



# PROTECT RATHBUN LAKE

## INTERIM WATERSHED MANAGEMENT PLAN

2014 – 2019



## **INTERIM WATERSHED MANAGEMENT PLAN SUMMARY**

### **RATHBUN LAKE AND WATERSHED**

Rathbun Lake is the primary source of water for Rathbun Regional Water Association, the largest rural water system in Iowa. The lake also provides recreation for one million visitors annually and is the site of Iowa's Honey Creek Resort State Park. In addition, the lake provides fish and wildlife habitat, flood damage reduction, storage for navigational flows, and water for the Rathbun Fish Hatchery. Rathbun Lake is located on the Chariton River in south central Iowa. The lake's watershed covers 354,000 acres. Corn and soybean production is the major land use on 146,000 acres. Grassland comprises 83,500 acres. Cropland in the watershed has increased by 38,700 acres in the last decade. This increase has been associated with the conversion of grassland and a decrease in land enrolled in the Conservation Reserve Program. There are approximately 820 farms in the watershed.

### **WATER RESOURCE CONCERNS AND SOURCES OF IMPAIRMENT**

Rathbun Lake's main basin and three of the lake's four arms as well as 15 other water bodies in the watershed are on Iowa's 2012 Section 303(d) List of Impaired Waters. Iowa's 2012 305(b) Water Quality Assessment indicates that Rathbun Lake does not support or only partially supports all of its designated uses due to algal and non-algal turbidity. The assessment also indicates that other water bodies in the watershed are impaired due to siltation, high ammonia, low dissolved oxygen, organic enrichment, and high bacteria levels. The Rathbun Lake Interim Watershed Management Plan addresses the algal and non-algal turbidity causes of impairments in the lake. The 305(b) Water Quality Assessment identifies agriculture as a source of this turbidity. Specifically, watershed assessment findings and water quality monitoring point to sediment and phosphorus from cropland as the principal sources of these causes of impairments. Most of this sediment and phosphorus is carried in runoff from priority land used for row crops. Priority land in the watershed has increased by 27,400 acres to a total of 83,800 acres as a result of the expansion of cropland in the last decade. While this priority cropland comprises just 24% of the watershed, it is the source of 80% of the sediment and phosphorus delivered to Rathbun Lake.

### **PROGRESS IMPLEMENTING ORIGINAL WATERSHED MANAGEMENT PLAN**

The Rathbun Land and Water Alliance and partners carry out efforts to protect land and water resources in the Rathbun Lake watershed. In 2002, the Alliance completed a watershed management plan that identified reduced sediment and phosphorus delivery to Rathbun Lake as the goal of the Protect Rathbun Lake Project. Project objectives included the application of best management practices (BMPs) for 30,000 acres of priority land to reduce annual sediment and phosphorus loading to the lake by 90,000 tons and 360,000 pounds respectively. Since 2004, project activities have expanded into 45 of 61 targeted sub-watersheds, assistance has been provided to 580 landowners, and practices have been planned and applied for more than 10,000 acres of priority land which will reduce annual sediment and phosphorus delivery to Rathbun Lake by an estimated 42,000 tons and 179,000 pounds respectively. In addition to reduced sediment and phosphorus delivery, water quality monitoring data provides an indication of the effectiveness of BMPs applied through the Protect Rathbun Lake Project. Specifically, long-term monitoring data indicates that the trend in water quality in the lake and its tributaries has been relatively stable in spite of the large increase in cropland in the watershed. The targeted application of BMPs for priority land has helped to prevent the deterioration in water quality in the lake and its tributaries due to sediment and phosphorus loading that might have otherwise occurred given the significant expansion of land used for row crops in the watershed.

## **DEVELOPMENT OF TOTAL MAXIMUM DAILY LOAD FOR RATHBUN LAKE**

The Iowa Department of Natural Resources (DNR) together with the Alliance and other partners are developing a Total Maximum Daily Load (TMDL) for Rathbun Lake. The results from expanded water quality monitoring in the lake and its tributaries combined with the collection of current field-level information from the watershed will be used to create models to prepare the TMDL. The Iowa DNR and Alliance expect the TMDL will be completed and receive approval of the US Environmental Protection Agency by 2019. The TMDL will provide the Alliance with specific pollutant load allocations for sediment and phosphorus. This information from the TMDL will enable the Alliance and its partners to identify strategies that will reduce the loading of sediment and phosphorus to Rathbun Lake. The TMDL and these strategies will serve as the basis for preparing a new nine-element water quality improvement plan for the Rathbun Lake watershed.

## **INTERIM RATHBUN LAKE WATERSHED MANAGEMENT PLAN**

The Alliance and its partners have prepared an Interim Rathbun Lake Watershed Management Plan. This interim plan will guide Protect Rathbun Lake Project activities from 2014 to 2019 during development of the TMDL and preparation of the new nine element water quality improvement plan for the Rathbun Lake watershed. The Alliance anticipates that BMPs will be applied for 5,000 total acres, of which 2,500 acres will be priority land, during the five-year interim plan period. These practices will contribute to the accomplishment of the Protect Rathbun Lake Project's overall goal and objectives by reducing annual sediment and phosphorus delivery to Rathbun Lake by an estimated 7,500 tons and 30,000 pounds respectively. This reduction in the delivery of sediment and phosphorus from the watershed is projected to benefit water quality in Rathbun Lake by decreasing the average total suspended solids and phosphorus concentrations and lowering the median trophic state index values for Secchi depth and total phosphorus in the lake by an estimated two percent. Project activities will continue in the 45 active targeted sub-watersheds and expand into the remaining sub-watersheds. In addition, water quality monitoring, geographic information system analyses, and watershed outreach will continue to be implemented as essential project activities.

## **RATHBUN LAKE AND WATERSHED**

**Rathbun Lake Features** Rathbun Lake is the primary source of water for the Rathbun Regional Water Association (RRWA). RRWA is one of the largest rural water systems in the United States and the largest system in Iowa. RRWA provides eight million gallons of water daily to close to 80,000 people for residential, agricultural, and business use in 18 counties and 51 communities in Iowa and Missouri. In addition to being an important source of drinking water, the 11,000-acre lake offers recreational opportunities for one million visitors annually and is the site of Iowa's Honey Creek Resort State Park. Rathbun Lake also provides flood damage reduction for 150,000 acres of downstream land, fish and wildlife habitat in the lake and on 21,000 acres of adjacent public land, downstream water quality improvement, storage for supplementing navigational flows, and water for the Iowa Department of Natural Resources' (DNR) Rathbun Fish Hatchery. Rathbun Lake is located on the Chariton River in south central Iowa. The US Army Corps of Engineers (ACOE) developed the lake in the late 1960s. The ACOE is responsible for managing Rathbun Lake, lake facilities, and adjacent public land.

**Watershed Area and Demographics** The Rathbun Lake watershed includes slightly more than 354,000 acres. The six counties in the Rathbun Lake watershed are Appanoose (52,063 acres, 15% of the watershed), Clarke (15,500 acres, 4% of the watershed), Decatur (7,280 acres, 2% of the watershed), Lucas (90,997 acres, 26% of the watershed), Monroe (6,523 acres, 2% of the watershed) and Wayne (181,697 acres, 51% of the watershed). The six counties in the Rathbun Lake watershed are among the least prosperous in Iowa. These counties have some of 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 ten communities and an estimated 820 farms in the watershed. The majority of farms are family owned and operated. Almost all of the residents in the watershed rely on Rathbun Lake for their drinking water. Maps 1, 2, and 3 that accompany this plan identify features in the Rathbun Lake watershed, including the 12-digit hydrologic units and subwatersheds.

**Watershed Geology, Soils, and Climate** The landscape in the Rathbun Lake watershed is characterized by rolling uplands, integrated drainage, and occasional broad alluvial plains. Most soils in the watershed formed in loess, glacial till, or alluvium. A few of the soils formed in colluvium, eolian sand, or shale residuum. The majority of soils in the Rathbun Lake watershed have characteristics that limit their potential uses. This limitation arises from a prevalence of soils that are highly susceptible to erosion, shallow to root-restrictive zones, excessively wet, and inherently low in fertility. The climate in south central Iowa and the Rathbun Lake watershed is classified as humid continental. Winters are cold and summers are quite hot. The average temperature in the winter is 27 degrees Fahrenheit. The average temperature in the summer is 73 degrees Fahrenheit. Total annual precipitation averages 35 inches, of which nearly 70% usually falls in April through September. The average seasonal snowfall is 27 inches. The average length of a growing season is 160 days.

**RATHBUN LAKE AND WATERSHED cont.**

**Land Use in the Watershed** As indicated, Rathbun Lake's watershed encompasses approximately 354,000 acres. Table 1 presents current land use information for the watershed. One of the most significant aspects of land use in the Rathbun Lake watershed during the last decade in terms of potential impacts on water quality in the lake and its tributaries is the increase in acres used for row crop production. Since 2004, cropland in the watershed has increased by 36% or an estimated 38,700 acres. This increase in cropland has been associated with the conversion of approximately 22,100 acres of grassland as well as a decrease in land enrolled in the Conservation Reserve Program (CRP) by an estimated 16,600 acres from the program's peak acreage in 2006. Maps 4 and 5 that accompany this plan present land use information for the Rathbun Lake watershed.

**Table 1 Land Use in the Rathbun Lake Watershed (2013)**

	Cropland	Land in CRP	Grassland	Woodland	Other
Percent	41	9.5	24	16	9.5
Acres	146,226	33,500	83,591	57,405	33,619

In general, cropping patterns in the watershed consist of continuous corn and soybeans on land with slopes of less than nine percent and two to four years of row crops in rotation with four to six years of meadow on steeper land. Grassland consists primarily of cool season grasses which receive relatively limited intensive management. Woodland is comprised primarily of oak, hickory, eastern cottonwood, and silver maple. Woodland receives very little to no management.

There are approximately 450 livestock operations in the watershed. Most are beef cattle operations that rely primarily on pasture for grazing with little or no confinement of livestock. The remaining operations confine livestock in lots or buildings for at least a portion of the year. Activities of the few larger operations, concentrations of smaller operations, and any operations that impact land in proximity to rivers and streams are potential water quality concerns.

There are 13 publicly owned areas in the watershed consisting of more than 24,000 acres. Most notable are the Rathbun Lake Project Area, Honey Creek Resort State Park, Colyn Marsh Area, Bob White State Park, and the Lucas County Greenbelt Complex.

## **WATER RESOURCE CONCERNS AND IMPAIRMENTS**

**Iowa's 2012 Section 303(d) List of Impaired Waters** Rathbun Lake's main basin and three of the four principal arms of the lake as well as fifteen other water bodies and water body segments in the watershed are included on Iowa's 2012 Section 303(d) List of Impaired Waters. Rathbun Lake impairments are caused by algal and non-algal turbidity. The fifteen other water bodies and water body segments in the lake's watershed are impaired due to siltation, high ammonia levels, low dissolved oxygen, organic enrichment, and high bacteria levels. A number of these water bodies and water body segments are also included on the Section 303(d) list for not supporting their designated aquatic life uses, most often due to biological impairment. These biological impairments are likely associated with several of the identified physical and chemical impairments in these water bodies and water body segments. Several factors contributing to the impaired conditions in Rathbun Lake as well as these other water bodies and water body segments have been identified by past and ongoing watershed assessments and water quality monitoring activities. Principal factors identified are the large amounts of sediment and phosphorus carried in runoff to these impaired waters from land used primarily for row crop production in the watershed. Map 6 that accompanies this plan identifies water bodies in the Rathbun Lake watershed on Iowa's 2012 Section 303(d) List of Impaired Waters.

**Iowa's 2012 305(b) Water Quality Assessment** This DNR assessment indicates that Rathbun Lake and other water bodies and water body segments in the lake's watershed are impacted by agricultural nonpoint sources of water quality impairment. The assessment determined that water quality in Rathbun Lake's main basin and Chariton, South Fork, and Honey Creek Arms did not support or only partially supported their Class A (primary contact recreation) and Class B (aquatic life support) designated uses. Fifteen additional water bodies and water body segments in the Rathbun Lake watershed have been assessed as not supporting or only partially supporting one or more of their designated uses. These water bodies and water body segments include Bob White Lake; Chariton River; Chariton Creek; Dick Creek; Fivemile Creek; Honey Creek (2); Jackson Creek; Jordan Creek; Ninemile Creek; South Fork Chariton River; Walker Branch; West Jackson Creek; and Wolf Creek. Primary causes of impairment in Rathbun Lake identified in the assessment are algal and non-algal turbidity. The assessment identifies siltation, high ammonia levels, low dissolved oxygen, organic enrichment, and high bacteria levels as causes of impairment in the other water bodies and water body segments in the lake's watershed. The DNR has also identified Rathbun Lake and other water bodies in the lake's watershed as phosphorus-impacted due to the algal blooms, organic enrichment, aquatic vegetation, and turbidity that impair their water quality.

## **WATER RESOURCE CONCERNS AND IMPAIRMENTS cont.**

**Water Quality Monitoring Program and Analysis** The Alliance, in partnership with the Iowa DNR, ACOE, State Hygienic Laboratory, and Iowa State University (ISU), have conducted a cooperative water quality monitoring program in Rathbun Lake and the lake's tributaries since 1997. The annual program has consisted of at least monthly sample collection and field measurements taken at as many as 20 fixed monitoring sites in Rathbun Lake, its tributaries, and outlet in the Chariton River. In 2011, event-based automated sampling was added to the monitoring program to better quantify sediment and nutrient transport associated with heavy precipitation events. Water quality monitoring efforts during the last 16 years have captured several drought periods and multiple flood events, allowing the Alliance and its partners to better understand sediment and nutrient loading to Rathbun Lake. The Iowa DNR's Rathbun Lake and Watershed 2013 Monitoring Summary, which includes an analysis of long-term monitoring data, accompanies this plan. Additionally, map 7 that accompanies this plan identifies the locations of water quality monitoring sites in Rathbun Lake, tributaries in the lake's watershed, and the lake outlet in the Chariton River.

The primary purpose of the Alliance's and partners' water quality monitoring program is to provide the data required to evaluate water bodies in the Rathbun Lake watershed for Iowa's Section 303(d) List of Impaired Waters and Iowa's 305(b) Water Quality Assessment. Monitoring data in Rathbun Lake indicate high to extremely high levels of algal and non-algal turbidity, very poor to extremely poor water transparency, very high to extremely high levels of phosphorus, low to moderately high levels of chlorophyll-a, generally low levels of atrazine, and very low levels of nitrate. The trend in lake water quality based on long-term monitoring results for these parameters has been relatively stable, although recent data suggests an increase in non-algal turbidity, especially during the early spring months, that is most likely due to the expansion of cropland in the watershed. Rathbun Lake continues to experience periods of extreme turbidity, especially after large rainfall events in the watershed, and frequent algae blooms in the arms of the lake. Results from monitoring in Rathbun Lake's tributaries indicate high levels of phosphorus and sediment throughout the watershed, especially after heavy rains. Long-term monitoring data shows relatively little change in nutrient and suspended solids concentrations in the lake's tributaries in spite of the increase in cropland in the watershed. Recent monitoring efforts focused on sediment and nutrient loading during precipitation events have found that the highest concentrations of nutrients and suspended solids in Rathbun Lake and the lake's tributaries are associated with heavy rainfall in the watershed.

## **SOURCES OF WATER QUALITY IMPAIRMENT**

Watershed assessment findings and water quality monitoring results to date indicate that land in the Rathbun Lake watershed which is used for row crop production is the primary source of the sediment and phosphorus that impair water quality in Rathbun Lake and the lake's tributaries. Specifically:

**Sediment from Agricultural Land** The annual sediment load to Rathbun Lake and its tributaries from land in the watershed is currently estimated at 314,200 tons as determined by recent land use data and ongoing assessment efforts. The principal source of this sediment is the 83,800 acres of priority land in the watershed that is used for row crop production. The annual sediment delivery to Rathbun Lake and its tributaries from this priority land averages three tons per acre. One of the more significant assessment findings is that even though this priority land comprises just 24% of the Rathbun Lake watershed it is the source of 80%, or 252,100 tons, of the estimated 314,200 tons of sediment delivered annually to Rathbun Lake and the lake's tributaries from the watershed. Map 8 that accompanies this plan identifies priority land in the Rathbun Lake watershed.

**Phosphorus from Agricultural Land** Recent land use data and ongoing assessment activities also indicate that the annual phosphorus load to Rathbun Lake and its tributaries from land in the watershed is currently estimated at 1,234,800 pounds. Assessments have determined that almost all of the phosphorus carried in runoff from land in the Rathbun Lake watershed is sediment-bound. As such, the principal source of phosphorus in the watershed is the 83,800 acres of priority land. Annual phosphorus delivery to the lake and tributaries from priority land averages close to 12 pounds per acre. Total annual phosphorus delivery from this priority land is more than 990,800 pounds of the estimated 1,234,800 pounds of annual phosphorus loading to Rathbun Lake and the lake's tributaries from the watershed.

**Conversion of Land to Row Crop Production** Current assessment findings in terms of the acres of priority land in the Rathbun Lake watershed and the estimated sediment and phosphorus delivery to Rathbun Lake and its tributaries are based on analyses using 2013 land use data combined with up-to-date field information. These analyses found that cropland acres in the Rathbun Lake watershed have increased by 36% in the past decade. During this period, an estimated 38,700 acres of land in the watershed that was previously used for grassland or enrolled in CRP have been converted to row crop production. Assessment analyses determined that this conversion of land to row crops has expanded the acreage of priority land in the watershed in recent years by an estimated 27,400 acres from 56,400 acres to 83,800 acres. This expansion of priority land in the watershed is projected to increase the annual loading of sediment and phosphorus to the lake and its tributaries from this land by close to 50% to 252,100 tons of sediment and 990,800 pounds of phosphorus. In comparison, previous assessment efforts estimated that 173,100 tons of sediment per year and 675,100 pounds of phosphorus per year were carried in runoff to the lake and its tributaries from priority land in the watershed.

## **PROGRESS IMPLEMENTING ORIGINAL WATERSHED MANAGEMENT PLAN**

**Rathbun Land and Water Alliance** The Alliance and its partners coordinate and support efforts to protect land and water resources in the Rathbun Lake watershed. Alliance members include local soil and water conservation districts (SWCDs), county governments, and RRWA. Private, state, and federal partners include: Farm Bureau, CoBank, Iowa DNR, Iowa Department of Agriculture and Land Stewardship's Division of Soil Conservation (DSC), ISU, Iowa Watershed Improvement Review Board (WIRB), USDA Natural Resources Conservation Service (NRCS), US ACOE, and US Environmental Protection Agency (EPA). The Alliance is organized as a nonprofit corporation under Iowa Code Chapter 504 and section 501(c)(3) of the US Internal Revenue Code.

**Rathbun Lake Watershed Management Plan** In 2002, the Alliance completed a watershed assessment and developed management strategies as part of an approved Rathbun Lake watershed management plan. At that time, the Alliance's assessment was one of the most comprehensive analyses of its type for a watershed the size of Rathbun Lake's in Iowa. The assessment identified and prioritized agricultural nonpoint sources of water quality impairment in the watershed. Assessment results were used by the Alliance to develop water quality protection management strategies for the Rathbun Lake watershed that are being implemented in the Protect Rathbun Lake Project.

**Protect Rathbun Lake Project** The Alliance developed strategies in the original Rathbun Lake watershed management plan that identify and address the reduction of sediment and phosphorus delivery to Rathbun Lake as the overall goal of the Protect Rathbun Lake Project. The Alliance considered the application of best management practices (BMPs) for one-half of the priority land identified in the Rathbun Lake watershed during development of the original management plan, approximately 30,000 acres, to be an achievable and significant objective in pursuit of this goal. Accomplishment of this objective would reduce annual sediment and phosphorus delivery to Rathbun Lake and its tributaries by an estimated 90,000 tons and 360,000 pounds respectively. The Alliance originally estimated that achieving these objectives of installing BMPs for priority land and reducing sediment and phosphorus loading to Rathbun Lake and the lake's tributaries would require a minimum of 30 years and at least \$25 million.

**Development of Total Maximum Daily Load for Rathbun Lake** The Alliance and its partners, in particular the Iowa DNR, recently initiated activities that will lead to a thorough revision of the original Rathbun Lake watershed management plan. The Iowa DNR is guiding the Alliance and other partners in developing a Total Maximum Daily Load (TMDL) for Rathbun Lake. The results from expanded water quality monitoring in the lake and its tributaries combined with the collection of current field-level information from the watershed will be used to create and apply credible models to prepare a robust TMDL for the lake-watershed system. The Iowa DNR and Alliance expect the TMDL will be completed and receive approval of the US EPA by 2019. The TMDL will provide the Alliance with specific pollutant load allocations for sediment and phosphorus. This information from the TMDL will enable the Alliance and its partners to identify strategies that will reduce the loading of sediment and phosphorus to Rathbun Lake. The TMDL and these strategies will serve as the basis for preparing a new nine-element water quality improvement plan for the Rathbun Lake watershed. The Alliance and partners have completed this interim management plan to guide water quality protection activities in the Rathbun Lake watershed until completion of the TMDL and the new water quality improvement plan.

**PROGRESS IMPLEMENTING ORIGINAL WATERSHED MANAGEMENT PLAN cont.**

**Evaluation of Plan Implementation** Protect Rathbun Lake Project activities were initiated in 2004. During the first ten years of project activities, significant progress has been made toward implementation of project activities, achievement of project objectives, and accomplishment of the project’s overall goal to reduce the sediment and phosphorus carried in runoff to Rathbun Lake from priority land in the watershed. Specifically:

- Project activities are underway in 45 of the 61 targeted sub-watersheds in the Rathbun Lake watershed. Map 9 that accompanies this plan identifies targeted sub-watersheds in which the project is active. In addition, a series of 45 targeted sub-watershed maps that illustrate progress in planning and applying BMPs accompanies this plan;
- Assistance has been provided to 580 landowners which resulted in 330 of these landowners, a participation rate of nearly 60%, agreeing to apply BMPs for priority land;
- BMPs have been planned and applied for 23,000 total acres, more than 10,000 acres of which is priority land (33% of project objective) with the remaining considered associate priority land since, due to its location, it must also be treated to address the priority land;
- BMPs that have been planned and applied will reduce the delivery of sediment and phosphorus to Rathbun Lake and its tributaries by an estimated 42,000 tons and 179,000 pounds per year respectively (47% and 49% of project objectives);
- Assistance was provided to landowners and other partners to restore more than 1,500 acres of wetland, riparian, and shoreline areas that will benefit water quality in the lake;
- Water quality monitoring, geographic information system (GIS) analyses, and watershed outreach activities are conducted in support of efforts to achieve the project’s priority land treatment and sediment and phosphorus reduction objectives and goal; and
- Long-term monitoring data show that water quality in Rathbun Lake and its tributaries has been relatively stable. These results indicate that the targeted application of BMPs for priority land has helped prevent any significant deterioration in water quality caused by increased sediment and phosphorus loading that might have otherwise occurred given the expansion of cropland in the watershed.

Table 2 presents progress to date by Protect Rathbun Lake Project activities to reduce loading to the lake and its tributaries from priority land in the watershed.

**Table 2 Protect Rathbun Lake Project: Priority Land Load and Reduction Estimates**

	Tons of Sediment	Pounds of Phosphorus
Estimated Load from Priority Land (2013)	252,100	990,800
Estimated Load from Priority Land (2002)	173,100	675,100
Estimated Increase in Load from Priority Land (2002-2013)	79,000	315,700
Original Load Reduction Objectives	90,000	360,000
Estimated Load Reduction Accomplished	42,000	179,000
Percentage of Load Reduction Objectives Accomplished	47%	49%

## **PROGRESS IMPLEMENTING ORIGINAL WATERSHED MANAGEMENT PLAN cont.**

**Factors Supporting Plan Implementation** The progress achieved in reducing sediment and phosphorus delivery to Rathbun Lake and its tributaries coupled with relatively stable water quality conditions in spite of increased loading of these pollutants due to the expansion of cropland in the watershed lead the Alliance and its partners to conclude that the strategy pursued in implementing the Protect Rathbun Lake Project during the last ten years has been successful and should continue in the future. The Alliance considers the following to be key factors that support successful project implementation:

- **Adequate Financial Resources** Success in implementing project activities, achieving specific project objectives, and accomplishing the overall project goal requires a substantial and sustained commitment of resources by Alliance members and partners. As an indication of this level of support, more than \$12 million has been invested by partners, including cooperating landowners, to install BMPs since 2004;
- **Qualified Field Professionals** A highly qualified team of field professionals, as is currently in place, has been and will continue to be essential to successfully implement project activities and achieve the project's objectives and goal. At this time, professional field staff dedicated to the project includes two environmental specialists and one technician, all of whom are supported by local, state, and federal partners' personnel;
- **Emphasis on Structural BMPs** The Alliance has found that structural BMPs such as terraces combine important features which make these practices especially effective at reducing sediment and phosphorus delivery to Rathbun Lake and its tributaries. These features are strong levels of landowner interest and adoption, high trapping efficiencies, and consistent performance with little maintenance over a relatively long lifespan. In contrast, the Alliance's experience with non-structural BMPs such as no-till and cover crops has been that the application of these practices is affected by such factors as weather, input costs, crop prices, differences in farming operations, and changes in landowner decision-making. While field staff assist landowners with the application of non-structural BMPs, in terms of the project's implementation strategy, these practices are considered less effective over time in achieving the project objectives and overall goal for reduced sediment and phosphorus delivery to Rathbun Lake;
- **Targeting BMPs for Priority Land** Experience from the Protect Rathbun Lake Project demonstrates that the targeted application of BMPs for priority land is a cost effective strategy to reduce sediment and phosphorus delivery to the lake and its tributaries. The Alliance has determined that the average annual cost for the targeted application of BMPs on priority land is less than \$15 per ton of sediment reduced. In comparison, the average annual cost for applying BMPs on land that has not been identified as priority by targeting is estimated at more than \$34 per ton of sediment reduced. Given this, the Protect Rathbun Lake Project strategy that targets priority land for BMPs results in a cost to protect water quality in terms of reduced sediment and phosphorus delivery that is less than one-half of the cost of applying BMPs on land without targeting; and
- **Responsiveness of the "Supershed" Approach** The "supershed" approach approved and employed as part of the Protect Rathbun Lake Project strategy has allowed project activities to be implemented and expanded in a well-managed and purposeful manner across the watershed that is also highly responsive to opportunities to apply BMPs for priority land. Specifically, this approach enables project resources for BMP application to be directed to any of the targeted sub-watersheds in response to such conditions as increases in priority land due to the conversion of land to row crops and changes in land ownership or operation that lead to greater interest in applying BMPs for priority land.

## **INTERIM RATHBUN LAKE WATERSHED MANAGEMENT PLAN**

**Project Description** The overall goal of the Protect Rathbun Lake Project under the interim watershed management plan will continue to be the reduction of sediment and phosphorus delivery to Rathbun Lake. The interim plan will guide water quality protection activities in the Rathbun Lake watershed for the five-year period from 2014 to 2019. During this five-year period, the Alliance plans to continue to implement the strategy which has proven to be effective during the initial ten years of the Protect Rathbun Lake Project, that is, work with landowners to achieve the targeted application of BMPs for priority land in the Rathbun Lake watershed. The application of BMPs for this priority land will reduce annual sediment and phosphorus delivery to Rathbun Lake and its tributaries. Project activities will continue in the 45 active targeted sub-watersheds and expand into the remaining sub-watersheds during the five-year period of the interim management plan.

**Element 1 Causes and Sources** BMPs will be applied for 5,000 total acres in the Rathbun Lake watershed during the five-year interim watershed management plan. Approximately 2,500 acres will be priority land with the balance considered associate priority land. An estimated 1,500 acres of this priority land will be located in the 45 active sub-watersheds while 1,000 acres of the priority land will be in the 13 remaining sub-watersheds. Three sub-watersheds in the Rathbun Lake watershed that will not be targeted due to the location of water bodies at their outlets are the Bob White Lake, Humeston Reservoir, and West Lake sub-watersheds. A series of maps that identify priority land in need of BMPs in the 13 remaining sub-watersheds in the Rathbun Lake watershed accompany this interim plan.

**Element 2 Load Reductions** During the interim watershed management plan period, the BMPs applied to address 2,500 acres of priority land and 2,500 acres of associate priority land in 58 targeted sub-watersheds will reduce annual sediment and phosphorus delivery to Rathbun Lake by an estimated 7,500 tons and 30,000 pounds respectively. This additional reduction in loading to Rathbun Lake accomplished during the interim plan period will achieve 55% and 58% of project's original objectives for the reduced delivery of sediment (will reach 49,500 tons reduced out of the 90,000 tons objective) and phosphorus (will reach 209,000 pounds reduced out of the 360,000 pounds objective) respectfully.

**Element 3 Management Measures** The BMPs that will be applied for 5,000 acres of priority and associate priority land in the Rathbun Lake watershed as well as the supporting activities to be implemented during the interim plan are described below. The Alliance's implementation strategy for the Protect Rathbun Lake Project emphasizes the application of structural BMPs such as terraces and water and sediment control basins. As indicated, the Alliance has found that structural BMPs combine features which make these practices highly effective at reducing sediment and phosphorus delivery to Rathbun Lake and its tributaries from the watershed. These structural practice features include strong levels of landowner adoption, high trapping efficiencies, and consistent performance over a relatively long lifespan. At the same time, Alliance partners' field staff will also assist landowners with non-structural BMPs such as no till and cover crops. Most of these BMPs are not, however, central to the Alliance's project implementation strategy due to factors which cause the application and effectiveness of these practices to be variable over time such as weather, input costs, crop prices, differences in farming operations, and changes in landowner decision-making. The Alliance and partners will ensure that all BMPs applied comply with NRCS Standards and Specifications (S&S), practices are maintained by landowners as per agreements with SWCDs, and any required permits are obtained:

## **INTERIM RATHBUN LAKE WATERSHED MANAGEMENT PLAN cont.**

### **Element 3 Management Measures cont.**

- Technical Assistance - The interim plan proposes continuation of the current staff of two Environmental Specialists and one Technician assigned to the project.
- Terraces (NRCS S&S 600) – Terrace systems will be constructed for 3,000 acres. Terrace trapping efficiency for sediment and sediment-bound phosphorus is estimated by NRCS at 95%.
- Debris Basins (NRCS S&S 350) - Debris basins will be constructed for 300 acres. Debris basin trapping efficiency for sediment and sediment-bound phosphorus is estimated by NRCS at 90%.
- Grade Stabilization Structures (NRCS S&S 410) – Grade stabilization structures will be constructed for 700 acres. Grade stabilization structure trapping efficiency for sediment and sediment-bound phosphorus is estimated by NRCS at 90%.
- Water and Sediment Control Basins (NRCS S&S 638) – Water and sediment control basins will be constructed for 800 acres. Water and sediment control basin trapping efficiency for sediment and sediment-bound phosphorus is estimated by NRCS at 95%.
- Priority Land Conversion (NRCS S&S 512) – Two hundred acres of priority and associate priority land used for row crop production will be converted to grassland. According to NRCS estimates, the conversion of land used for row crop production to grassland for pasture or hay reduces soil erosion on that land by more than 85%. As a result, this conversion of cropland to grassland reduces potential sediment and sediment-bound phosphorus delivery by an estimated 85%. In addition, NRCS also estimates that grassland has an average trapping efficiency of 50% which can reduce the delivery of sediment and sediment-bound phosphorus from adjacent cropland depending on the relative location of these two land uses.
- Improved Grazing Practices (NRCS S&S 528) - Improved grazing practices will be applied on 60 acres grassland converted from row crops. Practices will include rotational grazing, fencing, trough or tank, pipeline, and heavy use protection. Fencing will be installed to ensure that livestock are excluded or restricted from any areas adjacent to water bodies. The application of improved grazing practices can provide the operational infrastructure necessary for the long-term use of land as pasture. As a result, improved grazing practices can help to ensure that land converted from row crop production to grassland remains in use as pasture for extended periods of time. In other words, grassland on which improved grazing practices are applied is less likely to be converted back to row crop use than grassland on which an investment in these practices has not been made. In terms of water quality protection, the potential long-term reduction in sediment and sediment-bound phosphorus delivery from grassland with improved grazing practices is greater than from grassland without these practices.

**INTERIM RATHBUN LAKE WATERSHED MANAGEMENT PLAN cont.**

**Element 4 Technical and Financial Assistance** Implementation of project activities during the five-year interim management plan will require an estimated investment of \$5,455,740. The principal uses and sources of these funds are described below:

- Technical Assistance – An estimated \$1,308,940 to support two Environmental Specialists and one Technician assigned to the project. This amount will be comprised of \$1,065,710 from the Section 319 Program and \$243,230 from the DSC and Alliance.
- Terraces – An estimated \$1,890,000 to construct terrace systems for 3,000 acres. This amount will be comprised of \$472,500 from cooperating landowners, \$708,750 from the Section 319 Program, and \$708,750 from NRCS, DSC, and Alliance.
- Debris Basins – An estimated \$180,000 to construct debris basins for 300 acres. This amount will be comprised of \$18,000 from cooperating landowners, \$150,000 from the Section 319 Program, and \$12,000 from the Alliance.
- Grade Stabilization Structures – An estimated \$515,200 to construct structures for 700 acres. This amount will be comprised of \$128,800 from cooperating landowners, \$193,200 from the Section 319 Program, and \$193,200 from NRCS, DSC, and Alliance.
- Water and Sediment Control Basins – An estimated \$672,000 to construct basins for 800 acres. This amount will be comprised of \$168,000 from cooperating landowners, \$252,000 from the Section 319 Program, and \$252,000 from NRCS, DSC, and Alliance.
- Priority Land Conversion – An estimated \$50,000 to convert 200 acres of priority and associate priority land to grassland. This amount will be comprised of \$10,000 from landowners, \$20,000 from the Section 319 Program, and \$20,000 from NRCS.
- Improved Grazing Practices – An estimated \$11,400 to apply improved grazing practices on 60 acres of grassland converted from row crops. This amount will be comprised of \$5,700 from cooperating landowners and \$5,700 from NRCS and Alliance.
- GIS Analysis – An estimated \$20,800 for assistance from a GIS specialist to help plan, select, and evaluate the effectiveness of BMPs to reduce sediment and phosphorus delivery to the lake and its tributaries. This amount will be provided by the Alliance.
- Water Quality Monitoring – An estimated \$637,400 for water quality monitoring activities as indicated in Element 9 of this plan. This amount will be comprised of \$60,000 from the Section 319 Program, and \$577,400 from the ACOE, DNR, and Alliance.
- Information and Education – An estimated \$170,000 to implement the Rathbun Lake Protectors outreach activities described in Element 5 of this plan. This amount will be comprised of \$85,000 from the Section 319 Program and \$85,000 from the Alliance.

Table 3 presents a summary of sources of technical and financial assistance required to implement project activities during the five-year interim watershed management plan.

**Table 3 Summary of Sources of Assistance for Interim Plan Implementation**

Section 319 Program	Cooperating Landowners	Other Federal and State Partners	Local Partners	Total Investment
\$2,534,660	\$803,000	\$1,792,915	\$325,165	\$5,455,740

## **INTERIM RATHBUN LAKE WATERSHED MANAGEMENT PLAN cont.**

**Element 5 Information and Education** Alliance members and partners will continue to implement information and education activities through the Rathbun Lake Protectors watershed outreach program as part of the interim watershed management plan. The program's principal target audience is landowners who own and/or farm priority land in the Rathbun Lake watershed. The program's goal is to motivate these landowners to apply BMPs on this land to protect and improve water quality in Rathbun Lake and the lake's tributaries.

The Alliance and partners conducted a survey of landowners in the Rathbun Lake watershed as a companion effort to the original Rathbun Lake watershed management plan. The primary purpose of the survey was to understand landowners' perspectives on land use and farming practices in the watershed. Key findings that influenced the Protect Rathbun Lake Project and watershed outreach activities included: (a) a majority of landowners considered face-to-face contact as the most effective means of obtaining technical assistance; (b) more than three-quarters of the landowners identified soil erosion as the most important resource concern on the land they farmed; (c) almost half of the landowners were interested in adopting better conservation practices on their land; (c) three-quarters of the landowners agreed that water contamination was a concern in the Rathbun Lake area; and (d) a majority of landowners agreed that better conservation practices would improve water quality in Rathbun Lake. The Alliance proposes to conduct a follow-up landowner survey in conjunction with the development of the new nine-element water quality improvement plan for the Rathbun Lake watershed.

The Rathbun Lake Protectors watershed outreach program emphasizes one-on-one contacts between project field staff and landowners through farm visits. During these visits, field staff communicates information to landowners about the priority land that they own and/or farm, and helps them evaluate and complete the installation of BMPs that will reduce the impact on water quality of row crop production on this land. A cornerstone activity of the outreach program is the recognition of selected landowners as Rathbun Lake Protectors for their stewardship, and the accompanying promotion of their efforts in hopes of encouraging others to take similar actions to protect water quality in Rathbun Lake. Specific outreach activities include: (a) public recognition of six to ten landowners as Rathbun Lake Protectors at the Alliance's annual Protect Rathbun Lake meeting; (b) annual maintenance of existing and placement each year of as many as ten new on-farm Rathbun Lake Protector signs; and (c) four WHO radio interviews and four features in Wallaces Farmer magazine annually that highlight the stewardship efforts of Rathbun Lake Protectors. Complementary outreach activities include: (d) at least two watershed field days, workshops, and tours for landowners and others each year; (e) annual maintenance of existing and placement each year of as many as two new roadside signs to encourage BMP application; (f) at least two Protect Rathbun Lake Project presentations and displays at local and state events; (g) as many as four project related features in local print, radio, and television media each year; and (h) ongoing maintenance and development of the Alliance's Internet site [www.rlwa.org](http://www.rlwa.org) which has received an estimated 9,000 pageviews to date. The Alliance tracks the percentage of landowners who own and/or farm priority land that apply BMPs for this land as the principal means of evaluating the effectiveness of outreach activities. To date, close to 60% of the landowners who own and/or farm priority land in active sub-watersheds have agreed to apply BMPs for this land. In addition, the Alliance asks participants at the annual meeting, field days, and workshops to complete written evaluations of outreach activities. The Alliance and partners contract for assistance from an outreach specialist to help plan, carry out, and evaluate the Rathbun Lake Protectors watershed outreach program.

**INTERIM RATHBUN LAKE WATERSHED MANAGEMENT PLAN cont.**

**Element 6 Schedule** Activities of the interim Rathbun Lake watershed management plan will be implemented over a five-year period from 2014 through 2019. The proposed date to initiate activities in the plan is October 1, 2014. The schedule presented below reflects the implementation strategy successfully employed during the initial ten years of the Protect Rathbun Lake Project which emphasizes the application of structural BMPs for priority land in the watershed. In order to accommodate farming operations, the application of structural BMPs is primarily concentrated during the pre-planting (early spring) and post-harvest (late fall and early winter) periods each year. Assistance to landowners and supporting activities are, for the most part, carried out through the year.

Major Activities <sup>a</sup>	Y1 Q1	Y1 Q2	Y1 Q3	Y1 Q4	Y2 Q1	Y2 Q2	Y2 Q3	Y2 Q4	Y3 Q1	Y3 Q2	Y3 Q3	Y3 Q4	Y4 Q1	Y4 Q2	Y4 Q3	Y4 Q4	Y5 Q1	Y5 Q2	Y5 Q3	Y5 Q4	
Assist landowners plan and apply BMPs	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Install terrace systems	X		X		X		X		X		X		X		X		X		X		
Construct debris basins									X		X		X		X		X		X		
Construct grade stabilization structures	X		X		X		X		X		X		X		X		X		X		
Construct water/sediment control basins	X		X		X		X		X		X		X		X		X		X		
Priority land conversion	X		X		X		X		X		X		X		X		X		X		
Apply improved grazing practices					X		X		X		X		X		X		X		X		
GIS analysis to plan and evaluate BMPs	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Conduct water quality monitoring	X		X	X	X		X	X	X		X	X	X		X	X	X		X	X	
Perform information/education activities	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Alliance and partner meetings	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Submit workplans and reports	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
TMDL Development	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					
Preparation of new nine-element water quality improvement plan																		X	X	X	X

<sup>a</sup> As indicated, project activities will continue in the 45 active targeted sub-watersheds and expand into the remaining sub-watersheds during the five-year period of the interim management plan. As planned, project activities will expand into two to three of the remaining sub-watersheds each year. The total acres of priority land in need of BMPs in each of the remaining sub-watersheds will be used to determine the order in which project activities are expanded into these sub-watersheds.

## **INTERIM RATHBUN LAKE WATERSHED MANAGEMENT PLAN cont.**

**Element 7 Milestones** Success in implementing Protect Rathbun Lake Project activities during this five-year interim watershed management plan will be assessed in terms of the number and type of BMPs applied as well as the completion of supporting activities. Specific progress milestones will include:

- Technical Assistance - The current team of professional field staff comprised of two Environmental Specialists and one Technician will be assigned to the project during the five-year interim plan period.
- Terraces - A total of 300,000 feet of terraces will be installed during the five-year interim plan period. An average of 60,000 feet of terraces will be installed each year.
- Debris Basins - Three debris basins will be constructed by the end of the five-year interim plan period.
- Grade Stabilization Structures - Twenty-eight structures will be constructed during the five-year interim plan period. At least five or six structures will be completed each year.
- Water and Sediment Control Basins - A total of 200 basins will be constructed during the five-year interim plan period. An average of 40 basins will be installed each year.
- Priority Land Conversion - A total of 200 acres will be converted from row crops to grassland during the five-year interim plan period. An average of 40 acres will be converted annually.
- Improved Grazing Practices - Improved grazing practices will be applied on a total of 60 acres of grassland converted from row crop production by the end of the five-year interim plan period.
- GIS Analysis - GIS analysis will be performed as needed during the five-year interim plan period to help plan, select, and evaluate the effectiveness of BMPs to reduce sediment and phosphorus delivery to the lake and its tributaries.
- Water Quality Monitoring - Annual water quality monitoring activities will continue to be conducted during the five-year interim plan period as indicated in Element 9. Monitoring results will be used to develop a TMDL for Rathbun Lake as well as to evaluate the lake and other water bodies in the lake's watershed for Iowa's Section 303(d) List of Impaired Waters and Iowa's 305(b) Water Quality Assessment.
- Information and Education – Rathbun Lake Protectors watershed outreach program activities will continue to be implemented during the five-year interim plan period. These activities described in Element 5 of this plan will include one-on-one assistance to landowners; landowner recognition; project signage; annual meeting; tours, field days, workshops, presentations, and displays; television, radio, and print media coverage; and the Alliance's Internet site.
- TMDL and Water Quality Improvement Plan – Alliance and partners will complete the development of a TMDL for Rathbun Lake and the preparation of a new nine-element water quality improvement plan for the Rathbun Lake watershed.

## **INTERIM RATHBUN LAKE WATERSHED MANAGEMENT PLAN cont.**

**Element 8 Criteria** Progress in achieving the Protect Rathbun Lake Project's objectives for reduced loading to the lake during this interim watershed management plan will be based on the estimated reduction in sediment and phosphorus delivery that result from the application of BMPs. The Alliance and its partners will continue to combine GIS analysis with the Sediment Delivery Calculator and related models such as the Soil Erosion and Sediment Delivery Procedure to estimate the impact of BMPs in terms of reduced sediment and phosphorus loading. Estimated load reductions for planned BMPs are:

- **Terraces** – The installation of 300,000 feet of terraces for 3,000 acres will reduce the annual delivery of sediment and phosphorus to the lake and tributaries by an estimated 4,500 tons and 18,000 pounds respectively.
- **Debris Basins** – The construction of three debris basins for 300 acres will reduce the annual delivery of sediment and phosphorus to the lake and tributaries by an estimated 450 tons and 1,800 pounds respectively.
- **Grade Stabilization Structures** – The construction of 28 structures for 700 acres will reduce the annual delivery of sediment and phosphorus to the lake and tributaries by an estimated 1,050 tons and 4,200 pounds respectively.
- **Construct Water and Sediment Control Basins** – The construction of 200 basins for 800 acres will reduce the annual delivery of sediment and phosphorus to the lake and tributaries by an estimated 1,200 tons and 4,800 pounds respectively.
- **Priority Land Conversion** – The conversion of 200 acres of priority and associate priority land from row crops to grassland will reduce the annual delivery of sediment and phosphorus to the lake and tributaries by an estimated 300 tons and 1,200 pounds.

This total estimated reduction in annual sediment load of 7,500 tons and annual phosphorus load of 30,000 pounds from the watershed as a result of these BMPs is projected to benefit water quality in Rathbun Lake by achieving an estimated two percent decrease in the average total suspended solids and phosphorus concentrations as well as in the median trophic state index values for Secchi depth and total phosphorus in the lake.

**Element 9 Monitoring** Annual water quality monitoring in Rathbun Lake and its tributaries will continue during the five-year interim plan period. Monitoring will consist of at least monthly and event sample collection and analysis as well as field measurements from up to 20 fixed sites in Rathbun Lake, its tributaries, and outlet in the Chariton River. The Iowa DNR's Rathbun Lake and Watershed 2013 Monitoring Summary, which describes the monitoring program and includes an analysis of monitoring data, accompanies this plan. The results from water quality monitoring will be used to develop a TMDL for Rathbun Lake as well as continue to provide data to evaluate the lake and other water bodies in the lake's watershed for Iowa's Section 303(d) List of Impaired Waters and Iowa's 305(b) Water Quality Assessment. Accomplishment of the Protect Rathbun Lake Project's overall, long-term goal of reducing sediment and phosphorus delivery to Rathbun Lake is expected to lead to monitoring results which will, in the future, support the removal of sediment and phosphorus-related causes of impairment in the lake. In terms of evaluating the effectiveness of BMPs implemented during the five-year interim watershed management plan at reducing sediment and phosphorus loading to the lake, as indicated above, near-term monitoring is expected to find that water quality in Rathbun Lake has improved as measured by a decrease of an estimated two percent in the average total suspended solids and phosphorus concentrations and in the median trophic state index values for Secchi depth and total phosphorus in the lake.

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