SECTION 319 NONPOINT SOURCE POLLUTION CONTROL PROGRAM

WATERSHED PROJECT FINAL REPORT

RED RIVER BASIN RIPARIAN PROJECT
PHASE II

BY

David B. Rush, Environmental Projects Coordinator
Red River Resource Conservation and Development Council
Red River Regional Council

This project was conducted in cooperation with the State of North Dakota and the United States Environmental Protection Agency, Region VIII.

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RED RIVER BASIN RIPARIAN PROJECT PHASE II

EXECUTIVE SUMMARY

Project Start Date: March 1, 1998 Project Completion Date: June 30, 2003

Funding:	Total Budget:	$2,766,410
	Total EPA Section 319 Grant:	$1,659,846
	Total Expenditures of EPA Section 319 Funds:	$1,532,797
	Total Nonfederal Match Accrued:	$1,021,865
	Section 319 Funding Revisions:	*($ 127,049)
	Total Expenditures:	$2,554,662

*The Section 319 funding revisions represent the unexpended Section 319 funds at the end of the project. These funds will be used to support Phase III of the Red River Basin Riparian Project (RRBRP).

Summary of Accomplishments:

Phase II of the RRBRP was an expansion of Phase I and built on the initial program's successes. Phase II focused on implementing the restoration of riparian areas in continuous river reaches in selected areas of the basin as identified by local stakeholders (county water boards, watershed districts, and landowners). This project was the first large-scale, coordinated effort in the region to improve water quality through the reestablishment and improvement of riparian corridors. The two primary goals of Phase II were 1) to influence land management choices in the Red River Basin that improve forest condition, protect water resources, and improve water quality and 2) to restore riparian corridors on continuous reaches of rivers and streams within the basin using established and revised best management practices (BMPs). The project sponsors also identified six additional goals that guided the project through 5 years of implementation. The primary goals were met through the development of 341 Riparian Forest Management Plans for over 28,000 acres and the restoration of 74 miles of riparian zone. The six additional goals were met to varying degrees with shortfalls in accomplishment being attributed to lack of landowner interest, administrative delays, and a shortage of local cost-share for engineering and implementation. Through riparian zone restoration and development of management plans for riparian forests, the RRBRP has directly assisted in restoring and protecting the beneficial uses of rivers in

the Red River Basin, thereby helping to implement North Dakota's Nonpoint Source (NPS) Management Plan. The RRBRP also supports the NPS Program's Information/Education Goals by working to inform decision makers, natural resource managers, and landowners of the importance of proper riparian zone management and the value of healthy river systems.

RED RIVER BASIN RIPARIAN PROJECT PHASE II

1.0 INTRODUCTION

The Red River Basin Riparian Project (RRBRP) was established in 1993 to address nonpoint source pollution from agricultural practices adjacent to the tributaries and main stem of the Red River of the North. The focus of the project was to influence land management choices in the Red River Basin that improve forest condition, protect water resources, and improve water quality; to restore riparian corridors on continuous reaches of rivers and streams within the basin using established and revised BMPs; and to protect existing and restored riparian zones from destructive activities. The Red River Resource Conservation and Development (RC&D) Council and the Red River Regional Council (RRRC) initiated the project in response to reports of degraded water quality and aquatic habitat in the Red River Watershed.

U.S. Environmental Protection Agency (EPA) reports, such as the National Water Quality Inventory: 1998 Report to Congress (1998, 305(b) Report), indicated that nearly 300,000 miles of rivers and streams in 49 of 50 states are identified as impaired for one or more uses. Nonpoint source pollution was considered to be the leading cause of impairment with 60% of streams and rivers impaired by agriculture (EPA, 1998). The leading pollutants of surface waters included siltation, pathogens, and nutrients (EPA, 1998). Throughout the assessed watersheds, 70%–90% of natural riparian ecosystems were found to be degraded or missing entirely because of human activities (EPA, 1998).

In the 1993 North Dakota Nonpoint Source Pollution Management Program Report (NDDH, 1993), it was stated that all rivers, streams, and lakes assessed within the state are impacted to some degree by nonpoint source pollution. In addition, in several of the Priority Watershed Programs, the need for implementation of best management practices (BMPs) to restore riparian areas for improved water quality was identified. In eastern North Dakota, stream bank modification/destabilization was identified as a priority concern as early as 1988 in the North Dakota Nonpoint Source Assessment Report (NDDH 1988).

Although riparian buffers in eastern North Dakota currently comprise less than 2% of watershed areas, the project sponsors believed that existing forest buffers were strategically located along major rivers, streams, and drainages and could be increased through proper management procedures and selected riparian vegetation plantings. Many riparian areas in eastern North Dakota watersheds had been mismanaged and degraded or destroyed over the last 50 years because of overgrazing, agricultural and urban encroachment, and indiscriminate logging. At the time the Riparian Project was initiated, the North Dakota Water Quality Assessment 1996–1997: The Section 305(b) Report to the Congress of the United States (NDDH, 1998) documented that 1200 river and stream miles in the Red River Basin partially support aquatic life. In an additional 1800 miles, aquatic life was reported to be threatened. Statewide, 2800 river miles

were moderately impacted by grazing use. Riparian vegetation was estimated to have been cleared from another 300 river miles in the state.

Prior research had established that healthy riparian corridors provide significant benefits to a watershed (Schlosser and Karr, 1981; Peterjohn and Correll, 1984; Naiman et al., 1993; Castelle et al., 1994). Riparian zones filter and store sediment, nutrients, pesticides, and metals from upland surface and groundwater through infiltration, filtering, uptake, and transformation. The width necessary for filtering sediment from surface runoff is a function of water velocity and particle size. Infiltration, uptake, and chemical transformations are dependent on soil properties and land slope, as well as on species and density of vegetation. Typical widths for the riparian buffers are from 60 to 200 feet. Riparian zones also control the hydrodynamic interaction of the stream with the adjacent uplands, stabilizing stream banks, moderating flood discharges, and improving groundwater recharge. Riparian areas or ecotones also support high biological diversity and productivity of vegetation, mammals, birds, and fish.

During Phase II, which began in 1998, the Red River Basin Riparian Project has worked to improve the health of riparian areas in the Red River Basin. In 5 years of operation, over 74 miles of riparian area were restored and stream banks stabilized. Restoration activities ranged from tree planting to bank reshaping and bioengineering. In Phase II, 341 Forest Resource Management Plans were developed for over 28,000 acres in the watershed. In addition, the project worked directly with the Natural Resources Conservation Service (NRCS) and other cooperating agencies to assist in the implementation of over $1.5 million in conservation easements and the establishment of BMPs. Locations of Riparian Project activities in the basin are displayed in Figure 1. Interest from landowners requiring assistance with their riparian areas has continued to grow, with the project addressing over 350 requests during the 5 years of operation.

The Riparian Project also worked to influence land management choices and increase local resource managers', landowners', and general public awareness about the importance of riparian areas to the health of our river system. This was accomplished through the establishment of eight demonstration sites, hosting six workshops and training sessions, publishing five articles, and leading seven tours of project sites. The North Dakota Forest Service (NDFS) hosted landowner information meetings along priority reaches to increase awareness and interest. The project also purchased, in cooperation with NRCS's EQIP program, a stream table that was presented at schools, eco-education camps, conferences, and agricultural shows throughout the Red River Basin and North Dakota.

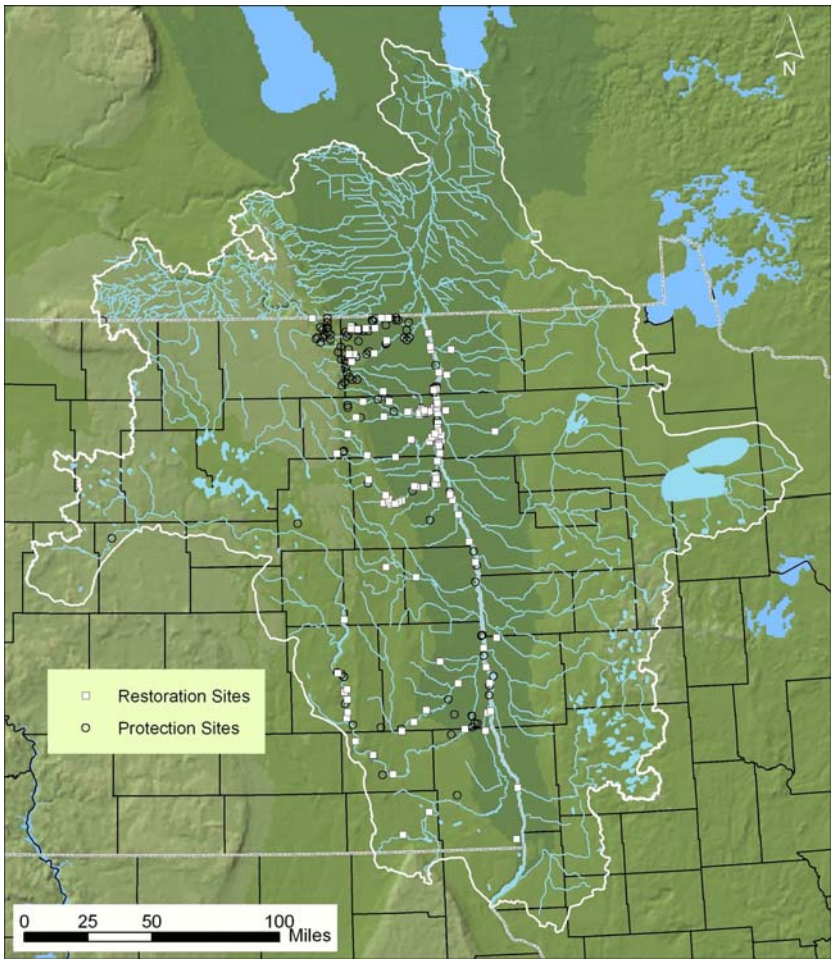

Figure 1. Locations of Riparian Project Phase II Activities.

2.0 PROJECT GOALS AND OBJECTIVES

Goals

The Phase II program was proposed as an expansion of Phase I and builds on the initial program's successes. Phase II of the Red River Basin Riparian project implemented the restoration of riparian areas in continuous river reaches in selected areas of the basin as identified by local stakeholders (county water boards, watershed districts, and landowners). This project was the first large-scale, coordinated effort in the region to improve water quality through the reestablishment and improvement of riparian corridors.

The two primary goals of Phase II of the Red River Basin Riparian Project were 1) to influence land management choices in the Red River Basin that improve forest condition, protect water resources, and improve water quality and 2) to restore riparian corridors on continuous reaches of rivers and streams within the basin using established and revised BMPs.

The project sponsors also identified six additional goals that guided the project through 5 years of implementation. All eight of the project goals are listed below with a brief description.

1. **Influence land management choices in the watersheds of the basin that improve forest condition, protect water resources, and improve water quality.** The purpose of this goal was to educate landowners, natural resource managers, and policy makers on how their management decisions and implemented practices affect the health of the Red River Basin. The project sponsors believed that this was a necessary first step toward achieving long-term improvements in riparian condition and water quality in the Red River and its tributaries. Project staff and partners developed information and education materials on the benefits of riparian areas and proper riparian management, held information and training workshops on riparian management and restoration, developed brochures and wrote articles for local publications, and made presentations to all types of stakeholders from school children to water resource districts.

2. **Restore a minimum of 100 river miles during the 5-year project term.** This goal involved the active restoration of degraded riparian areas, stabilization of stream banks and channels, and enhancement of existing riparian forests using current and revised techniques and BMPs.

3. **Establish up to eight additional demonstration sites in the Red River Basin.** With the success of the four demonstration sites in Phase I, the project sponsors felt that additional sites would be needed to continue to educate landowners and promote proper riparian management throughout the Red River Basin. Eight demonstration sites were established to showcase different riparian restoration techniques, demonstrate riparian restoration in different settings in the Red River Basin, and provide education and informational opportunities at the local level. Furthermore, these sites were strategically located throughout the basin to allow maximum exposure to interested stakeholders, including the public.

4. **Coordinate the delivery of multiple programs involving riparian management by combining efforts of the project sponsors and contributing agencies.** This goal was identified so that the Riparian Project did not create parallel or conflicting programs for riparian conservation with existing programs run through other agencies. This directive encouraged the project to cooperate with NRCS, Farm Service Agency, and the North Dakota Game and Fish Department in implementing conservation practices on privately owned lands.

5. **Provide direct assistance to landowners and communities in managing riparian areas.** This goal directly relates to Goals II and VIII and represents the connection between the projects main goals and on-the-ground management.

This goal was accomplished through project staff meeting with landowners and community officials to assist them technically and financially with restoration and management of their riparian areas.

6. **Utilize existing GIS technology and capabilities for data handling and presentation, for assessing needs, planning management techniques, and for monitoring changes in the riparian areas.** The purpose of this goal was to use emerging technologies to guide and track project progress. Geographic information systems (GIS) coverages for spatial data developed and acquired during Phase II will facilitate the planning of operations during Phase III. This technology was primarily used in Phase II to track the progress of riparian management and restoration in the basin.

7. **Increase awareness and expertise of resource managers, policy makers, and landowners.** To reach the two primary goals of the project, the sponsors saw the need to educate basin stakeholders on the benefits of healthy riparian areas, the current conditions of those areas in the Red River Basin, and what could be done to improve those conditions. This goal was accomplished through the information and education activities of the Riparian Project that included hosting five workshops, development of informational pamphlets, conducting site tours, and maintaining a project Web site. (http://www.health.state.nd.us/rrbrp).

8. **Produce 300 management plans representing 30,000 acres in priority areas, outlining forest management practices aligned with NDFS Best Management Practices.** This goal was primarily the responsibility of the Riparian Project's main partner and subcontractor, the NDFS. Riparian Forest management plans were compiled after an assessment of the landowner's objectives, condition of the resource, and consultation with a variety of professional resource managers to align the most appropriate prescriptions to address the need. The NDFS exceeded the goal of 300 management plans by 41 and nearly reached the number of planned acres (28,130 acres).

Objectives and Tasks

To achieve the goals described above, the RRBRP project sponsors developed five objectives and 32 tasks. The objectives fit into three categories: 1) project administration, 2) implementation of restoration and management, and 3) information and education. Many of the subsequent tasks are mundane and administrative, however, most have specific measurable outcomes associated with them. The section below outlines the objectives and tasks and provides detail about the accomplishments and outputs as they relate to the project goals.

Objective 1. *Establish and maintain an advisory committee and project staff to manage the project, coordinate efforts with local entities, and facilitate delivery of assistance available through the project.*

Task 1. *Utilize staff within the Red River Regional Council to coordinate local meetings, manage subcontracts, track expenditures and progress, and facilitate project implementation.*

Linda Kingery served as the initial project manager. In January of 2001, David Rush assumed responsibility as project coordinator. Since the beginning of the project, the Red River RC&D committee and the RRRC have overseen project implementation and expenditures. The RRRC provided two staff persons for administrative assistance with the grant.

Task 2. *Expand existing Riparian Advisory Committee (RAC) to assist the sponsors with the delivery and management of the project. This committee will be composed of members with expertise in forestry, range management, hydrology, engineering, wetlands, and water quality.*

At the onset of Phase II, the RAC, consisting of 21 members, was formed and met approximately 10 times annually. Information and Education (I&E), Site Management, and BMP/Monitoring subcommittees directed activities in their respective areas. The RAC included local water resource board and soil conservation district members; state agency representatives from the NDFS, North Dakota Department of Health (NDDH), North Dakota State Water Commission (NDSWC), North Dakota Game and Fish, North Dakota Department of Transportation, Minnesota Department of Natural Resources (MN DNR), Dakota Science Center; NRCS personnel from area and state offices, RC&Ds, and field offices. Personnel from the University of North Dakota's (UND's) Geology and Geological Engineering Department and the Energy & Environmental Research Center (EERC) serve on the RAC to provide expertise in engineering, GIS, graphic design, hydrology, and data handling. The project coordinator also possesses expertise in hydrology and water quality.

As the project progressed through 2000, the RAC decided to meet once every 2 months or as needed to approve site management applications and monitor progress of the project. It was determined that the three subcommittees, I&E, Site Management, and Monitoring, would meet at least once a month and on the same day as full-advisory committee meetings. At the December 2001 RAC meeting, the group decided to continue to meet every other month with subcommittees meeting monthly.

Task 3. *Conduct preliminary and follow-up meetings with local stakeholders (resource managers, soil and water conservation boards) to update them on the project and obtain input on the delivery of the project within their area.*

In addition to accepting requests from any interested landowner, project staff met with county water resource boards, soil conservation district

boards, and city councils. During the project period, personnel from the NDFS, RRRC, NRCS, and local water resource boards met with landowners from the Turtle River Watershed, the Lower Sheyenne River Watershed, and the Cole Creek Watershed. The project has also been directly cooperating with Barnes County, Walsh County, Grand Forks County, and Richland County to enhance NRCS restoration activities. Many communities in the Red River Basin requested assistance with their river corridors including Wahpeton, Drayton, Cavalier, Minto, Manvel, Walhalla, Hillsboro, Fargo, and Grand Forks, North Dakota, and East Grand Forks, Minnesota.

During the spring and summer of 2003, project personnel from the RRRC and NDFS attended county water resource district and soil conservation district meetings throughout the watershed. The meetings provided stakeholders with an update of project accomplishments and allowed the project to receive input for Phase III activities.

Task 4. *Subcontract with the NDFS for personnel to assist landowners in priority areas in developing management plans for riparian and upland forest resources. Two full-time employees will be hired under this project. Additionally, two current employees will dedicate 60 percent full-time equivalent (FTE) to the project. The foresters will be located in NDFS offices in Walhalla and Lisbon, North Dakota.*

The NDFS was the primary project partner and was the main contact with landowners and communities, as well as local boards and councils. During the 5 years of operation, the NDFS provided one part-time and three full-time foresters who developed 341 forest management plans for nearly 30,000 riparian acres, prescribed riparian restoration and best management practices, and assisted in coordinating implementation. In addition to providing over $288,052 in in-kind services, NDFS also published two editions of the North Dakota Forest Best Management Practice Manual (Appendix A), assisted with the planning of workshops and training sessions, and provided vehicles and equipment as needed.

Task 5. *Subcontract with the UND EERC for GIS services, preparations for conferences and workshops, monitoring, and report assistance.*

During the 5 years of operation, the EERC provided a variety of technical, logistical and financial support to the project. In addition to organizing the five conferences and workshops sponsored through the project (See list in Objective 5, Task 25), the EERC developed many of the educational and promotion materials for the project, as well as managed the project Web site during the last 2 years. The EERC also hosted the majority of the RAC meetings at its facility in Grand Forks. GIS and monitoring support were also key contributions by the EERC. Through a cooperative effort with the Red River Water Management Consortium (RRWMC), the EERC

provided $60,836 of in-kind services and facilitated cooperation between the RRBRP and basin industries, cities, and county entities.

Task 6. *Provide employment for undergraduate and graduate students interested in doing site characterization or restoration design under the guidance of UND Geology and Geological Engineering faculty.*

The Riparian Project subcontracted with the UND Geology Department for student assistance during all 5 years of the project. The success of the collaboration has lead to a continued subcontract with UND and the development of a subcontract with North Dakota State University (NDSU) for similar services during Phase III. Student involvement in the project provided the students with firsthand knowledge of riparian restoration, slope stabilization, and bioengineering techniques. The work also provided the students with real-world experience designing and implementing projects.

Students working on a senior engineering design project or as an hourly assistant for the project completed the following restoration designs or projects:

Wild Rice River Project, J. Hruby, J. Gilles, B. Arman
Park River Bank Stabilization Design, M. Mussetter
Wetland Design near Weinlaeder Seed Corporation, E. [Olson] Woods*
Grand Forks Country Club, J. Warne*
Silver Lake Shore Stabilization, J. Warne*
Natural Channel Restoration, Richland County, E. Woods, J. Warne, J. Spencer
Feasibility of Using Soil Bioengineering Techniques for Riparian Restoration Along Specific Reaches of the Sheyenne River Valley, C. Wolfe

(*Available designs are included in Appendix B.)

The following graduate thesis was also funded by the project during Phase II:

Development of a Regional Curve to Relate Discharge and Drainage Area to Hydraulic Geometry for the Red River of the North Basin, M. H. Johnson, 2003. (See abstract in Appendix B.)

Objective 2. *Prioritize specific river reaches within the project area to assist the advisory committee and project staff with the development of a work*

schedule for establishing the demonstration areas and restoring the highest priority river reaches.

Task 7. *Identify all data layers necessary for assessing riparian function. Determine availability of data layers such as drainage system, soils, vegetation, land use, dams and diversions, political boundaries, and hydrologic boundaries.*

During the 5 years of the RRBRP operation, significant advances were made in both the GIS technology and the availability of digital spatial data. Many data layers were acquired throughout the project including soils, digital elevation models (DEMs), 303 (d) and 305 (b) reach assessment information, ecoregions, political boundaries, geology, dams, gages, land use, and hydrologic boundaries. Additional digital soils maps were becoming available as Phase II ended.

GIS-based activities for the RRBRP during Phase II initiated the focus of employing this technology to inventory and assess the activities of the RRBRP. Much of the early effort was concentrated on acquiring existing data sets from local, state, and national sources. Through this 5-year time period, considerable GIS/Global Positioning System (GPS) efforts were being conducted in the Red River Basin as part of studies initiated from the 1997 flood. Many products from these efforts were obtained by the EERC on behalf of the RRBRP.

In addition to gathering the data, many map-based products were created for various applications from these data sets. Images for Web sites, brochures, reports, posters, and other outreach activities were produced at the request of the RRBRP.

Task 8. *Compile data layers to describe each watershed in the Basin.*

It was determined early in the project that compiling data layers for individual watersheds in the Red River Basin was an extensive undertaking that was beyond the scope of the Riparian Project and the funding allocated to that task. However, the data layers described above that were collected by project partners and collaborators for the entire Red River Basin were used to a great extent in examining the condition of river reaches on a subwatershed scale.

Task 9. *Augment existing data file with verified site-specific data such as forest inventory, geology, river classification, GPS-generated topography maps.*

Site-specific data is collected for each site prior to implementation of BMPs. This data includes inventory of riparian forest and vegetation, channel classification, hydrology, site soils, and site topography. Where sites were concentrated and the spatial data indicated high potential for

degraded river conditions, reaches were targeted for additional field data collection. For instance, additional field data were collected on the Park and Red Rivers in Walsh County, and the Pembina, Sheyenne and Turtle Rivers, and Cole Creek in Grand Forks County.

Task 10. *Use GIS to evaluate and prioritize river reaches in the basin for restoration work with input from county and watershed stakeholders.*

Factors such as landowner interest (density of requests), stream type, impairment, loss of riparian vegetation, and bank slope were used to select target reaches. Several reaches were targeted on streams in the Red River Basin with high site density. Those streams included the Park River, Red River, Sheyenne River, Turtle River, and Cole Creek.

GPS and GIS were utilized to assess a reach of the Turtle River between the Larimore Dam and the town of Mekinock, North Dakota, to identify and map bank stability problems, severe channel erosion, and excessive snags in the river. This information will be used by the RRBRP, North Dakota Game and Fish, North Dakota Parks and Recreation, and the Grand Forks County Water Board to address these concerns in the river. Turtle River State Park plans to use this information to restore degraded stream banks and enhance trout habitat. The final product was a report summarizing the survey of the river, including a GIS-based map with photos and descriptions of river condition. (The report is attached in Appendix C.)

Task 11. *Track progress in buffer establishment and improvement with GIS.*

Restoration and protection sites, at the request stage, are cataloged in a spreadsheet. Each of these sites is then referenced by geographic coordinates (longitude, latitude) such that GIS-based products can easily be produced. One such application is the production of a map showing the distribution of restoration and protection sites that have received the attention of the RRBRP.

Objective 3. *Increase local resource managers', landowners', and the general public's awareness of restoration options by developing up to eight demonstrations in the Red River Basin showcasing soil bioengineering, restoration techniques developed by Dave Rosgen and other appropriate practices.*

Task 12. *Identify and select up to eight sites for demonstrations in the prioritized areas. Sites will include a variety of river types, land uses, and remediation alternatives.*

The committee decided to let good demonstration sites "rise to the top" and become apparent during the project period. Eight sites were selected by the RAC to demonstrate BMPs in a variety of settings as well as to

serve as teaching tools when implementation did not go as planned. The table below lists the demonstration sites, their location, and the emphasis of the demonstration. Seven of the eight sites are completed and the eighth site is expected to be completed in summer 2004 during Phase III of the project. The educational and promotional materials for each site were in varying degrees of completion at the end of the project. The incompleteness of I&E materials on some of the sites is due to implementation late in the project as well as the RAC's interest in waiting to see if sites were successful before designating them as demonstrations.

Table 1. Demonstration site names, locations and brief descriptions.

Site Name	Watershed	Location	Restoration Summary
Hallock/Two Rivers	Two Rivers	Kittson County, MN	Channel stabilization of a cutoff meander
City of Fargo Xeriscape™ Gardens	Red River	Cass County, ND	Urban Xeriscape™ demonstration gardens
Park River Bible Camp	Park River	Walsh County, ND	Failed stabilization and subsequent repair
Grand Forks Country Club	Cole Creek	Grand Forks County, ND	Slumping stream bank stabilization with bioengineering
Lower Park Reach	Lower Park/ Red River	Walsh County, ND	Continuous riparian buffers and some bioengineering
The Lynstad Site	Forest River	Walsh County, ND	Sediment control dam with planned grazing system
The Raney Wetland	Red River	Pembina County, ND	Wetland construction for sediment and nutrient remediation of agricultural runoff
Drain 39 Channel Restoration	Bois de Sioux	Richland County, ND	Channel reconstruction of a natural drainage – incomplete

Task 13. *Determine the BMPs to be used at each site*.

Table 2. Description and status of BMPs applied to the demonstration sites.

Demo	BMPs Applied at the Site, Condition of Practices and Restoration Progress.
Hallock	Slope regrading, stream barbs and root wads, fascines, live willow stakes.
Xeriscape™	Comparison of high-to-low-water-use vegetation, native riparian vegetation for urban areas.
Bible Camp	Initial channel shift, root wads, willow stakes. Repair with greater floodplain access, joint planted rock toe, willow posts, willow stakes.
Country Club	Slumping in plastic clays initially stabilized by regrading, root wads, small rock toe, fascine, willow stakes. Continued slumping after 2 years repaired by regrading, branch packing in rock toe, willow stakes, live pole drains, willow silt dams on drain.
Lower Park	Installation of native grass buffers, forest buffer restoration and enhancement, live willow and cottonwood cutting block plantings.
Lynstad	Planned grazing system, sediment control dam construction, off-channel solar watering.
Raney	Wetland construction for filtration of agricultural runoff and wildlife habitat development.
Drain 39	Restoration of a meandering channel to a natural intermittent stream, CRP grass buffered floodplain.

Task 14. *Based on staff recommendations, solicit proposals from qualified entities for site specific assessments to develop restoration designs, determine costs, and provide oversight during restoration activities.*

Table 3. Entities responsible for design and implementation at demonstration sites.

Demo	Entities Responsible for Design and Oversight of Implementation.
Hallock	Kittson County, MN, highway department engineer, RRBRP staff for bioengineering.
Xeriscape™	City of Fargo Forestry Department and RRBRP staff for native riparian vegetation design.
Bible Camp	Engineering design by UND Geology and Geodynamics, Inc., bioengineering by RRBRP staff.
Country Club	Engineering design by UND Geology and Geodynamics, Inc., bioengineering by RRBRP staff.
Lower Park	Grass and forest buffer restoration design by NDFS and NRCS.
Lynstad	Design and oversight by NRCS project engineer and range management staff.
Raney	Design and oversight by NRCS project engineer and area biologist and NDFS staff.
Drain 39	Engineering and design by NRCS, Geodynamics, Inc., and K_2S Engineering, Inc.

Task 15. *Implement BMPs at each demonstration site.*

Table 4. Detailed description of demonstration sites.

Demo	Description of Completed Demonstration Sites and Subsequent Monitoring
Hallock	The Hallock Two Rivers demonstration site is one of the first completed in Phase II of the Riparian Project. The demonstration was initiated by the MN DNR at a location where the local highway department had an interest in protecting a township road bridge. The township proposed shortening a meander in the channel to protect the road embankment. Although the RAC did not agree with channel straightening, they did agree the project should try to use the site as a bioengineering demonstration since the work would be completed by the county regardless of their participation. The practices described in Table 1 were completed in fall 1998. The bioengineering at the site was initially successful as indicated by photo point monitoring the following year (See photos in Appendix D). However, floodwater from spring snowmelt in 2000 damaged the root wads and portions of the repaired stream bank. Additional monitoring scheduled for the site was not completed because of changes in project staff and the duties of subcontractors. It is expected that photo point monitoring and an engineering assessment of the site will be all the future monitoring that will occur unless completed by another agency such as a local soil and water conservation district or the MN DNR.
Xeriscape™	The purpose of the Xeriscape Demonstration Gardens was to provide examples of alternative low-water and low-fertilizer demanding landscape choices for the urban residents of semi-arid Fargo, North Dakota. The RRBRP became involved in the project because improper urban lawn care contributes to nutrient enrichment in storm water. The RRBRP also provided detailed plans for the Native Riparian Vegetation section of the garden to promote the restoration, protection, and maintenance of native riparian buffers for homeowners with river frontage. The Xeriscape Demonstration Gardens opened in summer 2001. Some of the Riparian section of the garden was not completed, but was expected to be completed by spring 2002. Interpretive information for the garden is currently under development by the Fargo Forestry Department. Cost-share for the garden was committed by the RRRC but will not be distributed until the planting and interpretive information is complete.

Bible Camp	Riparian restoration and stream bank stabilization work was completed on the Middle Branch of the Park River within the Park River Bible Camp (PRBC) to address severe stream bank erosion that was threatening a nature interpretive area of the camp and a utility pole. Assistance was requested by the PRBC in May 1998. By January 1999, a Forest Resource Management Plan was completed and outlined recommendations for stream bank protection, riparian buffer and wildlife plantings, and forest stand improvement practices. Several strategies were also being considered at that time for the stabilization of the stream bank. Final plans for the stream bank stabilization portion of the restoration project were presented in May 2000. The plan called for moving the channel 35 feet to the south of the existing channel and constructing a stable 3:1 slope from the new channel to the existing bank where the utility pole is located. Fill for creating the stable slope was borrowed from the floodplain area to the south, and the floodplain was lowered so the stream could access it sooner during periods of high flow. This floodplain access would allow the water to spread out and slow down during high water events, decreasing the erosive force on the repaired stream bank. In addition, the plan called for the installation of root wads at the bankfull elevation on the repaired slope. The root wads function to deflect flow back into the channel and decrease the erosive energy of the water. The earthwork was completed at the site in late August 2000. Above the channel and toe of the constructed slope, bioengineering practices were planned to stabilize the slope face. Bioengineering is the use of dormant live plant materials in an engineered installation to stabilize a stream channel or bank. The bioengineering plan at PRBC called for dormant live willow stakes and sedge seedlings, which were installed on the site by students from nearby Edinburgh School in early October 2000. The constructed slope was also planted with native grass seed mixture and covered with straw and a loose mesh geotextile net. During spring 2001, the Middle Branch of the Park River experienced a spring melt flood event that damaged the restoration work completed the previous fall. After assessing the site in fall 2001, it was determined that several factors in the design and the timing of the flood contributed to the damage. The design factors included miscalculation of the bankfull elevation leading to the misplacement of the root wads and the narrowing of the bankfull channel at the upstream end of the reach. In addition, vegetation did not have time to establish on the slope prior to being subjected to flooding. In fall 2001, repairs were made to the restoration that included lowering the south stream bank to allow the floodwater to access the floodplain sooner, armoring of the restored slope toe with rock, and additional bioengineering practices of willow posts and stakes installed on the constructed stream bank. In summer 2002, the restoration site at the PRBC was again subjected to flooding and survived with no damage to the riverbank or channel. The site will continue to be monitored by the RRBRP and as an annual science project of the Edinburg School.

Country Club	Glacial lacustrine deposits in the Red River Basin of North Dakota, Minnesota, and Southern Manitoba present significant challenges to river and stream bank stabilization efforts. The Brenna and Sherack Formations are highly plastic laminated clays subject to slope failure and slumping. Changes in local hydrology, decline of forest and grassland, urban development, and recent weather cycles contribute to increased frequency of slope failure along the Red River and its tributaries. For these reason, the RRBRP selected a site on Cole Creek in Grand Forks County, North Dakota, as a demonstration site. A nearly 2-acre slump along a 330-ft reach had damaged the Grand Forks Country Club's cart bridge and was beginning to narrow the stream channel and lift the channel bottom. These changes in channel morphology were causing downstream bank and channel scouring. An attempt was made to stabilize the failure during the replacement of the cart bridge in 2002 by regrading the slope, installing rock and root wads to protect the slope toe, and planting the slope to native vegetation. Subsequent summer flooding that inundated the site five times in an 18-month period, continued irrigation of golf course areas, insufficient grading, and improper installation of root wads led to continued failure. A second attempt was made in 2003 to stabilize the slope failure by grading the slope to at least 10:1, adding a more substantial rock toe and using bioengineering to alter the slope drainage and deflect flow energy in the channel. The slope and channel were determined stable in spring 2004 and will continue to be monitored by the RRBRP.
Lower Park	From 1999 to 2003 a total of 39.9 miles of riparian area were restored adjacent to the Park and Red Rivers in Walsh County, North Dakota, using BMPs such as riparian forest buffers, grass filter strips, wetland restoration, and bioengineering for bank stabilization. This cooperative effort was sponsored by the Walsh County/Three Rivers Soil Conservation District (SCD), the NRCS, and the RRBRP. A variety of federal and state conservation programs were utilized including NRCS's Emergency Watershed Protection (EWP) Program, Conservation Reserve Program (CRP), North Dakota Game and Fish Private Lands Programs, and Section 319 funds from the RRBRP (See in Appendix D). During 2000 the project assessed historic forest cover, soil types, flood frequency, and topography of the locations where requests for assistance were concentrated. The RAC prioritized river reaches using the information that was collected. In March 2001, the SCD and RRBRP sponsored a landowner information meeting to present information on available programs, BMPs, and cooperating agencies that could assist with restoration. The program offered management alternatives for frequently flooded land sustaining crop and infrastructure damage, loss of forest resources, debris and sediment deposition, and river bank erosion. The meeting was well attended, and interest grew as severe flooding continued throughout the remaining years of Phase II. Protocols used for reach selection and restoration on this demonstration site were used to enhance efforts on other reaches during Phase II.
Lynstad	The Lynstad site located within the Forest River Watershed demonstrates rotational grazing and off-channel watering for cattle. It also demonstrates how small dams on intermittent tributaries to the Forest River may be able to provide sediment and nutrient collection as well as minor flood reduction. The site was completed in the late summer of 2000, and several tours and workshops have used the site to demonstrate the benefits of rotational grazing to grassland health. The site also showcases off-channel watering technology via a solar pumping system to keep cattle out of the pond and stream channel.

Raney	The Raney Wetland Creation Project was initiated in 1996 with the intention of providing fill for the creation of a farmstead ring dike. The project expanded to the creation of a wetland when the landowner realized that his efforts could create wildlife habitat and minimize the impact of runoff from agricultural land. The wetland and farm pond were completed in 1999, creating 1.5 wetland acres. The system operates by diverting runoff from 320 acres of cropland out of a legal drain into the constructed wetland. The serpentine design of the wetland creates 1545 ft of flow length in a linear distance of 510 ft. As water exits the wetland, it enters the farm pond, flows into a 1070-ft-long grassed channel before reentering the original legal drain and finally the Red River. The total distance through the system (wetland, pond, grassed channel) is nearly 2900 ft, over seven times the distance the water would flow in the legal drain. The increased flow length allows time for sediment and dissolved solids to be removed from the water. The wetland was vegetated with plant materials native to the Red River Valley. The vegetation plan included planting materials such as prairie cord grass, sand bar willow, and false indigo along the water's edge. Upland areas were seeded to big bluestem, switchgrass, and prairie cord grass. In addition to the manual plantings, natural vegetation has occurred from cottonwood, cattail, and bulrush.
Drain 39	Intermittent streams in agricultural areas are frequently damaged by channelization, encroachment of crop fields, and alteration of flow. The upstream natural section of a legal drain in Richland County in the southeast corner of North Dakota is no exception. Since 1940, the intermittent stream has been farmed through in dry years, subject to frequent clean-outs, and influenced by more frequent bankfull flows from increased field drainage and the expansion of cropped fields. A wet period beginning in the 1990s caused frequent flooding along the natural drain and led to significant crop losses. The typical solution would have been to clean out the channel, only to have it fill back in from soil washed from the fields. Instead, the local Water Resource District, the NRCS, and the RRBRP decided to restore the channel to a natural functioning condition. Using information on local hydrology, measurements of the existing channel in more natural reaches, local knowledge and aerial photos from the early 1940's, a design was developed to restore the floodplain and meandering channel. The design was based on principles of fluvial geomorphology developed by Luna Leopold and Dave Rosgen. In addition to restoring the channel, the adjacent riparian areas were enrolled in Continuous CRP by the landowners and will be planted to native grasses. Plans for the channel restoration are finished, and the work is expected to be completed by summer 2004. Once completed, the channel should function to move water and its sediment load without aggrading or breaking out of the channel as frequently. The CRP grassed buffers will help to reduced sediment entering the channel from the fields and create a 5- to 10-year floodplain for the stream to access. Preconstruction monitoring of water quality and channel morphology was started in 2003 and will continue for the next 5 years as the work is completed and the restoration matures. This is only the second project of this scope in North Dakota and the Red River Valley.

Task 16. *Install signs at each demonstration site relating cooperators and BMPs implemented.*

The RAC determined that the installation of signs at each of the demonstration sites was not practical and would not effectively increase awareness and understanding of riparian restoration. Instead, the committee felt the development of educational pamphlets for certain

demonstration sites would be more useful for workshops, classes, and tours offered by the RRBRP and other local entities. Other sites were not near enough to completion at the end of Phase II for the development of signage and educational materials. Below is a summary of the I&E efforts for each site, and hard copies of materials can be found in Appendix D.

Table 5. Information and education materials developed for each demonstration site.

Demo	Description of Materials Developed
Hallock	I&E materials were not developed for this site because the success of the implemented BMP is not established. The site has been visited in only one tour.
Xeriscape™	Because the purpose of this site is the education of Fargo residents, a significant amount of materials have been and will continue to be developed. A Web site and brochure were developed by the City of Fargo Forestry Department. Signs and an informational kiosk are in development for the center of Xeriscape Demonstration Gardens. The gardens are the focal point of an urban riparian landscape educational initiative under way through River Keepers of Fargo and Moorhead, City of Fargo, Cass County, NRCS, the Red River Water Management Consortium, and the RRBRP.
Bible Camp	A sign and educational pamphlet are being completed for the site. Several articles have been written and presentations and tours given about the site.
Country Club	A sign and educational brochure are being developed for the site. An article about the restoration will be included in an upcoming NRCS publication.
Lower Park	Several articles and presentations have been written for this demonstration reach. The reach is too large for signage but will be highlighted in an informational pamphlet and display panel.
Lynstad	No educational materials have been developed for this site. Tours and workshops have used the site as an example of managed grazing. A sign will not be developed because of the landowner's concerns and the remoteness of the location.
Raney	A sign and informational pamphlet have been completed for this site.
Drain 39	Educational materials for this demonstration site will be developed after implementation during Phase III of the RRBRP. Materials will include pamphlets, presentations, articles, tours, and signs.

Objective 4. *Provide financial and technical assistance to restore and improve management of continuous river reaches.*

Task 17. *Establish and utilize a process for reviewing and approving the Riparian Management Plans.*

The RAC provided the Riparian Project Coordinator with programmatic and technical oversight on all aspects of the project through identifying program needs and evaluating program activities and accomplishments. RAC members provided the project with expertise in hydrology, water quality, wildlife and fisheries management, agriculture, forestry, GIS, education, and engineering. All assistance to landowners, such as

Riparian Forest Management Plans and restoration designs, were reviewed and approved by the RAC. Before Section 319 dollars were spent on establishing a practice, the practice and costs were reviewed by the Red River RC&D Council and the RRRC. This review and approval process is summarized in the flow chart (Figure 2) below.

Task 18. *Based on the priorities established in Task 7, provide technical assistance to landowners in developing plans for riparian buffer improvement and establishment, stream bank stabilization, and related practices.*

Direct assistance to landowners with management of their riparian areas was provided through the development of individual management plans for each landowner. Landowners who learn about the project through promotional efforts, cooperating entities, or direct solicitation were matched with a Riparian Forester from the NDFS. The forester inventoried the riparian forest, identified areas of concern, and worked with the landowner to develop a Riparian Forest Management Plan that met the landowner's objectives as well as the goals of the Riparian

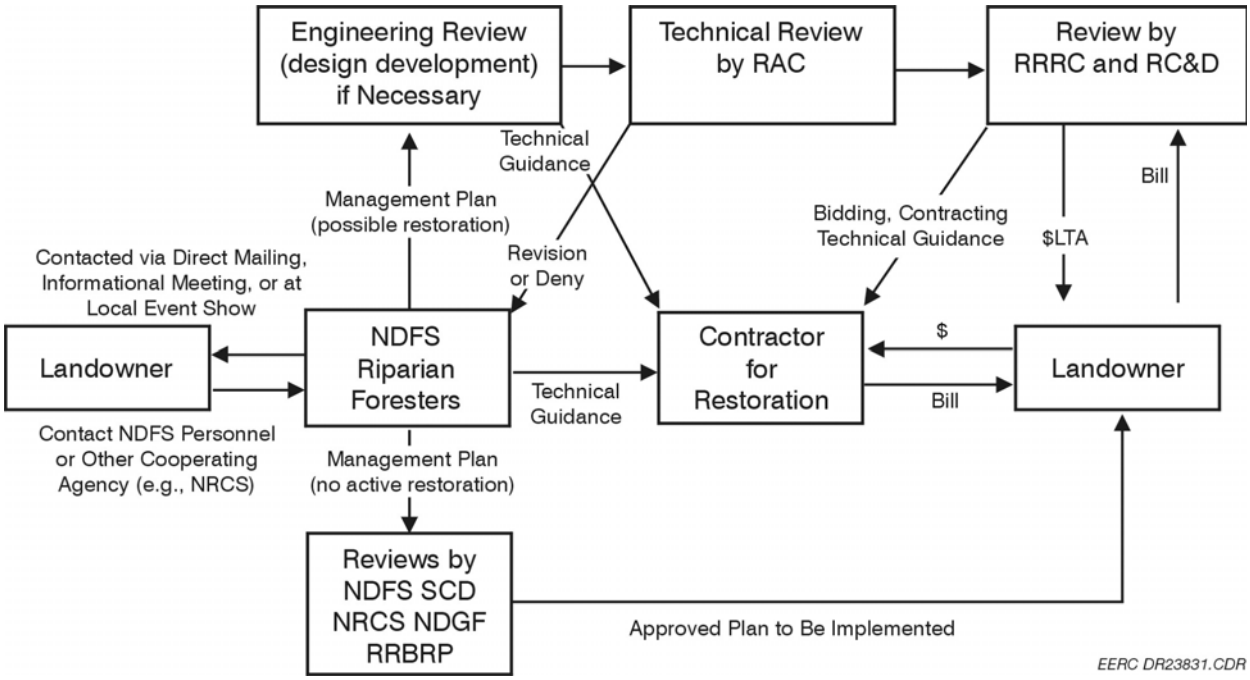

Figure 2. Approval process for riparian management and restoration plans.

Project. **The NDFS completed 341 Riparian Forest Management Plans for 28,129.85 acres in the Red River Watershed.**

The forester included recommendations in his plan for restoration activities and BMPs such as tree planting and bioengineering where necessary. In many cases restoration involved machine or hand planting of trees or dormant cuttings in areas where the riparian forest was decadent, narrow, thin from grazing, or nonexistent. Where stream banks were unstable and actively eroding, reshaping of the bank to a stable slope and application of bioengineering or traditional engineering solutions may have been required. The forester worked with an engineer contracted by the Riparian Project or one from a cooperating agency such as NRCS to review the site, determine if a solution could be engineered, develop a design, and assist with the implementation of that design. Example Riparian Forest Management Plans are included in Appendix C.

During the installation of a practice by the landowner or contractor, the NDFS, project engineer, or the project coordinator provided oversight and technical guidance when needed, as well as inspected the site when completed to ensure that the practices were implemented according to specifications.

Task 19. *Match plans to available cost share programs.*

Working with other contributing agencies such as the NRCS, the forester helped to deliver a variety of programs that provided the greatest benefit to the health of the river as well as the landowner. **In Walsh County alone, the Riparian Project helped to deliver nearly $1 million from the EWP program for restoration efforts.**

Once a restoration plan was completed, it was reviewed by the RAC and then presented to the landowner. If the landowner was interested in implementation, the forester or Riparian Project Coordinator assisted the landowner in identifying additional sources of cost-share and known contractors who could do the prescribed work.

The landowner was compensated for 60% of the project cost plus any additional cost-share that was provided through the Riparian Project from sources such as the North Dakota Game and Fish Department or a local water resource board. Additional contributions from cost-share programs or in-kind from local entities can be reviewed in the “Additional Sources of Funding” section of this report.

Task 20. *Install practices on continuous river reaches.*

During the 5-year period of performance, **the RRBRP provided technical and financial assistance to 80 landowners and technical assistance only to an additional 42 landowners by completing as follows:**

74 miles of riparian restoration, which included:

- **841.5 acres of riparian forest/buffer establishment**
- **16.5 acres of bioengineering for bank stabilization**

A detailed description of the BMPs applied by the RRBRP is included in Sections 2.3 and 3.0 of this report.

Task 21. *Develop data layer for GIS model showing the areas of restoration.*

Data layers were developed for both restoration and management sites. Restoration sites include site-scale polygons of the restoration completed. The resulting maps were used throughout Phase II to show restoration progress on the project's Web site, presentations, and conference display.

Task 22. *Monitor sites using photo points, indices of biological integrity (IBI), and water chemistry data.*

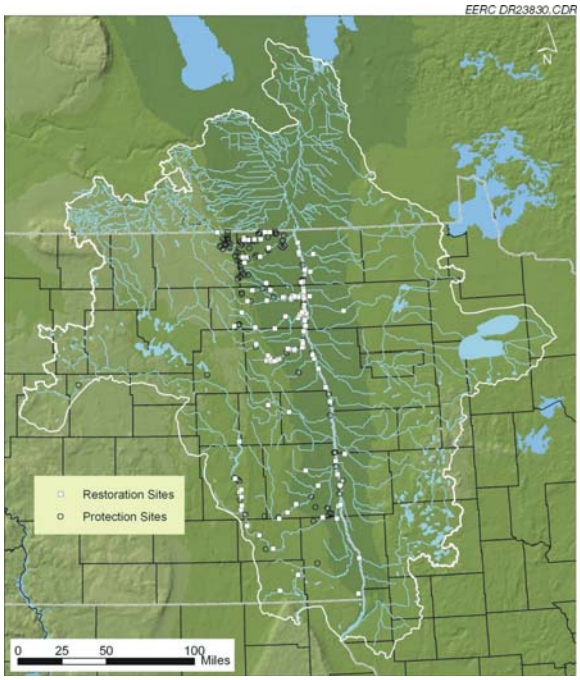

Figure 3. Locations of riparian restoration and protection sites in the Red River Valley.

Primary monitoring of sites consisted of photo points. Water chemistry and invertebrate data were collected at a few sites, especially along continuously restored or protected reaches. A description of the monitoring strategy and results are included in Section 4.0 of this report.

Objective 5. *Increase understanding of riparian management methods that can be used to effectively restore/manage riparian areas in the Red River Basin. The target audience is landowners and resource managers.*

Although not specifically listed as a task under this objective, the project has developed and maintains a web site that provides landowners and resource professionals with access to frequently updated information about the project and riparian areas in general. All project-related products are made available to the public via the Web site. The site also provides examples of restoration activities and information on how landowners may obtain assistance. The Web site address is: www.health.state.nd.us/rrbrp/.

Task 23. *Develop and publish proposed BMPs for Riparian Forest Management and River/Riparian restoration.*

Two editions of the North Dakota Forestry Best Management Practices Manual were published by the NDFS in cooperation with the RRBRP during Phase II, the first edition in July 1999 and the second in 2001. A copy of the latest edition is included in Appendix A.

Task 24. *Train natural resource managers that will be helping with the implementation of Forestry BMPs – Soil Conservation Districts, NRCS, NDSU Extension Service, North Dakota Game and Fish, NDFS, and Water Resource Boards.*

The RRBRP has provided training opportunities to natural resource managers in the Red River Basin through a variety of sources. In cooperation with the NDFS, a Riparian Forester Training Manual was developed in October 1998 to provide foresters aligned to the project and managers from other agencies such as the Soil Conservation Districts a basic understanding of riparian area management. The North Dakota Forestry Best Management Practices Manual, developed for Task 23, was also used for training purposes. Many training opportunities were provided in cooperation with the NRCS from state, regional, or national experts. Jointly sponsored training included:

Fluvial Geomorphology, Lyle Steffen, NRCS, July 1998.
Woodlot Management Workshop, RRBRP, NRCS, NDFS, March 1999.
Proper Functioning Condition, National Riparian Service Team, July 1999.
Fluvial Geomorphology, Lyle Steffen, NRCS, June 2000.

Infrared Aerial Photo Interpretation to Assess Riparian PFC, National Riparian Service Team, September 2000.
Managed Grazing Workshop, Gene Goven, ND Grazing Assoc., July 1999.

Additional training was provided through workshops and conferences that are listed in Task 25 and were organized and/or sponsored by the RRBRP. Project staff also sought training opportunities as they arose.

Task 25. *Host annual Red River Basin Riparian Workshop.*

A training workshop or conference was organized and hosted by the project for nearly every year of operation. Topics covered by the workshops ranged from concepts of riparian ecology and river management to more detailed training about river morphology and ecology. The audience attending the workshops and conferences was just as varied and included natural resource managers, soil and water resource district board members, city engineers, private engineers and basin landowners. Below is a list of the workshops held during the 5-year project. Agendas and detailed descriptions of the workshops are included in Appendix E.

Fluvial Geomorphology Training Workshop, featuring Lyle Steffen, NRCS, July 1998.
Successful River Corridor Management, featuring Jim Karr, Univ. of Washington, September 1999.
Fluvial Geomorphology Training Workshop, featuring Lyle Steffen, NRCS, June 2000.
Addressing Nonpoint Source Pollution in the Floodplain, session held at the 1st Annual Red River Basin Institute International Water Conference, featuring various presenters, April 2003.

Task 26. *Provide articles for newsletters, newspapers, and water magazines.*

Articles were written by several of the project partners and published in a variety of periodicals including local agency newsletters, local newspapers, state and federal publications, and peer reviewed journals. The following is a bibliography of the projects published articles. Several of the articles are included in Appendix A.

Interest in Riparian Zones Increases. David Knutson, Grand Forks Herald, March 1999.
Riparian Restoration Plantings Protect River Banks from Record Flooding. *Prairie Forester, Vol. 15:3*, NDFS, Winter, 2001.
Riparian Restoration Plantings Protect River Banks from Record Flooding. *Eastern Grand Forks County SCD Newsletter*, Winter, 2000–2001.

Reshaping the Course of A River's History *Journeys. North Dakota's Trail Towards Disaster Resistance*, Federal Emergency Management Agency, January 2001.
Riparian Projects New Trend in Improving Water Quality. *North Dakota Water,* North Dakota Water Education Foundation, July 2001.
Riparian Restoration of a Reach of the Turtle River Utilizing Soil Bioengineering. *Land and Water*, Vol. 45:5, Sept–Oct 2001.
Riparian Restoration Engineering: A Case Study in Continuing Engineering Education. Proceedings of the 8th World Conference on Continuing Engineering Education, Toronto, May 2001.
Riparian Project 3-Year Update. *Eastern Grand Forks County SCD Newsletter*, Spring, 2002.
Red River Regional Council News Letter, Winter 2002.
Red River Water Management Consortium Annual Report, Years 4–7, 2000 -2003: Energy & Environmental Research Center, Grand Forks, ND.

Task 27. *Develop a display with pictures of sites.*

The project purchased a professional display board at the beginning of Phase II. The initial display included basic information about the project, riparian ecological principles, and photos of restoration sites completed in Phase I. By 2001, the project had developed six informational panels addressing project organization, riparian grazing, the Turtle River bioengineering demonstration site, woodland management techniques, ecologically sound alternative forest products for riparian zones, and riparian vegetation. Small-scale versions of the panels are included in Appendix E.

The display has been presented at over 30 local and regional venues over the 5-year period and recently won an award for "Best Display" at a regional conference.

Task 28. *Conduct tours of demonstration sites and restored areas annually or upon request.*

The following is a list of tours conducted or assisted by project staff:

Riparian Advisory Committee and local agency guests, September 1999.
U.S. Forest Service and NDFS representatives, July 1999.
North Dakota State Forester, March 2000.
North Dakota State Stewardship Committee, September 2000.
North Dakota NRCS Area I tour, June 2001.
North Dakota Nonpoint Source Program and RAC members, September 2001.
North Dakota Interagency Tour, September 2001.
Riparian Project Site Tour, September 2002.

1st Annual Red River Basin Institute International Water Conference riparian restoration tour, April 2003.

Task 29. Present information relevant to the project at conferences.

RRBRP staff, subcontractors, and partners presented information at a variety of workshops and conferences during the period of performance. Those venues are listed below. Abstracts for these presentations are included in Appendix A.

8th World Conference on Continuing Engineering Education, Toronto, Ontario, May 2001.
National Water Quality Monitoring Conference, Madison, Wisconsin, May 2002
North Dakota Academy of Science, Grand Forks, North Dakota, April 2002.
1st Annual Red River Basin Institute International Water Conference, Moorhead, Minnesota, April 2003.

Task 30. *Coordinate educational efforts with the Environmental Quality Incentives Program (EQIP).*

The RRBRP has worked cooperatively with NRCS throughout both phases of the project and considers the agency to be an essential partner in accomplishing riparian restoration and protection. As with other U.S. Department of Agriculture (USDA) programs, riparian project staff have worked to coordinate the project's educational efforts with EQIP as much as feasible. Examples of direct coordination include 1) providing direct managed grazing assistance to producers interested in EQIP through a jointly sponsored grazing workshop; 2) developing a portable stream table model with some EQIP funds for presentations at schools, water festivals, conferences, and local eco education camps; and 3) developing a riparian protection and restoration video using some EQIP funds for promotion of and education about riparian management techniques for landowners in the Red River Basin.

Task 31. *Develop and distribute semiannual and annual project reports to the NDDH, EPA, and other interested parties and update them on project progress.*

Reports were provided annually and semiannually as requested. However, reports were not always submitted in a timely manner.

Task 32. *Develop and publish final report describing the project's original goals and accomplishments during the 5-year project period.*

Current report.

2.1 Milestones, Products, and Completion Dates for RRBRP Tasks

Table 6. Phase II Milestones.

Task No.	Milestone or Product	Date Comp.	Comments
1	Project administered through RRRC	10/98	Two project managers were hired during Phase II.
2	RAC established in Phase II expanded	10/98	
3	Met with WRDs, SCDs, cities, and towns	6/03	
4	Contracted for three full-time, one part-time forester position	10/98-6/03	One forester was released during last year of project.
5	Contract established for GIS, E&I, and monitoring assistance	10/98-6/03	Coordinated with stakeholder group – RRWMC.
6	Provided over 15 students and completed eight design projects	10/98-6/03	
7	Identified layers as they became available.	12/01	Some data layers were not digital even by the end of Phase II.
8	Some layers compiled for RR Basin	Partial	Objective found to be beyond scope of project.
9	Augmented data for six specific reaches	6/03	
10	GIS used for prioritization within specific reaches addressed by project	6/03	Used as necessary for site and reach prioritization.
11	Sites tracked in database referenced by geographic coordinates	6/03	
12	Selected eight demonstration sites	Partial	Not all were selected until end of project.
13	BMP's determined in design phase	6/03	
14	Engineering and design provided for all demonstration sites	6/03	
15	Over 20 different BMPs implemented at sites	Partial	All but Drain 39 channel restoration completed by 6/03.
16	Signs, brochures, panels developed	Partial	I&E not developed for later sites; some sites too remote for signs.

17	Review/approval process established	10/99	
18	341 management plans completed for 28,130 acres of riparian area	6/03	Many sites were small, causing a shortfall in acres managed.
19	Matched plans to 16 cost-share sources	6/03	Includes federal, state, and local sources.
20	Restored 74 miles of riparian area	6/03	Project reached only 74% of goal because of delays in early project stages.
21	Used site references to develop map	6/03	
22	Monitored sites with photo points, water quality, geomorphic, and biological data	Partial	Not all sites were monitored in detail or at all because of their high numbers.
23	Published two editions of BMP Manual	7/03	Manual published by NDFS.
24	Provided over nine training opportunities	4/03	
25	Hosted four basinwide workshops	4/03	Did not do workshop in 2001–2002 because there was a change in coordinator.
26	Provided over 13 articles for basin publications	6/03	
27	Six-panel display developed and updated	6/03	
28	Hosted or assisted with nine site tours	4/03	
29	Two major education efforts coordinated with EQIP	Partial	Video was not finalized at end of Phase II.
30	Information presented at 10 regional conferences	4/03	
31	Semiannual and annual reports completed and submitted to NDDH	4/03	Reports were not always submitted in a timely manner.
32	Final report	6/04	The final report will be submitted August 2004.

2.2 Relationship of RRBRP to ND NPS Management Plan

Completion of the eight main goals of the Red River Basin Riparian Project directly contributed to the implementation of North Dakota's Nonpoint Source Management Program goals as described in the 1999 North Dakota Nonpoint Source Management Plan. The mission of the State Nonpoint Pollution Task Force is to "protect or restore the chemical, physical, and biological integrity of the waters of the state...". In addition, "[t]he long-term goal...[for the program]...is to initiate a balanced program focused on

the restoration and maintenance of the beneficial uses of the state water resources impaired by NPS pollution." By restoring 74 miles of riparian zone and producing management plans for nearly 29,000 riparian forest acres, the RRBRP has directly assisted in restoring and protecting the beneficial uses of rivers in the Red River Basin. The RRBRP also suppports the NPS Program's Information/Education Goals by working to inform decision makers, natural resource managers, and landowners of the importance of proper riparian zone management and the value of healthy river systems.

2.3 Supplemental Information Related to RRBRP Objectives and Tasks

Additional information about and products of the above listed tasks are included in the report appendicies.

3.0 BEST MANAGEMENT PRACTICES IMPLEMENTED AND REVISED

A variety of BMPs were implemented during the course of Phase II to restore, protect, and manage 74 miles of riparian corridor. These practices can be broadly placed into the following three categories:

1) Protection and Management: These are practices prescribed through Riparian Forest Management Plans include timber stand improvement, scarification, culling, thinning, removal of invasive species, protection from overgrazing, and interplanting where necessary. The management plans are provided to the landowners to implement, and Riparian Project staff deliver financial and technical assistance when requested.

2) Restoration, Reforestation, and Wildlife Habitat Development: These are practices that are implemented to restore the riparian forest where none existed, to widen and/or lengthen the forest for water quality or wildlife habitat, or to enhance the health and vigor of an existing but threatened woodland. Practices prescribed and implemented include mechanical and hand planting of rooted conservation tree stock, development of food plots, fruiting tree and shrub plantings, native grass/prairie establishment, and dense nesting cover establishment. Many of the wildlife habitat BMPs were prescribed or installed under the Wildlife Habitat Incentive Program (WHIP).

3) Stream bank and stream channel stabilization: These BMPs were planned and installed to address an immediate stream bank stabilization, severe erosion, or channel stabilization problem. Most of these practices are considered bioengineering and included live dormant willow staking, live fascines and pole drains, willow post plantings, willow waddles, brush mattress, brush layering, root wads, stream barbs, and rock weirs. Additional practices installed under this category in more upland areas included live silt dams, wind breaks, and live pole drains.

A complete list of the BMPs installed by the RRBRP and example photos are included in Appendix F.

4.0 MONITORING STRATEGY AND RESULTS

Quantitative measurement of improvements to water quality from riparian zone restoration is a problem of scale. Previous research at the site scale has established that restoring riparian zones and stabilizing stream banks directly reduces sediment loading and pollutants from agricultural runoff to surface waters (Peterjohn and Correll, 1984). However, detecting changes at the larger reach or watershed scale is more difficult, as the effect of a single restored site is diluted by the pollution of the greater watershed. This fact was recognized early on in the project by the BMP/Monitoring subcommittee of the project. The subcommittee also recognized that time was another factor hindering monitoring efforts. Because of the nature of the BMPs installed, it would take many to dozens of years before the practices would mature enough to produce measurable improvements to water quality and habitat.

For these reasons, the strategy of the RRBRP during Phase II was to focus on the collection of baseline information prior to or just after the installation of a practice so that there would exist data to compare to future monitoring. The project did not monitor all aspects of every site because of the large number of project sites and limited monitoring resources. More intensive monitoring occurred on sites where practices new to the project were being tried or in reaches were there existed a concentration of restored sites. A manual of standard operating procedures (SOPs) for all monitoring activities was developed using the SOPs from a variety of credible sources. The following table describes the types and extent of monitoring that was initiated during Phase II.

Table 7. Phase II Monitoring.

Monitoring Activity	Extent	SOP Source
Photo Points	All sites	EPA R-93-017
Forest Inventory	100% of sites	NDFS
Restoration Compliance	100% of sites	NDFS, NRCS
Stream Visual Assessment	25% of sites	NRCS
Biological Indicators: Invertebrates	2 sites and 2 reaches	NDDH, EPA
Fluvial Geomorphology Parameters	100% bioengineering sites	NRCS, Rosgen
Water Quality Sampling	2 reaches and 3 sites	NDDH

Baseline forestry data collection included forest inventories to determine stocking, health, diversity, and age classification of woody and vegetative components at all riparian sites. Protocol for these inventories are based on fixed radius point sampling of the understory and variable radius plots for the overstory as outlined in the NDFS policy manual. The health and vigor of riparian sites was monitored by completing forest inventories every 5–10 years through NDFS Forest Stewardship plan renewals. In

addition, project staff used the North Dakota Forestry BMP Manual (NDFS, 1999) and Woodland Tree Care and Management guidance from the Field Office Technical Guide (NRCS, 2002) to certify compliance of all restoration and follow-up maintenance.

The results of the monitoring activities are included in Appendix G. Of particular note is the continuous monitoring that has been conducted by a local high school on the Park River Demonstration Site. This work is also highlighted in Appendix G.

In addition to monitoring sites and reaches for water quality improvements, the project also engaged in general operation and maintenance (O&M) inspections. Project staff continually evaluated restoration progress at sites through the photo point monitoring process and on-site inspections. On-site inspections were most frequently made at sites involving bioengineering, especially when the site was subject to a bankfull or greater flood event. Several sites inspected during the project period were found to be damaged or not functioning as planned, and repairs were made to those sites. O&M inspections of sites completed in Phase II will be monitored in the future phase until the restorations are determined to be mature and properly functioning.

5.0 COORDINATION OF EFFORTS

One of the most successful aspects of the Red River Basin Riparian Project Phase II was the excellent cooperation between federal, state, and local agencies to meet the goals of the project. This cooperation was coordinated by the Project Coordinator through the Riparian Advisory Committee and the Red River Regional and RC&D Councils.

5.1 State Agencies

Both North Dakota and Minnesota state agencies were involved in Phase II of the project in roles ranging from technical assistance to providing cost-share for BMPs. The Table 8 summarizes the contributions of these agencies.

5.2 Other State Programs

The RRBRP coordinated with other state natural resource entities including the county SCDs, water resource districts (WRDs), and other 319 watershed projects. Cooperation with these entities typically related to activities on sites within their respective jurisdictions. Staff from these entities assisted with site planning, coordination with landowners, and implementation of BMPs. SCDs and WRDs also provided local cost-share for practices on many sites.

Table 8. Contributions by state agencies to Phase II.

State Agency	Contribution to RRBRP	
	Involvement	Cost-share/in-kind
NDDH	Provided two staff for RAC. Contributed technical support for monitoring, BMP implementation, training for staff, and I&E coordination with other NDDH/319 programs.	N/A
NDFS	Subcontracted as BMP planning and implementation arm of the project. Provided staff to RAC, developed training tools and promotional information, tracked site status, contacted landowners, created restoration and management plans, and assisted in coordination with other state and federal agencies. Linked RRBRP with other forestry initiatives in the state.	$291,131
ND State Water Commission	Provided engineer to RAC. Contributed technical assistance and review of stream bank and channel stabilization/restorations, facilitated cooperation with local county water resource districts, and provided cost-share for some BMP implementation.	$8480
ND Game and Fish Department	Provided three staff to the RAC. Staff contributed technical review of restoration designs in relation to fish and wildlife habitat, and assisted with information dissemination. Provided cost-share and incentives to landowners through state-funded programs for wildlife habitat.	$27,364
ND Department of Transportation	Provided occasional staff to RAC. Contributed technical review of restoration plans and design related to wetland and upland habitat.	N/A

University of North Dakota	Provided staff to RAC through the Geology and Geological Engineering (GGE) Department and the EERC. Both entities were subcontractors to the project. GGE provided students and engineering oversight on many stream bank and channel stabilization projects. The EERC provided monitoring and I&E assistance as well as connection with basin stakeholders through the RRWMC.	GGE $64,872 EERC $92,762
Minnesota Department of Natural Resources	Provided staff to RAC during first 4 years of Phase II. Contributed a link with the Minnesota side of basin, technical review of stream bank and channel stabilization/restoration, and assisted with training and information dissemination. Established a jointly funded position for 2-years to assist with planning, monitoring, and GIS for project. Position also acted as a liaison between RRBRP and DNR.	$29,928
MN Pollution Control Agency	Provided staff to RAC to assist in coordination between state NPS efforts in Red River Basin.	N/A

5.3 Federal Agencies

The RRBRP cooperated primarily with three federal agencies: NRCS, the U.S. Fish and Wildlife Service (US FWS), and EPA. US FWS and EPA provided occasional staff to participate in RAC meetings. Cooperation with US FWS occurred when project sites were adjacent to US FWS lands or easement areas, and assistance consisted of technical contributions to restoration design and implementation.

Direct assistance from EPA was provided through the State NPS Program. However, through EPA Region VIII's Red River Basin Coordinator, the project participated and cooperated in several EPA-funded initiatives including The Red River Geoscience Education project, Biological Monitoring Workgroup, and the Fargo/Moorhead Riverwatch Program.

The most significant federal cooperation was with NRCS. The RRBRP worked cooperatively with NRCS staff at the field office and at the area, state, and national levels. NRCS staff from field offices, area offices, and the RC&D coordinators in the Red River Basin were regular attendants at RAC meetings, providing project direction, technical input and review of restoration plans, training, and coordination with USDA

programs (See Section 5.4). Many of the demonstration and restoration sites implemented in Phase II were the result of a cooperative effort with NRCS staff.

NRCS also provided educational materials and training to project staff and, in cooperation with project staff, to resource managers and landowners. Many of the workshop and training opportunities offered through the project were developed and presented by NRCS staff. Likewise, local NRCS staff has participated in Riparian Project training opportunities not developed through their agency.

NRCS also provided funding for education and restoration activities that helped the RRBRP attain its goals. EQIP educational funds were provided for the construction of a stream table and development of an educational video. The NRCS also coordinated cost-share funds through the many USDA programs for implementing BMPs planned in cooperation with RRBRP.

5.4 USDA Programs

The conservation programs offered by USDA through the Farm Service Agency (FSA) and NRCS were integral to the RRBRP completing 74 miles of restoration. In the early organizational stages of Phase II, the RAC recognized that USDA programs were some of the best tools available for implementing conservation. However, some gaps existed in how and where these programs could be applied. The RAC and project sponsors felt that the RRBRP should complement existing USDA programs and attempt to fill in these gaps where they existed. In this way, much of the restoration and conservation planned and implemented through the Riparian Project was completed as an augmentation to a USDA program. The Lower Park and Red River Reach Demonstration is an excellent example of this coordination and cooperation between programs.

5.5 Structure and Function of the Riparian Advisory Committee

Organized in Phase I and expanded in Phase II, the RAC provided the Riparian Project Coordinator with programmatic and technical oversight on all aspects of the project through identifying program needs and evaluating program activities and accomplishments. The RAC was subdivided into three subcommittees with distinct responsibilities that report back to the full RAC on progress. Table 9 lists the responsibilities and products from each of the subcommittees. RAC membership included federal, state, and local natural resource management agencies, local cities and communities, Red River Basin watershed management organizations, and environmental education groups. Committee members provided the project with expertise in hydrology, water quality, wildlife and fisheries management, agriculture, forestry, GIS, education, and engineering. All assistance to landowners was reviewed and approved by the RAC.

Table 9. Subcommittees of the Riparian Project Advisory Committee.

Riparian Advisory Committee Subcommittees		
Site Management	BMP/Monitoring	Information and Education
Establish site teams Track site progress Review restoration plans Recommend programs or BMPs for site restorations Determine levels of cost-share for BMPs at each site	Identify and review project BMPs for restoration Design assessment and monitoring plans Review assessment and monitoring data	Create display panels Develop training sessions Plan workshops Create and approve Web site content Develop brochure content Support watershed education activities

5.6 Additional Sources of Local Funding

Objective 4 of Phase II of the RRBRP was to provide technical and financial assistance for riparian restoration. The RAC and project sponsors took this objective to mean that identifying and securing additional sources of funding beyond the 60% provided by Section 319 should be a project priority. The project worked with state, local, and national natural resources management and conservation entities to provide over $107,000 in additional cost-share. Table 10 identifies the sources and quantities of additional funding.

Table 10. Sources and amounts of locally derived cost-share.

Natural Resources (Wetlands) Trust	$10,257.00
Counties and Townships	19,483.61
Water Resource Districts	9,983.70
Glacial Lake Agassiz Funds	1000.00
Board of Soil and Water Resources	14,113.00
Soil Conservation Districts	641.00
Otter Tail Power Company	500.00
Minnkota Power Cooperative	4,140.00
FM Area Foundation.	2,766.67
NDGF Missions in Woodland Habitats	27,364.00
ND State Water Commission	8480.00
Red River Joint Board	8480.00
Total.	$107,208.98

6.0 STAKEHOLDER PARTICIPATION IN RRBRP

Red River Basin stakeholders were directly involved in the organization and delivery of the Riparian Project. The primary interaction with stakeholders was through the project sponsors: Red River RC&D and Regional Councils. The two councils provide a direct

connection with basin residents. The Red River RC&D Council was the local board that initiated the RRBRP in the late 1980s. The board of local leaders receives requests from the region for technical and financial assistance with rural agricultural and environmental issues. A local county water resource district made the initial request for assistance with nonpoint source issues to the RC&D Council.

The RRRC is a four-county planning and development agency for the northern half of the Red River Basin in North Dakota. The RRRC itself is comprised of local elected and appointed leaders from county and city governments and agencies. The RRRC recognizes that sustainable economic development is based on the foundation of a healthy environment. Both councils provide project direction and oversight, review and track project progress, and approve all project expenditures.

Interaction with basin stakeholders has also occurred through regular meetings with local natural resource entities such as SCDs and WRDs. The project has also held a series of landowner informational meetings in several subwatersheds.

7.0 ASPECTS OF PHASE II THAT DID NOT WORK WELL

As with many large, comprehensive natural resource projects, there were elements or tasks within the RRBRP that did not work as expected. There were four main reasons that the project did not meet all of the goals or complete goals by the projected date. Completion of restoration was not on schedule, and the goal of 100 restored miles of riparian area was not met because of a lack of interest from landowners. This lack of interest was initially due to landowners not understanding the many benefits that riparian areas provide and not being aware of the assistance available from the RRBRP. It took several years to promote the project and the benefits of riparian areas to landowners.

However, even after significant information and education efforts, many landowners did not implement planned BMPs because their cost was too high or there was not an incentive to give up acres of productive farmland. Even when a program such as CRP was available, many times the producer was not eligible to enroll, or the eligible areas did not sufficiently cover the restoration acres.

Another hurdle for the project was receiving engineering assistance for restoration and bank stabilization designs. For the reason of cost listed above, the project attempted to use less costly sources for engineering, such as NRCS or university professors and students. But because restoration designs were not the primary focus of these entities, assistance was not timely. Private engineering contractors were used and could have been used more extensively, but most firms were both expensive and not well trained in fluvial geomorphology or bioengineering, the base of all project restorations.

Weather was the last challenge for the project and had a mixed affect on restoration goals. During Phase II of the project the Red River Valley was recovering from the worst flooding in over 100 years and over the next 5 years was subject to some of the wettest summer months on record. In the summer of 2000, over 20 inches of rain fell in

24 hours in one subwatershed, and in the summer of 2002, another subwatershed experience five summer floods. This flooding hampered restoration implementation, destroyed other restorations that were not yet mature, and placed financial burdens on producers as well as partner agencies that provided additional funding. Yet, the flooding and subsequent damage brought additional partnering opportunities, increased interest in restoration, and encouraged landowners to abandon farming in the frequently flooded riparian areas.

8.0 FUTURE RECOMMENDATIONS

Although the Red River Basin Riparian Project successfully met many of its goals and objectives during Phase II, for the future much work remains to be done to improve water quality in the Red River Basin. The 74 miles of riparian restoration only accounts for a very small number of river miles in the basin. The nearly 30,000 acres of managed riparian forest is a small sample of the riparian bottomland forests that should dominate the flood plains adjacent to the Red River and it's tributaries. Even as restoration of streambanks, channels, and riparian forests were completed, agricultural practices in the uplands, and development around urban centers continued to alter the landscape and hydrology.

Progress was made during Phase II to educate landowners and local soil and water management entities on the importance of healthy riparian areas. This effort has increased awareness of what riparian zones are and the benefits they provide, but it has not yet influenced general land management practices. Attitudes and practices are slow to change, even when changes are mandated by law. More effort in the future needs to be placed on changing the way agricultural producers and landowners management their flood plains and watersheds as a whole.

In addition to changing attitudes, landowners must receive tangible benefits for changing their land management practices. Current programs, such as the Continuous Conservation Reserve Program (Continuous CRP) do much to protect our surface waters from agricultural runoff. But they are limited by acreage, width, and eligibility in the Red River Valley. Programs should be developed either through EPA's Section 319 program or by other means to provide incentives to farmers to develop wider riparian zones or to protect acres that are not eligible because of cropping history.

Despite the efforts of this program to increase expertise of local resource management agencies, there remains a need for experts in bioengineering, fluvial geomorphology, riparian forestry, and holistic watershed management. The expertise may not come from a single individual, but rather a team with various backgrounds ranging from engineering to forestry to geology. Expertise will not come from training alone, but involving individuals from various areas in demonstration projects where people can gain hands-on experience.

The Red River Basin Riparian Project hopes to build on the success of Phase II and address the above recommendations during Phase III. Continued support of Riparian Project efforts is essential to changing the attitudes of landowners and managers, increasing expertise in the Red River Basin, and ultimately improving water quality in the Red River and its tributaries.

9.0 REFERENCES

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Appendix A

Red River Basin Riparian Project Publications

Appendix B

Student Restoration Designs and Publications

Appendix C

Riparian Zone and Stream Assessments and Management PlansD

Appendix D

Demonstration Site Informational Materials

Appendix E

General Project Information and Education Materials

Appendix F

BMPs Implemented with Example Photos

Appendix G

Products from Monitoring Activities