Watershed Management Action Plan

DNR GUIDEBOOK

Draft Version 1.0
July 2009

clean water
starts with you.
IOWA DNR WATERSHED IMPROVEMENT

WELCOME

This document is intended to aid watershed planning groups in creating a watershed management plan to improve water quality. Planning serves as a road map for turning today's problems into tomorrow's solutions. Water quality improvement is a big task, and trying to tackle it all at once can be daunting. This guide encourages a phased approach to implementation to ensure incremental progress is made within the framework of big picture goals for the watershed.

This guide provides a starting place for the planning process. It does not contain an exhaustive list of examples. The table of contents provides an outline for what is covered in the document. Each section heading and subheading contains information to help construct a valuable watershed plan including: what information is needed, why it is important, and who or where information can be obtained. Additionally, examples (hypothetical and/or from past plans) are cited for illustrative purposes.

The more time and effort invested in watershed planning, the greater the chance of success. The planning process consists of fact-finding, analysis and interpretation of information and trends concerning the local political, social, environmental and economic aspects of the watershed. The planning process takes into consideration viable alternatives and their cost effectiveness to create recommendations to meet present and future needs in a comprehensive plan.

Planning is a continuous process where progress and goals need to be revisited and revised at least every five years. This guidebook assumes community based planning has already matured to a level that enables the watershed group to have the knowledge and ability to successfully develop an effective watershed management plan.

The DNR and its partners are available to provide guidance and technical assistance in preparation of a watershed management plan. These organizations have dedicated water quality professionals interested in working collaboratively with stakeholders to revitalize Iowa waterbodies through community involvement.

The EPA has developed a helpful set of questions to evaluate the completeness of a watershed management plan, shown in Appendix A. Please review this document before, during and after the development of the watershed management plan to ensure the plan is complete.

The following are symbols for contact resources and agencies used throughout the template. Using these resources should help you in developing the referenced section of this guide.

CONTACT SOURCES

Iowa Department of Natural Resources
http://www.iowadnr.gov/water/watershed/index.html

Iowa Department of Agriculture and Land Stewardship (IDALS)
http://www.iowaagriculture.gov/Field Services/waterQualityProtectionProjects.asp

USDA - Natural Resources Conservation Service (NRCS)
http://www.ia.nrcs.usda.gov

Water Quality Improvement Plan – This information can be found if a Water Quality Improvement Plan has been completed by the DNR for the watershed.

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LIST OF FIGURES

1 COMMUNITY BASED PLANNING

WHAT INFORMATION IS NEEDED?

Summarize all community based planning efforts and the results of those efforts in this section, including a list of committed stakeholders and affiliations, a list of watershed advisory team members (if formed), a list of technical advisory team members and affiliations (if formed), and the number and nature of public meetings held. Include the results of community based planning efforts and those of the sub-groups. Additionally, identify any scheduled future community based planning efforts.

WHY IS THIS INFORMATION IMPORTANT?

Public involvement is a key component of developing a Watershed Management Plan, and implementing and sustaining water quality improvement efforts in public waters. Involving local stakeholders in the initial stages of watershed plan development helps ensure long-term success by getting local feedback on the complex set of economic, social and environmental data collected through the planning process. It also encourages local interest and action by fostering community ownership of the waterbody. Community based planning helps formulate a group vision of the watershed or waterbody that will inspire citizens to act by prioritizing the identified issues in the watershed.

WHERE CAN THIS INFORMATION BE FOUND?

For groups in the initial stages of watershed planning, community based planning precedes the rest of the contents of this guidebook. It is imperative to build an organized group before formulating goals. For assistance in initiating a community based planning process, contact the DNR Watershed Improvement Program, a local DNR Fisheries Biologist or Private Lands Biologist, IDALS regional Basin Coordinators, or the local USDA NRCS office. Established groups can benefit from contacting partner agencies as well to obtain information and insight.

WATERSHED GROUP AND SUB-GROUP INFORMATION

Community based planning is a voluntary, locally-led planning process involving integrating social, economic and environmental concerns. Stakeholders representing the community or local organizations and individual landowners and residents make up a watershed group. Successful watershed groups actively recruit members from diverse backgrounds and perspectives to take advantage of their unique skills and ideas. Watershed groups tend to develop smaller sub-groups to focus on different aspects of a Watershed Management Plan. A watershed advisory council (WAC) is a small group, usually five to 12 members, representing key stakeholder groups that lead the local planning process. The WAC is usually responsible for drafting the Watershed Management Plan. A technical advisory team is usually comprised of subject matter experts (like fisheries biologists, regional Basin Coordinators, water quality and watershed professionals, NRCS staff, etc) that may or may not be stakeholders in the watershed. The technical advisory team works closely with the watershed advisory council, providing technical information on the local watershed conditions and the feasibility and effectiveness of potential solutions.

EXAMPLE:
The fictional Cy-Hawk Lake Watershed Group boasts an impressive collection of stakeholders representing local landowners, local members of the Cy-Hawk Lake Association, environmental groups, local and state governments, and state universities. ***Figure 1-1*** contains stakeholder names, affiliations and titles, and what subgroup they belong to if applicable. The Cy-Hawk Lake Association was founded on March 7th, 2008 by Chuck Long. The group has since grown to 17 active stakeholder members and a committed technical advisory team of seven professionals from multiple government organizations.

The Cy-Hawk Lake Watershed Group has met many times since its inception. The first three meetings established the technical advisory team and introduced problems troubling Cy-Hawk Lake. Once the technical advisory team was established, the watershed group held its first public meeting.

The group has held four public meetings as a large group, beginning with the watershed plan kickoff meeting on May 11, 2008. This meeting was widely promoted by the group, which more than 35 people attended. Watershed maps, water quality brochures, restoration success stories from other watersheds and contact information were distributed to attendees. Members of the technical advisory team delivered a presentation about Cy-Hawk Lake and its problems.

The watershed group held a second public meeting on June 1, 2008 to prioritize stakeholder concerns. After a brief presentation of the potential watershed and lake restoration process, stakeholders were broken up into small groups of four to five people. Each group listed and prioritized their water quality concerns and the desired outcomes from the Watershed Management Plan. The larger group then identified and ranked the collective priorities. Finally, a watershed advisory council was formed to lead the development of the Watershed Management Plan.

The watershed group held its third public meeting on August 27, 2008 to present water quality improvement alternatives based on the results of the second public meeting and analysis of feasibility by the technical advisory team ***(Figure 1-2)***. Alternatives were finalized and the workload for preparing the Watershed Management Plan was divided between watershed advisory council members.

On March 16, 2009, the watershed group unveiled its Watershed Management Plan at the fourth public meeting. The projects within the plan slated for 2009 and their associated potential funding sources were discussed and finalized in addition to asking for volunteer labor for the upcoming projects.

NAMES	AFFILIATION & TITLE	SUBGROUP *(if applicable)*
Chuck Long	Local landowner, Cy-Hawk Lake Assoc. President	Watershed advisory council
Natalie Porter	University of Iowa professor	Watershed advisory council
Jared Devries	Chair of Linn County Board of Supervisors	Watershed advisory council
Chad Greenway	Mayor of Tipton	Watershed advisory council
Jessica Morris	Isaac Walton League member	Watershed advisory council
Jane Plainfield	Landowner, Cy-Hawk Lake Assoc.	Watershed advisory council
Sandy Jenkins	Sierra Club member	Watershed advisory council
Bill Smith	Landowner	
Sally Smith	Landowner, Cy-Hawk Lake Assoc.	
Jerry Wright	Landowner, Cy-Hawk Lake Assoc.	
Will Winter	Chamber of Commerce	
Jenny White	University student	
Sam Baugh	Cedar Rapids Social Club	
Ben Blood	Ducks Unlimited member	
Karly Gooden	Landowner, Cy-Hawk Lake Assoc.	
John Gooden	Landowner, Cy-Hawk Lake Assoc.	
Sarah Blake	Linn County Sanitarian	
Chris Parsons	DNR Fisheries Biologist	Technical advisory team
Aloysius Pendergast	NRCS District Conservationist	Technical advisory team
Vince Waterman	IDALS regional Basin Coordinator	Technical advisory team
Larry Brewer	SWCD Chairperson	Technical advisory team
Lisa Carpenter	ISU Extension associate	Technical advisory team
Rachel Grand	RC&D project officer	Technical advisory team
Shaun Lowry	DNR TMDL project manager	Technical advisory team

Figure 1-1: Cy-Hawk Lake stakeholder membership and subgroups

CY-HAWK LAKE KEY RECOMMENDATIONS

- The TAC will avoid any extended period of lake-drawdown, which impacts feasibility and methods of fishery management and dredging.
- Lake patrons speculated in a previous meeting that past dredging and canal construction may have resulted in "puncturing" the clay liner at the bottom of the lake and led to some of their water quantity problems. As a result, the TAC took extra care to select targeted dredging areas and will pump some dredged spoils to a suspected leaky part of the lake to "re-seal" it.
- Boaters expressed concern about any management practices that affected the areas available for recreational boating, as Cy-Hawk Lake is one of only two lakes in the Cedar Rapids metro area that provides recreational boating activities. The TAC committee took this into consideration and avoided extensive use of practices that would prevent boating for long periods of time.

Figure 1-2: Key concerns and issues identified by the WAC in Carter Lake

2 VISION STATEMENT

WHAT INFORMATION IS NEEDED?

The vision statement is a one sentence statement summarizing what the partners, landowners and citizens are striving for with the plan. This statement should embody the essence of the plan; why it is important, and why this plan deserves the time and resources to complete it.

WHY IS THIS INFORMATION IMPORTANT?

The opening section of a successful Watershed Management Plan is a chance to start with the end in mind. It is imperative that the goals of the local watershed group are focused to help drive positive change in the watershed. This is also the first statement regarding the watershed that a potential stakeholder or funding agency will read and can affect public outreach efforts. Implementing watershed plans hinge upon voluntary participation from neighbors and local community members. Describe the passion driving this plan to increase financial support and stakeholder participation.

WHERE CAN THIS INFORMATION BE FOUND?

The DNR Watershed Improvement Program can offer guidance to help your group develop and refine a vision statement. However, the vision statement should be driven by the group creating the plan with minimal outside input.

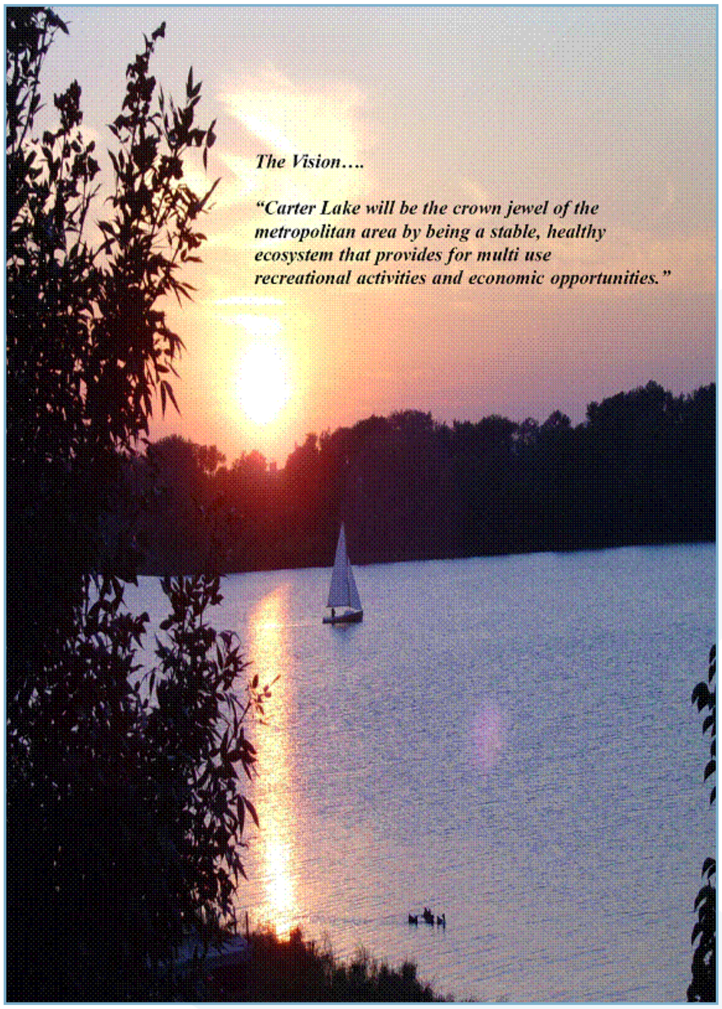


Figure 2-1: Carter Lake Vision Statement (Source: Carter Lake Watershed Management Plan)

3 PUBLIC OUTREACH

WHAT INFORMATION IS NEEDED?

Public outreach (also known as information and education, communications, marketing or public relations) is a way to motivate people to participate in water quality improvement. It goes beyond just informing the public and moves them to action. Public outreach takes a social science approach to water quality goals. The key to increasing participation in water quality improvement efforts is to gain an understanding of community, create incentives and motivate people to take action.

Public outreach efforts are most effective when they are:

- based on what is known about the audience
- planned ahead of time
- evaluated and refined for future efforts

Creating a public outreach plan should take place before a Watershed Management Plan is implemented. The outreach plan will provide tools to reach water quality goals. An effective outreach plan should follow these six steps:

- Plan goals from Section 1 and identify vision statement from Section 2
- Determine target audiences
- Research those audiences
- Use research to develop an outreach plan
- Carry out plan
- Measure successes and evaluate

WHY IS THIS INFORMATION IMPORTANT?

In order to sustain success throughout the implementation of a Watershed Management Plan, a focused, dynamic public outreach (information and education) campaign must be developed. Research shows that people respond to different approaches. Employing a variety of outreach tools and educational opportunities can increase public support and participation, which will lead to accomplishing planning goals.

WHERE CAN THIS INFORMATION BE FOUND?

The following pages represent a guideline to develop a custom outreach plan. Assistance is also available by contacting the DNR Communications staff at (515) 281-5131 or Jessie.Brown@dnr.iowa.gov.

A. SET YOUR PLAN GOALS

Take your plan goals and brainstorm how public outreach can help.
Make sure goals are measurable:

EXAMPLE GOALS: *(Use this section to restate your goals from Section 6)*

1. Increase public and landowners' awareness of and participation in Watershed Management Plan implementation
2. Reduce nutrient delivery by 40 percent
3. Reduce sediment delivery by 50 percent
4. Install five wetlands in targeted areas
5. Reduce number of residents using fertilizer on lakefront lawns by 50 percent

B. DETERMINE YOUR TARGET AUDIENCES

"General public" should not be your only audience. For your messages and outreach to be the most effective, they should reach the people you need in order for your plan to be a success.

IDENTIFY YOUR TARGET AUDIENCES: *(add spaces if necessary)*

- Who do you depend on to make changes to the land?
  -
  -
  -
  -
  - ***Examples***: row crop landowners, livestock producers, lakefront residents, non-farming rural residents, confinement operators in Washington Township

- Who do you depend on to keep your project afloat?
  -
  -
  -
  -
  - ***Examples***: partners and stakeholders, funding sources, local and state officials, Legislature, Congress

- Who do you depend on to spread your message to these people?
  -
  -
  -
  -
  - ***Examples***: media, citizens, partners and stakeholders, local landowners, anglers and hunters

C. RESEARCH YOUR TARGET AUDIENCES

Once you've decided *who* you need to reach, you'll need to determine *how* to best reach them with your messages and lead them to action. Knowing what landowners consider to be benefits and addressing their concerns is critical to make conservation practices appealing to the landowners. Research is important because what drives landowners' decisions may be different than anticipated.

> EXAMPLE
>
> Research indicated the following results on "what changes your mind on environmental issues?"
>
> - News coverage (57%)
> - First-hand experiences (49%)
> - Conversations with other people (40%)
> - Public meetings (15%)
> - Financial issues (9%)

The survey results were surprising to this watershed group. They assumed financial issues would rank highest.

For each target audience, research:

- Barriers to adoption, what incentives work
- How they like to receive information
- How they make decisions regarding their land, water
- Their feelings on and knowledge of water quality and conservation

Collect this data through:

- Pre-project surveys
- Face-to-face meetings
- Advisory boards
- Public meetings
- Third-party research
- Other methods

Using the following format may be helpful in organizing this data.

TARGET AUDIENCE #1: ***(repeat for each target audience)***

- Barriers:
    -
    -
    -
    -
- Motivators/incentives:
    -
    -
    -
    -

- Preferred ways to receive watershed project information:
    -
    -
- How they make decisions regarding their land:
    -
    -
- Perception of current water quality:
    -
- Perceived value of waterbody:
    -
- Most familiar conservation practices:
    -
    -
    -
    -

D. USE RESEARCH TO DEVELOP YOUR OUTREACH STRATEGY

- For each goal, use audience research results (surveys, etc.) to determine:
    - Barriers
    - Possible solutions
    - A "take-home" message
    - Ways to deliver that message
    - Measurable ways to evaluate the effectiveness of message delivery

EXAMPLE

GOAL: Establish no-till on 1,000 acres

BARRIERS:

- perceived cost
- would be seen as "sloppy" by neighbors
- rumors of lowered yields

SOLUTIONS/BENEFITS:

- cost-share and grants
- actual reductions in input and energy costs
- provide examples of no-till in use
- increases in yields

MESSAGE:

- No-till can save you money, time and soil

MESSAGE DELIVERY:

- face-to-face contacts with targeted landowners
- create fact sheet on no-till to leave with landowners
- host field days so farmers can see how neighbors have used no-till successfully
- list benefits of no-till in newsletter article
- work with local reporter to highlight a landowner successfully using no-till in newspaper
- ask landowners using no-till to place a sign in field

EVALUATION MEASURES:

- Keep contact log of calls received from landowners, why they called, how they heard about your effort or no-till options, and followup contact information (phone, e-mail)
- Keep track of number of face-to-face meetings and if those meetings result in no-till being applied (also track number of acres using no-till)
- Number of news stories in local media on watershed effort's and landowners' no-till efforts
- Attendance numbers at field day (also use sign-in sheet to capture contact information)
- In newsletter, offer free ball cap as incentive to those who call about using no-till on their land ("mention this newsletter and receive a free watershed ballcap")
- Number of signs installed

Follow this format for each plan goal.

E. CARRY OUT THE PLAN

Work with trusted community partners to spread your message. Time outreach efforts to tie in with other newsworthy events and stagger efforts to stay on the radar. Not all efforts and tasks must be scheduled and planned at the beginning of the process. It will be important to adapt as the plan progresses. Use the following template as a rough timeline for the first part of the schedule. Create one of these schedules for each year of your implementation plan. This will be used to fill in the implementation schedule in Section 9.

YEAR 1

First quarter
-
-
-
-

Second quarter
-
-
-
-

Third quarter
-
-
-
-

Fourth quarter
-
-
-
-

F. MEASURE AND EVALUATE EFFECTIVENESS; PROMOTE SUCCESSES

Evaluate public outreach efforts continuously to find the most effective approaches. Include an evaluation at the end of any outreach project to gather information that can be used in future projects. Many Watershed Management Plans will have multiple phases and last long periods of time. It will be a learning experience to find out what works and what does not. Encouraging participation in any way possible throughout implementation of the plan can increase participation and help to improve water quality.

Ideas on how to refine an outreach process:

- Keep track of how stakeholders heard about the Watershed Management Plan plan/effort
- Ask how landowners you've worked with made the decision to participate in your project – look for trends that can help you adjust your outreach efforts
- Conduct surveys (pre-, mid- and post-project)
- Offer incentives to encourage contacts
- Track the number of people that attend a field day; number that then sign up for the practice
- Track media coverage

Everyone likes to be part of a winning team. Have a plan in place to promote successes with enthusiasm and creativity. Fun and success are a good combination for increasing future participation in water quality improvement efforts.

4 WATERSHED ANATOMY

4.1 WATERSHED MAP WITH BOUNDARIES

WHAT INFORMATION IS NEEDED?

A watershed map is typically derived from a topographic map by outlining watershed boundaries. Additionally, if it is helpful to include a locator map showing the watershed's location within Iowa.

WHY IS THIS INFORMATION IMPORTANT?

This provides an idea of where the watershed is located and what features are contained within its boundaries. The watershed boundaries define the area that drains into a lake or stream. A watershed map is important for identification of the watershed's location, natural features in the vicinity and any urban areas.

WHERE CAN THIS INFORMATION BE FOUND?

For assistance creating watershed maps, contact the DNR Watershed Improvement Program GIS Staff or see a completed Water Quality Improvement Plan (TMDL).

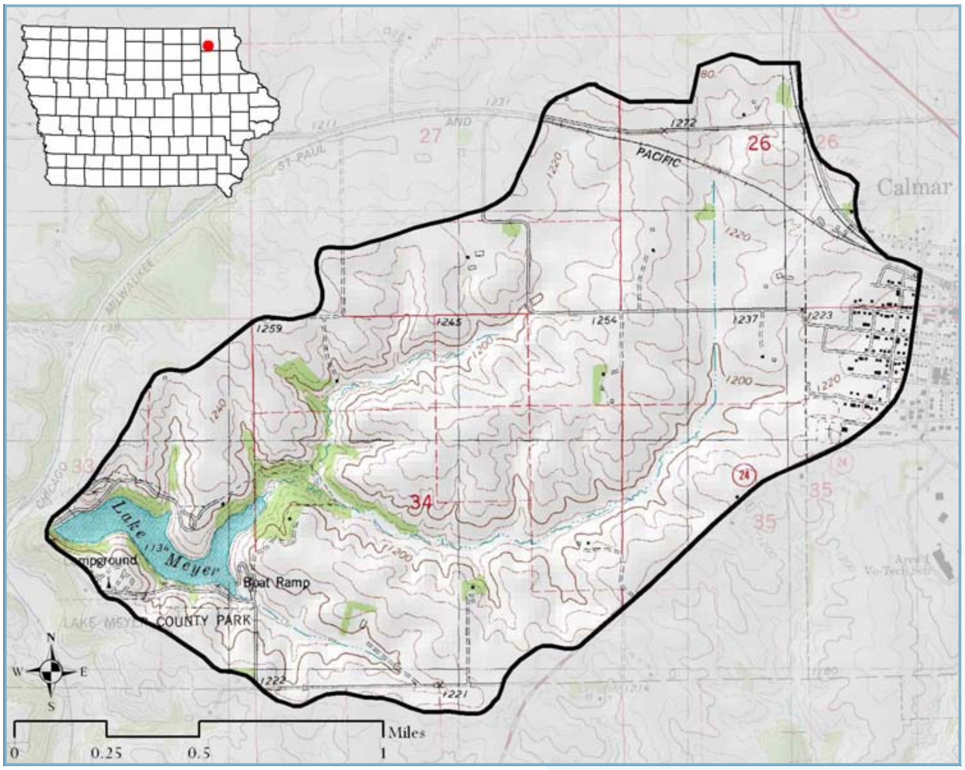


Figure 4-1: Example Watershed Map. Map of the Lake Meyer watershed in Winneshiek County. The boundaries of the Lake Meyer watershed are outlined in black, defining the area that drains to the lake. This map shows important information, such as intermittent streams feeding the lake and a portion of the City of Calmar within the boundaries. The Iowa map in the upper left hand corner identifies the watershed in Winneshiek County. A compass rose (or north arrow) and scale complete this map.

4.2 LOCATION NARRATIVE AND HISTORY

WHAT INFORMATION IS NEEDED?
Describe the location, demographic and land ownership information relating to the watershed.

WHY IS THIS INFORMATION IMPORTANT?
Providing a background of population demographics and land ownership information may guide decisions on how to successfully implement plan phases.

WHERE CAN THIS INFORMATION BE FOUND?
For assistance with this section, contact the Iowa DNR Watershed Improvement Program GIS Staff or see a completed Water Quality Improvement Plan.

LOCATION
Location information describes the location of the watershed, specifically in relation to counties, cities and towns and other political boundaries. If a watershed is located in multiple counties, calculate the acres and percentage of the watershed located in each county.

EXAMPLE FROM THE UPPER IOWA RIVER WATERSHED ASSESSMENT
The Upper Iowa River Watershed encompasses more than 640,900 acres, spanning portions of seven counties across northeast Iowa and southeast Minnesota. It includes parts of Allamakee, Howard, Mitchell and Winneshiek Counties in Iowa and Mower, Fillmore, and Houston Counties in Minnesota. Overall, 78.3 percent of the watershed is in Iowa and 21.7 percent is in Minnesota.

POPULATION
Population information should incorporate U.S. Census data to estimate the population of the watershed. Include the number of cities, towns and total population in the watershed. Estimate rural and urban populations separately if possible.

EXAMPLE FROM THE RATHBUN LAKE WATERSHED ASSESSMENT
The six counties in the Rathbun Lake watershed (347,537 acres) include:

- **Appanoose** - 52,063 acres, 15 percent of the watershed
- **Clarke** - 15,500 acres, 4 percent of the watershed
- **Decatur** - 7,280 acres, 2 percent of the watershed
- **Lucas** - 90,997 acres, 26 percent of the watershed
- **Monroe** - 5,623 acres, 2 percent of the watershed
- **Wayne** - 181,697 acres, 51 percent of the watershed

The counties in the Rathbun Lake watershed are among the least prosperous in Iowa based on per capita income. These counties suffer some the highest poverty and unemployment rates and lowest levels of income and farm sales in the state. Approximately 15,000 people live in the Rathbun Lake watershed. There are nine communities and an estimated 857 farms in the watershed. The majority of farms are family owned and operated. Almost all the residents in the watershed rely on Rathbun Lake for their drinking water.

OWNERSHIP

Ownership information describes the acres and percentage of the watershed privately and publicly owned. A map showing public and private land ownership illustrates the information well.

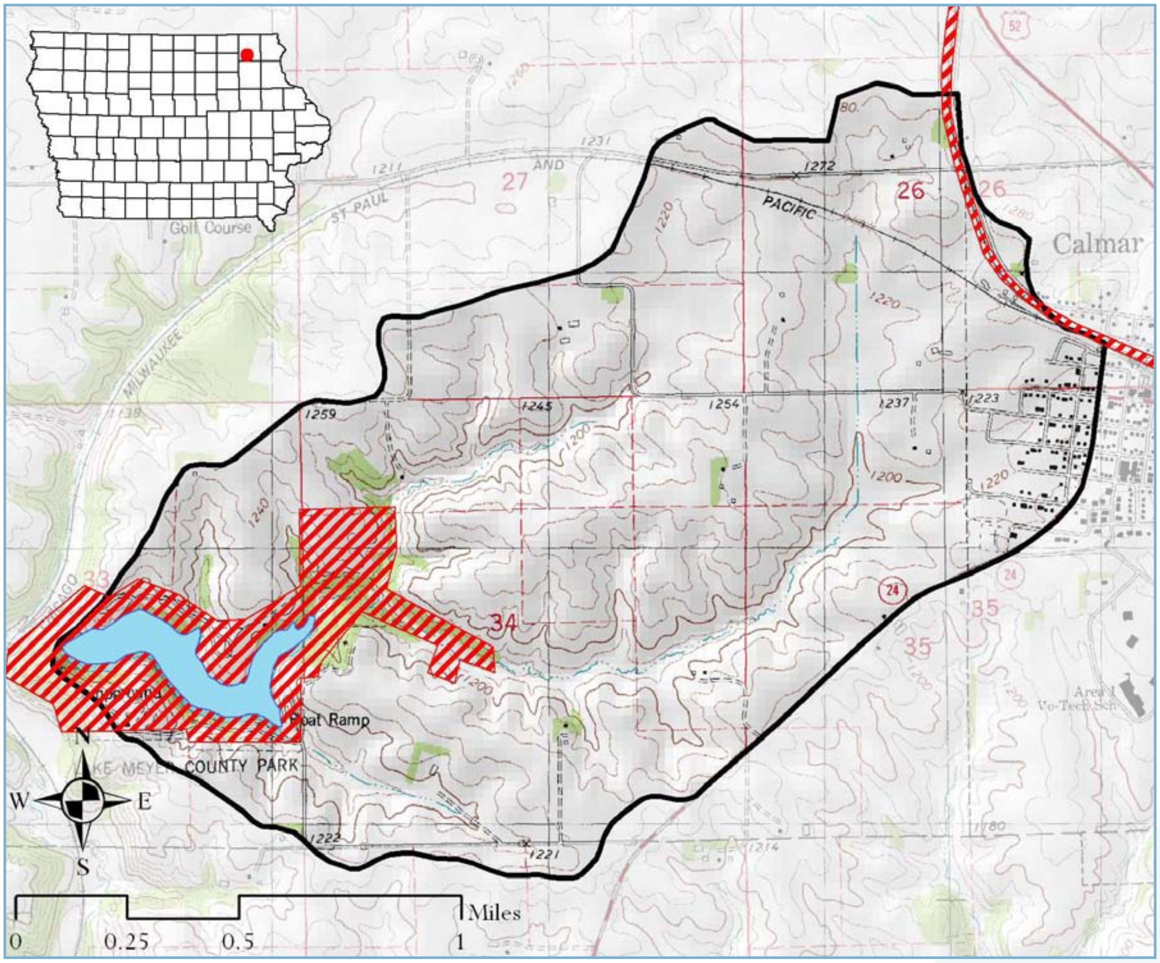


Figure 4-2: Map of publicly owned land in the Lake Meyer Watershed

EXAMPLE FROM THE LAKE MEYER WATERSHED

The Winneshiek County Conservation Board owns 155 acres (about ten percent) in the Lake Meyer watershed. The majority of this land surrounds Lake Meyer. Other public land in the watershed includes road right of ways (acreage data not available). The majority of the land in the watershed is privately owned.

4.3 PHYSICAL CHARACTERISTICS

WHAT INFORMATION IS NEEDED?

Provide brief descriptions of physical characteristics of the watershed, including maps when possible. Topics within this section include hydrology, soils, topography, geology, climate, threatened and endangered species, and current and historical land use. Other relevant topics may include fishery data, tourism information and lake construction and restoration information.

WHY IS THIS INFORMATION IMPORTANT?

Describing the physical characteristics of a watershed is vital for a watershed group to understand why the watershed functions and behaves the way it does. It describes the building blocks of the environment in which the watershed functions. This can dictate what best management practices are chosen for success.

WHERE CAN THIS INFORMATION BE FOUND?

For assistance contact the DNR Watershed Improvement Program or a completed Water Quality Improvement Plan.

HYDROLOGY

Describe the hydrologic network of the watershed by covering the following topics (dependent on watershed): total number of stream or river miles, perennial stream miles, lake area, watershed to lake ratio, stream gradients, and miles of High Quality (HQ) or High Quality Resource (HQR) waters. High quality waters have exceptionally good quality with exceptional recreational and ecological importance. Special protection is warranted to maintain the unusual, unique or outstanding physical, chemical, or biological characteristics which these waters possess. High quality resource waters have substantial recreational or ecological significance which possess unusual, outstanding or unique physical, chemical, or biological characteristics, which enhance the beneficial uses and warrant special protection

EXAMPLE FROM THE UPPER IOWA RIVER WATERSHED ASSESSMENT

According to Stralhers Stream Order survey of Iowa, there are 1,419 miles of streams and rivers in the UIRW. The highest stream order in the UIRW is a fifth order stream. The UIRW has been recognized by the State of Iowa as having some of the highest quality and priority waters in the state. 109.4 miles of the Upper Iowa River are designated as Class A, Human Contact. 152.2 miles of streams in the UIRW have been designated as BCW, coldwater resource. The UIRW has more miles of BCW streams than any other HUC 8 watershed in the State of Iowa. The UIRW also contains 183.9 miles of HQR, high quality resource waters, and 60.6 miles of HQ, high quality waters. In addition, there are 159.2 miles of streams designated as BWW, significant resource for warm water aquatic life, and 23.8 miles of stream designated as BLR, limited resource for warm water aquatic life.

SOILS

Discuss the major soil units within the watershed and describe the properties of those soil types. Be sure to mention the acres and percentage of highly erodible soils (HEL). A map should be included showing the location of different soil mapping units.

For mapping assistance contact the DNR Watershed Improvement Section GIS Staff. For soil information and descriptions, consult the following:

- USDA NRCS Web Soil Survey ***(http://websoilsurvey.nrcs.usda.gov/app/)***
- USDA NRCS Soil Series Descriptions ***(http://ortho.ftw.nrcs.usda.gov/cgi-bin/osd/osdname.cgi)***

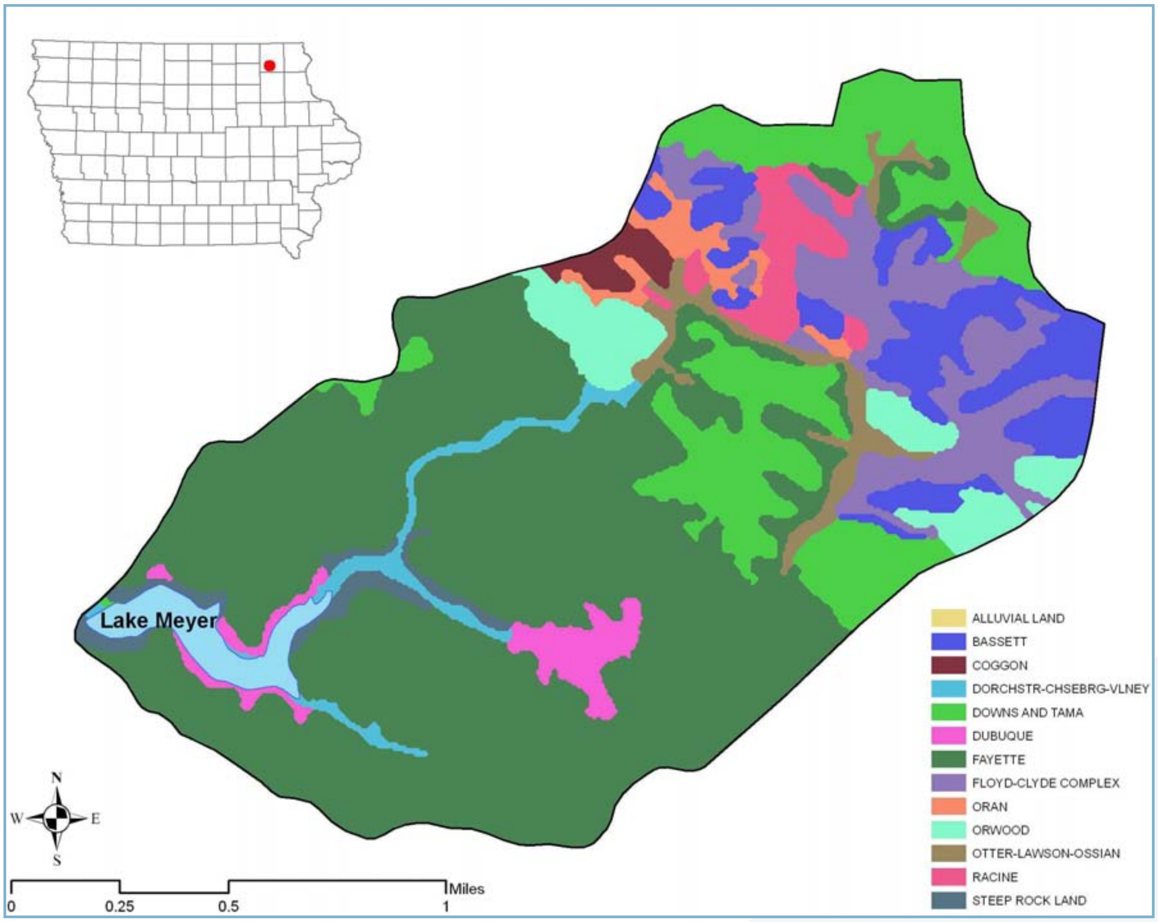


Figure 4-3: Example Soil Map. Figure 4-3 shows the soil map for the Lake Meyer watershed, which color codes the distribution of major soil types within the watershed. The state of Iowa map located in the upper left hand corner denotes the location of Lake Meyer within Iowa. A compass rose and scale complete this map.

EXAMPLE FROM THE LAKE GEODE WATERSHED ASSESSMENT

The predominant soil association is the Weller-Pershing-Grundy. It is a loess-derived soil mostly found on ridge tops and side slopes. Slopes range from 1 to 9 percent and the soils are moderately suited to growing row crops. NRCS has deemed this soil as a 3T soil, meaning only 3 tons/acre/year is allowed to erode to still retain productivity.

Secondary soil associations include Nira-Otley-Mahaska. A loess-derived soil found on wide ridge tops and short side slopes, these soils are well-suited for growing row crops. Also found in the Lake Geode watershed is the Givin-Hedrick-Ladoga soil association. This is a loess-derived soil found on ridge tops and is characterized by well-developed drainage ways. The slopes range from 1 to 9 percent and the soil is well-suited to growing row crops.

TOPOGRAPHY

Discuss the elevation and slope characteristics of the watershed. Specifically mention the high and low elevation of the watershed and the average slope of the land. Include an acreage breakdown of the watershed within each soil slope class (A through G).

EXAMPLE FROM THE UPPER IOWA RIVER WATERSHED ASSESSMENT

The Upper Iowa River Watershed has a high elevation of 1,438 feet above sea level and a low elevation of 612 feet above sea level, giving it a range of 826 feet. The mean elevation is 1,157 feet above sea level. The mean slope of land in the UIRW is 8.4 percent. The elevation of the Upper Iowa River Headwaters at Lake Louise is 1,261 feet above sea level, and the mouth at the Mississippi River is at 612 feet above sea. The river runs 133.6 miles from headwaters to mouth, giving the UIR an average drop, over its course, of 4.85 feet per mile. The topography of the watershed, by virtue of its size, varies from the west to the east. The western portion of the watershed has gradual slopes and rolling hills, moving east that transition into much steeper slopes and many vertical cliffs along the river valley wall.

SLOPE CLASS	PERCENT OF WATERSHED
A Slopes (0-2%)	2%
B Slopes (2-5%)	8%
C Slopes (5-9%)	12%
D Slopes (9-14%)	13%
E Slopes (14-18%)	8%
F Slopes (18-25%)	11%
G Slopes (>25%)	46%

GEOLOGY

Discuss the geology of the watershed by describing major bedrock units within the watershed and any geologic features, such as karst, that may impact water quality. Geologic information can be obtained from the DNR's Iowa Geological Survey ***(http://www.igsb.uiowa.edu/)***.

EXAMPLE FROM THE LAKE GEODE WATERSHED ASSESSMENT

Des Moines County is located within the Southern Iowa Drift Plain. The soil, substratum and underlying bedrock in this region consist of several types of materials. In most places, loess is at the soil surface. Loess consists of windblown, predominantly silt-sized soil particles. The loess in this part of the state, on stable upland positions, is as much as 15 feet in thickness.

The loess is underlain by Illinoian and pre-Illinoian glacial till. The glacial till was moved into this part of the state by vast sheets of ice known as glaciers. Since the till was moved by ice, it is comprised of materials that contain about 40 percent sand and rock fragments that can range from less than one inch to several feet in diameter. The glacial till ranges from a few feet in thickness to more than 100 feet over limestone bedrock.

CLIMATE

Discuss climatic information for the watershed including all relevant information, such as average rainfall, days with greater than 1 inch rainfall, and seasonal temperature extremes. Information can be found at the Midwestern Regional Climate Center ***(http://mcc.sws.uiuc.edu/)*** or the Iowa Environmental Mesonet ***(http://mesonet.agron.iastate.edu/)***.

> **EXAMPLE FROM THE LAKE GEODE WATERSHED ASSESSMENT**
>
> The climate in southeast Iowa is classified as humid continental. The average temperature in January is 14 degrees Fahrenheit. The average August temperature is 85 degrees Fahrenheit. Total annual rainfall averages 38 inches, while snowfall averages 25 inches. The Lake Geode watershed receives an average of 3 rainfall events over one inch per year. The length of the growing season for the area averages 183 days.

THREATENED & ENDANGERED SPECIES AND ENVIRONMENTS

Describe threatened and endangered plant or animal species found within the watershed. Examples of threatened and endangered species may include mussels, Indiana bats, Topeka Shiners, etc. Discussion may also include sensitive ecological communities, such as fens and algafic talus slopes. Local DNR Wildlife Biologists or the DNR Threatened and Endangered Species Program can help gather information. See the DNR website for a complete list of T&E species in Iowa. ***(http://www.iowadnr.gov/other/threatened.html)***.

> **EXAMPLE FROM THE UPPER IOWA RIVER WATERSHED ASSESSMENT**
>
> The UIRW is home to many endangered plant and animal species that rely on the unique environment of the watershed. According to the Iowa DNR, there have been 204 documented occurrences of threatened and endangered species and natural communities in the Iowa portion of the UIRW. Of that 204, 11 have been vertebrates, 59 invertebrates, 91 plants and 49 communities.
>
> One of the more unique ecosystems in the UIRW is the Algific Talus Slopes. There are approximately 50 Algific Talus Slopes in the UIRW. They remain cool throughout the year and are home to rare species of plants and animals. The slopes remain cool by a system of sinkholes, cracked bedrock and vents located on steep slopes. In the summer, air is drawn down through sinkholes, flows over frozen groundwater and is released out vents on the slopes. Summer temperatures on the slopes range from just above freezing to 55 degrees Fahrenheit. In winter, the air is drawn into the vents, and the groundwater again freezes.
>
> Because of the cool temperatures and moist conditions, unusual plants for this part of the country grow on the slopes. Typically growing in colder more northern climates, yews, balsam fir, showy lady's slipper and golden saxifrage can be found on the cool slopes. These cold microclimates of the slopes allow the rare plants and animals to survive.
>
> A tiny land snail, the Iowa Pleistocene snail, is smaller than a shirt button, at about 5 millimeters (1/4 inch) in diameter. Considered a glacial relic species, it has survived only on these small areas where temperature, moisture and food are suitable. Thirty-six known colonies are currently found in Northeast Iowa. The snail was thought to be extinct until 1955, when a scientist discovered it alive in leaf litter in Northeast Iowa.
>
> Several of the Algific Talus Slopes in the UIRW are included in the Driftless Area National Wildlife Refuge. The refuge, established in 1989, is helping to recover two federally listed species, the endangered Iowa Pleistocene snail and threatened Northern Monkshood, a purple hood-shaped flower belonging to the buttercup family. The US Fish & Wildlife Service manages the refuge as part of the National Wildlife Refuge System.
>
> In the Upper Iowa River itself a freshwater mussel survey was conducted under contract with the Iowa DNR. The survey identified several high quality mussel beds remaining in the river. Studies conducted through Luther College confirmed the quality of the mussel beds. These studies identified 10 live species of mussels in the UIR, including one species considered threatened.

HISTORICAL LAND USE

Provide a breakdown of historical land use of the watershed. Data can be found from the General Land Office historical vegetation reports and the local soil survey native vegetation information. For assistance with this information, contact the DNR Watershed Improvement Program GIS staff or a completed Water Quality Improvement Plan.

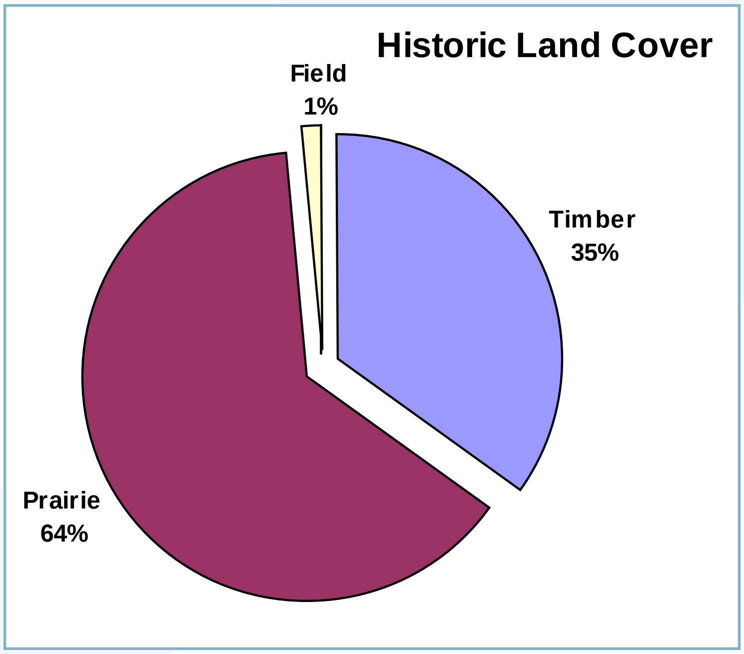


Figure 4-4: Example historical (1836-1859) land cover from Lake Geode

EXAMPLE HISTORIC LAND COVER

Historic land cover in the Lake Geode was dominated by prairie, accounting for 63.7% of the watershed, timber accounted for 34.9%.

HISTORIC LAND COVER IN THE LAKE GEODE WATERSHED

	PERCENT OF WATERSHED	ACRES
TIMBER	34.9%	3,612
PRAIRIE	63.7%	6,584
FIELD	1.4%	125

CURRENT LAND USE

Provide a breakdown of the current land cover of the watershed, including maps and charts. Data can be found from a recent watershed land cover assessment conducted specifically for the watershed. For assistance contact the DNR Watershed Improvement Program GIS staff for a completed Water Quality Improvement Plan.

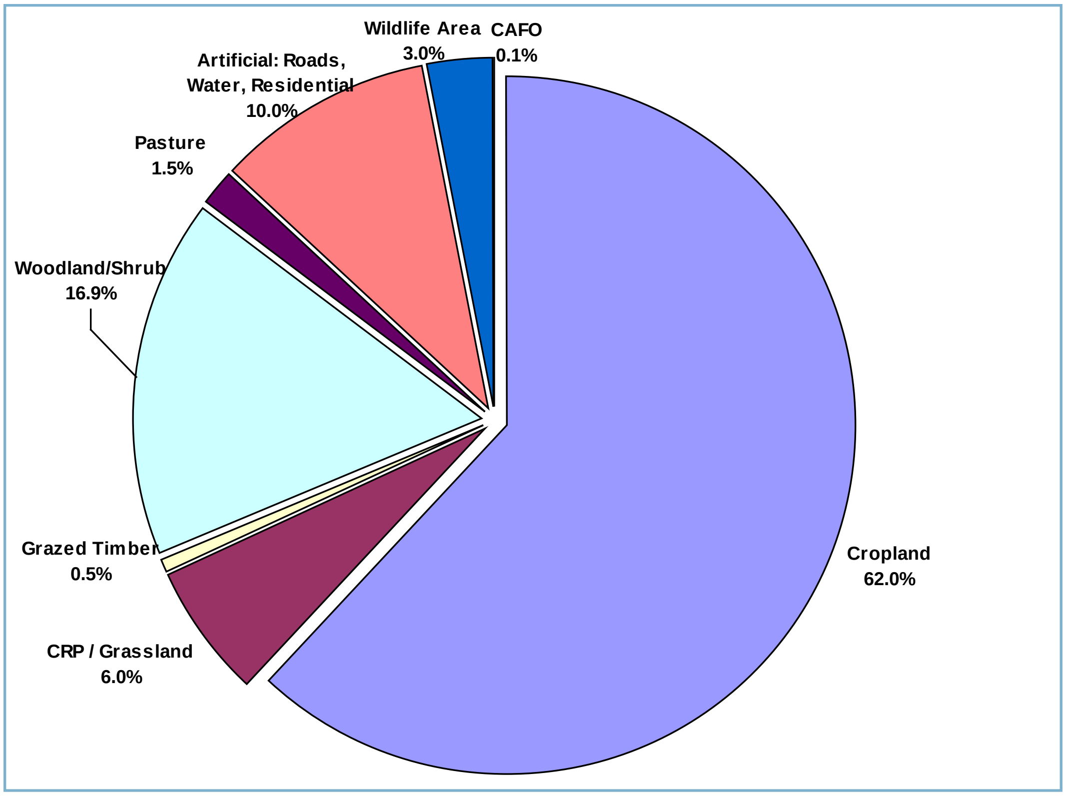


Figure 4-5: Example current land cover from Lake Geode

EXAMPLE FROM THE LAKE GEODE WATERSHED ASSESSMENT

The Lake Geode watershed consists of approximately 10,327 acres. Row crop production is the primary land use in the watershed. Corn and soybeans are the most commonly grown crops. Timberland is concentrated in the state park and along the tributaries that feed Lake Geode. Roughly 2 percent of the watershed is used for grazing. ***Figure 4-6*** illustrates the land use information for the watershed tabulated below

LAND USE IN THE LAKE GEODE WATERSHED

	PERCENT OF WATERSHED	ACRES
CROPLAND	62%	6261
CRP/GRASSLAND	6%	669
GRAZED TIMBER	0.5%	52
PASTURE	1.5%	154
WOODLAND/SHRUB	16.9%	1815
WILDLIFE AREA	3%	322
ARTIFICIAL: ROADS, WATER, RESIDENTIAL	10%	1038
CONFINED ANIMAL FEEDING OPERATION (CAFO)	1%	16

According to USDA-NRCS, of the cropland present in the watershed, approximately 30 percent (2,000 acres) is designated as highly erodible land. Within those acres, 95 percent have an approved conservation plan under the Food Security Act. It is documented that 70 percent of the plans are fully implemented.

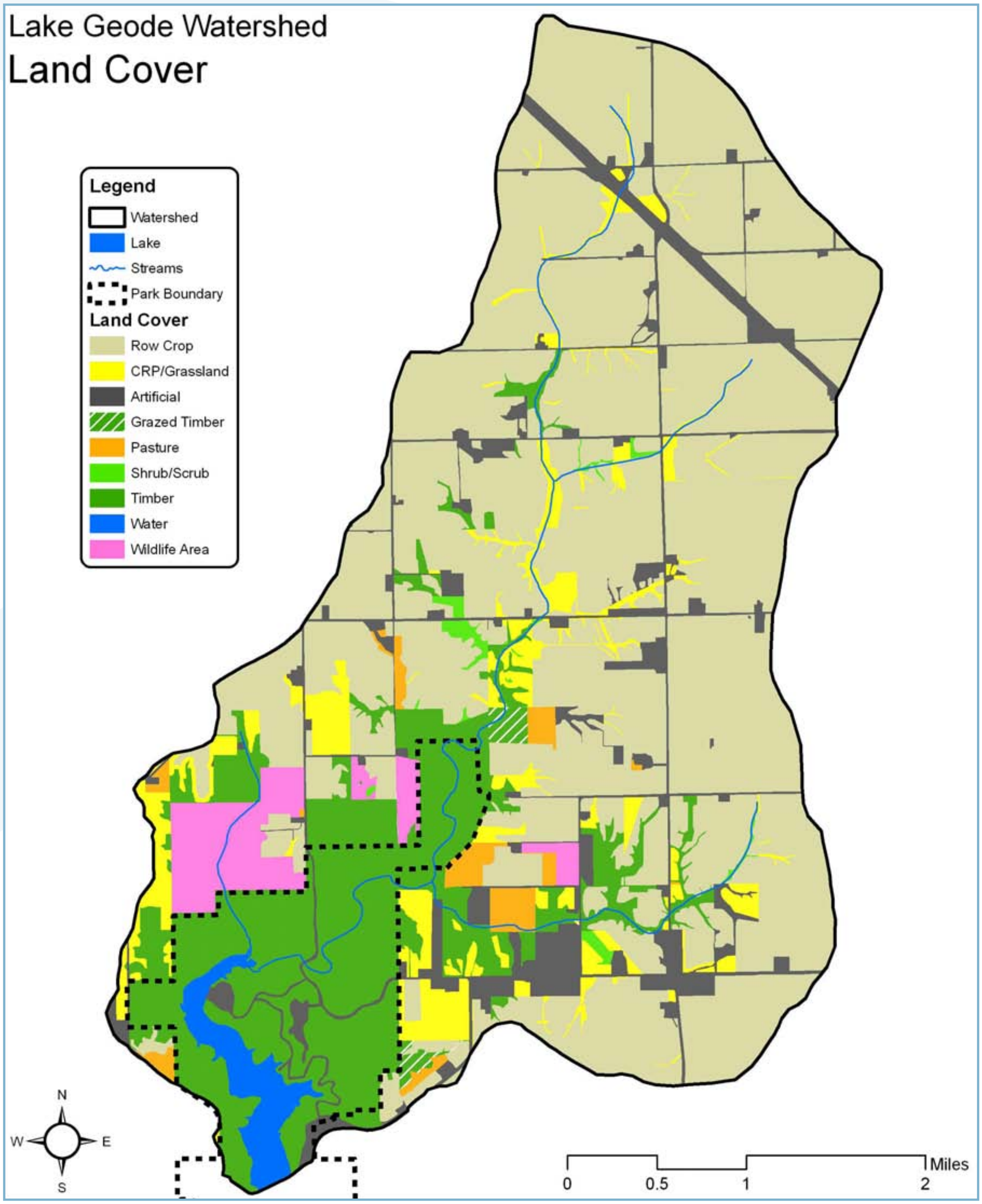


Figure 4-6: Land use map for Lake Geode

5 POLLUTANTS AND CAUSES

5.1 DESIGNATED USE

WHAT INFORMATION IS NEEDED?

Iowa's Water Quality Standards classify all surface waters in Iowa as being protected for general uses. Waters can also be protected for other designated uses, including drinking water, recreation uses like swimming, and supporting fish and other aquatic life. Designated uses are protected by specific water quality criteria and the state's antidegradation policy, as described in the Iowa Water Quality Standards. The Watershed Management Plan should include a complete list of all designated uses for the waterbody of concern, and should specifically identify any designated uses that are not being met due to poor water quality (also called "impaired").

WHY IS THIS INFORMATION IMPORTANT?

Information regarding designated uses is important for several reasons. First, corrective action cannot be taken unless the water quality problems are thoroughly understood. Knowing what uses the waterbody should be providing, and understanding why the waterbody is not currently supporting those uses, is the first step in defining the water quality problem. Second, some sources of funding require that impaired designated uses and the water quality problems causing the impairment be addressed to be eligible for funding. Third, understanding the uses that a lake or stream is intended to support helps decision makers better understand the watershed as a whole, and more readily identify potential threats to the waterbody.

WHERE CAN THIS INFORMATION BE FOUND?

- Find general information regarding designated uses of Iowa waterbodies on the DNR website at: ***www.iowadnr.gov/water/standards/summary.htm***l.
- Designated use information specific to your waterbody can be found by searching the online database at: ***http://programs.iowadnr.gov/adbnet/search.aspx***.
- After searching for the waterbody by name, click on the ***"View Segment"*** link towards the bottom of the page, and the full list of designated uses will appear, along with other background information. A discussion of the impaired designated use(s) is available in the ***"View Assessment"*** link.
- If a Water Quality Improvement Plant (also known as a "TMDL") has been completed for the waterbody, a thorough discussion of the impaired designated use(s) can be found in the report. A list of completed Water Quality Improvement Plans and the documents can be accessed at: ***www.iowadnr.gov/water/watershed/tmdl/index.html.***
- Make sure to use the most recent 303(d) report to ensure that additional designated uses have not been impaired since the completion of the Water Quality Improvement Plan: ***http://www.iowadnr.gov/water/watershed/impaired.html***

EXAMPLE

Black Hawk Lake in Sac County is protected for the following designated uses:

- Class A1 – Primary contact recreation
- Class B (LW) – Aquatic life (lakes and wetlands)
- Class HH – Human health (fish tissue)

The 2006 water quality assessment has identified the Class A1 (primary contact recreation) as "not supported" due to aesthetically objectionable conditions caused by poor water clarity. The assessment states that this impairment appears to be due primarily to inorganic turbidity and secondarily to large populations of suspended algae.

5.2 WATER QUALITY DATA

WHAT INFORMATION IS NEEDED?

Include a summary of water quality data that identifies, at a minimum, the pollutant(s) that is threatening or impairing the designated uses of the waterbody. The summary should include tables, figures and narratives that explain and interpret the data. If possible, spatial and temporal trends in water quality need to be identified. Historical or existing data must then be compared to the applicable water quality standards. If applicable, include a discussion of the data used in the ABDNet database ***(http://programs.iowadnr.gov/adbnet/index.aspx)***, as well as any additional information included in the Impaired Waters List ***(http://wqm.igsb.uiowa.edu/WQA/303d.html#2006)***.

WHY IS THIS INFORMATION IMPORTANT?

An adequate summary of available water quality data is required in order to effectively focus proposed improvement efforts on problems that contribute to poor water quality. To optimize the use of time, money and other resources, it is necessary to understand the existing water quality problems, the water quality standards violated, and any trends and problem areas. Understanding the water quality data will help stakeholders and decision makers develop a Watershed Management Plan that addresses the underlying problems and results in real water quality improvement.

WHERE CAN THIS INFORMATION BE FOUND?

If a Water Quality Improvement Plan has been completed for the waterbody, a summary of water quality data is available in the Problem Identification section of the document ***(http://www.iowadnr.com/water/watershed/tmdl/index.html)***. If not, water quality data can be obtained from the following sources

- ***http://wqm.igsb.uiowa.edu/iastoret/***
- ***http://limnology.eeob.iastate.edu/lakereport/***
- ***http://wqm.igsb.uiowa.edu/activities/beach/beach.htm***

The following are all examples from the Carter Lake Watershed Management Plan. The plan discussed in detail algae, water transparency, phosphorus, nitrogen, and bacteria.

ALGAE

The production of algae is controlled primarily by water temperature, light availability and nutrient availability. In addition to degrading aesthetics, dense growths of algae can lead to the depletion of dissolved oxygen. Blue-green algae blooms have frequently occurred at Carter Lake. High concentrations of toxins released by blue-green algae have resulted in beach postings for 18 weeks from the 2004 recreation season through the 2006 recreation season. Beach postings are alerts indicating possible health problems associated with full-body contact activities (e.g. swimming, wading and water skiing).

Chlorophyll concentrations are used as an indicator of algal biomass. This test is inclusive of all types of algae. Chlorophyll information for Carter Lake was sporadically available from 1990 through 2006. Annual growing season (May – September) median chlorophyll a concentrations ranged from 18.1 mg/m3 in May, 1993 to 521.1 mg/m3 in June, 2005 (Figure 3-1). The chlorophyll a target value identified in the Water Quality Improvement Plan is 33 mg/m3. Carter Lake has exhibited a significant increasing trend in chlorophyll concentrations from 2000 through 2006.

Blue green algae toxin data were available from 2004 through 2006. In 2004, beach postings were initiated when toxin concentrations exceeded 15.0 ppb. In 2005, the beach posting criterion was changed to 20.0 ppb. Four of the six samples collected in 2004 exceeded 15 ppb while three of twenty-one and four of twenty-two samples exceeded 20.0 ppb in 2005 and 2006 respectively.

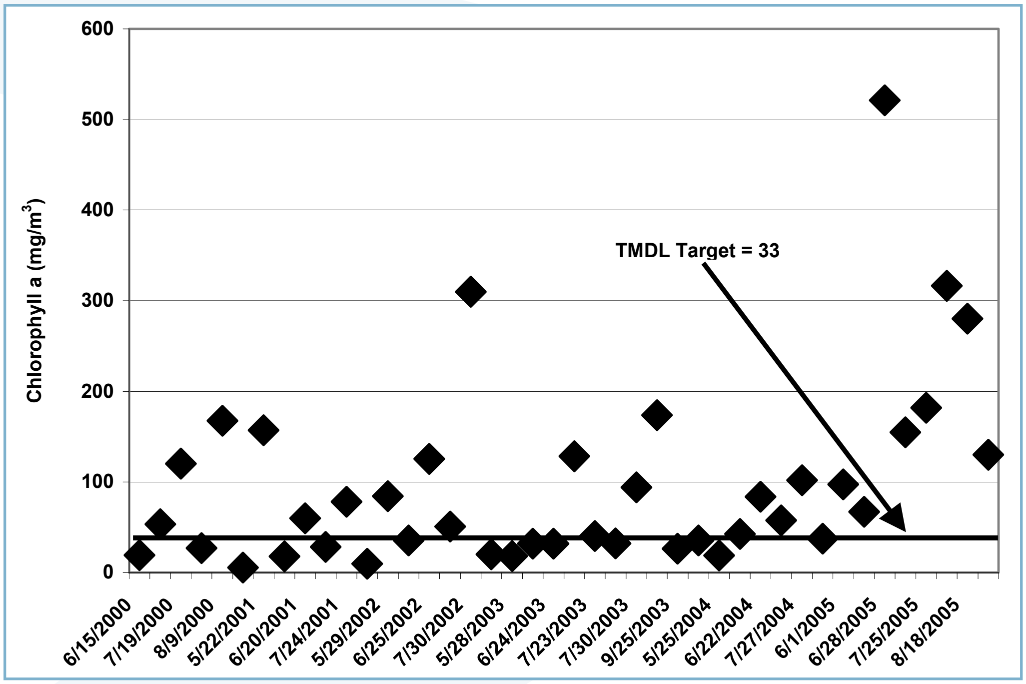


Figure 5-1: Algae Example, Growing Season Chlorophyll a Concentrations

WATER TRANSPARENCY

The transparency of water can limit or promote the production of certain species of algae, fish, and aquatic plants. The depth to which light will penetrate in a lake or reservoir is dependant upon several factors. Two main influences on light penetration are algae and suspended sediment.

Information on water transparency in Carter Lake was available from 2000 through 2005. Annual growing season water transparency measurements ranged from 4 inches on numerous dates to 83 inches in May of 2001 ***(Figure 5-2)***. The median water transparency from 2000 – 2005 was 14 inches. The goal established for the project is 54 inches. Carter Lake has exhibited a significant decreasing trend for water clarity since 2000.

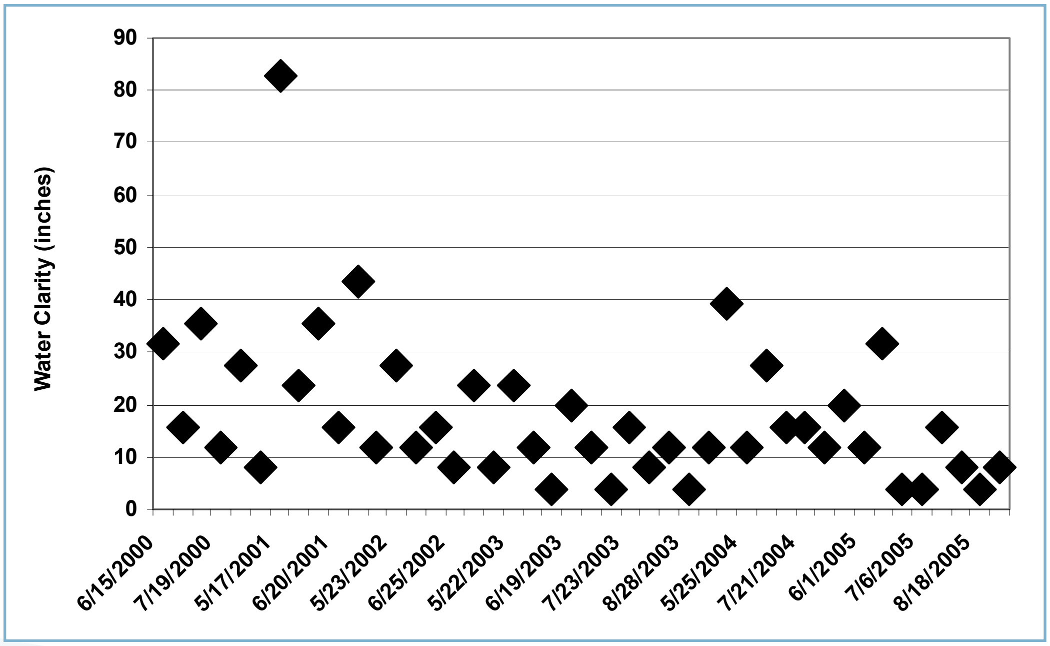


Figure 5-2: Water Transparency Example

NUTRIENTS – PHOSPHORUS

Phosphorus and nitrogen are the two nutrients most critical for the production of algae in lakes and reservoirs. High concentrations of these nutrients can stimulate the production of excessive amounts of algae commonly known as algal blooms.

Total phosphorus is comprised of both dissolved phosphorus and particulate phosphorus. Dissolved phosphorus is readily available for uptake by biological organisms while particulate phosphorus must be converted to the dissolved phase before utilization can take place. While total phosphorus indicates the amount of phosphorus that is "potentially available" to biological organisms, the amount of dissolved phosphorus plays a more important role in determining current productivity. Since particulate phosphorus is bound to soil particles, high nutrient concentrations can be associated with high sediment loads and/or high concentrations of suspended sediment. While there was no information on dissolved phosphorus, information on total phosphorus concentrations in Carter Lake was available from 2000 through 2005. The annual growing season median concentration of total phosphorus ranged from 19 ug/l in July of 2001 to 360 ug/l in August of 2005 ***(Figure 5-3)***. The total phosphorus target value identified in the Water Quality Improvement Plan, or TMDL, is 96 ug/l. Thirty-three of the 44 total samples collected since 2000 exhibited concentrations greater than the TMDL target value of 96 ug/l.

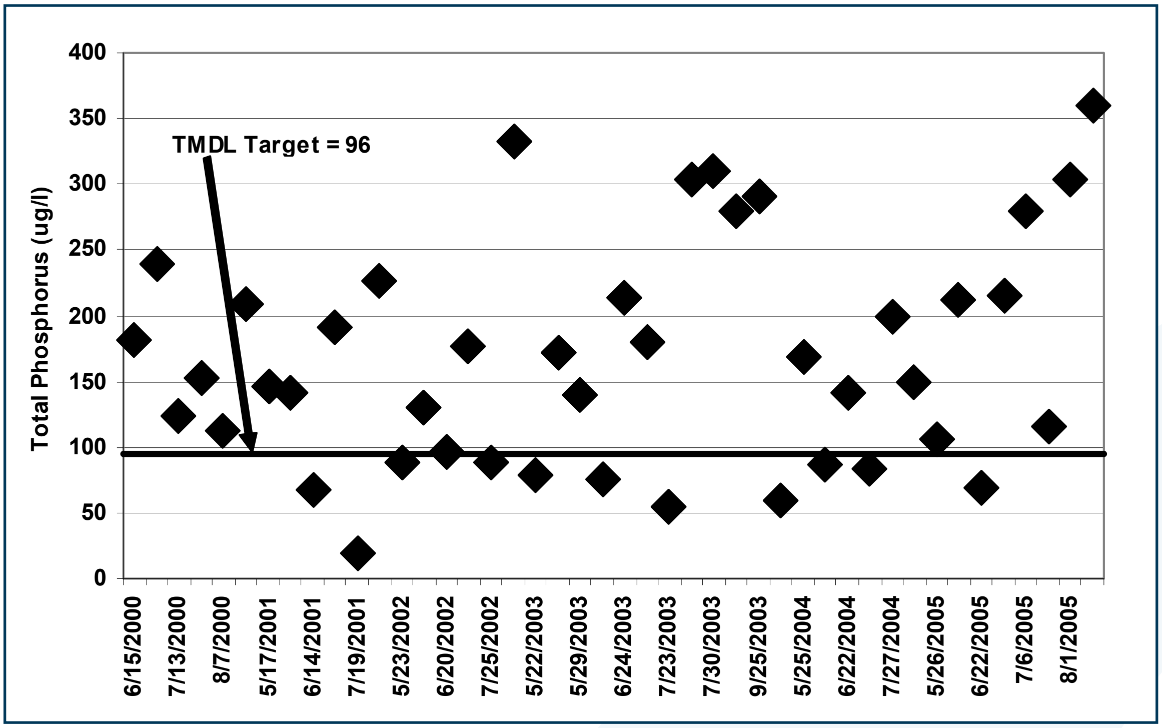


Figure 5-3: Nutrients Example – Phosphorus

NUTRIENTS – NITROGEN

Information on nitrogen constituents in Carter Lake was available from 1990 through 2005 ***(Figure 5-4)***. Total nitrogen was determined by summing kjeldahl nitrogen concentrations and nitrate-nitrite nitrogen concentrations. Total nitrogen concentrations ranged from 1,130 ug/l in May 1992 to 4,450 in August 2005. The median growing season nitrogen concentration for the period of record is 2,140 ug/l. Total nitrogen concentrations exceeded the water quality standard in thirteen of the twenty-three total samples collected.

Samples for total ammonia were collected in 1990, 1991 and 1992. Of the eight samples collected, none exceeded the Water Quality Standard.

Low Total Nitrogen (TN) to Total Phosphorus (TP) ratios can indicate potential problems with blue-green algae. The lower the ratio, the more favorable the conditions are for blue-greens to outcompete other types of algae. Literature suggests that ratios below 11.0 favor blue-green algae.

Ratios for Carter Lake ranged from a high of 21.5 in 2002 to a low of 6.7 in 2000. Ratios less than 11.0 were exhibited for nine of the 17 dates from 2000 through 2005. The median ratio for the period of record was 10.9.

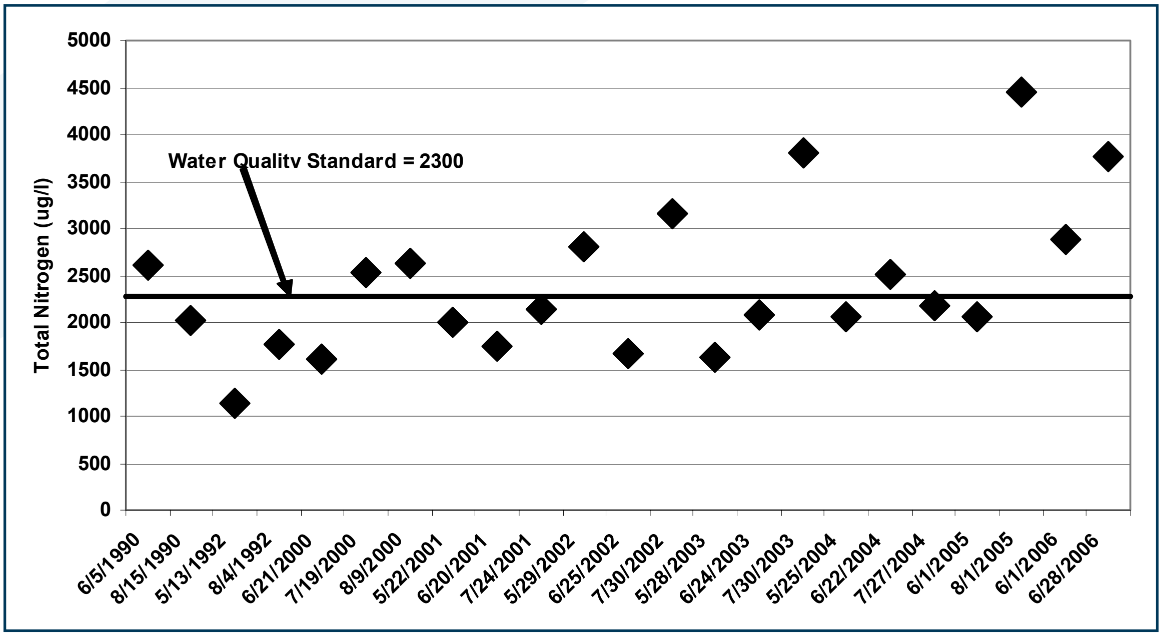


Figure 5-4: Nutrients Example – Nitrogen

BACTERIA

Microorganisms are ever-present in all terrestrial and aquatic ecosystems. While many types are beneficial, functioning as agents for chemical decomposition, as food sources for larger animals, and as essential components for the nutrient cycle, some can also cause illness if ingested by humans.

Waste from warm-blooded animals is a source for many types of bacteria found in waterbodies. Fecal coliform and *E.coli* bacteria are used as indicators for more serious types of organisms present. Unfortunately, most types of bacteria originate from a multitude of sources (sanitary wastewater, stormwater, livestock and wildlife), making it difficult to differentiate between individual contributors.

E. coli bacteria in Carter Lake were monitored during the 2000 recreation season (May 1 – September 30). In 2005 and 2006, *E. coli* monitoring was replaced with *E.coli* bacteria monitoring. Seven of the 23 fecal coliform samples collected in 2000 exceeded the Water Quality Standard of 235 colonies per 100 mls ***(Figure 5-5)***. The geometric mean was 178 colonies per 100 mls.

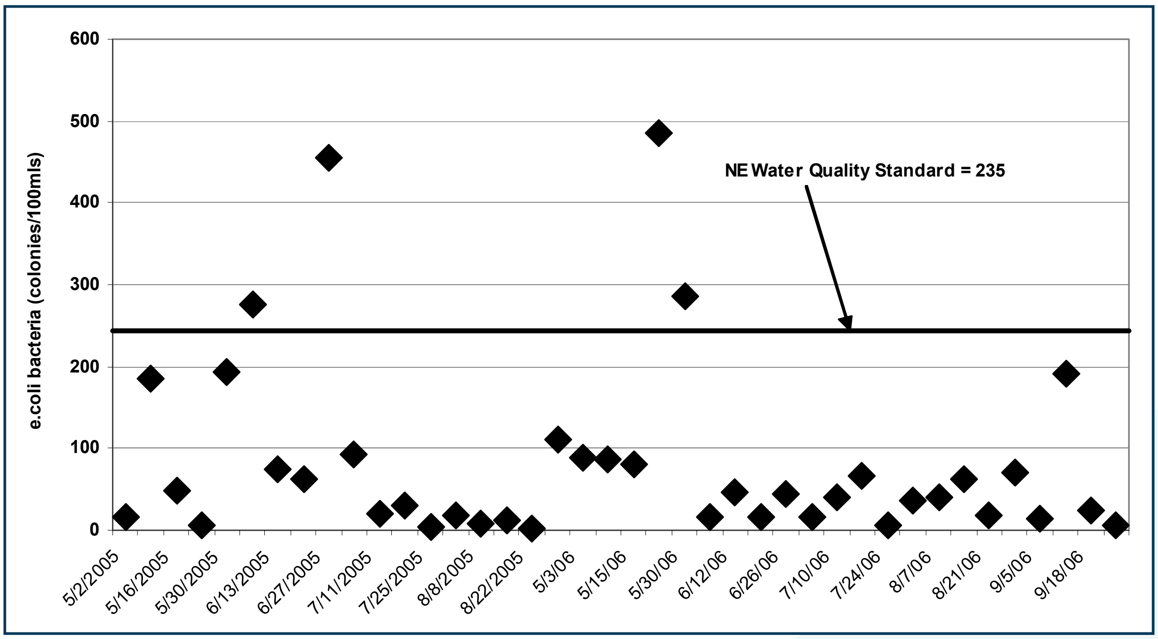


Figure 5-5: *E. coli* Bacteria Concentrations

5.3 WATER QUALITY IMPROVEMENT PLAN (TMDL) EXISTING LOADS, POLLUTANT ALLOCATION AND SUMMARY

WHAT INFORMATION IS NEEDED?

If there is a completed Water Quality Improvement Plan, also referred to as a TMDL, for the waterbody, it must be summarized in the Watershed Management Plan. The summary should identify the pollutants that were targeted in the Water Quality Improvement Plan and state the existing pollutant load as determined by the plan. Additionally, summarize the wasteload allocations, load allocations and margin of safety for each targeted pollutant. Include the allocation scheme if it was specified in the Water Quality Improvement Plan. Other components of a completed Water Quality Improvement Plan not discussed here will contain helpful information for other parts of the Watershed Management Plan.

WHY IS THIS INFORMATION IMPORTANT?

The Clean Water Act requires Water Quality Improvement Plan development for waterbodies not meeting one or more of their designated uses. The Water Quality Improvement Plan quantifies the maximum amount of a pollutant that the waterbody can tolerate without violating the state's water quality standards. The Water Quality Improvement Plan also provides a scientific basis for identifying the pollutant(s) of concern and identifies probable sources of pollution. Watershed Management Plans should be consistent with and incorporate the science that was used to develop the Water Quality Improvement Plan because it provides increased confidence the plan will result in observable water quality improvement. In addition, some funding sources require a Watershed Management Plan to help achieve the water quality target(s) identified in the Water Quality Improvement Plan . Lastly, much of the data collection and descriptive information required in a Watershed Management Plan is also reported in a Water Quality Improvement Plan. Using the Water Quality Improvement Plan as a resource will save time and resources when preparing the Watershed Management Plan.

WHERE CAN THIS INFORMATION BE FOUND?

A summary of the Water Quality Improvement Plan can be found in the chapter titled "Total Maximum Daily Load (TMDL) for <Pollutant Name>" in the Water Quality Improvement Plan written for the waterbody of concern. This section will include the existing pollutant load, wasteload allocation, load allocation, margin of safety, and pollutant allocation scheme. Iowa DNR maintains a list of draft and final Water Quality Improvement Plan at the following link: ***www.iowadnr.gov/water/watershed/pubs.html***

The following are examples from the hypothetical Cy-Hawk Lake Water Quality Improvement Plan

EXISTING POLLUTANT LOADS

The existing total phosphorus (TP) load to Cy-Hawk Lake stems from nonpoint sources of pollution. ***Figure 5-6*** reports existing TP loads from each pollutant source. The two largest sources of phosphorus loading to Cy-Hawk Lake are runoff from row crop agriculture (42.8 percent) and phosphorus that is recycled within the lake from bottom sediments (42.4 percent), also called internal loading.

TP SOURCE (LAND USES AND OTHER INPUTS)	DESCRIPTIONS AND ASSUMPTIONS	EXISTING LOAD (lb/yr)	TP LOAD (%)
ROW CROPS	corn, beans, oats, alfalfa	8.561	42.8
CONSERVATION AREAS	forest, grassland, wildlife areas, CRP	176	0.9
FARMSTEADS	farmsteads	68	0.3
URBAN/ROADS	residential land use, roads	164	0.8
SEPTIC SYSTEMS	49 septic systems, 30% failing	66	0.3
GEESE	150 geese (Oct.-Apr.); 100 geese (May-Sep.)	45	0.2
GROUNDWATER	TP inputs based on land use	2,160	10.8
ATMOSPHERIC	atmospheric deposition to lake	277	1.4
INTERNAL LOAD	recycled from lake bottom	8,469	42.4
TOTAL		19,986	100.0

Figure 5-6: Simulated TP source loads for existing conditions

POLLUTANT ALLOCATION

Wasteload allocation. There are no permitted point source dischargers in the Cy-Hawk Lake watershed, therefore, the TMDL wasteload allocation is zero.

Load allocation. The entire TP load to Cy-Hawk Lake is attributed to nonpoint sources, including internal and natural/background loading, which are included in the TMDL total load allocation. ***Figure 5-7*** shows a potential load allocation scheme for the Cy-Hawk Lake watershed that would meet the overall target TP load.

TP SOURCE	EXISTING LOAD (lb/yr)	LA (lb/yr)	LOAD REDUCTION (%)
ROW CROPS	8,561	3,168	63
CONSERVATION AREAS	176	158	10
FARMSTEADS	68	68	0
URBAN/ROADS	164	130	21
GROUNDWATER	2,160	2,160	0
GEESE	45	45	0
SEPTIC SYSTEMS	66	0	100
ATMOSPHERIC DEPOSITION	277	277	0
INTERNAL LOAD	8,469	1,694	80
TOTAL	19,986	7,699	61.5

Figure 5-7: Potential allocation scheme to meet the target load

The sum of the load allocations result in an allowable annual TP allocation of 7,699 lbs/yr. Using EPA's methodology for expressing annual loads as daily loads, the maximum daily TP load allocation specified by the TMDL is 41.5 lbs/day.

Margin of safety. To account for uncertainties in data and modeling, a margin of safety (MOS) is a required component of all TMDLs. An explicit MOS of 10 percent was used in the development of the Cy-Hawk TMDL. The 10 percent MOS is equivalent to 855 lbs/yr, or 4.6 lbs/day when expressed in terms of a daily maximum load.

TMDL SUMMARY

The following equation represents the total maximum daily load (TMDL) and its components for Cy-Hawk Lake:

$$TMDL = LC = \Sigma WLA + \Sigma LA + MOS$$

Where: TMDL = total maximum daily load
LC = loading capacity
Σ WLA = sum of wasteload allocations (point sources)
Σ LA = sum of load allocations (nonpoint sources)
MOS = margin of safety (to account for uncertainty)

Once the loading capacity, wasteload allocations, load allocations, and margin of safety have all been determined for the Cy-Hawk Lake watershed, the general equation above can be expressed for the Cy-Hawk Lake TMDL for total phosphorus.

Expressed as the maximum annual average, which is helpful for water quality assessment and watershed management:

TMDL = LC = Σ WLA (0 lbs-TP/year) + Σ LA (7,699 lbs-TP/year)
+ MOS (855 lbs-TP/year – implicit) = **8,554 lbs-TP/year**

Expressed as the maximum daily load, as recommended by EPA:

TMDL = LC = Σ WLA (0 lbs-TP/day) + Σ LA (41.6 lbs-TP/day)
+ MOS (4.6 lbs-TP/day – implicit) = **46.2 lbs-TP/day**

IDENTIFY POLLUTANT SOURCES

6.1 ASSESSMENTS

WHAT INFORMATION IS NEEDED?

Provide a detailed account of all watershed assessments conducted including resulting maps. Additionally, identify critical areas within the watershed and discuss how they impact the lake or stream. Possible assessments include: land use, sheet and rill erosion, stream, gully, and livestock. A large watershed management plan needs to break down assessment results by subwatershed. This section should contain many maps, figures and images.

WHY IS THIS INFORMATION IMPORTANT?

Watershed assessments are critical pieces of a watershed management plan. Assessment data helps develop pollutant budgets, target watershed improvement practices and estimate beneficial impacts of those practices.

WHERE CAN THIS INFORMATION BE FOUND?

It is important to note that a Watershed Management Plan will require a combination of the assessments discussed in this section depending on a number of factors. For assistance in determining what assessments are necessary, please contact the DNR Watershed Improvement Program GIS staff. Additionally, some information may be contained in a completed Water Quality Improvement Plan.

LAND USE, MANAGEMENT & TILLAGE ASSESSMENT

Information about land use and management practices identifies current control practices, potential practices and potential targets for future conservation management. Collecting land use, land management and tillage information can be made easier by using one of the DNR's tablet computers. These computers allow for simple and quick data collection for any size watershed. A map of land use is required in the Watershed Management Plan. The discussion should summarize the land use, management and tillage practices within the watershed and provide an acreage summary of all categories.

For assistance with a land use assessment, contact the DNR Watershed Improvement Program or the appropriate regional Basin Coordinator.

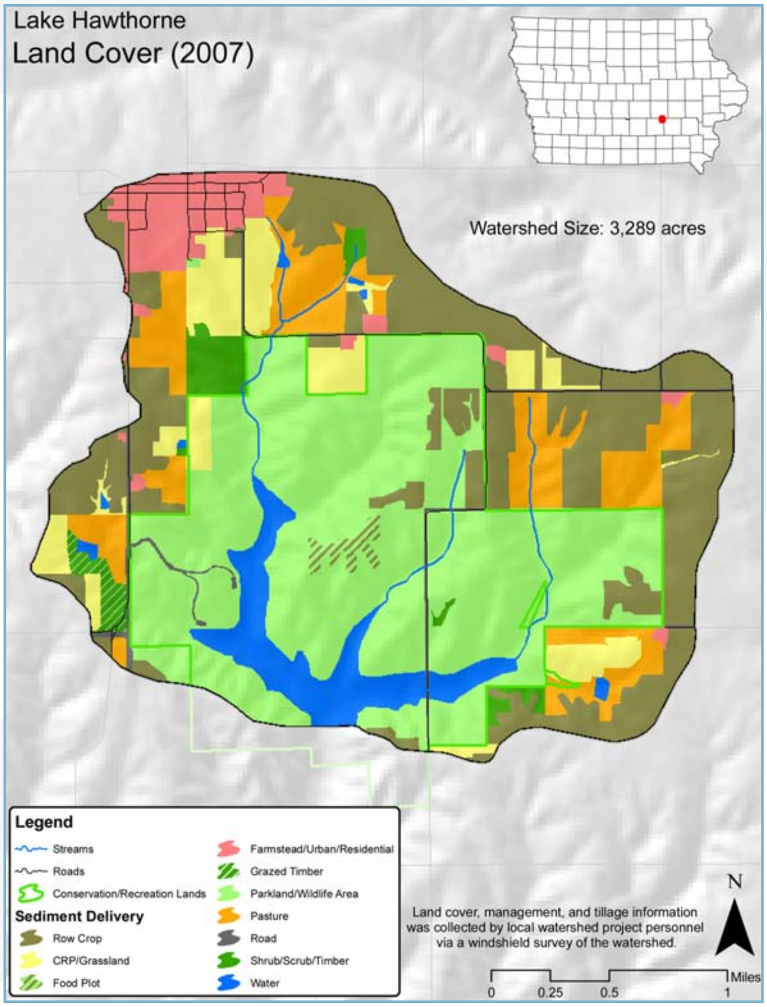


Figure 6-1: Example land cover map

EXAMPLE FROM THE LAKE HAWTHORNE WATERSHED ASSESSMENT

The Lake Hawthorne Watershed consists of approximately 3,289 acres in Mahaska County. Parkland – Woodland/Shrub accounts for more than 40 percent of the land area, concentrated in the state park and along Lake Hawthorne's tributaries. Corn and soybeans are the most commonly grown crops. Cropland accounts for approximately 820 acres or 25 percent of the watershed. Of the 820 acres of cropland, all is mulch tilled with the vast majority in contour farming. Roughly 12 percent of the watershed is used for grazing. ***Figure 6-2*** illustrates the land use information for the watershed area.

	PERCENT OF WATERSHED	ACRES
CROPLAND	25.2%	820
CRP/GRASSLAND	7.9%	257
GRAZED TIMBER	0.8%	25
PASTURE	11.3%	370
PARKLAND/WOODLAND/SHRUB	42.3%	1381
WATER	6%	194
ARTIFICIAL: ROADS, WATER, RESIDENTIAL	6.6%	216

Figure 6-2: Land Use in the Lake Hawthorne Watershed

SHEET & RILL EROSION

Sheet and rill erosion is the detachment and removal of soil from the land surface by raindrop impact, and/or overland runoff. It occurs on slopes with overland flow and where runoff is not concentrated. The Revised Universal Soil Loss Equation (RUSLE) calculates sheet and rill erosion and estimates average annual erosion in tons per acre per year. Procedures for RUSLE can be found in the NRCS "Field Office Tech Guide" (NRCS Erosion and Sediment Delivery 1998). The DNR provides modeling assistance to help estimate sheet and rill erosion. A map of sheet and rill erosion is the best way to represent this data and should be included in the Watershed Management Plan. It is also important to provide a summary of the results and acreage breakdown of each category of erosion.

For more information refer to the Erosion and Sediment Delivery document found within the NRCS electronic field office technical guide at ***http://www.nrcs.usda.gov/technical/eFOTG/***. The DNR Watershed Improvement Program can assist in this assessment.

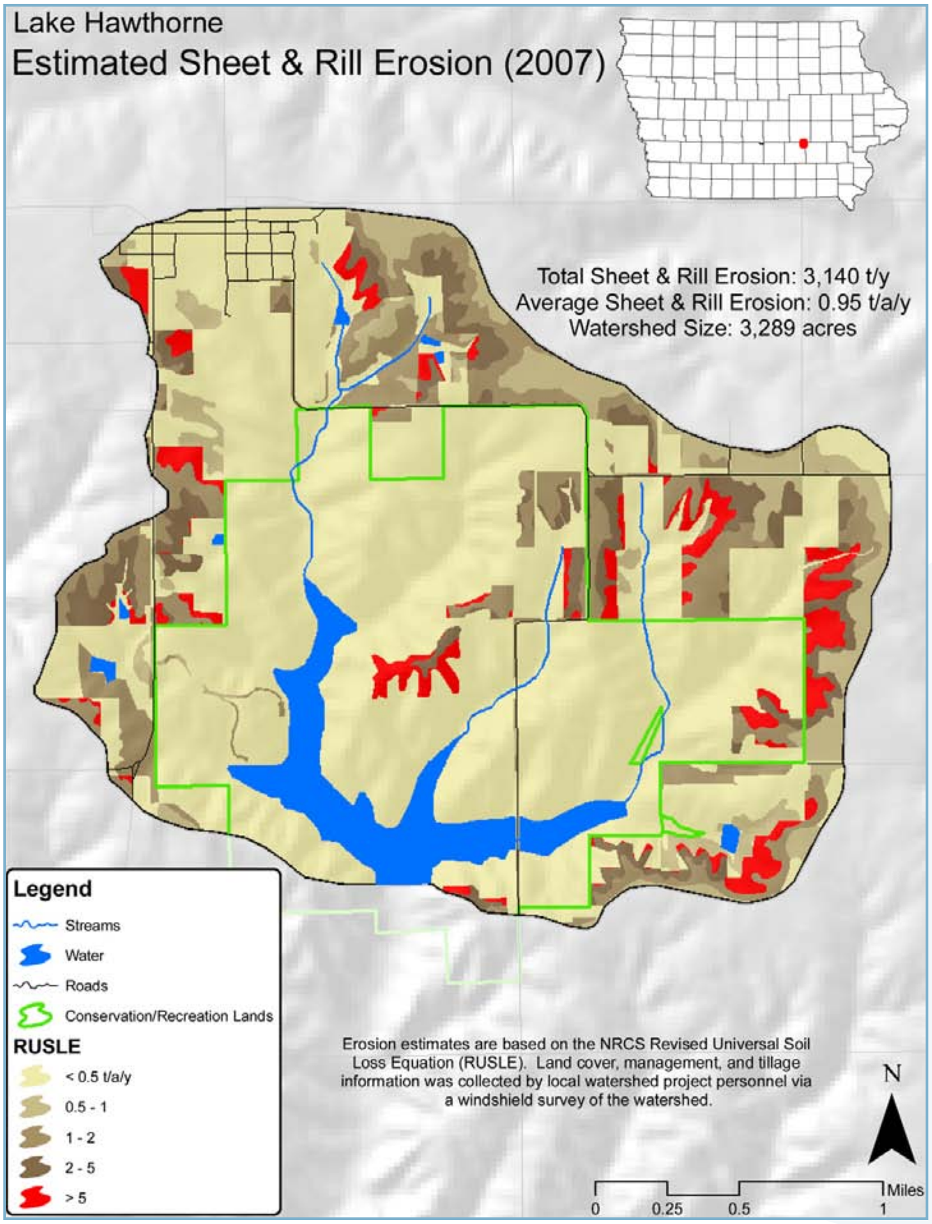


Figure 6-3: Example sheet and rill erosion map

EXAMPLE FROM THE LAKE HAWTHORNE WATERSHED ASSESSMENT

The RUSLE (Revised Universal Soil Loss Equation) analysis of Lake Hawthorne Watershed has determined that the relatively high rates of sheet and rill erosion are occurring in the upland areas outside the state park boundary. It is estimated that 3,140 tons of sheet and rill erosion occur in the Lake Hawthorne Watershed each year. Analysis reveals that 150 acres, or 4.5 percent of the watershed area, is eroding at a rate greater than "T" (5 tons per acre per year). These 150 acres contribute 42 percent of the total sheet and rill erosion in the watershed. The average sheet and rill erosion in the watershed is estimated at 0.95 tons per acre per year, however the average on cropland increases to 3.05 tons per acre per year. Other than cropland, the other significant land use contributing to sheet and rill erosion is pasture and grazed timber. There are 395 acres of pasture and grazed timber with total sheet and rill erosion of 226 tons per year. This results in an average of 0.57 tons per acre per year.

SEDIMENT DELIVERY

Sediment delivery is defined as the amount of net erosion that is delivered to a specific location, typically the outlet of a watershed. Sediment delivery modeling incorporates the beneficial impacts of watershed improvement practices (i.e. sediment basins, waterways, etc.) to estimate the amount of sediment reaching the waterbody of interest. The sediment delivery ratio is expressed as a percentage and reflects the watershed's efficiency at moving soil particles from the point of erosion to the outlet of the watershed. The Sediment Delivery Ratio takes into account watershed size, landform region and watershed shape to calculate a percentage of sheet and rill erosion reaching the waterbody. Include a map of sediment delivery to represent this data. It is also important to provide a summary of the results and an acreage breakdown of each category of sediment delivery.

For more information refer to the Erosion and Sediment Delivery document found within the NRCS electronic field office technical guide. ***http://www.nrcs.usda.gov/technical/eFOTG/***. The IDNR Watershed Improvement Program can assist in this assessment.

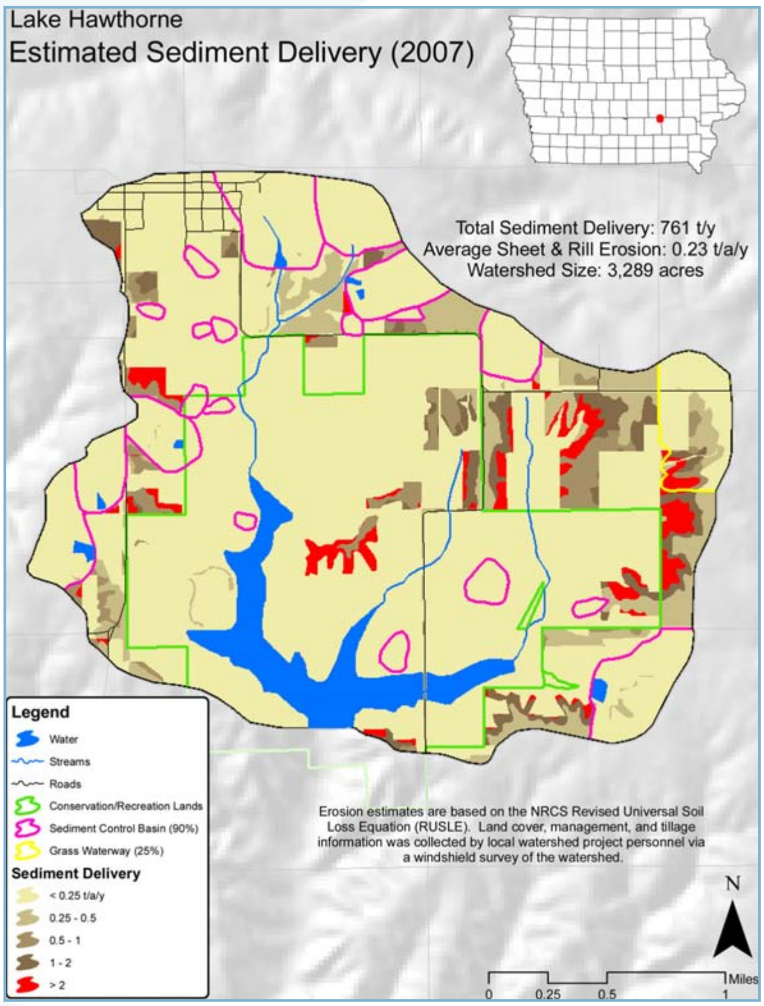


Figure 6-4: Example sediment delivery map

EXAMPLE FROM THE LAKE HAWTHORNE WATERSHED ASSESSMENT

The sediment delivery analysis of the watershed reveals 761 tons of sediment per year is reaching the lake. 223 acres (6.8 percent) of the watershed is delivering greater than one ton per acre per year, the total from this area is 468 tons per year, or 61 percent of the total. The watershed assessment identified several existing watershed improvement practices, including 17 grade stabilization structures, one grass waterway and two sediment basins. It is estimated these structures trap 243 tons of sediment per year (from sheet and rill erosion only gully and streambank erosion is not figured into these numbers). Most of the hotspots lie in the uplands of the watershed outside the park boundary.

STREAM ASSESSMENTS (RASCAL)

In-stream and near-stream assessments are important tools to help prioritize critical areas not addressed in other assessments. The RASCAL assessment (Rapid Assessment of Stream Conditions Along Length) is the suggested method for watershed groups to assess in-stream and near-stream conditions in Iowa. The DNR Watershed Improvement Program provides tools (GPS units) to watershed groups that would like to conduct a RASCAL assessment. The DNR also analyzes the data and provides overview maps and summary tables. Watershed groups need to identify priority areas for improvement based on this information.

Discuss the results of the stream assessment and provide important maps and summary tables. Additionally, describe issues facing particular segments of the stream. The RASCAL stream assessment generates many maps and summary tables so include only the most relevant in the Watershed Management Plan. Include additional text, maps and tables in the appendix. Watershed groups can consult the regional Basin Coordinator or the DNR Watershed Improvement Program for assistance with interpreting the results.

EXAMPLE FROM SPRINGBROOK CREEK STREAM ASSESSMENT

The Springbrook Creek stream network has been significantly changed over time, due to the building of Springbrook Lake and extensive drainage tile installations in the uplands. During baseflow conditions Springbrook Creek is fed primarily by a large tile outlet, approximately 40 inches in diameter, in the northeast corner of the park). Overland storm runoff from the watershed upstream of the park boundary likely accounts for a significant portion of stream flow during storm events, as flow from the drainage network is limited by the size of the outfall pipe. Inspection of the tile outfall pool uncovered little evidence of scouring, thus indicating that high velocity flows have not been leaving the tile network. The assessment of Springbrook Creek is broken into three distinct reaches (A, B and C). A description of each reach and potential management suggestions are provided in the following sections.

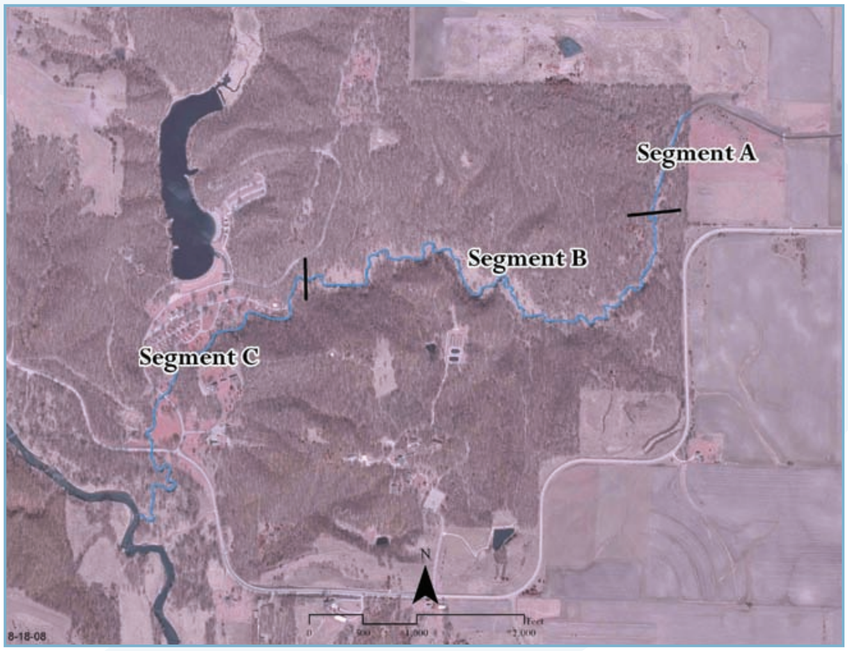


Figure 6-5: RASCAL Assessment Map

REACH A

This reach is fed primarily by overland flow from the Springbrook Creek subwatershed above the park boundary. Land use in the drainage area is dominated by row crop agriculture and grazed pasture. The stream corridor upstream of the park boundary was not walked during this assessment. However, a screening of aerial imagery from the area indicates that the corridor above Springbrook State Park can be characterized as a manicured drainageway with very little ungrazed perennial vegetation in the riparian corridor. Starting at the park boundary, the stream corridor is primarily timber with reed canary grass near the stream. At the time of the assessment reach A contained minimal flow, but signs of higher flows were present. Strong visual evidence exists indicating that reach A receives high velocity flows during storm events. Debris caught in the fence indicates that this portion of the stream receives flows which exceed the confines of the defined channel. Signs of stream down cutting were evident in the lower portion of this reach, highlighted by a series of nick points. One large nick point is estimated to be in the 10 foot range. The development and associated migration of this large nick point is evidence of an increase in storm flow volumes and velocities within this reach. Unless action is taken to address either the hydrologic alteration or protective structures are put in place, this nick point will travel upstream and could eventually damage private property.

REACH B

This reach begins near the outfall of a large tile. Reach B meanders through the eastern portion of the park and cuts through a well-defined floodplain area which is covered in perennial vegetation, mostly reed canary grass and a few trees. The stream channel itself contains abundant riffle pool sequences which are mostly free of silt and contain a mix of substrates (gravel, cobble, and boulders). A few large outside bends have bank stability issues but for the most part stream channel migration in this segment is consistent with natural stream channel evolution. A few banks in this reach might appear extremely raw but this is due to the stream channel migrating near the valley walls. This reach has streambank heights that average 3-6 feet allowing flood waters to inundate the floodplain. Sediment deposition in this reach appears to be limited to inside bends (point bars) which is the expected natural location for such activity. Overall it appears that this section of the channel is approaching a state of quasi equilibrium with the current flow regime.

REACH C

This reach begins just upstream of the campground and continues downstream to the Middle Raccoon River. This segment is characterized by lower gradients, depositional areas, narrow riparian areas, past bank stabilization efforts and the presence of mowed areas adjacent to the stream. This reach also marks the widening of the floodplain (see Alluvial Soils map), which the campground is built within. The stream channel in reach C would naturally meander across the floodplain in this area migrating between the confinements of the valley walls. Streambank stabilization efforts have been necessary in this area to prevent damage to the campground and other infrastructure. Downstream of the new bridge, the stream's flow is directed towards a hillside, causing slumping to occur on the outside bend. Recently a large slump slid into the stream, causing approximately five trees to lay vertically over the stream. During rain events, it is evident that water leaves the stream channel and inundates the floodplain. The flashy nature of the stream is likely associated with flows originating from the drainage area of reach A.

STREAMBANK EROSION ASSESSMENTS

Streambank erosion assessments are an important piece for building the sediment budget (sediment budget is the total amount of sediment reaching the waterbody of interest. This includes sediment from streambank erosion, gully erosion, sediment delivery from sheet and rill erosion, and any other sources in the watershed). In some cases, streambank erosion can account for the majority of sediment reaching a lake or stream. The DNR has developed an assessment procedure to help watershed groups gauge the amount of streambank erosion. The DNR can provide the equipment and training to conduct the assessment and can analyze the results. Discuss the results and provide a map of problem streambanks in the Watershed Management Plan. Also include the total tons of streambank erosion per year.

For assistance with streambank erosion assessments, contact the regional Basin Coordinator or the DNR Watershed Improvement Program.

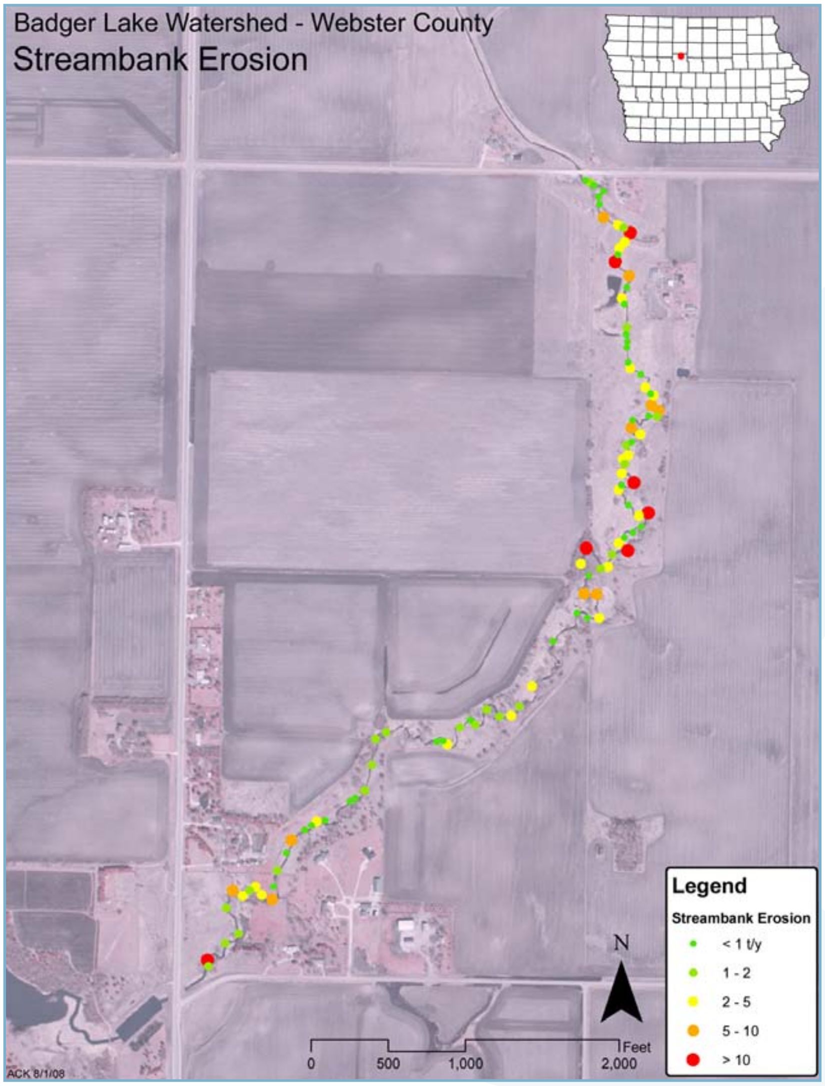


Figure 6-6: Example streambank erosion assessment map

EXAMPLE FROM THE BADGER CREEK STRAM ASSESSMENT

A streambank erosion assessment of Badger Creek has estimated streambank erosion at 340 tons per year. 100 locations of streambank erosion were identified with a total eroding length of 4,376 feet. Average bank height was estimated at 5.3 feet. The majority of locations (83) were found to be eroding less than 5 tons per year, but the remaining 17 locations account for 63 percent of the total streambank erosion. Comparing streambank erosion to sediment delivery in the watershed (12,572 acres), 49 percent of the erosion in the watershed is coming from streambank erosion verses 51 percent from sediment delivery.

GULLY ASSESSMENT

Sediment from gully erosion can account for a significant portion of the total sediment reaching a lake or stream. Compare gully erosion numbers to sediment delivered from sheet and rill erosion and streambank erosion to help prioritize the most critical lands in a watershed. Gully assessments can be difficult to conduct and may take a significant amount of time. The DNR has developed a method to assess gully erosion using the NRCS Direct Volume Method. The DNR can provide the equipment and training to conduct the assessment and can analyze the results. This section of the Watershed Management Plan discusses the results and provide a map of problem gullies. Include the total tons of gully erosion per year.

For assistance with gully erosion assessments contact the regional Basin Coordinator, the NRCS, or the DNR Watershed Improvement Program.

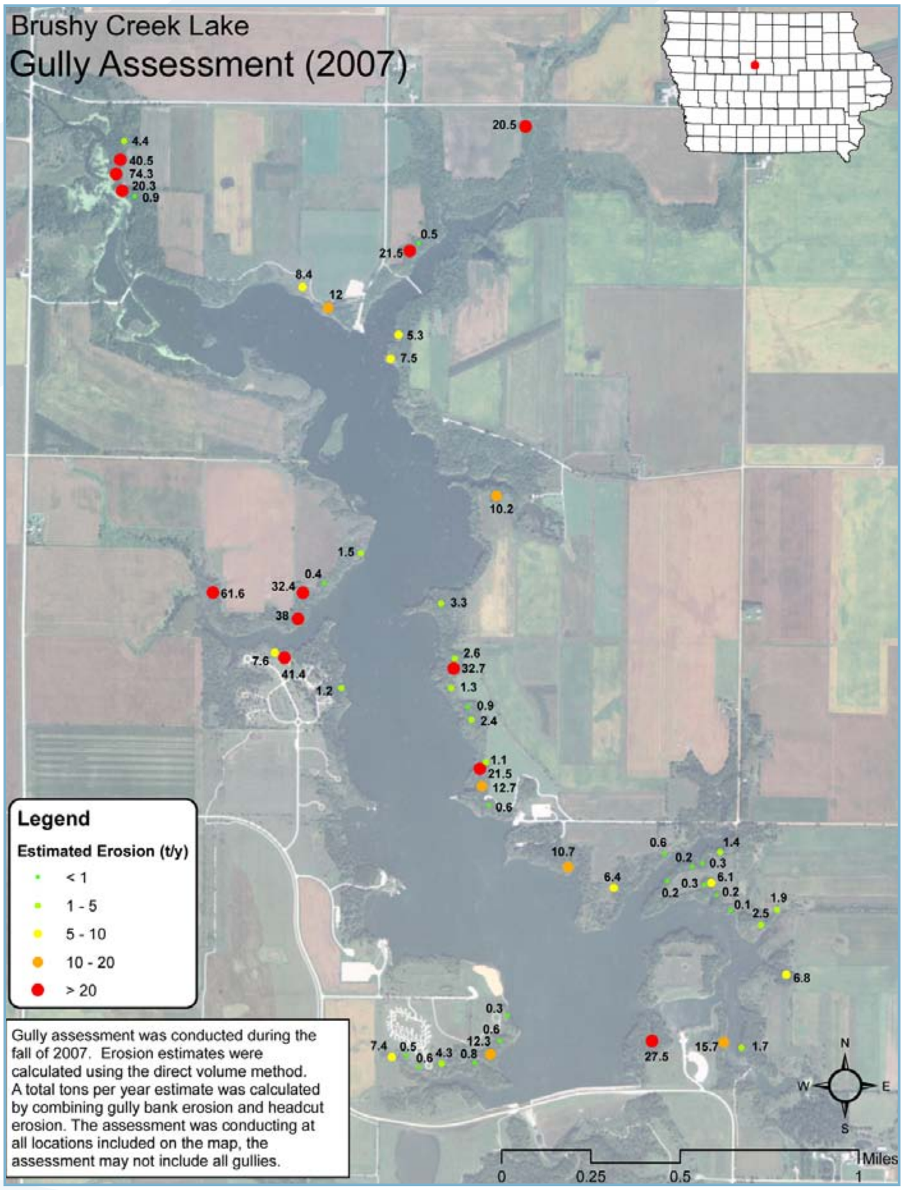


Figure 6-7: Brushy Creek Lake Gully Assessment

EXAMPLE FROM THE BRUSHY CREEK LAKE GULLY ASSESSMENT

A gully assessment of the area adjacent to Brushy Creek Lake has found 56 eroding gullies. The total erosion from these gullies is estimated at 598 tons per year. Out of the 56 gullies, 38 are eroding less than 10 tons per year. The remaining 18 gullies contribute 506 tons per year, or 84 percent of the total. The gully erosion map ***(Figure 6-7)*** shows the locations of the gullies: the larger the dot, the higher the erosion.

LIVESTOCK ASSESSMENT

Depending on the water quality concern, a livestock assessment may be the most important assessment a watershed group can conduct. Various models are available to analyze livestock data: AnnAGNPS, FLEVAL, MNFARM, etc. These models need to be run by someone with experience in scientific modeling or guided by a modeling expert. At the very least, a livestock assessment should gauge livestock numbers, proximity to water, manure storage, manure application and other factors associated with livestock producers that can help identify critical locations for improved management practices. Discuss the results of the livestock assessment, specifically the number of livestock producers, livestock head numbers, proximity to streams, manure storage and applications practices in the Watershed Management Plan. If possible, estimate the amount of manure generated and the nutrient and bacteria content of the manure.

For assistance with livestock assessments contact the regional Basin Coordinator or the DNR Watershed Improvement Program.

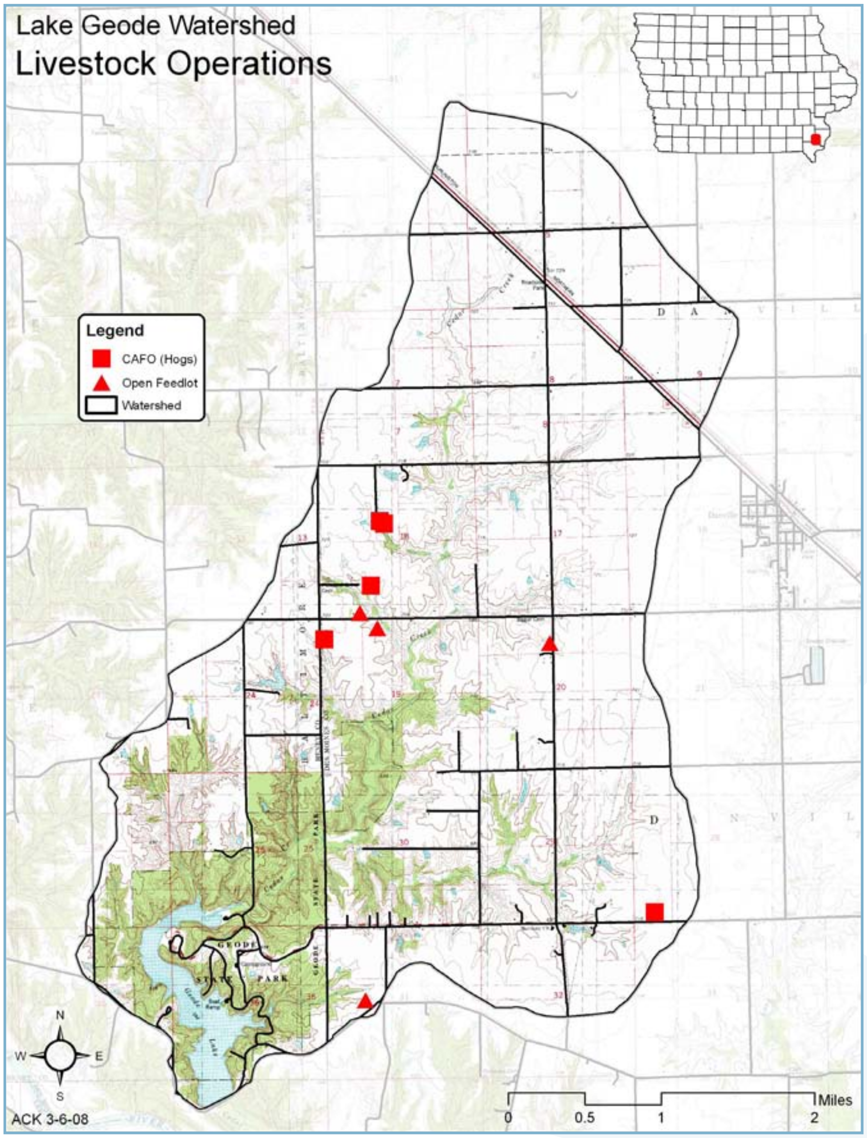


Figure 6-8: Example of livestock assessment

EXAMPLE FROM THE LAKE GEODE LIVESTOCK ASSESSMENT

There are five livestock operations (with eight locations) within the watershed: three swine and two beef ***(Figure 6-8)***. Of these operations, two of them meet the required thresholds for permitting by the Iowa DNR. This requires the producer to have a nutrient management plan for manure application that meets the standards and protocols set forth by the permitting process. Based on operator contacts, approximately 85 percent of all manure is injected, with the remaining 15 percent surface applied.

OTHER ASSESSMENTS

Other assessments may include urban runoff and pollutant modeling, bacterial source tracking investigations, septic system assessments, and more. Urban runoff modeling can help estimate what portions of an urban environment have the greatest amount of storm water runoff and could potentially transport significant pollutants to rivers and streams. To conduct an urban runoff assessment, watershed groups will need to have accurate location data for all storm sewer inlets and outfalls. This data, combined with accurate elevation data, can identify drainage areas for each storm sewer inlet. Knowing the drainage area for storm sewers allows for the calculation of event and annual runoff estimates. See the Iowa Stormwater Management Manual for additional information: ***http://www.ctre.iastate.edu/PUBS/stormwater/index.cfm***

Bacterial source tracking compares DNA profiles of E. coli bacteria from impacted waters to DNA profiles of E. coli from known sources of fecal material in the watershed. Fecal samples are collected from geese, humans, deer, cattle and swine and compared to bacteria found in lake, rivers and streams. Source tracking can help identify contributing sources within a watershed.

EXAMPLE FROM LAKE DARLING BACTERIA SOURCE TRACKING

As a whole, data from this project indicated that the sources of bacteria at the beach and in the lake were from animals throughout the watershed. In order to more fully understand the sources of bacterial contamination in the Lake Darling watershed, additional fecal samples were collected from domesticated animal sources. This should increase the size of the DNA library significantly and allow these groups to be looked at individually in determining sources of fecal contamination in the water. Link to bacteria source tracking at Lake Darling: ***http://publications.iowa.gov/5309/1/WFS-2005-04.pdf***

6.2 POLLUTANT DATA ANALYSIS

WHAT INFORMATION IS NEEDED?

Find out if a Water Quality Improvement Plan, also called a TMDL, has been completed for the waterbody. A Water Quality Improvement Plan will include a pollutant source assessment to use in the Watershed Management Plan. If no Water Quality Improvement Plan is available, a pollutant source assessment should be developed that allocates existing pollutant loads to various land uses, point sources and other inputs.

WHY IS THIS INFORMATION IMPORTANT?

This information determines what the primary contributors of pollution are, so that improvement alternatives can be focused on the real source(s) of the problem. Understanding which areas and/or sources are most significant allows watershed managers to prioritize pollutant sources, identify appropriate mitigation plans and strategically locate best management practices (BMPs). In the case of nonpoint sources, focus BMPs on areas/activities that significantly contribute to the water quality problems, rather than having BMPs randomly distributed throughout the watershed or focused exclusively in areas with willing landowner participation.

DNR

WQIP
Water Quality Improvement Plan

WHERE CAN THIS INFORMATION BE FOUND?

Source assessments are located in the Water Quality Improvement Plan. If a Water Quality Improvement Plan is unavailable, a pollutant assessment, sometimes included as part of a watershed assessment, must be conducted. The assessment can be conducted by local agency personnel, with the assistance of the DNR Watershed Improvement Program. See ***Section 6.1*** of the guidebook for more information regarding assessments.

EXAMPLE POLLUTANT ANALYSIS FROM HYPOTHETICAL CY-HAWK LAKE TMDL

The existing total phosphorus (TP) load to Cy-Hawk Lake stems from nonpoint sources of pollution. ***Figure 6-9*** illustrates the land uses in the watershed, as well as the relative TP contributions from the various sources. The Water Quality Improvement Plan revealed that the two largest sources of phosphorus loading to Cy-Hawk Lake are runoff from row crop agriculture (42.8 percent) and phosphorus recycled within the lake from bottom sediment (42.4 percent), which is often called internal loading.

Runoff from agricultural land contains phosphorus bound to small soil particles. Manure and synthetic fertilizer applied to a field can also contribute phosphorus to the lake. Soil erosion, over-application of manure or fertilizer, and improper timing of application can all exacerbate phosphorus loads to the lake from agricultural runoff. Sediment and phosphorus from these sources can cause water clarity problems immediately upon entering the lake, or they can accumulate over time and lead to clarity issues caused by internal loading.

Many Iowa lakes have an internal source of phosphorus in addition to external sources from the watershed. In shallow lakes that have accumulated large amounts of sediment in the lake bottom over time, phosphorus can mix back into the water column from the sediment. The presence of bottom-feeding fish such as carp and bullhead, long periods of high winds, and heavy boating activity can intensify this problem in shallow lakes. Water quality modeling and anecdotal data indicate that internal phosphorus loading is a significant source of the TP load to Cy-Hawk Lake. The lake is shallow, susceptible to wind-induced mixing, offers power boating and personal watercraft recreation, and has a large

Continued on page 45

carp and bullhead population. These facts all indicate internal TP loading is problematic and must be addressed. The water quality model for Cy-Hawk Lake indicated that internal loading comprises just under half of the existing TP load.

In addition to row crops and internal loading, smaller sources of TP to Cy-Hawk Lake exist. These include sediment and phosphorus from non-agricultural land uses, groundwater sources, failing septic systems, and natural or background sources. Background sources include wildlife in the watershed, geese that reside at the lake, and atmospheric deposition. There are no regulated point sources of phosphorus in the watershed. Groundwater sources of phosphorus are in the form of dissolved phosphorus (DP), and can result from synthetic fertilizer and transformations that occur in the soil as part of the phosphorus cycle. The largest source of DP is groundwater beneath row crop land uses. However, there are 49 septic systems, of which 30 percent are assumed to be failing or functioning improperly, which contribute to the DP load.

The largest two phosphorus sources, internal lake loads and loads from row crop agriculture, together comprise approximately 85 percent of the total phosphorus load. Water quality improvement alternatives must be focused on these two sources to achieve notable water quality improvement in the lake.

Figure 6-10 illustrates predicted sediment delivery rates throughout the watershed. Areas of the watershed that exhibit the highest levels of sediment delivery also have the highest potential for contributing phosphorus loads to the lake. Areas with high sediment delivery rates should be given the highest priority for the implementation of conservation practices to reduce erosion and associated phosphorus losses to the lake.

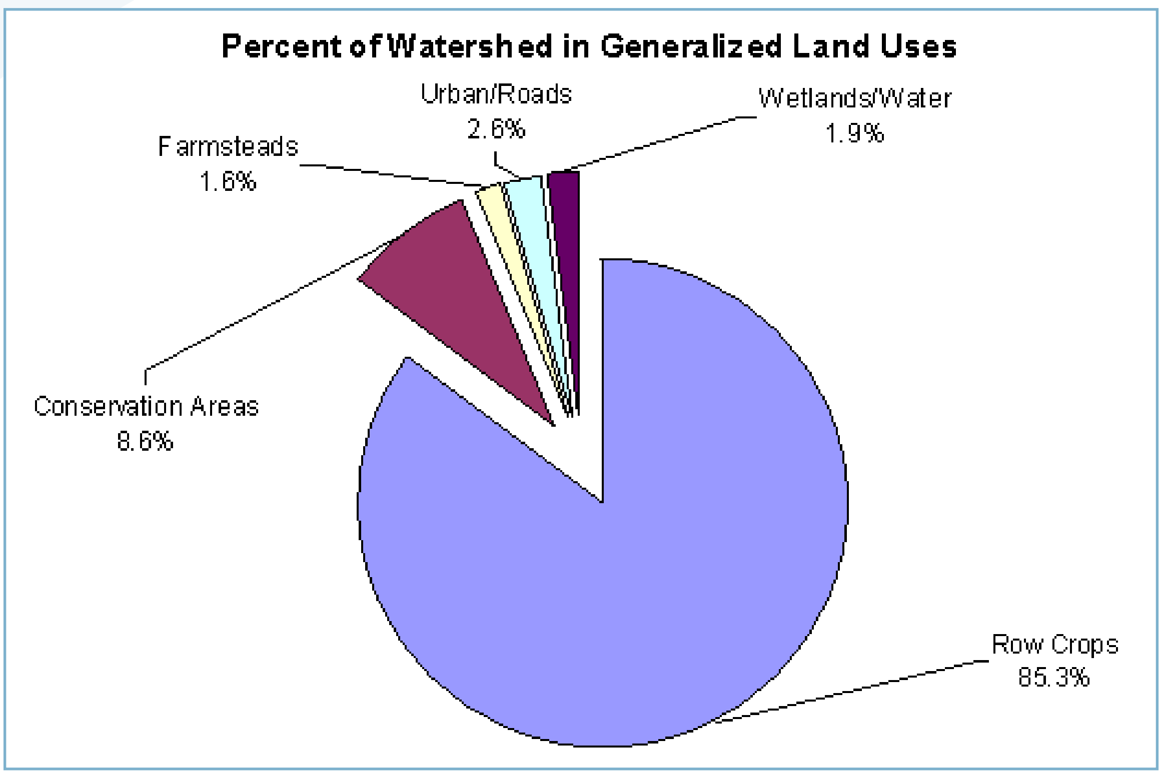
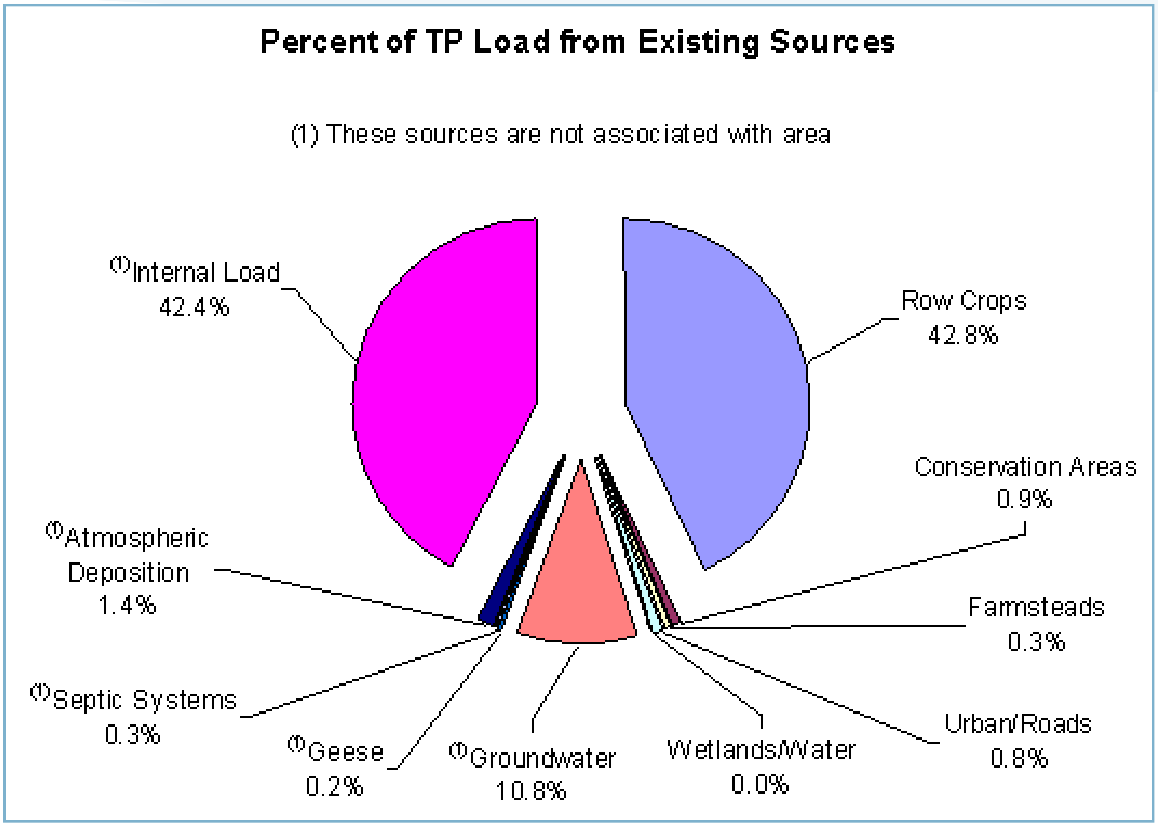


Figure 6-9: Land use composition of Cy-Hawk Lake (chart above) and relative sources of TP load contributions (chart on page 46).



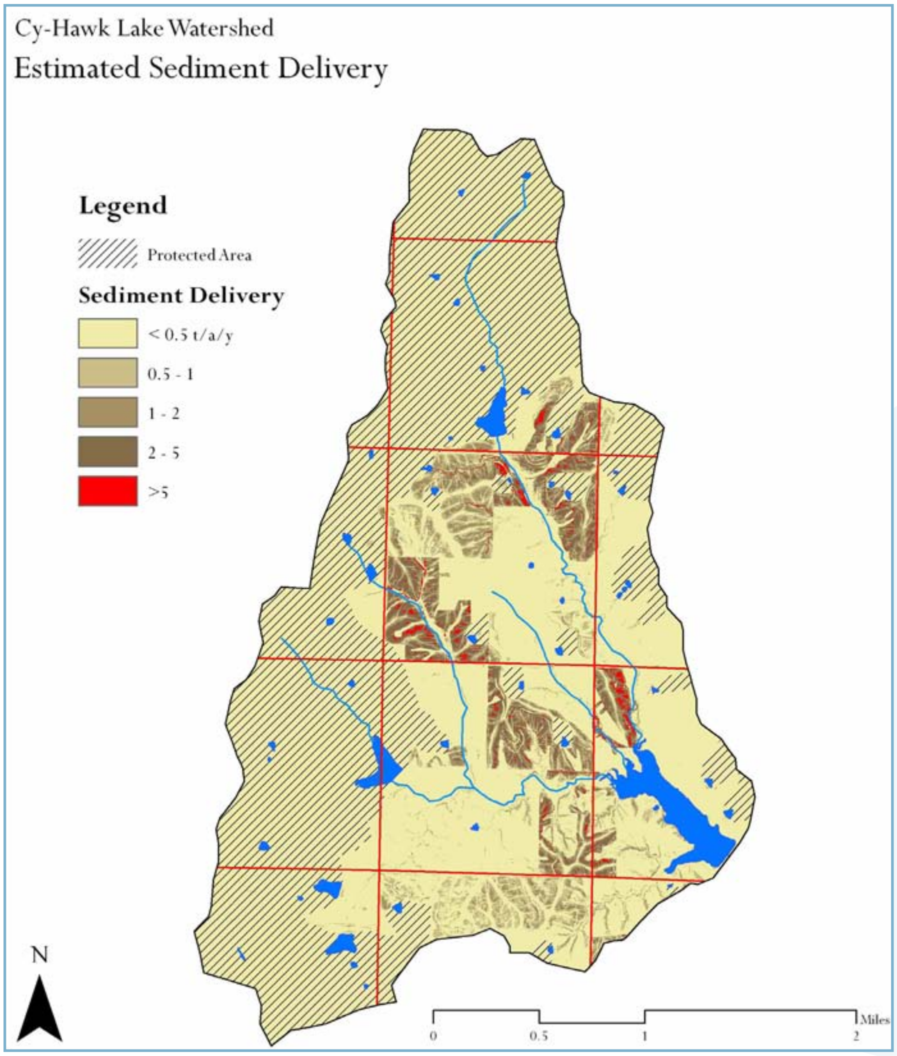


Figure 6-10: Sediment delivery rates throughout the Cy-Hawk Lake watershed

7 WATERSHED MANAGEMENT PLAN GOALS AND OBJECTIVES

7.1 STATEMENT OF GOALS AND OBJECTIVES

WHAT INFORMATION IS NEEDED?

Early in the community based planning process, develop and formally adopt goals for the waterbody. Outline the goals and associated objectives in the Watershed Management Plan. More importantly, develop components of the plan with the stated goals in mind. Focus goals on the desired benefits and/or uses the waterbody provides to various stakeholders (citizens, patrons, landowners, etc.). Improving water quality should drive most goals, but it is important to combine with other considerations, such as wildlife habitat and recreation to restore the entire ecological system. Within each goal, define specific, measurable objectives to provide milestones that indicate the progress toward reaching goals.

WHY IS THIS INFORMATION IMPORTANT?

The development of stakeholder consensus regarding the goals for the Watershed Management Plan is crucial to the ultimate success of the plan. Common goals foster a shared vision for success and can promote buy-in from groups and individuals with a vested interest in protecting the resource. Additionally, objectives to meet goals provide tangible outcomes critical for evaluating attainment of milestones. Water quality goals and objectives in this section should be qualitative or narrative, and used to formulate the numeric targets and required load reductions specified in ***Section 7.2***.

WHERE IS THIS INFORMATION FOUND?

Create goals as part of the community-based planning process, which should include public meetings and development of a stakeholder group. To the extent possible, the formulation of goals should be locally-driven. However, some funding sources (such as Section 319 funds) will require that specific water quality goals are based on an approved Water Quality Improvement Plan.

DNR staff can provide assistance in developing water quality goals to ensure that they are reasonable and attainable. Additionally, DNR can help develop understandable qualitative goals for all stakeholders involved.

EXAMPLE

A statement of goals and objectives may include the following (actual goals and objectives should be site-specific and developed as part of the community based planning process):

Goal 1: Restore the lake to a healthy and safe place for people to boat, fish, and swim.

- **Objective 1.1** Increase water clarity to fully support primary contact recreation and aesthetically pleasing conditions. In other words, increase water clarity for a person to be able to see their feet when standing waist deep in the water.
- **Objective 1.2** Reduce nutrients sufficiently to prevent unsafe blooms of blue-green algae.
- **Objective 1.3** Reduce bacteria levels and eliminate all beach swimming advisories during the recreation season.

Goal 2: Revitalize lake water quality to increase aquatic diversity and improve sport fishing.

- **Objective 2.1** Maintain a water column dissolved oxygen level that supports a diverse aquatic life.
- **Objective 2.2** Maintain a healthy aquatic habitat that supports balanced populations of fish, amphibians, reptiles, and invertebrates.
- **Objective 2.3** Provide a sustainable recreational fishery by adopting regulations and management plans as recommended by the DNR.

7.2 TARGETS AND LOAD REDUCTIONS

WHAT INFORMATION IS NEEDED?

Include specific quantitative water quality targets. Targets and reductions must be consistent with stated goals and objectives set forth in ***Section 7.1***. Set the targets and reductions at least as stringent as those stated in the Water Quality Improvement Plan, if one has been prepared.

WHY IS THIS INFORMATION IMPORTANT?

Numeric water quality targets and load reductions are needed to measure the success of the Watershed Management Plan. Numeric targets give decision makers an endpoint to work toward. They also help determine the type, location and extent of water quality improvement alternatives needed. Some funding sources, such as Section 319 funds, expect the implementation of the Watershed Management Plan to result in attainment of the water quality standards.

WHERE CAN THIS INFORMATION BE FOUND?

If a Water Quality Improvement Plan has been completed, set the numeric targets and load reductions based on the recommended targets and pollutant allocations. DNR maintains a website offering Water Quality Improvement Plans for download. Additional measures can be included if stakeholders wish to pursue more aggressive water quality goals. Targets and reductions for pollutants not specifically addressed in the Water Quality Improvement Plan may also be included. Contact the Watershed Improvement Program for help interpreting the Water Quality Improvement Plan to ensure clarity.

If a Water Quality Improvement Plan is not available for the waterbody of concern, the DNR and other resource agencies can help stakeholders determine appropriate targets and load reductions based on the goals and objectives stakeholders set forth in ***Section 7.1***.

EXAMPLE

Examples of targets and load reductions may include the following (actual targets and reductions should be site-specific and developed as part of the community based planning process):

- Reduce median in-lake total phosphorus (TP) concentration from 153 micrograms per liter (ug/L) to 75 ug/L.
- Reduce median in-lake total chlorophyll-a concentration from 62 ug/L to 33 ug/L.
- Increase median Secchi depth from 0.5 meters to 1.0 meters.

In order to meet the in-lake water quality targets, reduce the TP load from 3,550 pounds per year (lbs/yr) to 1,620 lbs/yr. This will be accomplished through intermediate goals. Future goals will aim to push beyond water quality targets to ensure the likelihood of successful restoration of the lake. The timeline is illustrated on the following table:

YEAR / PARAMETER	CURRENT	2012	2015	2020
In Lake TP (ug/L)	153	100	75	<75
Median in-lake chlorophyll a (ug/L)	62	45	33	<33
Median Secchi depth (meters)	0.5	0.7	1.0	>1.0

7.3 ALTERNATIVES ANALYSIS

SECTION TO BE DEVELOPED

7.4 BEST MANAGEMENT PRACTICES (BMPS)

WHAT INFORMATION IS NEEDED?

Identify management practices and measures to achieve water quality goals. From an initial list of potential practices, narrow down potential practices to the most promising and acceptable options. BMPs include practices, processes, outreach programs and other organized actions designed to improve water quality. BMPs may include changes in land management or land use, physical structures to mitigate against pollutant sources, or changes in human behavior or attitudes about the resources in the watershed and how they are perceived and valued.

Important Questions to consider when selecting BMPs:

- Are the site features or community values suitable for incorporating the practice? In other words, is the practice feasible?
- How effective is the practice at achieving management goals, objectives, and loading targets?

WHY IS THIS INFORMATION IMPORTANT?

BMPs are the building blocks to achieve water quality goals. Show all BMPs needed to achieve the ultimate goals of the project. When listing BMPs needed to effectively implement the Watershed Management Plan, money and time should not constrain the ideal plan.

WHERE CAN THIS INFORMATION BE FOUND?

DNR WQIP Water Quality Improvement Plan

Information on BMPs can be found from many sources including NRCS staff, DNR staff, DSC regional Basin Coordinators, local Soil & Water Conservation Districts, and Iowa State University Extension. Additionally, local stakeholders can provide insight on choosing proper BMPs because they may know what will likely be accepted by landowners in the watershed. If a Water Quality Improvement Plan has been completed for the waterbody of concern, some potential BMPs may be described in the chapter titled "Implementation Plan."

EXAMPLE

Identify BMP needs within the watershed

Results from our PRedICT model suggest aggressive goals that will need an extensive education and outreach program to help implement the number and variety of BMPs needed for water quality improvement. To achieve the load reduction levels provided in the Water Quality Improvement Plan, the following BMPs are required throughout the 135 farms in the Muddy Run Watershed.

- Implement conservation cover crops on 47 farms
- Implement conservation tillage practices on 14 farms
- Practice stripcropping / contour farming on 70 farms
- Implemented nutrient management plans on 65 farms
- Implement grazing land management on 36 farms
- Establish seven miles of stream bank vegetation
- Erect 10 miles of stream bank fencing
- Stabilize 2 miles of stream bank

8 WATER MONITORING PLAN

8.1 QUALITY ASSURANCE PROJECT PLAN (QAPP)

WHAT INFORMATION IS NEEDED?

A Quality Assurance Project Plan (QAPP) needs to be developed for water monitoring. A QAPP is a project-specific document that specifies the data quality and quantity requirements of the study, as well as all procedures that will be used to collect, analyze and report those data. A QAPP is normally prepared before sampling begins, and usually contains the sampling plan, data collection and management procedures, training and logistical considerations, and Quality Assurance (QA) / Quality Control (QC) components.

WHY IS THIS INFORMATION IMPORTANT?

Data collection programs usually have an approved QAPP before sample collection begins to help monitoring personnel follow correct and repeatable procedures and to ensure the collected data is usable by DNR and other agency staff to determine the status of the water quality. A QAPP also helps data users ensure the collected data meet their needs and that the necessary QA/QC steps are built into the project from the beginning.

WHERE CAN THIS INFORMATION BE FOUND?

For help developing a QAPP, contact Iowa DNR Water Monitoring and Assessment Section or the Watershed Improvement Program. Additional resources can be found on EPA's website on the following two web pages:

- **Quality Management Tools-QA Project Plans**
  http://www.epa.gov/quality/qapps.html
- **The Volunteer Monitor's Guide to Quality Assurance Project Plans**
  http://www.epa.gov/volunteer/qapp/vol_qapp.pdf

QAPP ELEMENTS

A QAPP for water quality monitoring requires discussion of standard sampling procedures for each analyte measured including sample collection criteria, sample volume and how the sample will be preserved.

> **EXAMPLE EXCERPT FROM A QUAPP**
>
> Bi-weekly sampling for pH and E. coli bacteria in Cy-Hawk Lake will follow the EPA standard protocol. The sampling will take place from March 1, 2009 to November 1, 2009 and will be analyzed immediately in the field for pH. Three locations in the lake will be sampled throughout the sampling season and the location will be recorded for each sample along with date and time of collection, name of the sample collector, and any follow-up analysis needed. Sample containers must be clearly labeled with waterproof ink. To ensure samples remain unchanged until they are analyzed, standard bacteria sampling bottles will be used to transport the sample from the field to the lab, where they will be analyzed for E. coli within 24 hours. A minimum of 100ml of water will be collected for each sample.

8.2 WATER MONITORING PLAN

WHAT INFORMATION IS NEEDED?

Data collection needs to be coordinated with water quality goals and objectives outlined in ***Section 7*** of the Watershed Management Plan. Additionally, design a watershed monitoring plan that effectively targets the pollutants of concern considering the resources available for the monitoring program, size of the watershed, and objectives of the monitoring program.

The water monitoring plan should serve as a guidance document containing all necessary information to set up a sampling network, collect samples, and analyze collected data. Additional monitoring to measure progress toward goals not directly related to water quality, such as landowner participation, adoption of BMP's, and increases in recreational usage or economic development may also be incorporated into the water monitoring plan.

When developing a monitoring design to meet your objectives, it is important to understand how to use the monitoring data. The following questions may be helpful:

- What water quality and watershed improvement questions need to be answered?
- What assessment techniques will be used?
- What statistical power and precision are needed?
- Can the effects of weather and other sources of variation be controlled?

Monitoring should be site specific depending on goals and objectives. For example:

- **Goal: Track BMP Performance**
  Create a detailed and intensive water quality monitoring regime
- **Goal: Restore swimming conditions at the beach**
  Track bacteria levels at beach during summer recreation season.
- **Goal: Restore the biotic integrity of a stream**
  Collect annual sampling of benthic invertebrates and fish.

WHY IS THIS INFORMATION IMPORTANT?

Pollutant loads are measured at many levels of resolution; watersheds and their subunits (tributaries) commonly serve as the geographic unit for load estimation. Loads are also measured for specific sub-watersheds or sources. The primary goal of a water monitoring plan is to evaluate the effectiveness of BMPs at improving water quality over time. This provides watershed managers with opportunities to track priority areas and determine if improvement efforts are directed efficiently to solve the water quality problems.

Measuring progress is critical to ensuring continued support of Watershed Management Plans designed to improve water quality. Progress is best demonstrated with monitoring data that accurately reflects water quality conditions.

WHERE CAN THIS INFORMATION BE FOUND?

The DNR Water Monitoring and Assessment Section can assist in developing your water quality monitoring plan. Important elements of a water monitoring plan may have been outlined during the completion of a Water Quality Improvement Plan. The description and guidance for developing a water monitoring plan provided in this document is only a small fraction of the information available. Do not develop a plan using this document alone. A vast amount of information is available online through the EPA. The following links provide information critical to the completion of a successful water monitoring plan:

- **Handbook for Developing Watershed Plans to Restore and Protect Our Waters**
  www.epa.gov/nps/watershed_handbook/
- **EPA monitoring page**
  www.epa.gov/owow/monitoring/volunteer/
- **Monitoring Guidance for Determining the Effectiveness of Nonpoint Source Controls**
  www.epa.gov/ncepihom/

The following are example monitoring plans from Any Creek, Iowa.

WATERSHED TARGETS AND LOAD REDUCTIONS

Any Creek is located in central Iowa and is impaired for aquatic life uses. The DNR performed a stressor identification on the watershed, which identified low dissolved oxygen and sedimentation as the primary causes of the impairment. The associated Water Quality Improvement Plan targeted a reduction of nitrogen and phosphorus delivery to the stream by 60 percent and 75 percent respectively. Reductions in sediment set by the Water Quality Improvement Plan were related to reductions in phosphorus delivery to the stream. The stressor identification indicated a need to decrease riffle embeddedness and silt deposition to improve habitat available for benthic macroinvertebrate colonization. Riffles sampled during the stressor identification had an average embeddedness of more than 80 percent. Riffle embeddedness at ecoregion biological reference sites fell between 30-50 percent. A minimum reduction in embeddedness of 38 percent is necessary to reach water quality goals.

BEST MANAGEMENT PRACTICES

The watershed project targets BMP that would both decrease sediment and nutrient delivery to the stream and would improve in-stream habitat availability. The following BMPs are identified as viable options for attaining water quality goals in the watershed:

- Targeted wetland installations at major tile outfalls
- CRP and wetland restorations
- In-stream riffle structures
- No-till farming
- Nutrient management
- Cattle exclusions
- Riparian buffers
- Streambank stabilization

MONITORING PLAN

The monitoring plan in this watershed includes water quality, biological, habitat and nutrient management sampling. The primary goal of the monitoring network is to track long-term improvements in the water quality, habitat and biological conditions of the stream system. The other major goal of the monitoring network is to track and demonstrate the effectiveness of BMPs deployed during the project. The location of all BMPs and monitoring sites are illustrated in ***Figure 8-1***.

BMP monitoring is a short-term goal of this project and will take place in each of the first three years of the project and then will slowly be phased out during the next two years ***(Figure 8-2)***. For the first three years, grab samples are collected once a week during the growing season (April 1 – October 1) at each of the two wetland structures installed at the outlet of major tile lines ***(Figure 8-1)***. During the next three years, samples are collected once every two weeks during the wet season (April 1-June 15). Two samples are collected at each wetland, one at the outlet of the tile and one at the outlet of the wetland. These samples are then tested for the components listed in ***Figure 8-3***. Data from these sites will be used to track the efficiency of the wetland installations.

Cornstalk testing ***(Figure 8-1)*** will be conducted at harvest for the first five years of the project. Data collected from these tests ***(Figure 8-3)*** will be used to fine-tune nutrient management plans on participating operator's fields.

Long-term monitoring of this stream system will take place over the 10 year life span of this project. The life span of monitoring for long-term goals can be extended, pending achievement of project goals and additional funding availability. One water quality sampling site is located near the outlet of the watershed ***(Figure 8-1)***. This site is equipped with a pressure transducer that will measure continuous stage during all non-frozen months. Water quality samples will be taken during the growing season (April 1- October 1) once a week for the first three years to develop a base line of data. Sampling frequency decreases to bi-weekly for the next four years and then will switch back to weekly for the final three years of the project. Continuous diurnal dissolved oxygen monitoring will take place at this water quality site and at the upstream biological sampling site ***(Figure 8-1)*** for a two week period in August in each year of the project.

Habitat analysis and biological monitoring ***(Figure 8-1)*** will occur in years three, six and nine. Data from habitat sampling will be used to track trends in stream sediment characteristics. Habitat characteristics are also sampled at each biological site. Data from biological sampling will be used to track improvements in the biological community.

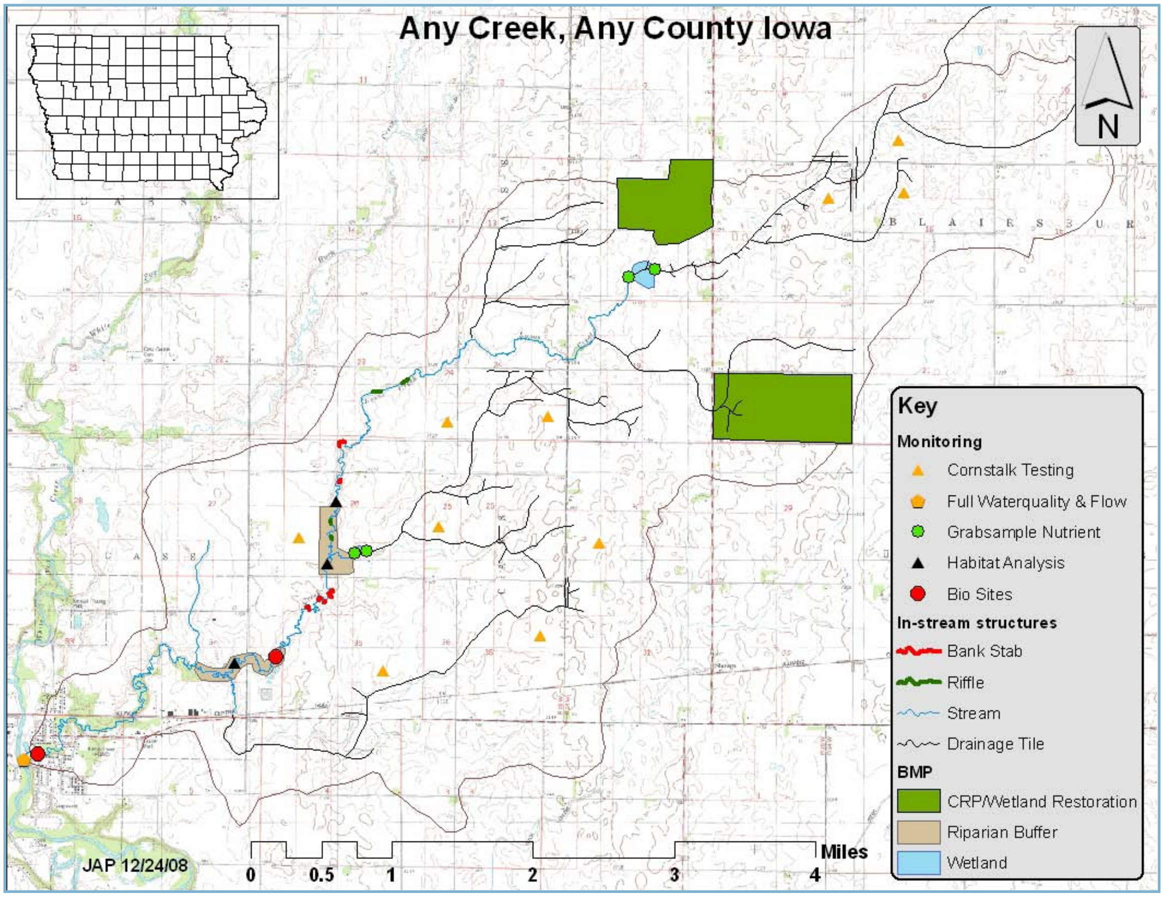


Figure 8-1: BMP installations and sampling locations in Any Creek Watershed

YEARS	MONITORING
1	Grab sample sites weekly (April 1 – Oct. 1) Full water quality site weekly (April – Oct. 1) Continuous flow (unfrozen) Diurnal dissolved oxygen (two weeks August) Cornstalk testing (harvest)
2	Grab sample sites weekly (April 1 – Oct. 1) Full water quality site weekly (April – Oct. 1) Continuous flow (unfrozen) Diurnal dissolved oxygen (two weeks August) Cornstalk testing (harvest)
3	Grab sample sites weekly (April 1 – Oct. 1) Full water quality site weekly (April – Oct. 1) Continuous flow (unfrozen) Diurnal dissolved oxygen (two weeks August) Cornstalk testing (harvest) Habitat analysis Biological sampling
4	Grab sample sites bi-weekly (April 1 – June 15) Full water quality site bi-weekly (April 1 – Oct. 1) Continuous flow (unfrozen) Diurnal dissolved oxygen (two weeks August) Cornstalk testing (harvest)
5	Grab sample sites bi-weekly (April 1 – June 15) Full water quality site bi-weekly (April 1 – Oct. 1) Continuous flow (unfrozen) Diurnal dissolved oxygen (two weeks August) Cornstalk testing (harvest)
6	Full water quality site bi-weekly (April 1 – Oct. 1) Continuous flow (unfrozen) Diurnal dissolved oxygen (two weeks August) Habitat analysis Biological sampling
7	Full water quality site bi-weekly (April 1 – Oct. 1) Continuous flow (unfrozen) Diurnal dissolved oxygen (two weeks August)
8	Full water quality site weekly (April 1 – Oct. 1) Continuous flow (unfrozen) Diurnal dissolved oxygen (two weeks August)
9	Full water quality site weekly (April 1 – Oct. 1) Continuous flow (unfrozen) Diurnal dissolved oxygen (two weeks August) Habitat analysis Biological sampling
10	Full water quality site weekly (April 1 – Oct. 1) Continuous flow (unfrozen) Diurnal dissolved oxygen (two weeks August)

Figure 8-2: Timeline and monitoring activities by project year

MONITORING	TESTS
Grab sample sites	Ammonia Nitrogen as N Total Kjeldahl nitrogen as N Nitrate + nitrite nitrogen as N Total phosphate as P Ortho phosphate as P Chlorophyll A Dissolved oxygen Flow rate Temperature
Full water quality site	Ammonia Nitrogen as N Total Kjeldahl nitrogen as N Nitrate + nitrite nitrogen as N Total phosphate as P Ortho phosphate as P Chlorophyll A Chloride Dissolved inorganic carbon Dissolved organic carbon Total organic carbon Total BOD 5 Total dissolved solids Total suspended solids Total volatile suspended solids Turbidity pH Dissolved oxygen Flow rate Temperature
Cornstalk testing	Nitrogen sampling of cornstalks to assess in field nutrient management
Habitat analysis	Sediment deposition measurement Embeddedness ranking Pool depth Sediment particle size analysis
Biological site	Full biological sampling matching that done during stressor identification/ TMDL monitoring

Figure 8-3: Monitoring sites and associated components

9 IMPLEMENTATION SCHEDULE

WHAT INFORMATION IS NEEDED?

The schedule illustrates implementation elements covered throughout the plan broken down in a phased approach. Think of it as a visual summary for the entire plan. Most information needed to construct an implementation schedule is developed in the previous sections of this document. An implementation schedule is used to chart plan progress, maintain focus on goals and objectives, and ensure goals and objectives are met in a timely manner.

When devising an effective implementation schedule, it is important to include milestones as indicators of achievement. Make sure all milestones are consistent with the goals and objectives for the Watershed Management Plan. Start by listing the specific tasks to achieve goals and the parties who will carry out the tasks. Identify anticipated indicators of success and milestones of achievement. If appropriate, include interim milestones to track progress and maintain momentum for implementing the plan.

Create an implementation schedule ambitious enough to meet water quality goals while realistic enough to give water quality a chance to recover. Account for seasonal variations, construction seasons, engineering needs and other factors when determining the schedule. The implementation schedule should be a "living document," adaptable and updated based on changing circumstances. Revisit and update the schedule often to track progress.

WHY IS THIS INFORMATION IMPORTANT?

An implementation schedule keeps the plan on track and shows measurable achievements. It allows for specific tasks to be completed in an organized and integrated manner. It will help all parties involved to determine what goals have been met, what goals still need work and how far the plan has progressed.

WHERE CAN THIS INFORMATION BE FOUND?

As stated previously, a majority of the information needed to construct an implementation schedule is developed in the previous sections of this document. Additional timeline and practical milestone estimates can be derived from previous experience. Agency resources have knowledge of seasonal variations, timing and sequence issues, and other factors that may be helpful in developing a workable schedule.

The following agencies can assist with timeframe and milestone estimates:

- **Soil and Water Conservation District**
  https://idals.iowa.gov/FARMS/index.php/searchEmployees
- **USDA Natural Resource Conservation Service**
  www.ia.nrcs.usda.gov/
- **Iowa Department of Agriculture and Land Stewardship, regional Basin Coordinators**
  www.iowaagriculture.gov/emailContact/index.asp
- **Iowa Department of Natural Resources, Project Officers, Watershed Improvement Program, 319 Program**
  www.iowadnr.gov/water/watershed/staff.html

IMPLEMENTATION SCHEDULE

Figure 9-1 illustrates use of a tool to map the tasks necessary to meet goals by using a phased approach to implementing the Watershed Management Plan. Keep in mind this is a fictitious simplified example offered as a guide for how to map a plan. Complete an implementation schedule for each goal and corresponding objectives and tasks. Implementation schedules will differ depending on the goals and timeframes developed by the stakeholder group developing the Watershed Management Plan. The resulting implementation schedule serve as a handy visual reference tool to easily recognize tasks scheduled for the upcoming year and focus the necessary resources for the current phase of the project. Update the goal schedule on a regular basis to reflect completed tasks, shifting priorities and unexpected delays.

EXAMPLE

Figure 9-1 illustrates the Cy-Hawk Lake implementation plan for the first goal. The first goal has three objectives, with three tasks each. Each task has a milestone goal and associated unit of measurement listed next to it. These milestones were determined through the work of the technical advisory team after thorough analysis of the watershed.

The Cy-Hawk Lake management plan breaks into three phases. The first phase will take place from 2009 – 2011. Based on prioritization of BMPs, the end of the first phase is marked by the completion of 1,080 acres of sediment control BMPs, the development of 130 homes participating in an urban landscape management programs, and a thorough inspection and maintenance program on the 70 septic systems in the watershed. Other aspects of the Watershed Management Plan begin in the first phase, including wetland restoration, manure and fertilizer management, and eliminating direct access of cattle in streams. These three activities extend into the second phase of the watershed management plan, scheduled for 2012-2013. Those three activities are all slated to reach milestone totals and finish implementation by the end of 2013, marking the end of phase two. Finally, phase three is scheduled to take place in 2014-2017. This final scheduled phase involves intensive in-lake work. A targeted dredging project on the upper section of Cy-Hawk Lake is scheduled for 2014. A full scale dredging project for the rest of the lake is slated for 2016-2017. Establishing riparian and aquatic vegetation is marked for completion in 2014 and 2015. Managing the geese population at the lake is a continuous challenge and will be a part of lake management every year.

Figure 9-1: Cy-Hawk Lake Implementation Schedule

GOAL 1	RESTORE LAKE TO A HEALTHY AND SAFE PLACE FOR PEOPLE TO BOAT, FISH, AND SWIM.	MILESTONE METRIC	MILE-STONE TOTALS	PHASE 1: 2009–2011			PHASE 2: 2012–2013		PHASE 3: 2014–2017			
				2009	2010	2011	2012	2013	2014	2015	2016	2017
Objective 1	***Increase clarity for primary contact recreation.***											
Task 1	Construct sediment control BMPs in priority target areas.	Acres Treated	1,080		540	540						
Task 2	Establish riparian and aquatic vegetation.	Linear Feet Restored/ Stabilized	5,000						2,000	3,000		
Task 3	Targeted dredging to remove known deposits and create deep water habitat.	Cubic Yards Removed	350,000						50,000		150,000	150,000
Objective 2	***Reduce nutrients to prevent unsafe blooms of blue-green algae.***											
Task 1	Implement wetland restoration projects in targeted areas of watershed.	Acres Restored	880		160	160	240	320				
Task 2	Enroll producers in voluntary manure and fertilizer management programs	Acres Enrolled	3,200		320	320	640	640				
Task 3	Develop urban landscape management programs	Lots/Homes Participating	130	30	50	50						
Objective 3	***Reduce bacteria levels to eliminate beach advisories.***											
Task 1	Eliminate direct access of cattle in streams throughout the watershed	Linear Feet of Access Eliminated	14,500		2,500	4,000	4,000	4,000				
Task 2	Conduct voluntary septic system inspections and maintenance programs to meet permit standards	Number of Septics Permitted	70	10	30	30						
Task 3	Goose waste management programs at the lake	Pounds of Waste Removed	680	100	100	100	80	80	60	60	50	50

10 RESOURCE NEEDS

WHAT INFORMATION IS NEEDED?

An estimate of resource needs (financial and human resources) is crucial to gain support from potential funding agencies. Resources needed by watershed groups can vary and depend on the goals of the plan, the location of the watershed and water quality objectives.

It is important to identify appropriate resource needs for each implementation task. Money and in-kind contributions are necessary to implement water quality improvement activities such as: BMP installation, public outreach activities, monitoring, administrative support, office space, supplies, contractual services, salary, training, equipment and land acquisition. Include a detailed cost estimate for each implementation task and make a list of potential funding source(s).

Focus resource needs on a phase-by-phase basis as identified in Section 9 or on a task by task basis. Once you have listed out all phases and associated tasks, begin to identify and list resources needed to complete each task; where these resources are obtained (by organization, person, profession, etc.); funds needed to complete each task; potential sources of funding; amount of funds needed from each funding source; and critical dates/deadlines for soliciting funds from each source.

WHY IS THIS INFORMATION IMPORTANT?

This information helps determine various funding options, in-kind opportunities and other assistance available. A critical factor in turning a Watershed Management Plan into a success is the ability to fund implementation activities and obtain proper expertise to assist in improving water quality.

WHERE CAN THIS INFORMATION BE FOUND?

The following agencies can help estimate costs and determine available technical assistance:

- **Soil and Water Conservation District, Conservationists:** *https://idals.iowa.gov/FARMS/index.php/searchEmployees*
- **USDA Natural Resource Conservation Service:** *http://www.ia.nrcs.usda.gov/*
- **Iowa Department of Agriculture and Land Stewardship, regional Basin Coordinators** *www.iowaagriculture.gov/emailContact/index.asp*
- **Iowa Department of Natural Resources, Project Officers, Watershed Improvement Program, 319 Program:** *www.iowadnr.gov/water/watershed/staff.html*

Potential funding sources will depend on the type of implementation activity, practice and location. Funding sources can be found at the following website: ***www.iowadnr.gov/water/watershed/files/fundinglist.pdf***

FUNDING SOURCES

Figure 10-1 illustrates use of a tool to map the estimated costs for each year of each task necessary for goal completion for all phases of the project. Keep in mind this is a fictitious, simplified example offered as a guide for how to map a plan. Complete a funding plan schedule for each goal and corresponding objectives and tasks. Cost estimates will differ depending on the BMP, extent of the work, availability of labor, etc. The resulting funding plan will mirror the implementation schedule discussed in Section 9. Include the potential funding sources for the individual tasks planned for targeting purposes. Update the funding plan schedule with the implementation schedule to reflect completed tasks, shifting priorities and unexpected delays.

EXAMPLE

The costs associated with implementation are illustrated in Figure 10-1, based on current estimates and the amount of BMPs necessary as cited in Figure 9-1. Likely funding sources are listed with each task along with a total cost estimate. Totals for each individual year are tallied on the bottom row to illustrate the needed funds for that year's implementation plan. The funding plan predicts a need for funding from multiple sources in a variety of denominations.

GOAL 1	RESTORE LAKE TO A HEALTHY AND SAFE PLACE FOR PEOPLE TO BOAT, FISH, AND SWIM.	FUNDING SOURCE	COSTS	PHASE 1: 2009-11		
				2009	2010	2011
Objective 1	***Increase clarity for primary contact recreation.***					
Task 1	Construct sediment control BMPs in priority target areas (treat 1,080 acres).	WIRB, 319	$802,800		$401,400	$401,400
Task 2	Establish riparian and aquatic vegetation (restore 5,000 linear feet).	319, Lakes	$750,000			
Task 3	Targeted dredging to remove known deposits and create deep water habitat (remove 350,000 CY).	Lakes	$3,500,000			
Objective 2	***Reduce nutrients to prevent unsafe blooms of blue-green algae.***					
Task 1	Implement wetland restoration projects in targeted areas of watershed (restore 880 acres).	CREP, WPF	$3,520,000		$640,000	$640,000
Task 2	Enroll producers in voluntary manure and fertilizer management programs (enroll 1,920 acres)	319	$96,000		$16,000	$16,000
Task 3	Develop urban landscape management programs (120 lots/homeowners participating)	REAP, WPF	$78,000	$18,000	$30,000	$30,000
Objective 3	***Reduce bacteria levels to eliminate beach advisories.***					
Task 1	Eliminate direct access of cattle in streams throughout the watershed	319	$13,731		$2,367	$3,788
Task 2	Conduct voluntary septic system inspections and maintenance programs to meet permit standards	WSPF	$35,000	$5,000	$15,000	$15,000
Task 3	Goose waste management programs at the lake	319	$9,000	$1,000	$1,000	$1,000
		Totals =	**$8,804,531**	**$24,000**	**$1,105,767**	**$1,107,188**

Figure 10-1: Cy-Hawk Lake Funding Plan

PHASE 2: 2012-13		PHASE 3: 2014-17			
2012	2013	2014	2015	2016	2017
		$300,000	$450,000		
		$500,000		$1,500,000	$1,500,000
$960,000	$1,280,000				
$32,000	$32,000				
$3,788	$3,788				
$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
$996,788	**$1,316,788**	**$801,000**	**$451,000**	**$1,501,000**	**$1,501,000**

APPENDIX A – REGION 7 WATERSHED MANAGEMENT PLAN REVIEW CRITERIA

A. IDENTIFICATION OF CAUSES & SOURCES OF IMPAIRMENT

- General Watershed information including HUC information
- List of the 303d listed streams in the watershed and why listed.
- Is there a TMDL? What streams? What pollutants are addressed?
- Are there any point sources? Identify them and their potential impacts.
- What are the NPS sources of pollution in the watershed? Please note if it is not addressed in the plan then EPA 319 cannot fund it, unless the plan is modified.
- What are the current loads from all pollution sources being addressed?
- Maps are helpful, but not required.
- Are there any streams that need protecting? What impacts are threatening them?

B. EXPECTED LOAD REDUCTIONS

- What load reductions are needed to meet designated uses in impaired streams?
- What is the source of the load reduction information? (TMDL, modeling, monitoring)
- What are the load reductions expected from BMPs? Will the proposed BMPs result in load reductions required to meet water quality standards?
- Please provide more then percentages, they are difficult to put into context.

C. PROPOSED MANAGEMENT MEASURES

- What BMPs/management measures need to be implemented to achieve the water quality goals?
- Have critical areas been identified? Are these areas mapped?
- Has the group prioritized areas of the watershed for implementation? What areas need to be addressed 1st, 2nd, 3rd, etc? What BMPs should be implemented in these areas?
- Are the BMPs and critical areas strategically targeted to have the greatest improvements in water quality?
- Does the plan quantify the projected BMPs? (i.e. miles of fencing, terracing, waterways, number of grade stabilization structures)

D. TECHNICAL AND FINANCIAL ASSISTANCE NEEDS

- Do the cost estimates reflect planning and implementation costs?
- Information is provided on how the cost estimate was determined?
- All potential funding sources have been identified for federal, state, local and private.

E. INFORMATION AND EDUCATION

- Does the plan have a reasonable strategy to inform and engage stakeholders (federal, state, local, private) in the watershed? Examples include public meetings, watershed events, multimedia campaigns, news articles, signage in high visibility areas, etc.
- Is there an evaluation process included?

F. IMPLEMENTATION SCHEDULE

- Plan describes the scheduled order of implementation including the planning process through actual implementation of BMPs and monitoring?
- Set time frames are projected to determine progress towards meeting goals – In other words, is there a timetable for addressing priority areas, a schedule for implementing critical BMPs, etc.?
- Does the schedule follow the prioritization of the critical areas? If not, is there a reasoning why?

G. MEASURABLE MILESTONES AND PROJECT OUTCOMES

- Does the plan include milestones with anticipated completion dates to mark accomplishments? This information can be incorporated into the schedule.
- Is there a way for those implementing the plan to evaluate progress?
- Milestones can include implementing a certain number of BMPs, addressing a number of critical areas, number of outreach events, etc.

H. LOAD REDUCTION EVALUATION

- This element looks for interim water quality milestones. The milestone can differ from the water quality standard violation; for example improvements in fish diversity, water clarity, benthic community, reduction of atrazine etc.
- These milestones measure progress towards meeting the overall water quality goals for the watershed.
- Does the plan identify a course of action if goals are not being met as anticipated?

I. MONITORING

- What water quality indicators are you monitoring? What parameters?
- Who is performing the sampling? How often are they sampling? Are they doing before and after sampling or upstream vs. downstream, for example?
- Is the monitoring supporting the milestones that are identified? Will it demonstrate the effectiveness of implementing BMPs over time?
- Is there a trigger to have the state reassess streams or the watershed?
- How are info/ed evaluations being considered?