertilizer. Research has shown that rate, timing and type of nitrogen applications all affect the release of nitrogen into the environment. With this increasing evidence of nitrogen impacts to surface waters, the MPCA will begin work on the development of ecoregion specific nutrient standards.
The impacts of excess nitrogen in surface waters also extend beyond the borders of Minnesota. It is linked to the hypoxia problem (an area of low dissolved oxygen that causes aquatic life to die) in the Gulf of Mexico. Scientific investigations document a zone of hypoxia on the Gulf of Mexico’s Texas-Louisiana Shelf with seasonally low oxygen levels (<2mg/l). Between 1993 and 1999, the zone had been estimated to be larger than 4,000 square miles. In 1999, it was 8,000 square miles.

The hypoxic zone is a result of complex interactions involving excessive nutrients, primarily nitrogen, carried to the Gulf by the Mississippi and Atchafalaya Rivers, and other factors. Some of these factors include channelization, loss of natural wetlands and vegetation along the banks, and wetland conversions throughout the Basin as well as stratification in the waters of the northern Gulf caused by the interaction of fresh river water and the saltwater of the Gulf.

The surface water portion of this action strategy is based largely on the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force’s “Action Plan for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico.” This plan indicates that the primary approaches to reduce hypoxia in the Gulf of Mexico will likely include: 1) reduction of nitrogen loads from watersheds to streams and rivers in the Basin, and 2) restoration and enhancement of denitrification and nitrogen retention within the Basin and on the coastal plain of Louisiana. The best current science indicates that sub-Basin strategies should be aimed at achieving a 30 percent reduction (from the average discharge in the 1980-1996 timeframe) in nitrogen discharges to the Gulf to be consistent with the goal for reducing the extent of hypoxia in the Gulf.

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**Nitrogen Fertilizer Management Plan**

*By the Minnesota Department of Agriculture*

The Nitrogen Fertilizer Management Plan has a three-phase structure. The 1989 Comprehensive Ground Water Protection Act (the Act) directed the Minnesota Department of Agriculture to develop a Nitrogen Fertilizer Management Plan (NFMP) for the prevention, evaluation and mitigation of nonpoint source occurrences of nitrogen fertilizer in the waters of the state. The Act mandates that the NFMP contain both a voluntary Best Management Practices (BMP) component and a component that allows for regulatory action in the form of Water Resource Protection Requirements (WRPRs). The legislature did not provide dedicated funding for implementation of the NFMP, so NFMP goals (such as evaluation of BMPs) has only been partially achieved and only in limited geographic areas.

The NFMP has a three-phase structure for responding to nitrogen fertilizer nonpoint contamination. Regulation of nitrogen fertilizer use can only occur in the third, or “Response” phase and only after joint designation of a Special BMP Promotion Area by the Department of Agriculture, Soil and Water Conservation District and the county water planning authority. To date, no Special BMP Promotion Areas have been designated in the state.

The NFMP three-phase structure consists of:

1. **BMP Promotion Phase**: Promotion of voluntary adoption and implementation of BMPs (*Note: BMP development and promotion is an ongoing process*);
2) **BMP Evaluation Phase:** Evaluation of the adoption and effectiveness of voluntary BMPs; 
*(Note: The state is currently developing and implementing BMP evaluation efforts in a limited number of wellhead protection areas.)*

3) **Response Phase:** Response to instances where voluntary BMPs have not been adopted or are ineffective in mitigating the occurrence of nitrate in local ground or surface water. The Response Phase will be implemented when initial attempts to resolve nitrogen contamination problems through voluntary action fail. Regulation governing nitrogen fertilizer use in vulnerable areas is possible after a series of intense BMP and ground water monitoring efforts justifies rule writing. The Response Phase (which incorporates additional BMP promotion and evaluation efforts) is composed of the following steps:

   a. **Special BMP Promotion Areas** – Before regulatory action can be taken, the MDA, SWCD and the county water planning authority must designate a localized Special BMP Promotion Area in which various evaluation efforts must occur. Time allotted for the BMPs to be further implemented and evaluated must be in proportion to the degree of the problem identified.

   b. **Nitrogen Management District** – If, after the creation of the localized Special BMP Promotion Area, agricultural sources of nitrate in drinking water remain problematic for at least a four year period, the area should be reclassified as a Nitrogen Management District. The establishment of the district initiates a process of change from a voluntary to a regulatory situation.

   c. **Water Resource Protection Requirements** – If BMP adoption and water quality remain unacceptable in the Nitrogen Management District after annual reviews, the MDA shall commence the promulgation of localized Water Resource Protection Requirements through rule making.

Only after these steps are taken does the Nitrogen Fertilizer Management Plan process recommend that state rules be promulgated to establish Water Resource Protection Requirements for the area in question. Details of the NFMP and the Three-Phase Structure are provided in the Recommendations of the Nitrogen Fertilizer Task Force on the Nitrogen Fertilizer Management Plan to the Minnesota Commissioner of Agriculture, August 1990, available from the MDA.

The chart (next page) illustrates the overall approach to responding to nitrogen contamination as established by the Nitrogen Fertilizer Task Force under statutory mandate in the 1989 Comprehensive Ground Water Protection Act (Minn. Stat. § 130H):
Nitrogen Fertilizer Management Plan Three-Phase Structure

PHASE I
BMP Adoption: Behavioral Changes in Management
- Effectiveness: GOOD
- Adoption: GOOD
  - Continue BMP Promotion
- Effectiveness: GOOD
- Adoption: POOR
  - Continue BMP Promotion
- Effectiveness: POOR
- Adoption: GOOD
  - Re-evaluate BMPs
- Effectiveness: POOR
- Adoption: POOR
  - Rule Writing: Water Resource Protection Requirements

PHASE II
BMP Effectiveness: Impacts on Water Quality

PHASE III
Recognize Threats to Minnesota's Environment
Water Quality Impairments

G. BIOLOGY GOAL

Improve the health of aquatic communities in the Minnesota River Basin.

Objective 1: Verify and develop appropriate tools for tracking the biological health of Minnesota River Basin streams and rivers.

**Targets:**
2002 – Verify that each component (metric) in the Index of Biotic Integrity (IBI) responds to human disturbance.
2002 – Establish an index to rate the quality of instream habitat (habitat index).
2003 – Establish a macroinvertebrate-based index.

**Measures:** Identify fish and macroinvertebrate communities associated with “good” and “impacted” streams and rivers.

Objective 2: Develop and implement a strategy for monitoring the biological health of Minnesota River Basin waters.

**Targets:**
2002 – Implement statistically based monitoring at Basin scale.
2005 – Conduct focused surveys of specific streams in Basin to identify problem areas.
2005 – Establish sites to evaluate effectiveness of various water quality management activities.

**Measures:** Strategies developed to assess and track health of aquatic communities.

Objective 3: Assess status of aquatic communities based on new biological data and comparisons from previous biological assessments such as the Minnesota River Assessment Project (MRAP).

**Targets:**
2005 – Compare to MRAP and other studies done prior to 2000.
2005 – Evaluate water quality data from statistically based monitoring, focused stream studies and effectiveness monitoring activities.
2010 – Compare to studies done prior to 2010.

**Measures:** Status and trends in aquatic community health.

Objective 4: Establish bioassessment targets for Basin/aquatic resource units in consultation with local partners.

**Targets:**
2004 – Determine scores representing healthy aquatic communities.
2004 – Present bioassessment information to partners.
2005 – Work with partners to set target biological scores at which to take action.
**Measures:** Appropriate goals set for aquatic community health in various regions.
Recognize Threats to Minnesota's Environment
Water Quality Impairments

H. HYDROLOGIC STORAGE

ACTION STRATEGY

Increase riparian water storage and the ecological integrity of Minnesota River Basin riparian corridors.

**CAC Recommendations:**
- Restore floodplain and riparian areas
- Restore wetlands

**TASKS**

1. Continue to assess the geological structure of the rivers in the Basin. Specifically, characterize channel and bank stability, active floodplain accessibility and the functional integrity of the larger riparian zone. The assessments will use Rosgen and Schumm classification systems. An estimated 70 sites will be examined over five years. The results will be used to rank sites for restoration (reconstruction of the channel and floodplain) with a goal of demonstrating restoration and water storage concepts at three to five sites in each major watershed.

2. Develop a strategy to store more water in upland and riparian areas and improve ditch, stream and river channel health. The strategy needs to address upland hydrologic pathways and associated storage options along with processes that store water in progressively larger riparian floodplains. The MPCA along with the U of M, MDA, BSWR, DNR, NRCS, Land Improvement Contractors Association, COE and USGS, will research drainage issues to better understand the hydrologic and environmental concerns raised by the Minnesota River Assessment Project and more recent assessments of the major tributaries.

3. Use existing GIS databases and develop new databases to identify, classify, and assess geomorphic characteristics of river reaches. Then develop regional relationships for major watersheds in the Basin. Collect information on current and historical surveys of river cross-sections. The overall information will be used to target highly unstable sites that are at a restorable evolutionary stage.

4. In cooperation with BWSR and USGS, evaluate lands that have been enrolled in CREP to better define hydrologic and water quality benefits.

5. Where practical, work with local water managers to develop projects that divert runoff and streamflow through riparian floodplains to limit and treat excessive in-channel nitrate-nitrogen.
MILESTONES

2. Conduct assessments and prioritize sites by 2005.

BACKGROUND

The Minnesota River Basin historically stored large volumes of water in wetlands, marshes and prairie lakes. These features in combination with the dense prairie and forest cover that dominated the landscape resulted in more water infiltrating the soil, evapotranspiration back to the atmosphere and less water runoff to the river.

Evapotranspiration (ET) has decreased over the past century and total watershed runoff has increased with changes in vegetation and agricultural drainage. Ditches and tile-drains have improved cropland by decreasing soil saturation. Urban areas promote rapid water movement via the impervious surfaces of roofs, driveways, roads, and parking lots.

The cumulative effect of decreased ET and increased total runoff is more water movement in stream channels. Water movement processes are complex because the interactions occur over different geographic scales. At the field scale, flow and transport processes are reasonably well understood. Certain processes such as flood routing and sediment transport are reasonably well understood at large watershed scales. However, at scales in between the small and large, physical, chemical and biological processes are not well understood and require more research.

Changes in Watershed Hydrologic Pathways Have Altered Channel Stability

An increase in the total volume of runoff along with the timing of peak flows will cause stream channel adjustments. Channel cross-sectional area will enlarge to handle increases in frequent annual peak flows associated with changes in the contributing drainage area and climate. Typically, a channel down-cuts and then widens until the channel evolves to a stable form based on the new watershed hydrology. This process, however, takes time and causes significant bank erosion before a new dynamic equilibrium is obtained for a given reach. Some bank erosion will aggrade (deposit) in areas with flatter channel slopes or in channel pools destroying important aquatic habitat. Although the sloughing of stream banks is a physical result of increasing runoff volume, the reaction is related to land-use management decisions and increased precipitation. Bed and bank instability impacts not only the stream itself but also the life in the stream and beneficial uses of the stream.

Water flowing with greater velocity in stream channels has the same result as in upland areas: it picks up nonresistant material and moves it downstream. The net result of runoff change is that both low flow and high flow events move sediment down stream to areas where the energy is
dissipated and the sediment re-deposits (in some cases only temporarily). This is often illustrated in pictures of a river where a tree, with part of its roots exposed, clings to the edge of a riverbank.

**Changes in channel shape and size have altered infrastructure**

Another occurrence in the Basin is the loss of historical structural features such as wooden bridges. Typically, the channel below and adjacent to bridges remains stable because county highway engineers often implemented erosion protection measures. However, as an upstream channel enlarges over time, flow velocities can become increasingly stronger beneath the wooden bridge and footings can be undermined and/or woody debris can knock out bridge supports causing the wooden bridge to collapse. This process has occurred in several counties throughout the Basin, particularly during the 1993 and 1997 floods. Increased flow velocity during floods is a function of channel incision (deepened channel). An incised channel will lack an active floodplain. An active floodplain disperses channel energy or stream power when the flow exceeds the channel forming or bankfull stage (water level).
**ACTION STRATEGIES**  
Recognize Threats to Minnesota's Environment

2. **MONITORING ACTION STRATEGY**

Provide an adequate level of monitoring in the Minnesota River Basin. Provide the water quality information needed to identify and assess water quality problems, provide focus to the environmental outcomes set in the Basin Plan, make resource management decisions, and evaluate changes in the water quality of the Minnesota River Basin as basin and watershed management efforts continue.

Water quality monitoring is done for many reasons and by several agencies, organizations, and individuals. Given the various monitoring efforts, needs, and expectations for the resulting data, this action strategy is an attempt to frame the specific information needs in Basin management that will be targeted through this plan. The purposes of monitoring are:

1. To quantify runoff and pollutant loads from the major tributaries and along the main stem of the Minnesota River for use in better characterizing the water quality at these sites, to identify resource management goals for the major watersheds, and to measure whether or not the pollutant reduction targets identified in the Basin Plan will be achieved.

2. To quantify the biological communities present in streams and rivers of the Basin for use in characterizing the health of the aquatic systems, to identify aquatic life use goals for the streams in the Basin, and to evaluate changes in water quality over time;

3. To incorporate volunteer monitoring to obtain cost-effective water quality information for enhancing the characterization of water quality in the Basin, to develop a greater awareness of water quality issues and the need for good stewardship, and to provide a “hands-on” approach to evaluating changes in water quality in the Basin.

The development of each component has a bearing on the other components. This demonstrates the importance of developing an overall monitoring strategy for the Basin. Obtaining the water quality information needed in making resource management decisions is complicated. The formation of an interagency team to actively coordinate efforts and resources is key to the development and adoption of such a monitoring strategy for the Basin, especially in relation to physical, chemical, and hydrologic monitoring.

**TASKS**

**General:**
1. Identify gaps in our knowledge and understanding about the condition of the various water resources in the Basin

2. Develop and implement a Basin monitoring strategy.
3. Determine how to incorporate data from specific projects and/or relatively short time frame projects into the overall assessment of water quality from a Basin scale down to individual water bodies.

4. Synthesize results of past and/or current monitoring efforts, especially the major watershed CWP projects, to provide a more comprehensive assessment of water quality in the Basin.

5. Identify additional monitoring needs (additional sites, parameters, revised sampling frequencies, etc.) for assessment needs in the Basin (small to large scales).

**Physical and chemical monitoring:**

6. Create an official multi-agency task force operating as a subcommittee of the Minnesota River Basin Joint Powers Board to coordinate the development and implementation of the Basin monitoring strategy and an ensuing long-term physical, chemical, and hydrologic monitoring plan.

7. Establish a long-term physical, chemical, and hydrologic monitoring network that will provide statistically valid estimates of flow-weighted mean concentrations and mass loads of pollutants for use in assessing long-term water quality trends.

8. Estimate costs and pursue the funding necessary to implement the monitoring plan. Funds likely would be needed for monitoring site equipment, staff, staff equipment, water sample analyses, and contract support services.

9. Implement the monitoring plan as funding and various agencies’ capabilities allow. The most critical need to implement the plan is for additional staff resources to complete the work.

10. Adjust current efforts, if needed, to meet the needs of temporal or spatial trend analysis.

11. Provide assistance to CWP projects, as possible.

**Biological monitoring:**

12. Develop a macroinvertebrate multimetric index for the Minnesota River Basin and validate the fish index of biotic integrity (IBI) developed during Minnesota River Assessment Project.

13. Conduct a probability-based monitoring program in the Minnesota Basin by 2003. Subsequent sampling events will occur every 7 to 10 years.

14. Incorporate monitoring of additional sites for use in problem investigation and/or effectiveness monitoring. Efforts will be made to partner with watershed or stream restoration projects currently underway.

15. Develop a habitat index for the Basin and relate results of habitat assessment to overall biological integrity.

**Citizen Stream-Monitoring Program:**

16. Promote and expand the CSMP to enhance volunteer stream monitoring at the basin, major watershed, and minor watershed scales.

17. Support other (non-MPCA) volunteer monitoring efforts in the Basin by providing technical support.
Combined:
18. Generate and publish an annual “State of the Minnesota River” report documenting annual monitoring results and long-term trends as a means of establishing a baseline for assessing trends and, then, following through with the evaluations as time goes by.
   a) Collect and consolidate data from relevant sources:
      i) Minnesota River Long-term Monitoring Network
         (a) Metropolitan Council Environmental Services and Minnesota Department of Agriculture
         (b) U.S. Geological Survey
         (c) Minnesota Department of Natural Resources
         (d) U.S. Army Corps of Engineers
         (e) MPCA “additional” sites
      ii) Current CWP projects
      iii) MPCA Biological Monitoring Program
      iv) MPCA Citizen Stream Monitoring Program
      v) MPCA Milestone Monitoring Program
      vi) Stream Channel Assessments
      vii) TMDL monitoring and assessment.
   b) Summarize findings in an annual report and present them to the Minnesota River Joint Powers Board Technical Committee.

MILESTONES

2. Complete and begin implementing the Minnesota River Basin monitoring strategy by 2002.

3. Complete and begin implementing the long-term physical, chemical, and hydrologic monitoring plan for the Basin.
   b) Formulate an analytical methodology – 2002.
   c) Estimate costs and secure funding.
      i) Equipment, and/or contract, analytical and staff costs – December 2002.
   d) Purchase and install additional equipment, as needed – Spring 2003.
   e) Operate monitoring sites – continuing for existing sites, begin new sites – Spring 2003.

   a) Develop a macroinvertebrate biological index for the Minnesota River Basin.
   b) Validate metrics used in the fish-based biological index used in MRAP.
   c) Select and monitor sites that will be used in this plan.
   d) Summarize and interpret data, and communicate results to provide local, state, and federal resource managers the information needed in determining whether or not biological designated uses of rivers and streams are being met.

5. Increase the number of Citizen Stream Monitoring Program volunteers in the Minnesota River Basin to 100 by June 2002.

**BACKGROUND**

Many individuals, organizations, and agencies conduct water quality monitoring in the Minnesota River Basin at several different scales and through several different programs. The MPCA has been involved in several monitoring efforts. For many years the Agency has conducted a long-term ambient stream monitoring program. Recently revised, it's now known as the Minnesota Milestone monitoring program. Other MPCA programs involve waste load allocation monitoring in streams and rivers, lake assessment monitoring, biological monitoring, and various special monitoring studies.

Much water quality assessment work has been done through the Minnesota River Assessment Project, Clean Water Partnership projects, and other programs or projects. The MRAP provided a basin-wide effort to evaluate the water quality of the Minnesota River and its tributaries. CWP projects have provided for more detailed assessment work in most of the major watersheds of the Basin. Many agencies and organizations have been involved in each of these programs, as well as, their own assessment efforts. Also, more local units of government are or are beginning to do their own monitoring.

Water quality monitoring information is needed to evaluate current water quality conditions, to identify the sources and magnitude of water pollutants, to make the appropriate linkages between the problems and resulting water quality conditions, and to evaluate the effectiveness of Basin management efforts in actually changing water quality in the Minnesota River Basin.

**Gaps Still Remain in Knowledge**

While much monitoring has been done, there are still gaps in our knowledge and understanding about the condition of the various water resources in the Basin. A challenge for everyone involved is to determine how best to maintain or improve assessment efforts so that we have adequate water quality information for making resource management decisions. To do this, as well as address the need for other types of monitoring, a basin monitoring strategy should be developed. The basin monitoring strategy and subsequent monitoring plans would contain the detailed information regarding the monitoring and assessment needs in the Basin.

The purpose of this action strategy is to describe the tasks needed to provide for the continuing assessment of current water quality conditions in the Minnesota River Basin. In some cases, new monitoring efforts may be needed. In other situations an integration or synthesis of past and/or current efforts may be all that is needed to provide the desired assessments. More comprehensive documents based on this action strategy will be forthcoming as the basin monitoring strategy and individual monitoring plans for the various types of monitoring emerge.
Issues that would be addressed through a basin monitoring strategy include:

- Monitoring and assessment of streams and rivers that don’t have adequate data;
- Integration of CWP watershed project data in characterizing existing water quality at the Basin level;
- Incorporation of stream flow and/or meteorological information into condition monitoring efforts;
- Coordination with other monitoring efforts;
- Incorporation of biological monitoring and assessment in characterizing use support;
- Expansion of citizen monitoring programs, especially the CSMP;
- Application of a regional approach to identifying water bodies as impaired via water quality standards in the 303(d) list;
- Linking water quality problems with their sources and transport processes in and through watersheds; and
- Evaluating changes in water quality over time.

**Three Types of Monitoring**

Many of these issues interrelate with each other and will be largely addressed through three main types of monitoring as the foundation for Basin monitoring in the Minnesota River Basin. The types of monitoring include long-term physical and chemical monitoring, comprehensive biological monitoring, and volunteer monitoring.

**Long-term Physical and Chemical Monitoring**

A primary component of the long-term physical and chemical monitoring will involve a network of monitoring sites on the Minnesota River and sites near the mouth of its major tributaries. This network will be used to measure and document the loads of various pollutants in the Minnesota River and its major tributaries via the incorporation of automated flow monitoring. The long-term monitoring should also include components that deal with smaller watershed scales for use in increasing our understanding of water quality impacts and changes from small to large scales and to enable better monitoring for measuring the effectiveness of watershed management efforts.

Several state and federal agencies and local groups currently are conducting monitoring within the Minnesota River Basin. Metropolitan Council Environmental Services (MCES), in conjunction with the Minnesota Department of Agriculture and the USGS, operate three long-term sites along the middle and lower Minnesota River and two sites near the mouth of the Blue Earth and Le Sueur Rivers. The USGS, in conjunction with various state and federal agencies or local organizations, is operating monitoring stations along the Minnesota River at Ortonville, Lac qui Parle, Montevideo, and Mankato. A number of additional sites are set up at or near the mouths of several of the Minnesota River’s major tributaries including the Chippewa, Yellow Medicine, Redwood, Cottonwood, Little Cottonwood, and Watonwan rivers. However, the long-term future of the sites is uncertain due to short-term funding sources for the sites.

**Biological Monitoring**

Much work has been done in recent years in the development of biological monitoring tools for measuring and characterizing the health of our water resources using the actual biotic communities present in streams and rivers. Fish and macroinvertebrate communities, in particular, have been used successfully as indicators of river and stream quality. They are responsive to the cumulative affects of physical and chemical disturbances. Also, they are easily sampled, predictable in their occurrence, sensitive to human induced changes in their environment over time, and easily understood and recognized by the public to be important indicators of a healthy environment.

The biological monitoring component of this action strategy will build upon the initial
biological survey of the Minnesota River Basin completed during the MRAP. During the MRAP, a fish-based multimetric IBI was developed to assess stream quality based on the structure of the fish community. A macroinvertebrate-based IBI is still needed to complement the existing fish-based IBI. MRAP also provided the baseline information necessary to begin assessing trends. Long term trend monitoring will continue using a probability-based monitoring program designed to determine the status, extent, changes, and trends in water quality within each major river basin of Minnesota.

The sampling design for this monitoring follows guidance developed by the EPA’s Environmental Monitoring and Assessment Program to provide statistically valid assessments of water quality using physical habitat, water chemistry, and biological indicators. At least 50 randomly selected sites ranging from first order streams to large rivers are sampled. In addition to the probability-based biological sampling, a limited number of sites will be selected to evaluate the effects of human disturbance on water quality.

**Volunteer Stream Monitoring**

Volunteer monitoring provides a cost-effective means of augmenting and/or expanding monitoring efforts and, often, a clearer linkage between water quality issues and the people living in the Basin. The Citizen Stream-Monitoring Program was developed following discussions with the volunteer monitoring community in the state. There are currently 66 CSMP volunteers enrolled to monitor streams and rivers in the Minnesota River Basin.
3. GROUND WATER

Protect, maintain, and restore the quality and quantity of ground water in the Minnesota River Basin.

Objective: Increase, according to the following schedule, the number of communities that have a Minnesota Department of Health (MDH) approved wellhead or source water protection plan. As of 2000, 34 communities are in the wellhead protection program in the Minnesota River Basin.

Targets: 2005: 67 communities

Measures: Number of communities that have a MDH approved wellhead or source water protection plans.

**ACTION STRATEGY**

**TASKS**

1. Develop Minnesota River Basin Information Document for ground water. The document will summarize existing ground water information.

2. Work with the Minnesota Department of Health (MDH) to review the MDH public water supply database to identify which aquifers have elevated concentrations of constituents of concern including nitrate, iron, manganese, sulfate, arsenic and pathogens.

3. Encourage and provide assistance to counties to conduct hydrologic characterizations of ground water resources.

4. The MPCA will complete list of regional and statewide ground water information resources for local government. Information on geology and hydrogeology will be included. Local government can add county or watershed specific information.

5. Support MDH in source water and wellhead protection efforts.
   
   - Provide data on potential contaminant sources as requested.
   - Provide assistance to local communities in locating potential contaminant sources.
   - Incorporate wellhead protection areas into widely available GIS coverages for the Basin.

6. Provide assistance in education efforts including best management practices for fertilizer, manure, and pesticide application, feedlot operations, irrigation, petroleum storage, and other activities that may be present in a wellhead or source water protection area.
7. Promote basin-wide interaction of interagency ground water programs with the goal of prioritizing of efforts. This will efficiently protect and restore ground water resources through MPCA and non-MPCA programs. MPCA programs include Leaking Underground Storage Tanks, Voluntary Investigation and Clean up, Superfund, Closed Landfill Program, Feedlots, Wastewater, Salvage yards, Solid Waste, agricultural chemical clean ups, and petroleum and chemical storage.

8. Promote research on deep aquifer recharge. Deep aquifer recharge is an issue during drought conditions. Promote studies to delineate and quantify useable ground water supplies, especially in southwest Minnesota.

**MILESTONES**

1. Develop set of information resources by 2003.

**BACKGROUND**

People living in the Minnesota River Basin depend on a good quantity and quality ground water supply for drinking water and irrigation. Both rural and urban residents rely on this resource. However, ground water quality varies by region and aquifer. In some areas in the western part of the Basin, individuals rely on shallow bedrock aquifers, which often have elevated nitrate concentrations. Many municipalities in these areas draw water from deeper bedrock aquifers; however water from these deeper aquifers frequently has high concentrations of iron, manganese, sulfate, and arsenic. These come from geologic materials in the aquifers themselves, and generally not surficial sources. Arsenic has an associated health risk limit that is sometimes exceeded. Iron, manganese, and sulfate have associated secondary standards. Elevated concentrations of these constituents may cause taste, odor, and plumbing problems.

In the central and eastern part of the Basin, individuals and communities draw water from alluvial, glacial, and Cretaceous-age aquifers. Water from these aquifers also may have elevated concentrations of arsenic, iron, manganese, and sulfate. Some individuals in the southwest part of the Basin rely on water from the Sioux Quartzite aquifer. Well water drawn from this aquifer commonly has elevated nitrate concentrations. Pathogens such as bacteria and viruses are also a concern. Viruses, in particular, can be problematic since they can persist in ground water for several years. They can pose a threat to supply systems that are poorly constructed or rely on very young ground water.

Sufficient supplies also are a problem in the southwest part of the state. Rural water systems are being used due to a lack of good quality drinking water. Some of the pollutant sources that pose a threat to ground water include industrial disposal, improper application of pesticides and fertilizers, former dumps, landfills and hazardous waste disposal.
**ACTION STRATEGIES**

**Recognize Threats to Minnesota's Environment**

4. **MODELING FOR ANALYSIS OF MANAGEMENT OPTIONS**

**ACTION STRATEGY**

Develop and use computer models to characterize and predict pollutant loads and water quality responses in the Minnesota River and its tributaries, given the complex water quality, land use, and pollutant source issues in the Basin.

**TASKS**

1. Work with Tetra Tech to develop, calibrate, and use Hydrologic Simulation Program Fortran model. Meet with stakeholders in Basin to gather their input as modeling work progresses.

2. Generate results for sample scenarios using the operational Basin model. Listed below are the type of scenarios that will be used:
   - Scenario No. 1: Progress made in achieving 40 percent reduction in BOD since mid 1980s.
   - Scenario No. 2: Point source options to achieve TMDL.
   - Scenario No. 3: Nonpoint source options to achieve TMDL.

3. In cooperation with partners, determine what other types of modeling have been done in Minnesota River Basin. Compare modeling results and determine what changes to suggest based on these results.

**MILESTONES**


2. Sample scenarios generated and reported by September 2002.

3. Compare HSPF results to other models and suggest changes by July 2002.

**BACKGROUND**

Computer models are essential in the evaluation of hydrology and water quality at large watershed scales. Various modeling efforts have been undertaken in the Minnesota River Basin. One effort, in particular, forms the basis of this action strategy. This involves use of the EPA HSPF model as an extension of the Lower Minnesota River TMDL for dissolved oxygen and Minnesota River Assessment Project work. Focus on the HSPF modeling as part of the TMDL does not preclude the value and use of other models and modeling efforts.

The Minnesota River HSPF modeling study has four main objectives:
1. To quantify the pollutant sources contributing to water quality standards violations in the lower Minnesota River;
2. To quantify atmospheric, point, and nonpoint source contributions by land use category to water quality conditions;
3. To quantify pollutant contributions by subwatershed for targeting priority areas for rehabilitation; and
4. To develop a tool for evaluating the impact of management practices and rehabilitation alternatives. The project will involve the development and/or refinement of individual models for nine of the 13 major watersheds in the Basin and their linkage together for the simulation of the mainstem of the Minnesota River.

HSPF is a comprehensive model that simulates nonpoint source pollutant loads from urban and rural lands, and watershed hydrology and aggregate water quality in natural and man-made water systems. The model allows the simulation of land and soil contaminant runoff processes with instream hydraulic, water temperature, sediment transport, nutrient, and sediment-chemical reactions. Final development of the Minnesota River Basin HSPF modeling is to be completed by September 2002.

As the HSPF modeling is completed, the results will be used in the TMDL development process to begin formulating waste load and load allocations for phosphorus for the Minnesota River and its major watersheds above Jordan, Minnesota. The modeling results only provide one component in the development of the load allocations. Other components include stakeholder involvement in identifying source contributions, implementation options, potential load reductions, and their affect on the water quality of the lower Minnesota River.

As this process progresses, other resources may be incorporated in the completion of the TMDL. One such resource is the Agricultural Drainage And Pesticide Transport (ADAPT) modeling by the University of Minnesota. More detailed modeling may then be desired as watershed level load allocations are carried to a smaller scale for specific identification and targeting of implementation measures.
ACTION STRATEGIES
Prevent, Limit, and Clean Up Pollution

5. LIVESTOCK/FEEDLOT ACTION STRATEGY

The MPCA will implement regulations for a clean environment while maintaining a viable livestock industry. Several organizations worked on proposed new rules through the Feedlot and Manure Management Advisory Committee including producer groups, environmental groups, county staff, and other agencies.

BACKGROUND

In 2000, the MPCA proposed significant changes to update Minnesota’s feedlot rules to better reflect modern agriculture, incorporate technical standards, streamline the permitting process and develop a more realistic schedule for fixing open lot problems. Under the new rule, all feedlots (except those with a capacity under 10 animal units in shoreland areas or less than 50 animal units outside shoreland areas) must be registered by January 1, 2002, and must register at least once every four years following 2002. An accurate and current Level II or Level III inventory by a county fulfills the registration requirement.

The new feedlot rule also provides a unique opportunity to farmers with fewer than 300 animal units that have pollution hazards related to open lot runoff. If registered, the owner can sign an agreement to phase in corrective measures over several years. As part of this agreement, lower cost interim measures need to be installed by 2005 to reduce runoff through specified BMPs or by using other means to reduce pollutant levels by 50 percent. All measures must be completed by 2010. If the open lot agreement is not signed by 2005, an interim permit is required and the pollution problems must be fixed within 24 months.

To help the understanding and adoption of the new rules, this strategy will focus on the open lot runoff agreement, manure management components of the rules, and working with counties in the Minnesota River Basin to ensure that feedlots are in compliance.

CAC Recommendations:
Encourage land management practices
Enforce existing laws

MPCA photo
This feedlot in Pope County uses a rock dam and earthen berm to prevent runoff from getting into a wetland.
**TASKS**

**A. Education on feedlot rule**  
1. In cooperation with county government (Minnesota Extension Service, County Feedlot Officers, County Planning and Zoning, and SWCDs), implement campaign to inform producers of requirements for registration, permits, manure application, manure storage, the open lot agreement, and other ongoing feedlot management practices.  
2. Implement targeted campaign on the feedlot program and how it has changed. Approach groups such as lenders and commodity organizations.

**B. Permitting/registration**  
1. Strongly encourage counties in the Minnesota River Basin that have not received feedlot program delegation to become delegated. This will allow them to become eligible for grant money through BWSR. This money can be used for additional staff to assist with feedlot registration and producer assistance.  
2. MPCA will assist delegated feedlot counties in the registration process. Develop streamlined permit tracking system. During summer of 2001, work with delegated counties to ensure that the registration process will be completed as required.  
3. Prepare notices for non-delegated counties to make producers aware of requirements of new rule.  
4. In cases where farmers have signed an open lot agreement, local agency staff will develop a strategy to provide assistance to producers and suggest options to reduce/eliminate discharges. Tour other farms that have solved similar problems.

**C. Priority areas in the Basin**  
1. Ensure that feedlots in priority areas are identified and inspected. Priority areas can include wellhead protection or shoreland areas, CWP or watershed project areas or land near stream reaches that have been identified on 303(d) list as impaired for fecal coliform bacteria or dissolved oxygen. Work with feedlot officers and water planners to determine what will be done to ensure safety of water resources in priority areas. Inspections of both feedlots and manure application records in these areas are a high priority.  
2. Continue to follow-up on reported complaints, particularly when a priority area is involved. Delegated counties investigate all complaints reported in their respective counties.  
3. In priority areas, develop comprehensive list of informational materials, practices, and organizations available to assist farmers in managing pollution hazards and having sound manure application practices.

**D. County block grants**  
1. A good mechanism has been developed by awarding block grants to assist counties in running their own feedlot programs. County feedlot plans and implementation efforts will be evaluated annually to measure results of implementing the plans.  
2. Support continuous funding of county block grants. Increase funding proportional to the number of delegated counties so the amount of funding per county remains the same.
**MILESTONES**

1. Initiate broad-based education campaign in the summer of 2001.

2. 100 percent of feedlots registered by Jan 1, 2002.


4. Work with local agency staff to assist producers who have signed open lot agreement in suggesting options to reduce/eliminate discharge by 2004.

5. Develop informational materials for priority areas by 2005.

ACTION STRATEGIES
Prevent, Limit, and Clean Up Pollution

6. INDIVIDUAL SEWAGE TREATMENT SYSTEMS

Work with local government to implement Minnesota ISTS rules, Chapter 7080. Local governments in the Minnesota River Basin have documented that 60 percent of ISTSs are not in compliance. Non-complying septic systems can contribute bacteria and nutrients into tributaries that eventually reach the Minnesota River.

BACKGROUND

Minnesota Stat. § 115.55 has been modified each year since 1994 to address changing ISTS industry needs. Minnesota R. chapter 7080 was amended in October 1999. The revised rules include new technology approval, enhanced ISTS professional licensing requirements, offer local adoption of performance standards, and allow alternative (less restrictive) local standards provided they are not a public health or environmental risk. The 1997 statutory amendments required all counties to adopt a 7080-complying ordinance by January 1, 2000, unless all towns and cities in the county have adopted such ordinance. Most counties have complied with this requirement. Cities and townships vary greatly in compliance.

Several counties in the Minnesota River Basin have used the state revolving fund to accelerate ISTS compliance. This model works well in those locations. Other counties will be encouraged to use this method of applying for loan money to increase compliance.

CAC Recommendations:
Improve land management practices
Enforce existing laws

TASKS

1. In cooperation with the University of Minnesota, provide technical assistance through fact sheets and web site.

2. Work with MPCA partners to establish an ISTS maintenance, training and licensing program.

3. Track and review county annual reports.
4. Work with counties to accelerate ISTS compliance through adoption of new ordinances (e.g., adding inspection triggers such as at property transfer and adding and enforcing stronger compliance language).

5. Recommend counties apply for state revolving funds to accelerate ISTS compliance.

6. Encourage local units of government to examine alternative local standards to ensure protection of public health and the environment.

7. Encourage local units of government to develop strategic plans for maintenance of ISTSs and identification of systems not in compliance.

8. Encourage county staff to become certified as Designer 1, the highest training level in the ISTS Program.

**MILESTONES**

1. ISTS maintenance, training, and licensing program established by 2005.

2. Counties have updated ordinances complying with Chapter 7080 by 2005.

3. All local governments fully implement, administer and enforce ISTS Program in their counties by 2010.

4. The goal for system compliance is 2020.
ACTION STRATEGIES
Prevent, Limit, and Clean Up Pollution

7. COMPLIANCE ACTION STRATEGY

Compliance with Minnesota Laws: The MPCA implements its programs to ensure compliance with Minnesota laws that have been established to protect water quality. These programs are necessary to maintain fairness, credibility and increase motivation. The MPCA will use various enforcement tools to lead those who are in violation of a law back into compliance.

BACKGROUND

Permitting, technical assistance, education, and enforcement are all methods used to ensure that Minnesota’s laws to protect water quality are met. Permitting establishes accountability. In the permitting process, permittees agree to meet a set of requirements established in their permit. If these requirements are not met, the permit is violated and the permittee must come back into compliance. When MPCA staff first become aware of a noncompliance situation they evaluate it to determine: 1) what standards have been violated, 2) how serious the violations are, 3) the cause for the violation, 4) whether the violations are repeat violations, 5) the potential for harm to human health and the environment, and 6) the overall compliance history of the source. The method selected to bring the permittee back into compliance depends on the nature of the violation(s) as outlined above. One situation may require a letter listing the violations and corrective actions while another may require a court order.

Decisions made on the method of leading the permittee back into compliance are not made by one person. Appropriate enforcement actions are determined by a group (i.e. MPCA staff and supervisors and legal counsel) to ensure fair and consistent enforcement application for similar violations across the state.

Education and technical assistance are part of maintaining compliance. These methods provide permittees with the latest information on treatment technology and assistance in technical areas.

TASKS

1. Use computer tracking system (known as DELTA) to maintain efficiency. Due to the large number of permits issued in Minnesota, manually tracking permits is time consuming. In DELTA, permits are tracked along with inspections and violations. Permittees submit monthly self monitoring reports. MPCA staff are notified of any violations and take action as needed.

2. As staff is notified of complaints, enter information into the MPCA’s Incident Management System database and develop a plan on how to address the complaint. Staff will notify other entities (such as cities or counties) if responsibility is in their jurisdiction.
3. Reduce backlog of permits. Address new construction permits first, then expansion permits, and finally reissuances of expired permits.

4. Consider increased levels of compliance in wellhead protection and source water protection areas.

5. Reevaluate permitting process for canneries/spray irrigation. Water quality data indicate excessive pollutants in tile lines and surface runoff.

**MILESTONES**

1. All information from complaints is entered into the Incident Management System database and investigated within a reasonable time.

2. Permits are issued or reissued in a timely manner. Permits for new construction are issued first, followed by permits for facility expansions, then reissuances of existing, expired permits.

3. Source water and wellhead protection areas have fewer violations.
ACTION STRATEGIES
Prevent, Limit, and Clean Up Pollution

8. STORM WATER ACTION STRATEGY

Lessen impact of urban storm water on the Minnesota River by implementing principles of the Phase II Storm Water Program.

TASKS

1. Complete the development and implementation of the Phase II Storm Water Program.
   
   A. Finalize a list of cities subject to the Phase II Storm Water Program. Begin working with them to develop storm water or surface water management plans and related ordinance development.
   
   B. Make model plans and model ordinances available for all communities, not just those included in Phase II requirements.
   
   C. Develop a construction Storm Water Permit program that effectively permits smaller one to five acre sites through local oversight.

2. Encourage all communities to adopt the principles of the EPA Phase II Storm Water Program. The six Minimum Control Measures of the Phase II Rule are stated as:
   
   A. Illicit discharge detection and elimination for oils, toxics and other pollutants from entering storm water systems.
   
   B. Municipal operations pollution prevention efforts to reduce the impacts of poor operations and designs (street sweeping, salt use and storage, debris removal, etc.)
   
   C. Construction site requirements to reduce sediment discharges. One acre or larger need a plan, a permit, and BMPs.
   
   D. Construction storm water BMPs to reduce the amount of pollutants and the physical impact of new development. The BMPs are both structural (ponds, wetlands, devices) and administrative (fertilizer and pesticide control, advanced site design, economic incentives, etc.).
   
   E. Public education and outreach to build community support and improve compliance.
   
   F. Public involvement and participation to broaden support, reduce obstacles, gain expertise and build connections (storm drain stenciling, citizen watch groups, public meetings, etc.).
Communities will need to establish:
- goals on how they will meet the six Minimum Control Measures (defined above)
- BMPs to reach the goals
- how they will measure progress

3. Encourage municipalities and local units of government to consider ordinance requirements for Better Site Design.

Better Site Design promotes more greenspace and less impervious surface along with better preservation of natural areas. Better Site Design coupled with appropriate BMPs, such as swales and wet detention ponds, provide for the least impact to wetlands, lakes and streams. Designing to minimize runoff generation up front instead of trying to solely retrofit BMPs is a more cost-effective and efficient treatment option. Existing development plans should be revisited early in the approval process to minimize road lengths, widths, and cul de sac designs, decreasing large lot sizes and peak parking lot sizing designs.

4. Encourage storm water management (or permitting) on a watershed basis to protect the hydrologic integrity and water quality of surface waters (and ground water).

For more information on stormwater BMPs, visit http://www.pca.state.mn.us/water/pubs/sw-bmpmanual.html

MILESTONES

1. Develop list of cities subject to Phase II Storm Water Program and begin working with them by March 2002. Have the Phase II "MS4" community applications in by March 2003.

2. Fully Implement the Phase II Storm Water Program, as required by the EPA, by March of 2008.

3. Assist non-regulated communities in developing ordinances and surface water management plans.

4. Evaluate MPCA’s Storm Water Program activities for consistency with Basin goals by 2005.

5. Determine the feasibility of a watershed approach to urban storm water permitting by July 2002.

BACKGROUND

In the 1970s surface water restoration focused on point sources (wastewater treatment plants that treat wastewater generated from municipalities and industries). At that time storm water was considered a non-point source. As this work progressed, studies indicated that more diffuse sources of pollution still caused water quality impairment. In 1987 Congress amended the Clean Water Act to require a comprehensive program for addressing non-agricultural sources of pollution from storm water discharges.

Urban storm water runoff does affect streams. Pollutants such as sediment, trash and debris, nutrients, oxygen-demanding substances, and bacteria flow with storm water into Minnesota’s
streams. Toxic chemicals from air emissions and oils and metals from automobiles can be deposited on and washed off impervious surfaces. Chlorides used to melt snow and ice from roads, parking lots and sidewalks are also carried to ditches and streams. Storm water, which has been heated by contact with a warm surface or pond, can influence stream temperature. The quantity of water from storm sewers and overland discharges into rivers and lakes has increased due to impervious surfaces causing erosion and river and lake degradation. The quality and quantity of storm water has major effects on our lakes and streams.

Phase I of the Storm Water Program was implemented in the early 1990s. It established criteria for different types of industrial, construction, and large municipal activities that would be covered under the storm water permit program. Under Phase I, cities with Municipal Separate Storm Sewer Systems (MS4) serving more than 100,000 people must obtain a National Pollutant Discharge Elimination System (NPDES) Permit. Minneapolis and St. Paul were the only cities in Minnesota that fell under the Phase I municipal requirements and were required to cut the volumes of pollutants entering the Mississippi River through storm water runoff. The permits cover infrastructure, monitoring at points where storm water enters lakes and rivers, and strategies for preventing polluted runoff from degrading water quality.

The Phase I Program also required sediment and erosion control permits for construction activities that disturb five or more acres of land. Industrial activities with certain standard industrial classification codes (SIC), were also required to obtain a general industrial storm water permit which contains pollution prevention requirements.

Phase II of the Storm Water Program is currently under development at the MPCA, as required by EPA rules, effective December 1999. Under Phase II, the EPA will require Municipal Separate Storm Sewer System permits for communities with a population of 10,000 to 100,000 people. This will greatly increase the number of communities required to obtain a permit for storm water discharge. NPDES permit applications must be submitted by March of 2003. The details of the Municipal Separate Storm Sewer System permits are not final.

Also, under the Phase II Program, the threshold for coverage under a general construction permit for erosion control, will drop from five acres to one acre. This will cover the majority of construction activities in the state of Minnesota. Also, communities with populations less than 10,000 can be included in this program if they are located in areas with sensitive waters, where local water quality does not meet water quality standards, with expected high growth, or if they meet certain density population criteria and are located near a larger urban area.

The MPCA’s Storm Water Permit Program is designed to maintain or improve the quality of surface waters by treatment of urban storm water runoff. Additionally, the program will require efforts to reduce or eliminate the contact of pollutants with storm water from municipal, construction and industrial permittees. Permits for storm sewer system discharges must include a requirement that effectively prohibits non-storm water discharges into storm sewer systems, and prevents or reduces contaminants from leaving a site to the maximum extent possible.
ACTION STRATEGIES

Improve Government Services and Collaboration

9. INTEGRATE PLANNING

Integrate the Minnesota River Basin Plan with other water planning efforts in Minnesota including, but not limited to, comprehensive local water plans and the Water Management Unification Initiative. The MPCA will use the elements of the Basin Plan along with other state policy when reviewing local water plans.

TASKS

1. Provide timely review and comment on local water plan updates. Help water planners incorporate watershed management into plans as well as provisions of the CWA (TMDLs, meeting designated uses, etc.). Provide information on how local government can access MPCA programs, grants, etc.

2. Integrate results from CWP assessment and implementation projects back into county water plans when CWP projects are completed.

3. Support BWSR in helping counties develop comprehensive local water plans on a watershed basis.

4. Update the Environmental Performance Partnership Agreement and insert evolving outcomes, performance measures, and activity commitments. EnPPA is updated every two years.

5. Participate in outreach of the Water Management Unification Initiative. Assist other agencies in developing strategies, forming targets for where the state’s water quality will be by 2010.

6. Make Minnesota River Basin Plan available to other planning efforts. Encourage use of goals and strategies in other planning processes.

7. Ensure Minnesota River Basin Plan is a living document by using, referencing and updating.


MILESTONES

1. Make Minnesota River Basin Plan available to public. Post plan on MPCA Web Site.

2. Comprehensive local water plans are reviewed and recommendations for adjustments offered in a timely manner.

3. Comprehensive local water plans are consistent with CWP project results.

5. The Water Management Unification Initiative and the Basin Plan have consistent and complementary goals, objectives, indicators and targets.


7. The State Nonpoint Source Management Plan is revised to reflect the needs of the restoration efforts for the Minnesota River and consistent with the Minnesota River Basin Plan by 2002.

8. Conduct annual assessment of plan milestones and need for adjustments.

BACKGROUND

The Minnesota River Basin Plan is one among several types of plans dealing with watershed management in the Minnesota River Basin. Watershed plans are developed along hydrologic boundaries. Other plans dealing with water are developed along political boundaries (county and state). Although these plans are written at different scales using various boundaries, efforts are underway to unify the planning processes dealing with water quality to ensure consistency and harmony among the various units of government.

Some similarities exist among these plans. Comprehensive local water plans written by counties identify local goals and desired land use changes. Plans for the 13 major watersheds of the Minnesota River Basin are larger in scope. The two types of plans are similar in that they both take place at the local level and influence land use decisions. At the next higher scale, the Basin Plan focuses on the entire Minnesota River Basin. Beyond that, the focus shifts from one basin to the state’s 10 river basins in Minnesota’s Water Management Unification Initiative. The Water Management Unification Initiative, the state’s overall water plan, is being developed “by Basin” for the first time. This Basin Plan and the Water Management Unification Initiative deal with the larger scale issues such as the cumulative effect of a pollutant. Phosphorus is one example. Seemingly low concentrations upstream add up to produce problems in the lower Minnesota River during low flow conditions.

An even higher level plan is the EnPPA. This biennial agreement describes the comprehensive collection of Minnesota programs, responsibilities and measures by which the MPCA and the EPA will meet mutual goals. By providing a more complete picture of the environmental activities occurring in Minnesota, the agencies hope to increase public understanding of environmental goals and the progress made in achieving these goals.

Aside from Basin-specific plans, the MPCA must also abide by Section 303 (e) of the Clean Water Act. It requires each state to have a Continuing Planning Process document describing the processes and procedures it uses in water quality planning. The State of Minnesota’s Continuing Planning Process for Water Quality Management provides a management framework and link for programmatic commitments and goals that are contained in the Environmental Performance Partnership Agreement and the Minnesota River Basin Plan. The purpose of the Continuing Planning Process is to document how the state will make its water quality management decisions and explain how the state manages its water pollution control programs.

Coordination of the plans mentioned above avoids duplication, prioritizes efforts, and aids in determining whether targets are being achieved. It is not the intent of this Basin Plan to replace other plans or determine what those other plans will do, but to develop a plan at the Basin level for issues that affect the Minnesota River Basin.
ACTION STRATEGIES

Improve Government Services and Collaboration

10. SUPPORT EDUCATION

Education creates greater public awareness and understanding of Basin water quality issues. It gives people tools and encourages personal responsibility to help clean up the Minnesota River.

BACKGROUND

Most MPCA programs have an education component. It generally occurs as an in-house effort, but the agency also relies on outside organizations for assistance. For planning purposes we will divide the audiences into two areas: non-point sources and point sources. Each audience receives information they need to do their part to improve water quality.

Non-point sources - support education for all citizens, government, non-profits, etc. regarding environmental protection needs and opportunities. The MPCA will support environmental education in our elementary and secondary schools. It will provide leadership and support to the Watershed Institute.

Point sources - support education for people responsible for designing, evaluating, owning, operating, and maintaining wastewater treatment facilities that discharge to waters of the state.

CAC Recommendation:
Engage the general public
Improve technical assistance to local government

MnRAT Recommendation:
Engage the general public
Educate the public

TASKS

Non-point sources:

1. Support the Watershed Institute to provide an opportunity for creating and enhancing watershed efforts in ways that improve water quality, the economy, and community within the Minnesota River Basin.
2. Continue educational focus on pollutants of concern identified in the MRAP including bacteria, phosphorus, sediment, nutrients, and oxygen demanding materials. Identify one pollutant or issue annually as a target; develop educational materials/programs around issue. Work in cooperation with other agencies and organizations, such as the Minnesota River Basin Data Center and Minnesota River Basin Joint Powers Board.

3. Support Rivers Curriculum in an effort to include water quality information in classrooms.

4. Work in cooperation with Public Information Officers and CWP project managers to inventory each CWP's educational needs. Provide assistance in meeting these needs.

5. Participate in the environmental education component of tourism/interpretive centers being proposed in the upper Basin. Work with existing environmental learning centers in the Basin.

6. Determine people's attitudes on the Minnesota River. Work with other organizations to identify current information on social attitudes. If current information is insufficient, conduct an assessment (survey, focus group, etc.).

Point sources:

1. Continue to provide training to maintain wastewater operator's certification. Each year, at least 16 wastewater training seminars are held at various locations within the state (four in the South District). Topics include various aspects of wastewater treatment (pond systems, activated sludge, etc.), collection system operation and maintenance, and biosolids management. Pursue funding to continue offering the seminars.

2. Update wastewater treatment plant operators on new water quality issues, providing a forum for exchange of information on issues that impact wastewater treatment facilities.

3. Sponsor exhibits or presentations at annual conferences for wastewater operators such as:
   - Wastewater operators conference;
   - Collection system operators conference;
   - Land application of biosolids, residuals, and effluents; and
   - Industrial operators conference.

4. Inform significant point sources of CWP activities in their watershed, and how the point source phosphorus strategy will affect them.

MILESTONES


2. Complete inventory on CWP education needs by 2004.

3. Educational information is developed on Minnesota River and pollutant(s) yearly.

4. Wastewater treatment plant operators maintain certification.

ACTION STRATEGIES

Improve Government Services and Collaboration

11. PURSUE SUSTAINABLE DEVELOPMENT

Build understanding for sustainable quality of life decision-making. Evaluate interrelated community, environmental and economic factors within the watershed and use this knowledge to inform decision-makers on water quality problems. Local water plans should guide communities to mitigate and minimize the impacts of growth. Water quality funding should be directed to demonstrate innovative solutions that promote sustainable growth.

CAC Recommendation:
Improve technical assistance to local governments

TASKS

1. Establish an MPCA technical assistance team to work with and advise communities on the environmental aspects of their planning efforts. This would complement local planning. Team members should be representative of the MPCA to cover land, water, and air issues, as well as more complex growth and management matters. The team could also draw on other agencies having authority in relevant issue areas.

2. Encourage communities to take advantage of frameworks for community planning including the Minnesota design team model.

3. Develop materials to provide communities with useful information on more environmentally sound development patterns. Suggest ways for communities to achieve environmental protection while enhancing their quality of life.

MILESTONES

1. Establish technical assistance team by 2003.


BACKGROUND

Several Minnesota River Basin communities are in the process of expanding, especially in the Lower Minnesota River Watershed. Expansion of cities results in the alteration of hydrology. Previously porous soil surfaces are converted to streets, driveways, parking lots, and rooftops. Prior to development, these locations may have stored water in soils and vegetation. However, replacing soil and vegetation with concrete, asphalt, and other structures not only eliminates this ecological
function, but also speeds up the delivery of water to the river. Storm water can also carry pollutants.

Another consequence of development is the increased amount of wastewater generated. Even if treated, the wastewater outflow still exerts pressure on the river that brings the river system ever closer to its carrying capacity (i.e., the ability to assimilate pollutant and nutrient loads without significant impairment of overall water quality and ecological function). Left unmitigated, the potential exists for growth to cause an increase in both point and nonpoint source pollution. In fact, the lower 25-mile stretch of the river has low dissolved oxygen levels. In 1985, a wasteload allocation was established for dischargers on the Lower Minnesota River so that all sources including both point and nonpoint pollution would be maintained within the river's assimilative capacity. Instead of adding pollutants to the river, communities are now trying to maintain the levels of pollutant load discharged to the river.

With these complex issues, it is important for communities to plan their growth. Many approaches to planning are currently available that take into consideration the interrelationships among community, environmental, and economic factors. Use of these types of approaches will help to protect the environment in concert with the community and the economy.
ACTION STRATEGIES
Improve Government Services and Collaboration

12. SUPPORT WATERSHED MANAGEMENT/FUNDING

Support watershed planning and implementation efforts by providing financial and technical assistance to watershed partnership teams. The MPCA supports developing inclusive watershed partnership teams for each of the major watersheds in the Minnesota River Basin.

BACKGROUND

Watershed teams will play an increasingly important role in the identification of problems and development of solutions for improving and protecting water quality. The Minnesota River Basin Joint Powers Board together with many state agencies and organizations support watershed management. A variety of local organizations lead watershed teams: Watershed districts, counties, SWCDs, other joint powers boards, and non-profits. The MPCA along with other agencies will provide financial and technical assistance to locally led watershed efforts. The MPCA will support the decisions of the watershed partnership teams by providing assistance (point and non-point source) to those projects working to achieve priority water quality goals.

CAC Recommendations:
- Improve land management practices
- Monitor water quality throughout the Minnesota River Basin
- Establish local joint powers agreements
- Improve technical assistance to local governments.

MnRAT Recommendations:
- Establish and focus partnerships
- Involve agriculture and local governments in watershed planning
- Engage the public
- Educate the public
**Steps to a Successful Watershed Project**

1. Establish and train a watershed management team. Conduct one year of planning. A watershed team should involve stakeholders in the watershed. This group may include, but is not limited to, people representing the farming community, cities, industry, or residents. Forming this team and doing some preliminary planning can help team members agree on what the problems are and identify an approach to solve them.

2. Carry out broad-scale projects identified in the major watershed work plan. Once the initial planning is finished, the team may be able to do some broad scale projects such as BMP promotion or education, which may take them toward meeting their goals.

3. Initiate problem-investigation monitoring to answer questions identified in the major watershed work plan. Science is a good tool to use if there are specific questions identified by the team that need to be answered in order to proceed. Two examples: What is causing the problem? or How do we efficiently solve this problem? This is a good time to seek help in the form of financial and/or technical assistance.

4. Focus implementation on priority areas. Once the initial problem investigation monitoring is completed, implementation activities should be focused on high priority areas. Targeting resources helps to ensure that time and money are well spent.

5. Help local water planners incorporate watershed plan elements into comprehensive local water plans. Following problem investigation and implementation, comprehensive local water plans need to be adjusted. If the identified problem is yet to be solved, the water plan may need to reflect a more targeted approach to achieving the solution. If the problem no longer exists the water plan may identify new priorities, maybe switching to a different body of water or another pollutant.

6. Design monitoring system to track implementation and evaluate effectiveness. Follow-up monitoring is important as a check on the effectiveness of the adopted land use changes. Evaluation of the entire project may help to identify strengths and weaknesses. Knowledge from follow-up monitoring and evaluation activities can be used in future projects.

**Tasks**

1. The MPCA will provide assistance, as resources permit, to projects that are able and motivated. Since resources are limited, those projects that will most benefit basin-wide goals have high priority. More details can be found in the funding action strategy.

2. Work with other agencies and organizations to assist watershed partnership teams with 1) identification of water quality problems and the prioritization of water resources of concern, 2) identification of water quality indicators (biological, physical, and chemical) and measurable targets for indicators, 3) assessments of sources of pollutants, 4) identifying linkages between sources of
pollutants and measurable targets, 5) the determination of loading allocations and reductions needed to meet water quality goals, 6) the development of implementation plans, and 7) implementation activities as needed. Involve Minnesota River Basin Data Center.

3. Urge project applicants to clearly define local commitment, priority areas, problems, and solutions in future project applications. Successful watershed projects have been those in which applications have demonstrated these criteria. Suggest watershed projects follow “Steps to a Successful Watershed Project” outline above.

4. Urge watershed projects to work toward sustainability. The amount of state funding available is likely to remain near present levels. As the number of water quality improvement efforts increase in Minnesota, there may be less funding per project. It will be important for local watershed projects to be sustainable if state funding decreases. Part of sustainability includes generating funding on a local level.

5. As resources become available, locate project manager in Mankato area.

6. Work with local CWP project staff to integrate TMDL reaches into CWP projects.


**MILESTONES**

1. Watershed partnership teams have been established for all 13 major watersheds by 2002.

2. By 2004, 11 of 13 major watershed teams will have completed a water quality assessment and develop comprehensive implementation plans.

3. All of the 13 major watershed partnership teams will be in some stage of implementation by 2005.

4. Locate project manager in Mankato area by 2005.

**FUNDING ACTION STRATEGY**

Seek funding for necessary activities and assist local government organizations that demonstrate the capability to deliver services efficiently. Provide available funding in a manner that provides an incentive for good fiscal and environmental stewardship. Support decision-making at the local level that is consistent with Basin goals and objectives.

**TASKS**

**Supporting effective local institutions**

1. Encourage locally derived stable and sustainable funding for an administrative officer and as needed technically skilled staff accessible to each of the major watersheds. The MPCA and other agencies would provide short term financial and technical assistance for high priority projects. In
some cases alliances may be desirable between watersheds to efficiently access and support these local staff. The MPCA views this as important to: establish local leadership of environmental projects, develop sustainable local project schedules, and increase local skills and capabilities. These local staff will be critical to coordinate the long-term implementation of the watershed plan through multiple local, state and federal supportive programs. MPCA should allow the cost of these staff to be eligible as in-kind match.

2. Seek better coordination of multi-agency funding. Work with Minnesota River Basin Joint Powers Board (MRJPB) and other agencies and organizations to develop a five-year multi-agency plan for financial support for critical activities.

3. Encourage grass roots, citizen-based involvement in Minnesota River Basin. The MPCA will evaluate the potential to provide one-time funding to major watershed management organizations to engage citizens in their respective watersheds.

4. Maintain a stable level of funding by the MPCA for the Basin as well as from other state and federal agencies for implementation of state programs in the Minnesota River Basin and for priority in statewide project funding through 2005. Re-evaluate funding needs in accordance with progress on TMDLs after 2005.

**Support adaptive management through continued planning**

5. Provide funding for continued assessment, planning and evaluation. Implementation programs of the MPCA and other agencies will have the benefit of understanding both the needs that exist as well as analysis of management options that are both efficient and effective. Each subsequent planning round should increase local subwatershed resolution in priorities and targeting and watershed organizations should re-evaluate and adjust plans to be consistent with completed TMDLs and assigned load allocations. Watershed plans should be integrated into comprehensive local water plans. Current levels of pass-through funding available to watershed organizations includes $250,000 per year from Minnesota River funds. Under $½ million is typically available and used statewide for CWP Phase One projects. Minnesota River program general funds require a federal funding match.

6. Coordinate MPCA funding through CWP, 319 and State Revolving Fund with assessment and implementation plans of watersheds. Where necessary recommend program and rule modifications as appropriate. Provide an opportunity for greater resolution and additional prioritization and targeting of implementation efforts in high priority subwatersheds where the greatest loading reductions are assigned.

**Provide implementation assistance to high priority projects**

7. Provide clear information on state and national priorities to local resource managers so that where possible, they may coordinate a "win-win-win" approach so that projects are identified that have benefits to the implementor, as well as meet local, regional and national water quality goals. Seek funding from all sources to support these projects.

8. Fund the highest priority local projects both strategically and environmentally. Priority projects should be identified in watershed implementation plans and comprehensive local water plans. Competitive selection will continue to be part of the funding allotment process for implementation projects in this Basin. Rather than try to implement all the activities important in a major watershed at one time, watershed planning should identify those areas where accelerated implementation is most critical. A comprehensive implementation plan should be developed for these areas and funding and programmatic assistance should be coordinated within the MPCA for these priority sub-
watersheds. MPCA project selection integration will help to coordinate these priorities with available funding sources managed by the MPCA. Where planning is insufficient to identify priority among projects, the MPCA will seek to improve regional coordination of project priority ranking by using the MRBJPB in project ranking.

**Fund efficient local delivery in statewide programs**

9. Local implementation programs are supported in feedlots and through BWSR for other programs. Implementation activities should support applied research and demonstration, education, BMP implementation, financial and technical assistance to landowners, and reporting and evaluation.

**MILESTONES**

1. Create and distribute to local units of government an annual schedule of (estimated) available funding. Also update annually Table 9 on status of major watershed projects.

2. Distribute base program and project funding as available and scheduled. Report annually to the Regional Environmental Management Director and the MRBJPB on MPCA pass-through funding provided to the Basin.

3. Urge BWSR to undertake an analysis of funding in special units of government statewide, including participation of locals. Report the results of that analysis.

4. Create task force on funding through Water Unification Planning to assess the current mix of funding. Assess whether current funding is effectively and efficiently being distributed to provide a basin-wide base as well as accelerated funding to the highest strategic and environmental priorities, and recommend an appropriate mix of state and federal funding to local water quality projects.

5. The MPCA will seek to coordinate local water quality projects with regional and national plans and implementation programs. Report to MRBJPB as well as major watershed teams, annually, national and statewide issues relevant to the Basin along with opportunities to seek funding.

6. Track loading reduction costs and use information to improve efficiency in future program and projects.

**BACKGROUND**

Restoring, enhancing and preserving the environmental quality of the Minnesota River Basin will require significant funding from both private and public sources. The MPCA provides financial and technical assistance to each of the focus areas covered in this plan, namely, efficient programs, effective high priority projects and assistance to local governments for high local priority projects and environmental resources. Figures D and E show MPCA funding provided to the Basin for point and non-point activities respectively. Funding has been targeted at supporting effective local institutional arrangements; for improving implementation effectiveness through improved environmental information and planning at the watershed level, and for support of environmental improvement through BMP implementation, and improved wastewater treatment. MPCA funding for local pollution control programs varies from ongoing funding for the county feedlot programs, to funds for local administration of watershed planning. In addition, funding for BMPs and watershed implementation projects is provided. Where grants are awarded in most cases they will be used to match local or federal funding.
### Table 8 - Funding assistance to Minnesota River Basin

<table>
<thead>
<tr>
<th>Sep-01</th>
<th>Funding Assistance to Minnesota River Basin</th>
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<td>Minnesota River Implementation (1993)</td>
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<tr>
<td>System Tile Research (1995)</td>
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<tr>
<td>Wastewater Treatment Facilities (1989-99)</td>
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<tr>
<td>ISTS - Training (1995-96)</td>
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<tr>
<td>Feedlot - training (1995-96)</td>
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<td>Minnesota River-NPS (1994-95)</td>
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<td>Minnesota River-NPS (1996-97)</td>
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<tr>
<td>Minnesota River - NPS (1998-1999)</td>
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<tr>
<td>Minnesota River - NPS (2000-2001)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>$12,638,419</td>
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</table>

For local projects, the State of Minnesota provided approximately 50% of the total project cost. Local funding provided the other 50%.
Figure D

Minnesota Wastewater Funding
(Actual Figures FY89-99, Projection FY99-09)
Figure E

Funding to Minnesota River Basin Projects

Dollars

Years


CWP Loans
Grants
Watershed Management Funding

The MPCA looks to local government to provide the service delivery component to landowners and managers for nonpoint source related activities. As a result, financial assistance targets will take into account long-term base administrative and technical support for land use controls and watershed management. MPCA funding is currently provided to supplement this support through programs and financial and technical assistance to high priority watershed projects. Funding is currently provided through programs such as the feedlot program for improved local regulatory assistance including delegation of county feedlot program administration. Minnesota River general funds support improved environmental information development and planning and implementation targeting and prioritization.

In some cases one-time funds also are provided to watershed districts and county joint powers organizations and others to help establish viable watershed coordination. CWP, 319 Clean Water Action Plan, and Minnesota River funds are used for specific work tasks such as diagnostic studies, implementation planning, and high priority implementation projects. As comprehensive watershed plans are developed all sources of funding should be considered including but not limited to MPCA funding sources. In selecting high priority projects consideration should be given to environmental need, efficiency, strategic importance and stakeholder readiness.

Figure D shows a projection of wastewater funding availability through 2010 for the Basin at current levels. While some statewide funding increases are anticipated, establishment of Basin Plans in the rest of the state is expected to increase funding demands and priorities in those areas and is likely to consume increases in total funding made available for pass-through at the MPCA.

Implementation funding will be provided through programs as well as projects funded through CWP and 319 funds. Currently, funding projects in the Minnesota River Basin compete on an annual basis against watershed projects and other nonpoint source projects in other parts of the state. The amount of funding needed and requested is far greater than the funding available, so there are no guarantees that projects will secure funding through these programs. In addition, funding is provided through other federal and state sources. Table 9 represents estimates of an anticipated schedule of project readiness and associated funding needs by various management entities in the Basin.
Table 9  **MAJOR WATERSHED MANAGEMENT CYCLE**
11/21/01

<table>
<thead>
<tr>
<th>Major Watershed Project</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
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<tr>
<td>Upper MN River (Big Stone Area)</td>
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<td>P?</td>
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<tr>
<td>Lac Qui Parle River</td>
<td>PI</td>
<td>PI</td>
<td>PI</td>
<td>PII</td>
<td></td>
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<tr>
<td>River/Yellow Bank River</td>
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<tr>
<td>Chippewa River</td>
<td>PI</td>
<td>PII</td>
<td>PII</td>
<td>PII</td>
<td>PII*</td>
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<td>Shakopee Creek</td>
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<td>Yellow Medicine River</td>
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<td>Hawk Creek</td>
<td>PI</td>
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<td>PII</td>
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<tr>
<td>Redwood River</td>
<td>PII</td>
<td>PII</td>
<td>PII</td>
<td>PII</td>
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<tr>
<td>Cottonwood River</td>
<td>PII</td>
<td>PII</td>
<td>PII</td>
<td>PII*</td>
<td>PII</td>
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<tr>
<td>Middle Minnesota River (Area tributaries)</td>
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<tr>
<td>Little Cottonwood River</td>
<td>PI</td>
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<td>PII</td>
<td>PII*</td>
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<td>Seven Mile Creek</td>
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<td>PII</td>
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<tr>
<td>Blue Earth River</td>
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<td>Le Sueur River</td>
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<td>Lower Minnesota River (Area Tributaries)</td>
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<tr>
<td>High Island Creek</td>
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<td>Sand Creek</td>
<td>OP</td>
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<td>PI</td>
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</tbody>
</table>

**Key**

- Organize Project: OP (Seed funding not included)
- Phase I Assessment: PI (Predicted start up year)
- Phase II Implementation: PII (Predicted start up year)
- Phase II Continuation request: PII *

**Expected funding request year in bold.**
New System Streamlines Allocations

The MPCA is developing a system to improve the efficiency and effectiveness of how competitive state and federal pass-through dollars are allocated among local units of government. It would streamline the existing system by combining many of the administrative aspects of these funding programs, including a single funding application, integrated priorities and criteria for funding, and a unified application scoring and ranking process. These changes will save time and money for applicants in preparing applications, and for agencies in the review of applications. The new system will eventually assist with determining how to allocate funding appropriately between point source and non-point source needs. It is envisioned that the system will start out by integrating MPCA-administered programs in 2000 and 2001. It could gradually expand to include funding programs of other state and federal agencies, such as the NRCS EQIP program, the BWSR Challenge Grant program, and the Metropolitan Council Environmental Partnership program.
**13. COORDINATION OF OVERALL CLEANUP EFFORT**

Support coordination of overall cleanup effort to avoid duplication and minimize cost. Work closely with the Minnesota River Basin Joint Powers Board, which helps provide overall coordination among local, state, and federal agencies.

**CAC Recommendation:**
Establish a Minnesota River Commission.

**MRAT Recommendation:**
Establish and focus partnerships

**TASKS**

1. Assist in planning Minnesota River Summer Conference and other MRBJPB events. Work with MRBJPB to develop and deliver educational messages on Minnesota River issues (e.g. sediment, phosphorus, and bacteria).

2. Solicit MRBJPB input on appropriate Minnesota River issues. This may include MPCA plans, policies, etc.

3. Supply MRBJPB with details on MPCA funds spent in Basin. This will enable them to track the amount spent by local, state, and federal organizations on the Minnesota River.

**MILESTONES**

1. MPCA is involved in conferences and other MRBJPB events. Educational information available to public.

2. Provide yearly update on MPCA funding spent in the Minnesota River Basin.

**BACKGROUND**

The Minnesota River Citizens’ Advisory Committee recommended creating “a Minnesota River Commission to oversee the cleanup effort.” They wanted to ensure government accountability and citizen participation. The MRBJPB was established in 1995 and given this responsibility.

Although the task of coordination is not complete, the MRBJPB works toward filling this role.

County commissioners from the 37 counties in the Basin comprise the MRBJPB. The Joint Powers Board coordinates efforts on both the policy and technical levels. On the policy level, the MRBJPB
organized the Blue Ribbon Committee composed of leaders of state and federal agencies. On the technical level, the MRBJPB has organized the Minnesota River Data Review Team composed of technical experts, and the Minnesota River Technical Advisory Committee, composed of county water planners and SWCD and watershed project staff. Locally the MRBJPB works with partners within each major watershed of the Minnesota River Basin.

It has been suggested that the MRBJPB represent a broader range of stakeholders interested in the Basin. This could include expanding its membership beyond county government or reflecting the leadership that will emerge from the 13 watershed teams currently being formed in the Basin. Other organizations active in the Basin include tribes, the private sector, recreation and sportsmen’s groups, environmental organizations, regional development commissions, and farm/commodity groups. Citizens could also be represented.
ACTION STRATEGIES

Provide Responsive Services to Citizens and Stakeholders

14. IMPROVE ACCESS TO AGENCY SERVICES

Minimize number of entries people need to get the information they need from MPCA. Coordinate programs, where appropriate, to reduce the number of contacts people must make (phone calls, visits, or letters) to find an answer, obtain a permit, or get funding.

TASKS

1. Conduct media campaign to inform public of MPCA’s Internet services.

2. Have all staff assigned to sub-district offices be located there within three years.

3. Continue to provide high quality training opportunities.

4. Set up and staff a booth at 75 percent of county fairs.

5. Develop a media packet for the Minnesota River that includes local watershed project contacts and program information.

MILESTONES


2. Assess with managers staffing levels in districts at beginning of each fiscal year.

3. Contact and work with MPCA’s training unit to continue workshops and training.

4. Work with each county fair board on renting space for booths.

BACKGROUND

The MPCA reorganized in 1998. One of the goals was to provide better customer service and reliable public access. The new divisions -- South, North, and Metro -- replaced media-based divisions that were used since the creation of the MPCA. In addition, staff was assigned to the sub-district offices based on geographical locations.

Prior to the reorganization, the MPCA recognized the frustration of citizens who contacted the agency and needed assistance with permits, rules, questions, and a host of other issues. They often ended up talking to the wrong person who did not know the answer to their question or simply could not get through to the MPCA. This led to greater frustration.

With the restructuring of the MPCA came the increased staffing of sub-district offices. This gives citizens local access to the agency’s
programs and local expertise to go along with those programs. There are often situations in geographical areas that allow decisions to be made in light of local conditions. The reorganization of the MPCA allows decisions to be made at the local level.

**Web Service**

The Internet in recent years has provided greater, easier, and faster access to information. There are fact sheets from all programs that provide instant access, up to date news releases, training opportunities, and permit applications just to name a few. The MPCA web site is a clearinghouse about all activities in the agency, and provides an excellent starting point for information being sought by citizens. The future only will expand these opportunities.

**Customer Assistance Center**

When the MPCA reorganized its operations in 1998, it was with the promise of better customer service and focus, more creative problem solving, and common sense decision-making that protected the environment. In September of 1999, the Customer Assistance Center opened up for service. It is set up to be the agency’s troubleshooters for air, water, hazardous waste, solid waste, and tanks. As a nexus to the MPCA’s frequently used hot lines and help lines, the Customer Assistance Center provides easy access to application forms, guidelines, publications, regulations, and other information that customers need immediately.

**Workshops and Course Offerings**

The MPCA provides many statewide training opportunities for the environmentally regulated community. The MPCA believes that training is an integral part in helping our customers understand our rules and regulations, as well as being in compliance with regulations. Training is provided in most program areas, including solid waste, wastewater, hazardous waste, tanks, and air.

The MPCA registers approximately 4,000 people at about 50 training events throughout the year. An Events Calendar is available on the Internet for interested parties to view MPCA-sponsored events that have been scheduled for the year. (MPCA website address: http://www.pca.state.mn.us)

**Sub-District Public Information Officers**

Public information officers (PIO) have been staffed in MPCA sub-district offices over the last three years. This has provided instant access to local media, print, radio, and television that previously had to work with PIO staff from St. Paul. Sub-district PIO staff also provide local environmental news releases, staff booths at trade shows and county fairs, and answer questions on general issues of the local offices.
ACTION STRATEGIES
Provide Responsive Services to Citizens and Stakeholders

15. BASIN PLAN EVALUATION

Evaluate the effectiveness of the basin planning process itself—especially the success of efforts to integrate internal MPCA programs—to learn from this experience and improve future basin planning efforts.

BACKGROUND

One component of this basin planning process has involved integrating internal MPCA activities (such as permitting, monitoring, and nonpoint source pollution work) on a basin-wide basis. This has been a challenging process, and undoubtedly there is room for improvement. Future planning efforts in the Minnesota River Basin and other basins could benefit greatly from learning what worked with this integration process, what did not, and how the process might be improved. In addition, the completion of the Minnesota River Basin Plan provides an opportunity to gather input from partner agencies, local governments, Basin residents, etc. about how this planning process worked and how it might be improved in the future.

TASKS

1. Based on the initial reaction to the completed plan and the insight of the MPCA Minnesota River Basin planning team and others, determine what general questions the planning team wishes to try to answer.

2. Gather input on strengths and weaknesses of the Basin Plan. Make changes to basin planning process based on input. These changes will benefit ongoing basin planning efforts.

3. Publish yearly report on progress of meeting goals and implementing tasks identified in the Basin Plan.

MILESTONES

1. Identify general questions by July 2002.

2. Results of survey available by February 1, 2003.

**MINNESOTA RIVER BASIN PLAN TABLES AND FIGURES**

**Tables**

1. Page 18 - 1998 303(d) list of impaired waters in the Minnesota River Basin.
2. Page 20 - 12 steps in the TMDL process.
4. Page 31 - Gross estimates of phosphorus loads to the Minnesota River at Jordan.
7. Page 35 - Summary of swimmable use support for assessed lakes in the Basin.
8. Page 100 - Funding assistance to Minnesota River Basin.

**Figures**

- Page 19 - Map of 1998 303(d) list.
- Page 30 - Relative proportions of total phosphorus at different flows.
- A. Page 44 - Number of days per flow category.
- B. Page 45 - Average sediment tons per day at Mankato.
- D. Page 101 - Minnesota wastewater funding
- E. Page 102 - Funding to Minnesota River Basin projects
# MINNESOTA RIVER WEB SITES

## State

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<thead>
<tr>
<th>Website</th>
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<tr>
<td><a href="http://www.pca.state.mn.us/water/Basins/mnriver/index.html">www.pca.state.mn.us/water/Basins/mnriver/index.html</a></td>
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<td><a href="http://www.mrbdc.mnsu.edu">www.mrbdc.mnsu.edu</a></td>
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<td><a href="http://www.rccra.com/">www.rccra.com/</a></td>
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## Other Water-Related

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<td><a href="http://www.amrivers.org/">www.amrivers.org/</a></td>
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These websites provide information on the Minnesota River Basin, including data, news, and resources from various organizations and agencies. The list includes links to websites such as the Minnesota Pollution Control Agency, the Minnesota River Basin Data Center, and the Coalition for a Clean Minnesota River, among others.
MINNESOTA RIVER BASIN PLAN ACRONYMS

BMP .......................Best management practice
BOD .......................Biological Oxygen Demand
BWSR .....................Board of Water and Soil Resources
CAC .......................Minnesota River Citizen’s Advisory Committee
CBOD .....................Carbonaceous biochemical oxygen demand
CCMR .....................Citizens for a Clean Minnesota River
Cfs ........................cubic feet per second
CLMP .....................Citizens Lake Monitoring Program
COE .......................U.S. Army Corps of Engineers
CREP .....................Conservation Reserve Enhancement Program
CURE .....................Clean Up our River Environment
CWP .....................Clean Water Partnership
DNR .....................Department of Natural Resources
EMAP .....................Environmental Monitoring and Assessment Program
EPA .....................Environmental Protection Agency
EQB .....................Environmental Quality Board
ET .......................Evapotranspiration
GIS .....................Geographical information system
EnPPA .....................Environmental Performance Partnership Agreement
HSPF .....................Hydrologic Simulation Program Fortran
IBI .......................Index of biotic integrity
ISTS .....................Individual sewage treatment system
MDA .....................Minnesota Department of Agriculture
MDH .....................Minnesota Department of Health
MPCA .....................Minnesota Pollution Control Agency
MRAP .....................Minnesota River Assessment Project
MnRAT .....................Minnesota River Agriculture Team
MnTAP .....................Minnesota Technical Assistance Program
MRBJPB ...................Minnesota River Basin Joint Powers Board
MSU .....................Minnesota State University
MS4 .....................Municipal Separate Storm Sewer System
NPDES .....................National Pollutant Discharge Elimination System
NRCS .....................Natural Resources Conservation Service
NTU .......................Nephelometric turbidity unit
PCB .......................Polychlorinated biphenyl
RIM .....................Reinvest in Minnesota
SWCD .....................Soil and Water Conservation District
TAC .....................Technical Advisory Committee
TMDL .....................Total maximum daily load
TSS .......................Total suspended sediment
USDA .....................United States Department of Agriculture
USGS .....................United States Geological Survey
WLA .....................Waste load allocation