Section 1 - INTRODUCTION

1.1 Basin Overview

The Little Blue River Basin (Basin) is located primarily in south-central Nebraska, with a small portion existing in north-east Kansas. It includes 43 incorporated cities and villages, as well as parts of the Nebraska counties of Adams, Clay, Fillmore, Franklin, Jefferson, Kearney, Nuckolls, Thayer, and Webster. Nearly the entire Basin exists within the boundaries of, and is managed by, the Little Blue Natural Resources District (LBNRD), Figure 1. The portion of the Basin located in Kearney County, Nebraska is managed by the Tri-Basin Natural Resources District (TBNRD).

There are increasing water quantity and water quality challenges within the Basin. Use of water for human activities, exacerbated by periodic droughts, has reduced both stream flows and groundwater levels in parts of the Basin. Meanwhile, demands for domestic water supplies, irrigation development, recreation and aquatic habitat needs have increased. Human activities, such as agriculture and infrastructure development, have impacted water quality.

Currently, nine communities within the Basin area are taking measures to protect consumers from excess nitrate contamination in drinking water supplies. High nitrate levels detected in water sources for 15 other communities are producing concerns about the future viability of those sources and the resulting effects on domestic water supplies. Of the 13 reservoirs in the Basin that have assigned designated uses, 10 are impaired for recreation or aquatic life primarily due to excess nutrients, *Escherichia coli* (*E. coli)* and/or toxic algae. Nine of the 38 designated stream segments are impaired for recreation or aquatic life use, primarily because of *E. coli* and/or atrazine. One of the stream segments is impaired for public water supply.

The Basin includes part of the Rainwater Basin wetlands complex; an internationally important resting and rearing area for migratory waterfowl and shorebirds, such as whooping cranes (*Grus americana*). It is estimated that more than 90 percent of the acreage of the historical Rainwater Basin has been lost to development and agricultural conversion. Primary threats include draining and filling, sedimentation, conversion to cropland, diversion of water away from the wetlands, and infestation by invasive plant species.

1.2 Plan Overview

In 2014, LBNRD and TBNRD began work on the Little Blue River Basin Water Management Plan (Plan) to establish a comprehensive strategy to manage surface water and groundwater quality and quantity in the portions of the Basin that exist within Nebraska (1,702,393 acres) over the next 30-years. This Plan provides a single coordinated strategy to identify water quality and quantity threats and needs, prioritize watersheds and areas for improvement, and identify practices and activities appropriate to address the known deficiencies in water quality and quantity in the Basin.

The intent of the Plan is to make management action recommendations that will: reduce pollutant loading; help protect the quality of source-water aquifers; stop or reverse groundwater level declines; maintain surface water flows; establish conservation practices; and encourage property owners and agricultural producers to participate in plan development and plan implementation.

Both NRDs have been proactive in assessing and addressing human impacts on the water resources in the Basin. A network of groundwater monitoring wells provides data on groundwater contamination

and guides decision making. The LBNRD's recent hydro-geologic study quantified and mapped the groundwater resources in the majority of the basin and is an important source of information used in development of the plan.

The Plan utilizes an adaptive management framework, which allows for easy modifications to the plan based upon the experiences gained from initial management strategies. EPA describes adaptive management as a tool used to improve implementation strategies. Adaptive management involves assessing, planning, action, monitoring, evaluation and adjusting according to knowledge gained. When adaptive management works, decision-making improves over time as more information is gathered.

Adaptive management in the Basin will include the implementation of practicable controls in targeted sub-basins while additional data collection and analysis are conducted. Monitoring addresses the uncertainty in the efficacy of implementation actions and can provide assurance that implementation measures are succeeding in attaining water quality standards. The cost-effectiveness of the recommendations in this Plan will need to be tested early during implementation so the overall strategy can be adapted to emphasize those measures which are working best. This strategy can then be applied to other sub-basins in the watershed. The advantage of this approach is that it will avoid major up-front expenditures for untested strategies, but it will also require a sustained investment in monitoring and follow-up communication.

Plan development was overseen by a steering committee consisting of 25 stakeholders from across the Basin, including citizens, agricultural producers, and technical members from resource agencies. This committee provided input to NRD staff and the project team responsible for writing this Plan. During Plan development, the stakeholders met four times to provide input on the planning process. A group of technical representatives including members of the project team and resource agencies also met on several occasions and provided input.

The Plan is intended to be dynamic and is based upon an adaptive management approach that will make it convenient to update and modify based on changing needs and priorities, new information, and new approaches to address water resource quality and quantity challenges.

Moving forward, the Plan will guide continued collaboration and interaction between municipal, state, and federal levels of government, as well as between local stakeholders. Management approaches provided in this Plan will support goals of several other programs, such as the Nebraska Department of Natural Resources (NDNR) Water Sustainability Fund, Nebraska Department of Environmental Quality's (NDEQ) Nonpoint Source Management Program, and the United States Department of Agriculture-Natural Resources Conservation Service (NRCS). The United States Environmental Protection Agency (EPA) Nine Elements for Watershed Plans (Nine Elements) has also been addressed in this Plan. The document chapters include:

- Chapter 1: Introduction
- Chapter 2: General Basin Inventory
- Chapter 3: Target Pollutants and Sources
- Chapter 4: Areas of Interest
- Chapter 5: Management Practices
- Chapter 6: Implementation Approach
- Chapter 7: Monitoring and Evaluation

- Chapter 8: Education and Outreach
- Chapter 9: Milestones
- Chapter 10: Technical and Financial Resources

1.3 History and Function of NRDs

In 1972, Legislative Bill (LB) 1357 was enacted to combine Nebraska's 154 special purpose entities into 24 NRDs (later changed to 23). NRDs were created to address natural resources issues such as flood control, soil erosion, irrigation run-off, and groundwater quantity and quality issues. The boundaries of the original NRDs were based on Nebraska's major river basins to enable the application of appropriate management practices to areas with similar topography. Nebraska's NRDs are involved in a wide variety of projects and programs to conserve and protect the state's natural resources.

Water management responsibilities for NRDs are outlined under Nebraska State Law. These responsibilities pertain to human health and safety, resource protection and enhancement, and recreation. Specific NRD responsibilities related to water management and how they apply to the Plan are listed below:

- Reduce runoff and control erosion.
- Protect human health and property damage from floodwaters and sediment.
- Develop and protect water supplies for beneficial users.
- Promote the wise development, management, conservation, and use of ground and surface water.
- Control pollution to water resources.
- Coordinate drainage improvement and channel rectification.
- Develop and manage fish and wildlife habitat.
- Develop and manage water based recreational facilities.

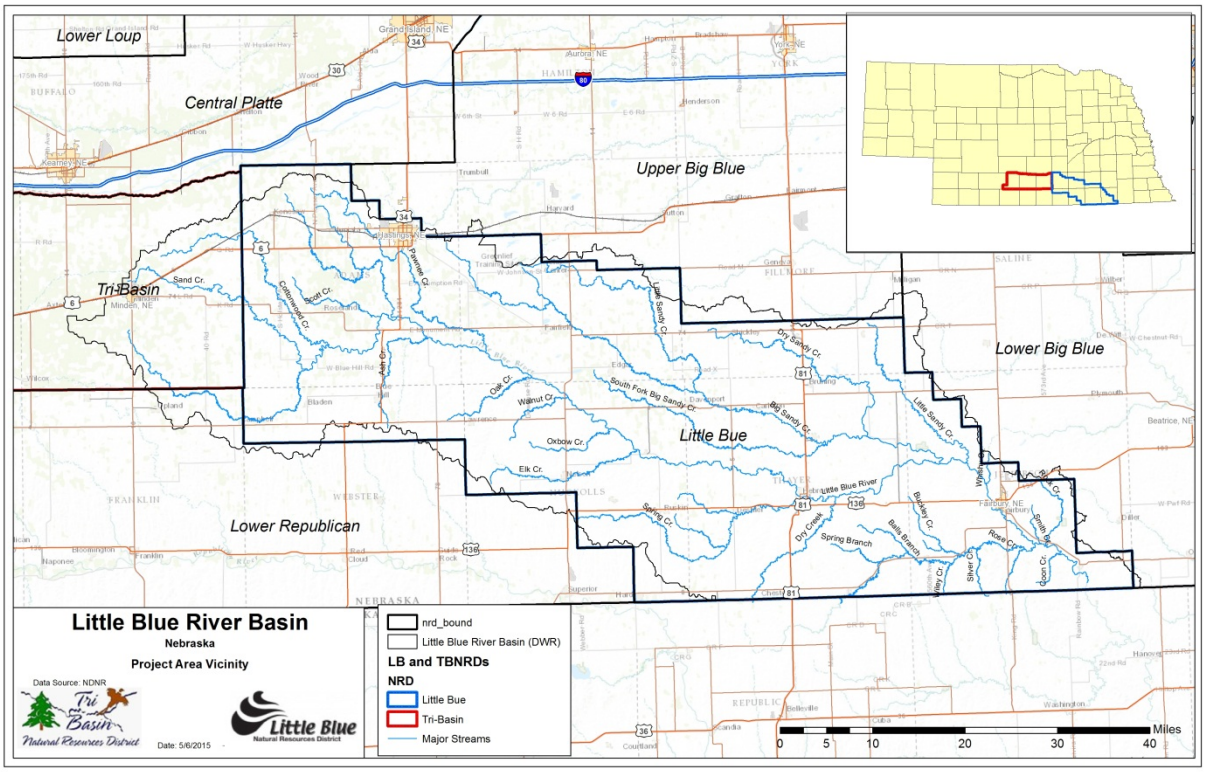
This Plan was developed to assist the NRDs in meeting their management responsibilities by:

- ✓ Providing an inventory of water resources in the basin
- ✓ Identifying water management issues and concerns
- ✓ Identifying water management barriers and opportunities
- ✓ Evaluating current monitoring activities and identifying data gaps
- ✓ Establishing water management priorities
- ✓ Evaluating current water management efforts, and
- ✓ Providing recommendations for future actions.

Each NRD is governed locally by a Board of Directors elected by the public for a 4-year term. The Board of Directors is responsible for establishing annual budgets, priorities, regulations, and oversight of NRD staff. Each NRD has its own staff and work with NRCS Field Office secretarial staff in each District county.

Funding operations and NRD programs are derived from levied property taxes, a uniqueness to NRDs. Property taxes are often used to match other local, state, and federal funding. This Plan was developed through a combination of NRD local funds, NDEQ 319 funding, and funds received from the Nebraska Environmental Trust.

Figure 1-1: Vicinity Map



1.4 Planning Area Boundary

The Basin has two formally recognized basin delineations. The Department of Water Resources (DWR) boundary—created by NDNR in cooperation with NRCS, USGS, NDEQ, and the NGPC for purposes of conducting the State Water Planning and Review Process in 1973—will be recognized as the official planning area for this Plan

A second boundary delineated by hydrologic unit boundaries, also called Hydrologic Unit Codes (HUCs), is slightly larger and is commonly used by NDEQ, USEPA, and USGS for various purposes, including watershed planning. The HUC boundary was used for pollutant modeling associated with this Plan.

Furthermore, small segments of the LBNRD lie outside of the DWR planning boundary for the Basin. It is recognized that these portions of the LBNRD are to be included within this planning document. Specifically, these portions include Lake Hastings, Heartwell Lake, and other associated watersheds which contribute to a water body of interest listed in this Plan.

Part of the Big Blue River Basin, the Little Blue River flows generally from the northwest to the southeast into Kansas. The Little Blue River crosses the Nebraska-Kansas border north of Hollenberg, Kansas. The Little Blue River joins the Big Blue River near Blue Rapids, Kansas, where approximately 15 miles downstream the Big Blue flows into Tuttle Creek Reservoir near Manhattan, Kansas.

Table 1-1: Little Blue River Basin Characteristics

Characteristic	Little Blue River Basin
8 Digit Hydrologic Unit Codes	Upper Little Blue (10270206); the upper portion of the Lower Little Blue (10270207)

Location (Nebraska)	Adams, Clay, Fillmore, Franklin, Jefferson, Kearney, Nuckolls, Thayer, and Webster Counties
Population	50,000
Latitude/Longitude	40.313067 / -97.811415
Stream Name	Little Blue River
Basin Area within Nebraska (HUC Boundary)	1,722,222 acres
Additional Major Streams	Big Sandy Creek, Spring Creek, Rose Creek
Watershed Length	approximately 125 miles west to east and approximately 30 miles north to south
Major River Watershed	Missouri River
Minor River Watershed	Big Blue River
Major Economic Activity	Agriculture
Major Crops	Corn, soybeans, alfalfa
Major Livestock	Cattle and swine
Number of Beneficial Use Designated Stream Segments	38
Number of Beneficial Use Designated Lakes/Reservoirs	13
Stream Miles (designated)	545 miles
EPA Region	VII
TMDL Pollutants	*Fecal coliform* and *E. coli* Bacteria, Atrazine
Stream Segment Designated Uses	Primary Contact Recreation Aquatic Life – Warmwater Class A (14 reaches) Class B (24 reaches) Water Supply – Public Drinking Water (1 reach) Agriculture Class A (38 reaches) Aesthetics – (38 reaches)
Impaired Uses	Primary Contact Recreation, Aquatic Life - Atrazine, Public Drinking Water Supply

1.4.1 Topography

The Basin land surface generally slopes from the west-northwest to east-southeast, with a maximum elevation of approximately 2,100 feet above mean sea level in Adams and Webster counties, to 1,200 feet in Jefferson County. The topography is characterized as relatively flat uplands and gently rolling hills, with narrow valley regions of low relief found along the major streams and rivers (LBNRD Hydro-Geologic Study 2011).

1.4.2 Soils

The Basin is located entirely within the Central Loess Plains Land Resources Area. Geologic materials in the Basin occur as unconsolidated deposits of Pleistocene (Quaternary) Age overlaying either semi-consolidated bedrock of the Ogallala formations of the Tertiary Age or consolidated bedrock of Cretaceous and Permian Age. The unconsolidated materials are principally windblown clayey silts and loess, overlying sands and gravels of alluvial origin.

These loess deposits and fine grained alluvial materials range in thickness from a few feet to about 100 feet, with the greatest thickness occurring in Adams County. Some of the major tributaries of the Little Blue River have cut into underlying sand and gravel, especially in western Adams County where dune type topography is present. Surficial materials along the nearly level floodplain of the river are predominately silts and clays in the upper reaches, becoming progressively sandier eastward as the sand carrying tributaries join from the northern basins. Surficial materials of terraces adjacent to the river are generally finer in texture.

A small area of glacial till, covered by a thin loess mantle is present in Jefferson County east of the Little Blue River. Outcrops of various rock formations can be found at numerous locations in LBNRD (LBNRD Master Plan 2009).

1.4.3 Hydrogeologic Setting

The Basin overlaps portions of 3 of the 13 groundwater regions defined in Nebraska (Flowerday, C.A. et. al, 1998). The three regions include: the Republican River Valley and Dissected Plains in the west and southwest; the South Central Plains in the north and central; and, the Nebraska Glacial Drift (Till) in the east. The groundwater regions of Nebraska are defined by groundwater having similar chemical characteristics, the age and depositional history of geologic formations, and by the presence of the major water-bearing formations. The regions include the overlying unconsolidated aquifers and any significant water-bearing bedrock formation. Boundaries between these regions represent zones of gradual change (LBNRD Hydro-Geologic Study 2011).

1.4.4 Climate

The climate of the Basin is typical of the plains region, with warm summers and cold winters. There are wide seasonal variations in temperature, as well as in the amount of rainfall. The average annual total precipitation across the LBNRD ranges from approximately 25 inches in the west to 31 inches in the east. Based on climate data reported by Thayer County, rainfall is generally light in early spring and fall with over 60 percent of the mean annual precipitation occurring during May through September. Widespread, severe drought conditions occur throughout the Basin, such as severe drought in 1934-1936 and 2012 (LBNRD Hydro-Geologic Study 2011).

1.4.5 Land Cover

Land cover throughout the Basin is dominated by agricultural production. Over 70 percent of the entire Basin was cropped into agriculture as of 2013. A complete land cover analysis is provided in Chapter 2. Below is a Basin-wide summary of land cover from 2013 based upon the HUC boundary.

Table 1-2: Land Cover 2013

Category	Acreage	Percent Total
Corn	702,781	40.8%
Sorghum	8729	0.5%
Category	Acreage	Percent Total
Soybeans	370,453	21.5%
Winter Wheat	59,943	3.5%
Other Hay/Non Alfalfa	10,120	0.6%

Table 1-2: Land Cover 2013

Popcorn	1,403	0.1%
Alfalfa	18,918	1.1%
Fallow/Idle Cropland	1,461	0.1%
Deciduous Forest	43,083	2.5%
Woody Wetlands	5,825	0.3%
Developed	81,780	4.7%
Open Water	5,144	0.3%
Grass/Pasture	412,582	24.0%
Total Area	**1,722,222**	**100%**

Source: NASS 2014

1.4.6 Demographics

There are a total of 43 communities within the Basin each listed below with their 2010 census population. By using information from both NRDs, the total population of the planning area, including rural areas, was estimated at just below 50,000. Note, the * highlights that the city of Hastings lies within two basins, and as such, some of the population lives outside of the Little Blue River Basin boundary.

Table 1-3: 2010 Community Populations

City	Population	City	Population
Ong	63	Nora	21
Glenvil	310	Nelson	488
Fairfield	387	Lawrence	304
Edgar	498	Norman	43
Deweese	67	Minden	2,923
Clay Center	760	Heartwell	71
Hubbell	68	Steele City	61
Hebron	1,579	Reynolds	69
Gilead	39	Fairbury	3942
Deshler	747	Endicott	132
Davenport	294	Daykin	166
Chester	232	Roseland	235
Carleton	91	Kenesaw	880
Byron	83	Juniata	755
Bruning	279	Holstein	214
Belvidere	48	Hastings*	24,907
Alexandria	177	Ayr	94
Tobias	106	Campbell	347
Blue Hill	936	Strang	29
Bladen	237	Shickley	341
Ruskin	123	Ohiowa	115
Oak	66	**Total**	**43,327**

1.5 Water Quality

1.5.1 EPA Nine Elements for Watershed Plans

This Plan has been guided by the Nebraska Nonpoint Source Program and was based upon EPA's Nine Elements; therefore, the management strategies listed in the Plan are eligible for funding under NDEQ's Nonpoint Source 319 grant funding program. Names of major sections mirror the Nine Elements structure to make the review process convenient for NDEQ and EPA reviewers. In addition, the implementation strategy has been drafted to correspond with requirements requested as part of NDEQ's 319 applications. For each concept listed in the Plan, general information required in NDEQ's grant application has been included, such as: project description; ownership; site selection criteria; project summary; maintenance; estimated cost; water quality benefits; and estimated annual pollutant load reductions. Table 1-4 provides a summary of the location in the Plan where one of the 9-elements has been addressed.

Table 1-4: USEPA 9-Element Plan Location

Element	Location in Plan
Pollutant Sources/Impairments	Section 3
Pollutant Load Reduction	Section 3
Management Practices	Section 5
Information and Education	Section 8
Implementation Schedule	Section 6 and Action Plan
Milestones	Section 9
Evaluation Criteria	Section 6
Monitoring	Section 7
Technical and Financial Resources	Section 10

1.6 Water Quantity

The interaction and relationship between surface and groundwater quantity in the Basin has been assessed to proactively identify opportunities for improved resource management. The first step of the assessment process was to review available information on the water budget for the Basin to establish water quantity goals based on current and future water needs. The hydrology review included an understanding of historical flows and compliance with the Blue River Compact Agreement with the State of Kansas. Water quantity goals established for surface and groundwater will be the driver for storage, recharge, stream augmentation and related projects intended to provide a sustainable supply of water for multiple beneficial uses. This water quantity assessment identifies issues/overlap/integration with water quality management as described above. The Plan has identified implementation approaches for both water quality and quantity issues that are effective and socially accepted, as well as the cost and general timeline of implementing those approaches and program/project evaluation measures.

1.7 Plan Purpose and Function

There are numerous water resource management challenges. The Basin has exhibited groundwater level declines; surface water degradation from sediment, nutrients, pesticides, and bacteria; and increased demands for domestic water supply, irrigation development, and water-based recreation. Several communities within the LBNRD—including Edgar, Prosser, Steele City, Hastings, Fairbury, Hebron, Chester, Hubbell, and Glenvil—are battling contaminated drinking water supplies. Another 15 communities have elevated nitrates between 5 and 8 parts per million (ppm); the maximum

contaminant level is 10 ppm, set by the drinking water standard. The NRDs recognize that human activities on the land surface have impacts on both surface water and, ultimately, groundwater resources. To effectively meet these challenges a collaborative approach, using science and stakeholder input, must be taken.

The NRDs strive for a comprehensive and balanced resource management approach which considers resource needs and priorities, available funding, and specific methodologies to reach the goal of providing quality water in quantities that are sufficient to meet all future beneficial uses. This Plan will be used to drive short- and long-term water management decisions, and will guide programs, projects, practices and activities that will maximize public benefits and most efficiently use other sources of funding to achieve water quantity and quality goals.

1.8 Basin Plan Long-term Goals

The Plan's overall goals, objectives, and tasks have been established to guide decision makers on management actions for water resources over the next 20 to 30 years. The Plan goals consider the desire to address several topics including the following, listed by priority: nitrates; groundwater recharge; nonpoint source pollution; monitoring; maintaining stream flows; enhancing watersheds; multi-benefit projects; implementation; and public involvement and outreach. These goals have been written with consideration of the NRDs' overall responsibilities, the EPA's 9-Elements of Watershed Planning, and consideration of the desire to work towards sustainability of water resources throughout the Basin.

Goal #1: Develop a better understanding of the Basin's nitrate contamination levels and how to reduce nitrate loading to groundwater to maintain a quality water supply.

Objective: The NRDs' staff and Board of Directors will adopt recommendations within the Plan to guide management actions related to fertilizer management, irrigation management, installation of BMPs, and other nitrate reduction actions.

Task 1: Collect additional data necessary to evaluate and address nitrate threats to community groundwater supplies.

Task 2: Continue to assist communities with data collection and assessment of water resources within Wellhead Protection Areas to support sound decision making.

Task 3: Provide cost-share and incentives to property owners and producers to increase implementation of management practices to reduce nitrate loading.

Goal #2: The NRDs will achieve sustainability of water resources in the Basin with a better understanding of groundwater and surface water quantities, and by facilitating the implementation of projects that utilize both resources to recharge groundwater aquifers and maintain flows.

Objective: The NRDs will manage water resources in a manner that will further enhance capabilities for agricultural development while maintaining necessary stream flows in the Little Blue River.

Task 1: Reduce impacts to surface water irrigators by implementing programs, projects, and actions that will increase perennial stream flows during dry periods.

Task 2: Utilize the excessive Little Blue River surface water flows and potential surface water irrigation project discharges to recharge groundwater aquifers within the Basin to support sustainability of irrigation and the local economy.

Task 3: Facilitate the construction of in-stream structural groundwater recharge practices.

Task 4: Recharge groundwater by utilizing excess flows by diverting water to adjacent wetlands, oxbows, and other features.

Goal #3: The NRDs will utilize the Plan as a comprehensive and collaborative program guide that efficiently and effectively implements actions to restore and protect water resources from impairment by nonpoint source pollution.

Objectives: Implement conservation practices, install structural projects, and perform environmental restoration measures to improve water quality of streams, lakes, and wetlands within the Basin while also increasing the biodiversity of aquatic species, increasing wildlife habitat, and restoring vegetation along riparian corridors.

Task 1: Promote practices that will enhance riparian areas along perennial streams to improve wildlife habitat, filter pollutants, and encourage development of aquatic habitat.

Task 2: Reduce the threat of bacterial contamination to recreational water by upgrading onsite wastewater treatment systems and installing vegetative treatment systems at animal feeding operations.

Task 3: Facilitate the stabilization of eroding streambanks and lake shorelines.

Goal #4: The NRDs will continuously improve resource management through monitoring by acquiring adequate data and information to make educated management decisions.

Objectives: The Plan's monitoring and evaluation strategy will guide actions for obtaining data and information to fill data gaps.

Task 1: The NRDs will follow sound, defensible monitoring strategies and networks, properly manage data, and disseminate information to decision makers and other stakeholders.

Task 2: Continue to monitor in-stream water quality and groundwater to understand changes in concentrations and the relationship between water quality improvements and management practices.

Task 3: Utilize monitoring as a key tool in the adaptive management approach to support management decisions.

Tasks 4: Enhance the existing monitoring network as recommended in the monitoring strategy to increase the understanding and relationship of stream flows throughout the Basin.

Goal #5: The NRDs will utilize beneficial management practices, which benefit surface and groundwater quality and quantity, when making decisions regarding future water programs, projects, or activities.

Objective: Strong working partnerships and collaboration with neighboring NRDs and other resource agencies will maximize opportunity for multi-benefit projects that can have local and state-wide significance.

Task 1: Develop projects with comprehensive scope and consider groundwater benefits when planning surface water projects.

Task 2: Incorporate bio-engineering techniques into traditional methods of shoreline and streambank stabilization to increase habitat for aquatic and terrestrial species.

Task 3: Take into consideration flood benefits of projects that are primarily associated with improving water quality, such as small dams, flow diversion to riparian wetlands, and conservation practices that 'slow the flow' (e.g., no-till, buffers, terracing, etc.).

Task 4: The NRDs will enhance the scope of the Basin's recommended projects and actions by leveraging available local funding as match towards grants such as 319 Nonpoint Source, Nebraska Environmental Trust, Water Sustainability Funds, and others.

Goal #6: The NRDs will educate property owners, agricultural producers, and other watershed stakeholders on the importance of watershed stewardship.

Objectives: Provide outreach and education opportunities to Basin stakeholders that emphasize the importance of responsibility, on an individual level, for improving the health of the watershed. Ensure stakeholders feel engaged by providing opportunities to share ideas and assist with Plan implementation.

Task 1: Utilize outreach tools listed in the Plan, such as mailings, advertisements, signage, field tours and workshops, to update and educate property owners, agribusiness, and the public on opportunities the Plan presents them to reduce pollutant loading and/or help maintain water supplies.

Task 2: Utilize the coordinator position to work with producers one-on-one to identify project and program implementation opportunities.

Task 3: Support youth environmental programs and activities such as Water and Earth Jamboree, Rainwater Basin Conservation Day, and Environthon.

Task 4: Work with other agencies, such as NDEQ and University of Nebraska – Lincoln (UNL) Extension to educate rural property owners and agricultural producers on water resources management subjects.

Task 5: Create a program or public outreach campaign for 'Groundwater Recharge Awareness Areas' (GRAA) to increase knowledge on the importance of conserving groundwater within target areas listed in the Five Year Implementation Plan.

Task 6: Identify and install a variety of demonstration projects to showcase specific land treatment practices, stream restoration techniques, and other similar actions.