

INTERRELATED WATER MANAGEMENT PLAN PROGRAM

APPLICATION OVERVIEWS

JUNE 2010

(Note: Applications 44 – 49 were filed for approval and FY 2011 funding; application No.'s 31 – 37 & 39 - 43 requested FY 2011 funding for ongoing research; and the remaining applications are included as this is intended to be a comprehensive list of project overviews taken from the original applications)

Name: **Blue River Basin Groundwater Model**
Number: **1** (*Not Requesting Additional Funds*)

The project for which the sponsors seek funding includes development of a groundwater model and supporting database to be used for evaluating the hydrologic connectivity of streams and groundwater in the Blue River Basin of Nebraska. The modeled area overlays the Upper Big Blue, Little Blue, and Lower Big Blue Natural Resources Districts, including a large sub-region of the COHYST Eastern Regional Model. To the extent possible, the COHYST database will be used. Additional data, such as streambed conductance, estimates of stream base flow, and geologic layer refinements, will be added to improve the model. The model will be developed in accordance with industry standards.

Name: **Characterization of Near-Surface Lithologies under Selected Irrigation Canals within the North Platte Valley, Western Nebraska, using Geophysical Methods**
Number: **2**

The scarcity of water supply in comparison to demand means that the available water needs to be managed carefully to optimize its use. Portions of the North Platte River Basin are designated by the State of Nebraska Department of Natural Resources (DNR) as over-appropriated. To support careful management in compliance with State Law, the North Platte Natural Resources District (NPNRD) and DNR, is developing an Integrated Management Plan for groundwater and surface water. A necessary component to this type of work is a clear understanding of the groundwater and surface water systems to be managed and the development of management tools that will be used by the participating agencies and the public to manage ground-water recharge using leakage from irrigation canals.

The study area lies within the North Platte River valley upstream of Lewellen in the Nebraska panhandle. Within the valley, 27 irrigation districts operate canals delivering irrigation water to approximately 360,000 acres. Leakage from canals is a major source of ground-water recharge to aquifers. This recharge later discharges as base flow to streams creating an intricate combined ground water / surface water flow system.

The Integrated Management Plan will use a suite of management tools to reduce consumptive water demands from over appropriate to fully appropriated level. To support the decision making process and to design a plan of using the canal systems as a method of delivering intentional groundwater recharge to the aquifer system, a groundwater flow model is being developed (2006, Luckey). The U.S. Bureau of Reclamation has estimated that 40-50 percent of the water carried by the canals leaks through the canal bottom to become ground water recharge. Information on where this water is leaking preferentially will improve the recharge estimated for the model and provide critical insight into the relationship of ground water and surface water.

Name: **Eastern Nebraska Water Resources Assessment**
Number: **3**

Eastern Nebraska has experienced one or more glaciations in recent geologic time that have altered depositional and erosional patterns on existing landforms, rivers, and alluvial aquifers.

In addition, the older underlying Dakota aquifer is an important water bearing formation in Eastern Nebraska that varies greatly in both water quantity and water quality. The extent and hydrologic connection of these different aquifers with surface water and with each other is little understood. Population growth in Nebraska is expected to increase in the eastern portions of the State and place a greater demand on these water resources.

In order to better understand and manage this resource, several Natural Resources Districts, State and Federal Agencies have formed the Eastern Nebraska Water Resources Assessment group (ENWRA) and are proposing to do a geologic framework study at three locations. These pilot studies will evaluate different methods and techniques to characterize and map the subsurface. One of these methods will use Helicopter Electromagnetic (HEM) surveys, which is a geophysical method that can quickly map the subsurface geology over a fairly large area. HEM has been used successfully in other parts of the United States. A separate study funded by the Nebraska Department of Natural Resources will look at other geophysical methods to test their effectiveness, such as Direct Current Resistivity survey. Information from that study will be incorporated into this project. Test holes and monitoring wells will also be installed to verify these different geophysical methods and will be used as long-term ground water quantity and quality monitoring sites in the future. If successful, geophysical techniques could provide a rapid assessment technique to characterize other glaciated areas of eastern Nebraska. This project will lay the groundwork for future studies (including ground water modeling efforts) and improving on existing water management plans.

Name: **Elkhorn-Loup Modeling Study**
Number: **4**

The Elkhorn-Loup Modeling (ELM) project is a study of surface water and groundwater resources in the Elkhorn River basin upstream of Norfolk, Nebraska and the Loup River basin upstream of Columbus, Nebraska. The study will assist the Nebraska Department of Natural Resources and the Natural Resources Districts within the study area by characterizing the groundwater system and by providing a regional groundwater flow model that could be used to evaluate surface water/groundwater interaction in the study area. The study will also provide data and interpretations that could serve as the basis for future management of the regional water resources.

Name: **Groundwater Mound Geology and Water Level Data Collection**
Number: **5**

The goal of the Tri-Basin NRD Groundwater Level Observation Project (GLOP) is to create a district-wide network of dedicated observation wells that have highly detailed geologic data. Data gathered by this project will be used to manage groundwater resources to protect streamflows and the aquifer itself. Data will also be used to improve simulations of groundwater levels in computer models such as the COHYST project and the Republican River Compact model.

Tri-Basin NRD has been drilling dedicated observation wells throughout the district since 1998 as part of an on-going program to gather geologic data and continuous water level data. So far, we have drilled 43 observation wells and installed continuous recording data loggers in them, but a minimum of another 56 wells are needed at 34 sites to complete the network (see attached map). These wells would be completed as cluster wells, with one well screened in the

upper (Pleistocene) aquifer and the other screened in the Ogallala formation, in those areas where both formations are present (this is why we are planning on 56 wells at 34 sites). Water level and geology data are critical to insure informed management of the groundwater mound in Gosper, Phelps and Kearney counties.

Name: **Magnetic Resonance Sounding for Ground Water Aquifer Detection**
Number: **6**

Two sets of test wells will be installed on Cottonwood Ranch. USGS hydrologists will perform slug tests in the confining layer to gather information on the hydraulic conductivity of the upper and lower aquifer systems. The IRIS NUMIS^{PLUS} MRS system will be deployed by the USGS at the Cottonwood Ranch as well as at four other sites within the Central Platte Valley. These sites will be selected from the following locations that have had aquifer pump tests performed in the past by the Central Platte NRD and the University of Nebraska-Lincoln Conservation and Survey Division, minimizing the costs of collecting traditional ground-truthing data: the Management Systems Evaluation Area (MSEA) site, Wood River, Grand Island, Chapman, and Silver Creek (attachment 1). Additional site will be added depending on available funds. Time-domain electromagnetic, two-dimensional direct-current resistivity, magnetic, and borehole induction geophysical data will be collected by the USGS to provide background geophysical data necessary to fully process the MRS results. All of these data will be used in conjunction with the existing aquifer test data to develop a comprehensive model of the test areas.

By creating a collaborative relationship with the USGS and NRD the staff will analyze the data acquired in this study with the accompanying hydrogeologic data gained through previous aquifer test and verify the new advanced model while also providing the most accurate and technologically advanced data possible for this study. To better constrain the results of the MRS inversion model, a ground-water flow model will be constructed by the USGS for the study area surrounding Cottonwood Ranch. This model will be used as a tool for refining the MRS inversion, as well for assessing the effectiveness of the MRS data as an input for ground-water models. This ground-water model will be provided to the Central Platte NRD to be used as a local management tool.

Name: **Measuring Components of the Hydrologic Water Budget on Different Landscapes in the CPNRD**
Number: **7**

The Platte River is a vital natural resource for the people (irrigators, communities, recreation, travelers), animals (migratory birds, endangered species, native species), and plants in Nebraska. Changes in land use just like changes in weather effect the surface and ground water supply within a geographic area. Collecting water budget data on various land use under differing land management practices will provide valuable information on which to make water management decisions for our groundwater and integrated management plans. The focus of this study is to measure a portion of the water budget, Evapotranspiration (ET) and soil moisture. ET will be measured using the Eddy-Covariant method at several locations near existing UNL automated weather stations. Objectives of this study are to compare potential ET to measured ET, see how measured ET changes on various land uses with different farming practices, and measure soil moisture through out the profile to see if water in the soil is moving into the Vadose Zone. The land use types we could study include dryland pasture or hay-land

with various grazing and haying periods, irrigated cropland ET under different irrigation practices and tillage practices, and dryland crop ET under different tillage practices.

Name: **Nemaha NRD IWMPFF Request**
Number: **8**

This project is designed to provide the Nemaha Natural Resources District with the proper scientific data to develop an appropriate groundwater flow model for a portion of the District that is thought to contain all four principle aquifer types. Continued drought and recent high capacity well development within the proposed study area has resulted in conflicts between local groundwater users. The Nemaha NRD is currently in the process of updating the quantity portion of our Groundwater Management Plan and feels that this project would contribute significantly to making sound management decisions.

Name: **Remote Sensing Technology to Produce Consumptive Water Use Maps for the NE Panhandle**
Number: **9**

The goal of the project is to accurately quantify net consumptive water use (CWU) for different crops by processing LANDSAT images from 1997, 2002, and 2005. The initial CWU maps will be developed by the University of Idaho (UI) using the Mapping Evapo Transpiration with High Resolution and Internalized Calibration (METRIC) algorithms. The South Platte NRD, the North Platte NRD, UI and the University of Nebraska will work together to develop, test and demonstrate tools that will take these CWU maps and turn them into usable products for planning, managing and regulating groundwater resources. UI will provide training in applying the METRIC equations. The tools/products to be developed and demonstrated include: (1) Developing CWU maps for areas irrigated by groundwater sources and surface water. (2) Sampling of project area CWU data to develop locally calibrated Kc curves for specific crops (alfalfa, wheat, corn, dry beans and sugar beets). (3) Producing maps of net differences in CWU from irrigated agriculture and CWU from rainfed (dryland) agriculture and; (4) Producing maps for net differences in CWU from irrigated agriculture and CWU from natural vegetation. The year 1997 represent the cutoff year for groundwater adjudication, 2002 was an exceptionally dry year, and 2005 was a normal to slightly above normal year after 3 years of some form of water restriction and conservation measures. The project will develop capability to interpret CWU maps for water balances and will develop crop curves for specific crops to delineate irrigated and non-irrigated acres for the reference years listed. The net water use during 1997, 2002, and 2005 will provide the NRDs with the information they need to conjunctively manage ground and surface water as mandated by Nebraska Law LB962. An NRDS Conservation Innovation Grant will be the main support for this project. DNR funds will allow additional resources to enhance the project.

Name: **Republican River Augmentation Appraisal**
Number: **10 (Not Requesting Additional Funds)**

The objectives of the proposed project are to identify potential augmentation water supplies to the Republican River and to conduct a technical appraisal of an augmentation project utilizing those supplies determined to be practical for the purpose of achieving and maintaining compliance with the Republican River Compact and the Republican River Compact Settlement Agreement when considered in conjunction with other ongoing activities in the basin. The study

would first identify practical augmentation water supplies, both ground and surface water, with the potential to significantly increase Republican River flows, in effect increasing Nebraska's allocation under the compact. For those supplies determined to be practical a technical appraisal of hydrologic properties would be conducted to quantify streamflow augmentation potential for each source of supply. The infrastructure requirements of each potential augmentation project will be compiled. Hydrologic properties and infrastructure needs will be utilized to construct cost estimates for each potential augmentation project. The impact of each augmentation project upon Nebraska's compact allocation and consumptive use in both the short and long term will be quantified. The effect of each augmentation project on Nebraska's ability to comply with its compact obligations will be determined by applying the compact sub-basin allocations and accounting procedures. The final task of the project will be to compile a cost to benefit analysis for each of the potential augmentation sources.

Name: **Republican River Basin Riparian Management Study and Demonstration**
Number: **11**

Republican River riparian areas have received little to no management in the last fifty years. As a result, most of it has become overgrown by invasive plant species, which are thought to be contributing to stream-flow depletion. Year one activities of this study will include removing invasive plant species and excess native plant species on a one mile length of river in each of the Republican NRDs as a demonstration and research area. Land owners involved will be encouraged to apply for NRCS cost share monies for tree removal and secondary management afterward. When approved, NRCS cost share monies will add to the scope of the study and ensure that secondary management plans are executed. Regardless of cost shares, a management plan will be developed for each area that will fit the land owner's needs and improve riparian function and wildlife habitat. Southwest RC&D will host field days at each demonstration area to educate the public on riparian management and wildlife habitat development. Water use and conservation will be monitored by water vapor flux meters in treated and adjacent untreated areas and by static water level in observation wells that will be placed in the alluvium of treated areas and adjacent, upstream untreated areas.

Year two activities will include continued data collection at each site and additional educational field days. Available management options for regrowth control will be compared for effectiveness, cost per land unit and ease of use. The resulting data will be included in field day presentations. A yearly report of results will be prepared for the Natural Resource Commission and all partners. It will be available to the public on the various partner's web sites or by request from any partner. Year three activities will be a continuation of year two activities.

Name: **South Platte River Compact Water**
Number: **12**

In the early 1920's, Nebraska and Colorado settled the litigation over the flows of the South Platte River. Through a compact, Nebraska was promised a certain level of flows in the summertime and a certain quantity of water for a proposed project during the non-irrigation season.

This project will implement a water project utilizing the water available for Nebraska during the non-irrigation season from a proposed diversion of water from the South Platte River in Colorado which would be carried through a canal in Colorado to Nebraska.

The Platte River Basin within the TPNRD has been designated Over Appropriated. Stakeholders are currently meeting to prepare recommendation for an Integrated Management Plan that must include provisions for returning the Platte River Basin to Fully Appropriated.

The State of Nebraska is currently considering whether to support a Platte River Recovery Implementation Program (Program). In this Program, Nebraska, through its "new depletions plan", commits to no new depletions since July of 1997.

The TPNRD Board of Directors has taken action to collect and compile information and research related to the South Platte River Compact and that the TPNRD file the necessary documents, materials, and permit applications with the Department of Natural Resources (and any other necessary State or local agency, whether located in Colorado or Nebraska), in order to fully use and exercise the rights and entitlements described in Articles IV, V, and VI of the South Platte Compact.

Because of the time that it will take to proceed with this project, and the immediacy of the need for water, approval of this application is critically important to the development of this water supply. As a result, TPNRD is submitting this application for the purpose of proceeding with the design of the project contemplated by the South Platte River Compact.

Name: **Water Banking**
Number: **13**

The Central Platte Basin has been declared "fully appropriated" and, additionally, that part of the Basin above Elm Creek has been designated "over appropriated". Either of these designations requires NRDs to develop "Integrated Water management Plans" in cooperation with the Nebraska Department of Natural Resources.

When a basin is found to be "fully appropriated" or "over appropriated", new uses must be offset (replaced) so they don't take away from an existing use. There are several methods or sources of water for offsets:

- *retire existing uses
- *water right transfers
- *water rights leasing
- *conservation or other practices may add water
- *development of "surplus" supplies
- *other

Some of these methods are currently being used, however, no one is inventorying the changes and recording the savings. Two examples:

1. As a farmer replaces furrow irrigation with a center pivot, many times there are fewer acres irrigated due to corners on the field.
2. As a city expands housing out into land previously irrigated, new uses are needed for domestic consumption, lawns and parks: but the water previously consumed by the crop is no longer used.

In both cases, there are unrecorded “savings” in existed uses that are neither being accounted for nor inventoried: and therefore not “documented” so they could be used later to “offset” new uses.

That’s where a “water bank” comes in. A water bank is a system to keep track of (account for or “bank”) changes in water use that reduce water consumption or alter water use patterns in order to have that inventoried water that was “banked” available for offset of new or expanded uses.

This project involves the development of a technical tool to help make accurate decisions on the hydrologically connected groundwater and surface water and will enhance the economic benefits of the available water supplies.

Name: **Middle Platte Ground Water Modeling**
Number: **14**

The Twin Platte Natural Resources District (TPNRD), the Tri-Basin Natural Resources District (TBNRD), and the Central Platte Natural Resources District (CPNRD) have entered into an Interlocal Cooperative Agreement for Ground Water Modeling within the three Natural Resources Districts (NRD).

The NRDs are seeking funds to provide the resources, services and facilities needed by the parties to the agreement to (1) complete development of scientifically supportable hydrologic data bases, models and other analysis tools that relate to the hydrologic connection between surface water and ground water in the Middle Platte portion of the Platte River Basin; (2) update and maintain those data bases, models and other analysis capabilities as new information becomes available; (3) perform such modeling analysis as may be needed by the parties to the agreement in developing and implementing their individual ground water supply and integrated management plans and projects; and (4) perform such modeling and other analysis as may be needed by the parties to the agreement to evaluate impacts on their residents and resources from projects or programs that may be proposed, either from within their NRD, or from outside their NRD.

The TPNRD, TBNRD, and CPNRD have a common desire to share administrative responsibilities and costs of the modeler position to carry out and enhance the objectives first established by the Cooperative Hydrology Study (COHYST), and to possibly assist in other projects and programs in the future.

Name: **Lower Platte North NRD Sub-area Delineation Study**
Number: **15**

This project is to identify aquifer sub-areas; those that are isolated or in hydrologic connection with other aquifers and surface water in the Lower Platte North NRD (LPNNRD) so the District can better manage it’s ground water resources. In addition to updating the geologic information of the District, the study will also address current and future land use and water use, and further refinement of the District’s GIS database. These components will be used to rewrite our Ground Water Management Plan and update the District’s Rules and Regulations. With the release of the Nebraska Department of Natural Resources report “2007 Annual Evaluation of Availability of Hydrologically Connected Water Supplies,” it appears that the Lower Platte River basin is much closer to being declared “fully appropriated.” Therefore, the LPNNRD in the next few years will

likely have to draft an Integrated Water Management Plan. Information from this Ground Water Sub-area Delineation Study also addresses surface water resources and their connection to ground water, therefore, the District is already planning for this contingency.

Upon completion of this study, the District plans to develop ground water models for each sub-area to better manage the resource. Data generated from this study such as lithology, saturated thickness, hydraulic conductivity, transmissivity, etc. will greatly aid in this modeling effort. Increased monitoring efforts, such as installation of monitoring wells and focused sampling efforts for both water quality and quantity, will also be targeted to sub-areas that currently may have little information. Refinement of the District's GIS database will allow closer management of current and future land and water use. In summary, LPNNRD views this Sub-area Delineation Study as the cornerstone of our future management decisions.

Name: **Lower Platte River Modeling Study**
Number: **16**

The purpose of this project is to develop a regional groundwater flow model that will be used to analyze the interactions of aquifer-stream-well systems and to determine the 10/50 boundary line for wells that are hydrologically connected to rivers and streams. The model will focus on the following counties: Saunders, Butler, Colfax, and Dodge, which are administered by the Lower Platte North NRD. This project consists of two phases: phase I – development of model framework; phase II – hydrologic data collection and groundwater-stream model development.

Name: **Lower Salt Creek Aquifer Ground Water Modeling Project**
Number: **17**

The purpose of this project is to evaluate several different ground water quantity trigger calculation methods for a possible update of the District's ground water management plan. The District would like to test these trigger methods in terms of their ability to prevent adverse ground water and surface water depletions in the hydrologically connected areas of the Lower Salt Creek Aquifer. A ground water flow model will be constructed to simulate potential future conditions and observe the resulting hydrographs in the simulated monitoring network. Various trigger calculation methods will be applied to the hydrographs to determine which is most effective at triggering water quantity management in the aquifer before adverse depletion levels are reached. The funding requested here will be used to develop data sets needed for construction of the model and to purchase modeling software.

Name: **North Platte NRD Water Management Simulation and Optimization Analysis**
Number: **18**

For many years, the North Platte Natural Resources District (NPNRD) staff has been actively collecting data and studying water resources in their area. As in many other parts of Nebraska, surface- and ground-water resources in the NPNRD are closely related, and changes in either one lead to impacts on the other. Recent drought, leading to decreases in surface-water inflows and outflows in both streams and canals, have highlighted the tenuous balance between use of the resource and protection, as well as the importance of system management.

The North Platte Natural Resources District, in cooperation with the U.S. Geological Survey, have proposed to expand upon recent work by R. Luckey analyzing the effects of management of canal seepage recharge in the North Platte Natural Resources District, by expanding the

previous study area to include the majority of the surface-water irrigation area in the North Platte NRD, and by using Optimization approaches (GWM package for MODFLOW) to simultaneously evaluate multiple management activities and locations where these activities are used. This study will lead to a tool that can be used to evaluate effects of water management options over most of the surface-water irrigated area in the NPNRD, including areas both north and south of the North Platte River, from 6 miles within Wyoming east to about the area of Broadwater, Nebraska.

Name: **Recharge Estimation across the Central Platte River Basin**

Number: **19**

To better understand and most effectively manage water resources in Nebraska, the Nebraska Platte River Cooperative Hydrology Study (COHYST) ground water flow model was constructed to simulate current and future ground water and surface water conditions within the Central Platte River basin. The predictive accuracy of this model depends upon the quality and quantity of hydrogeologic data available in the study area. The COHYST ground water modelers have identified that more accurate measurements of recharge are needed as a priority to improve the predictive accuracy of their models. Therefore the primary objective of the proposed study is to obtain improved measurements and understanding of ground water recharge under various land use practices and the east to west climate gradients across the Central Platte river basin. Successful completion of this objective will result in improved COHYST models, therefore providing improved estimates of groundwater and surface water conditions leading to informed decisions by water resource regulators and planners.

To meet these objectives, a cooperative partnership between the Central Platte NRD, and the U.S. Geological Survey is proposing to establish 8 new recharge assessment sites in strategic locations across the Central Platte River basin. Construction and instrumentation of each recharge site will consist of instrumentation to track meteorological events and corresponding sub-surface water movement. These sites will provide recharge measurements by land use which would improve modeling assessments. Although, the proposed funding over the next 3 years covers the installation of these sites, the monitoring and data collection at these sites will continue into the foreseeable future by the cooperative partnership. These permanent recharge sites will provide valuable, long-term information about ground water recharge and climate gradients, which will benefit future water management in Nebraska. In addition to the recharge data these sites will also provide valuable information about the affect of land use practices on the water quality of recharge, which will benefit future water quality best management practice decisions in the Central Platte NRD.

Name: **Surface Water Model of Platte River Basin**

Number: **20**

The Department of Natural Resources, Nebraska Public Power District, and the Central Platte Natural Resources District, all cooperating under an interlocal agreement, are soliciting Proposals for professional services from a Consultant to provide assistance in development of conjunctive management scenarios for portions of Dawson and Buffalo County in the central Platte Valley. Large portions of the area in question are extensively irrigated with ground water, surface water, or both.

The technical assistance required from the Consultant as part of the project includes the construction of a surface water model and integrating it with a ground water model (COHYST).

The same technical assistance in developing a surface water model and integrating it with COHYST is needed for the South Platte, North Platte and the other portions of the Middle Platte above Columbus, Nebraska in order to increase the understanding of the connection between surface water and ground water and allow the NRDs and the State to analyze impacts of various management options. Such a tool will allow the NRDs and the State to implement projects that enhance the benefits and better utilize the available water supplies.

Name: **Central Nebraska LIDAR**
Number: **21**

The Little Blue, Upper Big Blue, Central Platte, Tri-Basin, and Lower Republican Natural Resources Districts, are proposing the South-Central Nebraska LIDAR (Light Detection and Ranging) Project to provide accurate elevation data for 12,000 square miles within parts of the Blue, Republican and Central Platte river basins. Detailed topographic maps will be able to be produced from the raw elevation data collected via the LIDAR sensor. The LIDAR process develops extremely accurate topographic elevations by precisely measuring the time it takes for a laser pulse transmitted from an aircraft to be reflected from the ground surface. The process produces accurate elevation data (+/-several centimeters) on a scale that is not practical to attain through any other techniques. The primary deliverable product will be a 2-foot contour map at 95% accuracy. The DNR or Rainwater Basin Joint Venture will be hosting the data locally for distribution to partners. The groundwater and surface water models developed to predict water conditions in rivers and streams require accurate elevation inputs.

Name: **Central Platte Conjunctive Management Water Plan**
Number: **22**

This grant request is to study scenarios for improving conjunctive water management, develop a process to implement the program, public education, and an assessment of social/political/economic impacts. Sponsors will conduct a comprehensive analysis of conjunctive water management in the study area and develop implementation plans.

Name: **Tri-basin Conjunctive Management Water Plan**
Number: **23**

The project is intended to utilize tools produced as part of an ongoing project to develop a conjunctive management model for a portion of the Platte River basin in Gosper, Phelps and Kearney Counties in Nebraska. The model will include the Central Nebraska Public Power & Irrigation District's irrigation service area and will be able to evaluate conjunctive management strategies related to water deliveries, canal and reservoir operations, recharge and well withdrawals.

Name: **Identification & Prioritization of Water Management needs**
Number: **24**

This project will hire a consultant to conduct Basin Assessments on the Platte River basin above Chapman and the Republican River basin. The basin assessments will consist of an Inventory of Management Activities and data and science needs, along with their estimated costs and funding alterations. The identified needs will be prioritized into short and long term needs and compiled into basin reports, which will be presented to the Water Policy Task Force for review and recommendation. The report, along with the recommendations of the Water policy Task

Force, will be forwarded to a five member committee responsible for making recommendations to the legislature on funding potential management activities and data/science needs.

Name: **Eastern Nebraska Water Resources Assessment**
Number: **25**

This grant is part of the ENWRA project and will overlap with year 3 of the pilot study work. The overlap is possible, and not part of the initial study, because a geophysical method assessed in years 1 and 2 of the pilot study is immediately applicable to some areas of eastern Nebraska. This method, called Helicopter Electromagnetics (HEM), can map sand bodies that occur under glacial till that is not too thick or too clay rich. The purpose of this grant is to start applying HEM to areas where it is likely to penetrate the till and where groundwater management plans will benefit from the information.

Name: **South Platte River Compact Water – Phase II**
Number: **26**

This project will allow for an in-depth analysis of the very complex issues as to whether water may be available for Nebraska during the non-irrigation season, as well as developing options and assessing benefits of implementing a water project utilizing the water available for Nebraska.

Name: **Central Platte Conjunctive Water Management Tools**
Number: **27**

HDR and others are providing assistance in the development of conjunctive water management models for the Platte River Valley across the Twin Platte, and Central Platte NRDs. The technical assistance required from HDR as part of the project includes the construction of a daily surface water model that accounts for routing of land use runoff and recharge. The technical assistance will also include the integration of surface water tool with a ground water model that the sponsors will develop using the COHYST CMU and EMU. The development of these tools will provide an integrated approach to analysis and management of the hydrologic water budget for the Central Platte, South Platte and North Platte Rivers below Lewellen, Nebraska.

Name: **Republican River Elevation Study**
Number: **28**

This study is intended to further the NRDs' understanding of the connection between surface water and groundwater within the Republican River basin. Specifically, the Republican River Elevation Study hopes to more precisely report the streambed elevation of the river to the Republican River Compact Administration to improve the accuracy of the models. Inaccurate assumptions regarding streambed elevation can greatly impact the outcome of the models run on a water system. This will be done by obtaining elevation readings using survey grade GPS equipment within the basin.

Name: **Republican River Water Balance Study**
Number: **29**

The Republican Water Balance Study intends to quantify the balance of water inflow and water outflow, for a better understanding of supply, demand, and potential water management goals

within the basin. The objectives of this project include identifying water sources and water usage within the Republican River Basin; the out-put should include a basin-wide study, as well as breakdowns by NRD within the basin. Historical and existing data sets – ranging from precipitation volume to rangeland and cropland statistics and pumping volume – will be analyzed to develop an annual water balance as well as understandings of variations and trends over time. Findings will be published for governmental, education and public use.

Name: **Republican River Augmentation Study**
Number: **30**

The Republican River Augmentation Engineering Study is the next step in developing groundwater augmentation of the Republican River. This study will solidify the effects of streamflow augmentation to the Republican River and make strides to implement the augmentation process. This project consists of two phases; detailed site analysis, and project and infrastructure design. The study will first analyze sites identified in the feasibility study and related work with more precise modeling to ensure the sites selected are capable of supplying sufficient water for both augmentation and existing uses for both the short and long term. Second, the engineering design of infrastructure needed for each of the variable sites selected for development will be completed. The study objective is to identify the most beneficial location from which to supplement stream flow; to identify the existing uses to retire to offset the depletions of augmentation pumping; and to complete the initial engineering design of infrastructure for each of the sites selected for development.

Name: **North Platte NRD Canal Geophysics Study**
Number: **31**

The North Platte NRD canal geophysics study seeks to evaluate the lithologies under the canal along the North Platte River. The results of this study should provide seepage estimates of the various canals. These seepage estimates can be incorporated in groundwater models for evaluation of the effects on stream flows in varying the diversion rates and timing through the canal systems. The project may conduct additional geophysics studies, install hydro acoustic measurement devices, collect additional geoprobe borings, establish recharge rates through temperature profiling, and other methods.

Name: **North Platte NRD and South NRD Western Water Use Model**
Number: **32**

The North Platte NRD, South Platte NRD, and the Department plan to cooperatively develop a groundwater model, water portioning code, and surface water operations model for the North Platte River, South Platte River, and Lodgepole Creek basins upstream of approximately Lake McConaughy. This model will be utilized for tracking the success of the integrated management plan and controls being implemented within those plans. Once the modeling tools are developed various simulations of management activities will be evaluated to determine appropriate future actions related to integrated management planning.

Name: **Upper Niobrara-White Conjunctive Management Model**
Number: **33**

The Upper Niobrara-White NRD and the Department plan to cooperatively develop a groundwater model, water portioning code, and surface water operations model for the Niobrara River Basin upstream of approximately the Mirage Flats Irrigation District. This model will be

utilized for tracking the success of the integrated management plan and controls being implemented within the IMP. Once the modeling tools are developed various simulations of management activities will be evaluated to determine appropriate future actions related to integrated management planning.

Name: **Central Platte River Basin Conjunctive Management Model**
Number: **34**

The Central Platte NRD, Twin Platte NRD and the Department are currently working to develop a groundwater model, water portioning code, and surface water operations model for the Central Platte River Basin downstream of Lake McConaughy and upstream of the confluence with the Loup River. This model will be utilized for tracking the success of the integrated management plan and controls being implemented within the IMP. Once the modeling tools are developed various simulations of management activities will be evaluated to determine appropriate future actions related to integrated management planning. This project will focus on evaluating the output from the model simulations being conducted through the modeling process to assess the economic impacts of various management alternatives.

Name: **Little Blue NRD Groundwater Monitoring**
Number: **35**

The Little Blue NRD plans to drill additional test holes and install additional monitoring wells and within various areas throughout their NRD. These funds would also assist with the installation of data loggers to collect data at much greater temporal resolution than current monitoring efforts. The results of the testhole work would be compiled with existing data to allow for a more extensive dataset of hydro geologic properties within the NRD. These datasets would then serve as the basis for model development or model refinement within the area.

Name: **Elkhorn-Loup Modeling Project**
Number: **36**

The Elkhorn-Loup Modeling (ELM) project is a study of surface water and groundwater resources in the Elkhorn River basin upstream of Norfolk, Nebraska and the Loup River basin upstream of Columbus, Nebraska. This project will assist the Nebraska Department of Natural Resources and the Natural Resources Districts within the study area by characterizing the groundwater system and by providing a regional groundwater flow model that could be used to evaluate surface water/groundwater interaction in the study area. This study will build on the efforts currently being made in Phase II of the modeling effort and will seek to incorporate refinements to the groundwater model, as necessary. The study should also provide data and interpretations that could serve as the basis for future management of the regional water resources.

Name: **Eastern Nebraska Water Resources Assessment I**
Number: **37**

Eastern Nebraska has experienced one or more glaciations in recent geologic time that have altered depositional and erosional patterns on existing landforms, rivers, and alluvial aquifers. In addition, the older underlying Dakota aquifer is an important water bearing formation in Eastern Nebraska that varies greatly in both water quantity and water quality. The extent and hydrologic connection of these different aquifers with surface water and with each other is little

understood. Population growth in Nebraska is expected to increase in the eastern portions of the State and place a greater demand on these water resources.

In order to better understand and manage this resource, several Natural Resources Districts, State and Federal Agencies have formed the Eastern Nebraska Water Resources Assessment group (ENWRA) and are proposing to do a geologic framework study at three locations. This project will build on the efforts of the current pilot study. Tasks that will be completed include: compilation, review, update, and publication of existing information and data to identify existing areas where hydrogeologic data is insufficient to develop a hydrogeologic framework and water budget for eastern Nebraska. This project seeks to complete the initial phase I undertakings and develop a long-range plan for future study activities

Name: **Eastern Nebraska Water Resources Assessment II**
Number: **38**

This project would seek to conduct additional geophysical surveys of Eastern Nebraska using techniques tested in the initial pilot study. This project would also intend to expand the existing vadose zone monitoring network which currently exists from the pilot study activities. These efforts would be conducted prior to the results of the pilot study being fully evaluated.

Name: **Republican River Water Budget Study**
Number: **39**

The Republican River Water Budget Study would focus efforts to quantify water inflows and outflows within the Republican River Basin. Brown and Caldwell have been contacted to carry out much of this study. This firm has done similar work, including their study, "Proof of Concept Study for a Consumptive Use Based Method of Water Management."

This study will expand on similar to work started with DNR to quantify the inputs and outputs to a Republican River Basin Water Budget. DNR will work with the others involved to provide data that has already been gathered, as well as provide insight to the future of this study.

Once completed, this in-depth study will help to provide a better understanding of what is happening with surface and ground water in the basin. It will also provide data that can be used to identify "trouble spots" in the basin needing more research. Water use will also be related to specific economic, environmental, and social factors.

Name: **Lewis and Clark NRD Water Study**
Number: **40**

This project is to identify aquifer sub-areas; those that are isolated or in hydrologic connection with other aquifers and surface water in Lewis and Clark NRD (LCNRD) so the District can better manage it's ground water resources. Upon completion of this study, the District could utilize the data to develop ground water models or other tools for evaluating groundwater quantity triggers. Data generated from this study such as lithology, saturated thickness, hydraulic conductivity, transmissivity, etc. will greatly aid in tool development efforts. Results from this study will also summarize areas of sparse data so that future data collection efforts may be more focused in sub-areas that currently may have little information.

Name: **Central Platte NRD Evapotranspiration Study**
Number: **41**

This study will build on the efforts currently being funded and continue to focus on the study of Evapotranspiration (ET) and soil moisture. ET is being measured using the Eddy-Covariant method at several locations near existing UNL automated weather stations. Objectives of this study are to compare potential ET to measured ET, see how measured ET changes on various land uses with different farming practices, and measure soil moisture through out the profile to see if water in the soil is moving into the Vadose Zone. The land use types being studied include dryland pasture or hay-land with various grazing and haying periods, irrigated cropland ET under different irrigation practices and tillage practices, and dryland crop ET under different tillage practices. The results of this study could assist in calibration of models and raising the quality of tools currently being utilized for integrated water management.

Name: **South Platte NRD Water Accounting**
Number: **42**

The South Platte NRD and North Platte NRD are jointly working to develop a water tracking accounting GIS. The water accounting GIS will serve as a tool to monitor and track allocations, poolings and transfers within the SPNRD and NPNRD. This project would provide funds for a consultant to develop these tools to track water use activities including allocations within their respective NRDs and ensure effective management of these controls. This tool will be critical to effective management of the allocations being implemented within these NRDs.

Name: **Central Platte NRD Riparian Evapotranspiration Study**
Number: **43**

This project seeks to characterize the amount of riparian evapotranspiration (ET) associated with selected plant communities along the Platte River. This study will build on previous work and try to establish ET rates for various plant communities in the Central Platte River Basin. The three core objectives of this project are:

1. To communicate the results of existing riparian ET research to a wide audience, including local stakeholders and the general public through presentations and the publication of a fact sheet.
2. Continue data collection for an existing study designed to compare riparian woodland ET with that of a riparian pasture.
3. To compare the ET rates from the riparian woodland and pasture and release those results in a peer-reviewed scientific report.

Name: **Economic Implications of Reduced Groundwater Allocations in the Nebraska Panhandle and Educational Programming to Improve Management with Less Water**
Number: **44**

The goal of this project is to provide farm-level economic analysis of limited irrigation impacts for crops grown in Nebraska's panhandle and to provide educational programming for producers about more effective management of groundwater irrigation in areas that have recently instituted

pumping allocations. Irrigation production functions developed from research data for 2005-2009 encompass a range of extremely dry to above normal precipitation in the panhandle. The crops include corn, winter wheat, dry edible beans, sugar beets, and canola. Most of the database is a five-year-no-till limited irrigation project that includes irrigation allocations of four inches to full irrigation (non-ET limited). The production functions will be used to develop individual crop or multi-crop budgets that reflect farm-level impacts of different water management scenarios.

The second part of this project is an education and demonstration project that will help producers more effectively manage lower groundwater allocations. The South Platte NRD, North Platte NRD, Upper Niobrara White NRD, and the University of Nebraska will work together to provide training and cost share for ET measuring devices (atmometers) and soil moisture sensors. The University of Nebraska will hire an extension educator who will install, maintain, and read information from cooperator sites and conduct educational programs on water management tools. This part of the project is designed to: (1) teach producers the importance of soil water monitoring and tracking evapotranspiration to improve irrigation water management; (2) provide hands-on teaching to properly install, maintain, and read soil and ET monitoring equipment; (3) teach producers how to download, manage, and manipulate data to provide soil moisture graphs and water balance calculations that can be used to schedule irrigations; and (4) develop, maintain, and monitor a network of ET monitoring sites in the Nebraska panhandle to provide more localized (site-specific) information to improve groundwater irrigation management.

Name: **Hydro-Geologic Study for Groundwater Management Plan Evaluation**
Number: **45**

The Little Blue NRD's Groundwater Management Plan divides the district into eight geographic units based on the aquifer's saturated thickness and irrigation well pump draw downs. DNR's annual evaluation of hydrologically connected water supplies did not declare the district fully appropriated, but did project there are 186,000 additional acres in the NRD that could be brought into groundwater irrigated crop production. A compilation of the hydrologic and geologic information available is needed for the NRD to better define the geographic sub-areas with marginal well yields and poor development potential. This data would include bedrock geology, transmissivities, specific yield, lithology, geologic cross sections, saturated thickness, annual change in water table elevation, recharge potential, etc. The grant application is for monetary assistance to employ a professional firm to evaluate the data available and complete a report and mapping of the district's groundwater resources. Boundaries for potential sub-areas would then be drawn based on sound scientific information and the NRD could then update their Groundwater Management Plan to address quantity or quality issues that may arise.

Name: **Recharge Estimation across the Central Platte River Basin**
Number: **46**

To better understand and effectively manage water resources in Nebraska, the Nebraska Platte River Cooperative Hydrology Study (COHYST) groundwater flow model was constructed to simulate current and future groundwater and surface-water interactions within the Central Platte River Basin. The predictive accuracy of this model depends upon the quality and quantity of hydrogeologic data available in the study area. In an effort to improve the predictive accuracy of their models, the COHYST groundwater modelers identified the need for more accurate measurements of recharge. Therefore, the proposed study's primary objective is to obtain improved measurements and understanding of groundwater recharge under various land-use

practices and the east-to-west climate gradients across the Central Platte River Basin. Successful completion of this objective will result in improved COHYST models, thereby providing improved estimates of groundwater and surface-water conditions and leading to better-informed decisions by water resource regulators and planners.

To meet this primary objective, a cooperative partnership between the Central Platte NRD and the U.S. Geological Survey was started in March 2008 to establish eight new recharge assessment sites strategically located across the Central Platte River Basin. Construction and instrumentation of the last three of the sites will be completed by June 2010. All sites consist of instrumentation used to track meteorological events and corresponding sub-surface movement of water. These sites provide recharge measurements as a function of land use, which could improve modeling assessments. The proposed funding over the next three years covers continued monitoring and data collection at these eight sites, plus analysis and reporting of the data. The eight permanent recharge sites will be maintained to provide valuable, long-term information about groundwater recharge and climate gradients, which will benefit future water management in Nebraska. Additionally, these sites will provide valuable information about the effect of land-use practices on the quality of the recharging water and the migration of agricultural chemicals through the unsaturated zone. Understanding these effects will benefit future water quality best management practice decisions in the Central Platte NRD.

Name: **Lodgepole Creek Flow Evaluation**
Number: **47**

The South Platte NRD and DNR have recently adopted an integrated management plan with goals to incrementally achieve and sustain a fully appropriated condition in the Lodgepole Creek sub-area. This project will support efforts to refine management objectives for the first ten-year increment of the integrated management plan as well as study the feasibility of augmentation to support meeting these management objectives.

The project will consist of three key objectives. Objective one is to review historical streamflow data to determine the extent of live stream within the Lodgepole Creek sub-area and a hydraulic evaluation of how such flow translates to the South Platte River in Nebraska. Objective two is to refine the existing stream depletion analysis completed by COHYST (2008) to provide a refined assessment of the depletions that must be offset in the Lodgepole Creek sub-area. Objective three is to evaluate the feasibility of utilizing flows in the Lodgepole Creek sub-area to augment flows in the South Platte River.

Name: **Identifying Difference Over to Fully Appropriated**
Number: **48**

This project has two basic components. The first component is the completion of the final three tasks in refining the procedures for evaluating fully appropriated conditions for river basins in Nebraska. This effort was started by Central Platte NRD and the DNR in 2009. The firm, HDR, was hired in mid-2009 to address the first two tasks of the evaluation, including (1) background data collection and review; (2) development of potential refinements and recommendations for refining evaluation procedures. These two tasks are currently underway and are expected to be completed by early May 2010.

This project begins where the two evaluations tasks leave off. The first component of this project will involve the selection, development, and incorporation of the new methodology. The second

component will be testing of the new methodology, and the third will be the evaluation and finalization of a methodology or procedure for evaluating fully appropriated conditions.

Once that procedure is tried, tested, and accepted, it will become the basis for the second component for this project, which is to identify the difference in water volume between fully appropriated and over appropriated in the Platte River Basin above Elm Creek.

This identification of differences will be identified for each NRD area so they and the DNR can incorporate the numbers into the Basin-Wide Plan and the individual NRDs' IMPs.

Name: **Stream Aquifer Relationships in the Elkhorn River Basin**
Number: **49**

The hydrologic relationship between surface water and groundwater is the foundation for analyzing and estimating the effects of groundwater irrigation on stream flows. This project will help the State of Nebraska and NRDs manage surface water and groundwater resources more effectively by refining tools to evaluate and quantify the degree of connectivity between the two resources.

The University of Nebraska Conservation and Survey Division and the Upper and Lower Elkhorn NRDs have, since 1997, located test holes, multi-level monitoring wells, and streambed conductivity measurements near stream gage sites in the Elkhorn River Basin to determine the hydrologic relationship between groundwater and surface water and learn more about the connectivity between aquifers. MODFLOW, a popular groundwater flow model, will be used to combine this information and quantify the degree of connectivity between these resources.

The following will be used to quantify the relationship between surface water and groundwater: (1) determination of streambed conductance, (2) calculation of the hydraulic gradient between the river and the aquifer, (3) evaluation of the effects of groundwater irrigation on stream stages, (4) evaluation of the response of groundwater levels to the flooding events, (5) determination of the hydraulic connectedness between shallow alluvial aquifer and the deep Ogallala Aquifer, (6) additional data collection for streambed hydraulic properties.

The techniques and information from this project will be useful to the State and NRDs to improve their decisions by using more accurate information and will help the public to better understand the state's groundwater and surface water.

A project report and a peer reviewed journal article will be produced, and presentation to the public and water resources managers will be performed at the conclusion of the project.