Scope of Work
Arkansas River Basin John Martin Wetlands and Neenoshe Reservoir Non-consumptive Needs Quantification

This Scope of Work is divided into four sections as suggested in the Grant Application Instructions. Section 1 provides a description of each major task associated with the project along with a functional description of who will be completing the work and a description of the deliverables associated with the task. Section 2 lists the key personnel proposed for the project along with a brief description of their relevant project experience. Section 3 presents a detailed breakdown of the costs to complete the study and Section 4 presents the proposed Project Schedule.

Section 1 Task Summary

Introduction and Background

The Arkansas Basin nonconsumptive needs assessment subcommittee has been meeting for 18 months to complete the Arkansas Basin's Nonconsumptive Needs Assessment, which is required under HB05-1177. The subcommittee's efforts have focused on the following key efforts:

- Identifying environmental and recreational attributes in the Arkansas Basin
- Prioritizing environmental and recreational needs in relation to water resources in the Arkansas Basin
- Identifying what areas in the basin require further analysis regarding quantification on environmental and recreational needs

The nonconsumptive needs assessment subcommittee is adopting a phased approach that will allow the Arkansas Basin Roundtable to prepare an initial gap analysis for consumptive and nonconsumptive needs in the basin while we pursue quantification needs of those identified high priority areas for which quantification is lacking. This phased approach will avoid delaying the basin gap analysis while ensuring that all of the high priority needs areas are adequately assessed and incorporated into the gap analysis in later phases. The nonconsumptive needs assessment subcommittee has identified three critical areas of focus for the next assessment phase. These include site-specific quantification for wetlands west of John Martin Reservoir that support bird habitat, site-specific quantification of lake levels for Neenoshe Reservoir that support Least Tern and Piping Plover breeding habitats, and development of a river restoration plan for 44 miles of Fountain Creek that has multiple problems associated with impacts of increased population. The Fountain Creek portion of the needs assessment is being addressed under a separate contract and is considered an in-kind service for the overall needs assessment effort. These assessments will provide vital information for the needs assessment of both environmental and recreational attributes including the following: preserving habitat for birds that are of statewide conservation concern and/or listed as Threatened and Endangered; maintaining, improving, and providing additional wetlands that reduce area flooding by storing water, recharging water aquifers, and filtering

sediment that protects downstream reaches and reservoirs from sediment loading; maintaining wetland and aquatic habitats that serve as waterfowl production areas that are needed to maintain and enhance waterfowl hunting opportunities; providing aquatic habitat necessary for fishing opportunities; and maintaining and/or improving general wildlife and especially bird watching recreational activities.

Study Objectives

The objectives of the study are to:

- Identify flow needs to support wetlands west of John Martin Reservoir that support critical environmental and recreational bird habitat.
- Identify lake levels needed to support habitat of Least Tern and Piping Plover near Neenoshe Reservoir.
- Preparation of a river restoration plan for 44 miles of Fountain Creek including land use mapping for the entire stretch (not contained in this scope of work but in-kind services will provide this information).
- The site-specific quantification will focus on the timing of existing flows within the basin. The applicant realizes that the Arkansas Basin quantification identified as part of the project will need to be considered in light of existing water rights. The purpose of the quantification is to identify future multi-purpose opportunities with planned projects such as the Super Ditch project.

Task 1 Meetings, Coordination, and Methodology Development

Task 1.1 Kick-off Meeting and Site Visit

Kick-off Meeting

Consultant will conduct a kick-off meeting with the Arkansas Basin Nonconsumptive Needs Assessment Subcommittee and other key project stakeholders such as Colorado Division of Wildlife (CDOW) and water providers in the basin to discuss the following:

- Review of scope of work
- Review schedule
- Coordination with CDOW and other stakeholders on existing data for John Martin Reservoir and Neenoshe Reservoir
- Discuss Task 1.3 Methodology Development

Site Visit

Consultant will conduct an initial site visit to delineate the study area and assist with methodology development. The Consultant will meet with the stakeholders in the field to discuss what sites should be covered during field data collection. The site visit will be conducted over one day at both John Martin and Neenoshe Reservoirs. At the end of the site visit the Consultant should have a map of areas to focus on for the field data collection effort and the quantification study.

Task 1.2 Coordination Meetings

The primary means of coordinating on project activities will take place through the Arkansas Basin Nonconsumptive Needs Assessment Subcommittee. This subcommittee will include water providers in the basin.The Consultant team will meet with the Subcommittee on a bi-monthly basis during the course of the project. At a minimum the CDM project manager will

meet with the Subcommittee. When key deliverables are presented to the Subcommittee, other project team members will attend the Subcommittee meetings. It is anticipated that other project team members will attend up to four subcommittee meetings. The CDM team will also develop monthly status reports on study progress. The following topics will be discussed during the bimonthly Subcommittee meetings:

- Coordination on field efforts with CDOW and other stakeholders
- Discuss historic data collection
- Discuss field data collection
- Discuss data analysis
- Draft report summarizing study results
- Utilizing work efforts in coordination with other studies in the basin such as the Super Ditch project

Task 1.3 Methodology Development Meetings

Consultant will conduct this task in three phases:

1. An initial phase to draft alternative methodologies for determining wetland flow needs and minimum lake levels;
2. A second phase in which experts will be brought together via conference call and an internet meeting to discuss which methodology is most appropriate for the John Martin wetlands and Neenoshe Reservoir nonconsumptive needs quantification; and,
3. A final phase where stakeholders, including water providers and water rights holders, are brought together via conference call or webinar to provide their input and final buy-off.

The results of this task will be documented in a technical memorandum that will become the basis of the next tasks that include historic data collection results, the data gap analysis, and the methodology for field data collection. It is assumed that the initial phase of drafting a list of alternative methodologies for determining wetland flow needs and minimum lake levels will be discussed at the kick-off meeting.

Deliverables

Consultant will prepare meeting agendas and summarize action items for the kick-off meeting, coordination meetings and meetings conducted regarding methodology development. Consultant will develop a technical memorandum describing the recommended methodology to quantify flow needs at John Martin Reservoir and Neenoshe Reservoir.

Task 2 Data Collection

Task 2.1 Historic Data Collection and Site Visit

Initial data collection for John Martin and Neenoshe Reservoirs will include gathering hydrologic/hydraulic data, wetlands studies, and species data. The following sections discuss each type of data, methods for data collection, and potential sources. For this task the Consultant will:

- Research primary sources for this data
- Obtain data by the most appropriate means available
- Summarize data in a technical memorandum

Hydrologic and Hydraulic Data
Consultant will collect hydrologic data near John Martin Reservoir and Neenoshe Reservoir from the U.S. Geologic Survey (USGS) National Water Information System (NWIS) via internet download. Consultant will gather water diversion data near John Martin Reservoir and Neenoshe Reservoir from Hydrobase and other sources recommended by the Needs Assessment Subcommittee.

Consultant will download digital elevation models (DEM) or national elevation data (NED) in order to develop contours for both John Martin and Neenoshe Reservoirs. Consultant will work the Needs Assessment Subcommittee and CDOW to historic hydrologic and hydraulic data for Neenoshe Reservoir including:

- Bathymetric data or surveys
- Inflow and outflow records
- Stage relationships
- Evaporation rates
- Historic lake level data

Wetland Studies
The Colorado Natural Heritage Program (CNHP) and the CDOW have conducted wetland studies throughout the state. Consultant will gather available wetland studies or other wetland data from these potential data sources through phone calls and internet searches. Additionally, the U.S. Fish and Wildlife Service (USFWS) may have data available through their National Wetlands Inventory (NWI). This data is not currently obtainable digitally, but paper copies may be available from local USFWS offices. Consultant will discuss with USFWS if there is any more recent data than the current data sets.

Wildlife Species Data
Both the John Martin Reservoir area and Neenoshe Reservoir (as part of the larger Queens State Wildlife Area) are managed by the State of Colorado. As such, the CDOW will most likely have information on threatened and endangered and other wildlife species that use wetland and other aquatic habitats within these locations. Phone calls to the CDOW and Parks Department should generate, at a minimum, wildlife species lists for both reservoirs. In addition, Consultant will work with nonconsumptive needs assessment subcommittee chair to identify birding organizations that may have additional species information. Consultant will contact these organizations via conference calls.

Task 2.2 Data Gap Analysis

Based on Task 1.3 and comparing with the historic data collected, the Consultant will identify data gaps that need to be filled by field data collection and develop a sampling plan to collect data gaps through field work.

Task 2.3 Field Data Collection

Based on the data gap analysis, the sampling plan, and the initial site visit in Task 2.1, the Consultant will implement a field data collection effort. The following sections outline the basis and assumptions associated with field data collection for each type of data.

John Martin Reservoir

Hydrologic and Hydraulic Data

The Consultant is assuming that field collection hydrologic and hydraulic data will not be necessary beyond visual surveys and anecdotal information noted during the wetland studies because species lists will be gathered during the historic data collection task.

Wetland Studies

The Consultant will conduct field surveys of wetland habitat at John Martin Reservoir, particularly in the Ft. Lyon area. Surveys for wetland and other aquatic habitats will conform to the *Corps of Engineers Wetlands Delineation Manual* (1987) and the *Interim Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Great Plains Region* (2008). All habitats within the study area will be mapped using Cowardin et. al's *Classification of Wetlands and Deep Water Habitats of the United States* (1979). Data will be collected using the appropriate data forms and a sub-meter accuracy GPS. Collected data will include:

- Plant species, soil type, and hydrology indicators at each sampling point entered onto a field data form
- GPS data for each sampling point
- GPS data for the limits of each identified wetland
- GPS data and field notes for any other pertinent habitats, species locations (i.e., special-status wildlife; invasive plants; bird nests)
- Photo documentation for each sampling point and delineated habitat

Wildlife Species Surveys

The Consultant is assuming that field collection of wildlife species data will not be necessary beyond visual surveys and anecdotal information noted during the wetland studies because this data should be available as a result of historic data collection.

Neenoshe Reservoir

Hydrologic and Hydraulic Data

The Consultant is assuming that field collection hydrologic and hydraulic data will not be necessary beyond visual surveys and anecdotal information noted during the habitat surveys. CNHP has studied the area around Neenoshe reservoir and the Consultant will review this study for any hydrologic information.

Habitat Surveys

The Consultant will conduct field surveys of habitats at Neenoshe Reservoir. Surveys for wetland and other aquatic habitats will conform with the *Corps of Engineers Wetlands Delineation Manual* (1987) and the *Interim Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Great Plains Region* (2008). All habitats within the study area will be mapped using Cowardin et. al's *Classification of Wetlands and Deep Water Habitats of the United States* (1979). The types of habitat that the Consultant identifies include sand bars, mudflats, and open water which would be captured when completing a wetland and other aquatic habitats delineation; therefore, the methodology is the same as for John Martin Reservoir. Data will be collected using the appropriate data forms and a sub-meter accuracy GPS. Collected data will include:

- Plant species, soil type, and hydrology indicators at each sampling point entered onto a field data form

- GPS data for each sampling point
- GPS data for the limits of each identified wetland
- GPS data and field notes for any other pertinent habitats, species locations (i.e., special-status wildlife; invasive plants; bird nests)
- Photo documentation for each sampling point and delineated habitat

Wildlife Species Surveys
The Consultant is assuming that field collection of wildlife species data will not be necessary beyond visual surveys and anecdotal information noted during the habitat surveys.

Deliverables

Consultant will develop following deliverables for Task 2:

- Technical Memorandum on data gaps
- Sampling Plan

Tasks 2.1 and 2.3 will be summarized in Task 3 technical memorandums.

Task 3 Data Analysis

Task 3.1 Data Summary and Processing

The Consultant will enter all field data into databases as necessary to conduct needs quantification based on the methodologies developed in Task 1.3. Additionally, the consultant will complete initial data processing. The sections below provide more detail on the data entry and processing for each type of data.

Hydrology and Hydraulic Data Entry and Processing
No new hydrology/hydraulic data will be collected during the field surveys; therefore, data entry and processing will be confined to the data collected in Task 2.1. Flow data and lake levels will be placed in an *Excel* spreadsheet. DEMs or NEDs will be converted to contours using GIS applications and saved as shape files. Mapping of information will be created for stakeholder review.

Wetland and Habitat Data Entry and Processing
Wetland and habitat data collection consists of filling out field data forms and obtaining GPS mapping points. The Consultant will enter field data forms into an Excel spreadsheet and convert GPS points into a shape file that can be mapped for stakeholder review.

Wildlife Species Data Entry and Processing
No new wildlife species data is anticipated to be collected during the field surveys; therefore, data entry and processing will be confined to the data collected in Task 2.1. Wildlife species lists will be placed in a table and expanded to include listing status, habitat requirements, and whether or not the species might require consideration during the needs quantifications (e.g. nest flooding of piping plovers).

Task 3.2 John Martin Wetlands Quantification

Three methods of analysis have initially been identified for quantifying wetland water needs at John Martin Reservoir. The implementation of these methods is dependent upon model and data availability. At a minimum, a method similar to the Wetland Net Water Requirements

Modeling as described below will be utilized for the wetlands needs at John Martin Reservoir. As part of the analysis, seasonal and water year quantities will be specified.Therefore, all three methods and their associated assumptions will be discussed below. Generally, the Consultant assumes:

- A simple quantification scheme will be developed based on historical and field collection data
- The primary source of water for wetlands (Arkansas River, groundwater, canal seepage, etc.) will be identified during field data collection
- Quantification will not include highly detailed hydrologic or hydraulic modeling if existing models are not available to the Consultant

The following three methods are options for estimating wetlands water requirements. The method chosen will be completed after the site-visit and Task 1.3.

Hydraulic Modeling

Hydraulic modeling can be used to determine flood elevations in adjacent/connected wetlands under various flow regimes. Consultant will investigate whether an existing hydraulic model has been developed by the Federal Emergency Management Agency (FEMA) for unincorporated Bent County. Preliminary research and inquiries indicates that Flood Insurance Rate Maps (FIRMs) exist for Bent County, but the existence of a Flood Insurance Study (FIS) and consequently a hydraulic model (a HEC-2 OR HEC-RAS model) has not been determined. If a model exists and if the model cross sections extend to the wetlands being investigated, Consultant would run the model under various flows and identify those flows necessary to sustain the wetlands. Criteria required to sustain the wetlands include depth and duration of saturation during a portion of the growing season. This method assumes that the Arkansas River and the John Martin Wetlands being investigated are hydraulically connected.

Correlation between Upstream Gage and Wetland Water Level

Consultant will utilize the upstream Las Animas gage data to develop a correlation between river stage and water surface elevation in the wetlands. This method would require regular (daily) sampling, primarily during the growing season and other critical diversion seasons, of several points in the various wetlands. Consultant would perform site reconnaissance visit in which wetland sampling points would be identified and subsequently would train stakeholders (potentially Las Animas High School team or other interested stakeholders) to collect the needed data. This method assumes that stakeholders can be identified to perform the sampling, that stakeholder samplers have GPS equipment with sub-meter accuracy and that the wetlands are hydraulically connected to the river. This method recognizes that there is likely to be some lag in response between change in elevation in the river and in the wetlands.

Wetland Net Water Requirements Modeling

The Consultant will model the change in water table at the wetland site using DRAINMOD based on the procedures developed by Zhonghua Jia and Wan Luo for their study *Modeling Net Water Requirements for Wetlands in Semi-Arid Regions (Agricultural Water Management, June 2005).* This effort will lead to a water quantity necessary to produce wet conditions for sustaining wetlands. The Consultant assumes that the following data will be available for the John Martin wetlands site:

- Depth to impermeable layer
- Pressure head and soil water content
- Water table depth, volume drained, and upward flux
- Green-Ampt infiltration parameters
- ET correction factors

Should none of these or equivalent methods be available, the consultant will not be able to complete this task. The consultant will notify the subcommittee and CWCB that the funds associated with this subtask and indicated in the budget will not be spent.

Task 3.3 Neenoshe Needs Quantification

Consultant assumes the following regarding the Neenoshe Reservoir Needs Quantification:

- Quantification estimates will be based on physical conditions of the reservoir (flow levels) as they relate to habitat type for piping plover and least tern
- Analysis will not take into account water quality issues in the reservoir
- Analysis assumes that stage change in the reservoir can be estimated from available GIS information and historic water management records

The Consultant will combine the contours developed from the DEM/NED, the historic water level data, and wildlife species habitat data in GIS to identify water levels that will provide sufficient water for fish resources without significantly impacting wildlife species habitat. These water levels will be developed to include seasonal issues (e.g. bird nesting) and water year type. Three seasons will be considered: nesting, birds present but not nesting, and birds not present. Three water years types will be considered: dry, normal, and wet.

Task 3.4 Recommendations

The Consultant will prepare a set of water level and or flow recommendations for John Martin and Neenoshe Reservoirs based on the quantification results. These recommendations will be summarized in a technical memorandum, and will include how to maintain or improve levels, and what incremental impacts of decreased water available for identified habitats would be.

Deliverables

Consultant will prepare databases, process the data, and conduct needs quantifications for both John Martin and Neenoshe Reservoir, including seasonal and water year type variations and associated water level ranges. The end result of Task 3 will be data contained in Excel spreadsheets, GIS shape files, quantification results, and a technical memorandum which will include methods, results, and recommendations.

Task 4 John Martin and Neenoshe Reservoirs Nonconsumptive Needs Assessment Study Documentation

Task 4.1 Develop Draft Report

A draft report to document study activities and results will be developed from the Task 1 and 2 technical memorandum and the results of Task 3.

Task 4.2 Develop Final Report

The draft report developed as part of Task 4.1 will be finalized based upon QA/QC review and stakeholder comments gathered during task 1.3.

Task 4.3 Develop Final Presentation

A PowerPoint presentation will be developed based upon the final report for use in the Arkansas Basin Roundtable, stakeholder meetings,other meetings as necessary.

Section 2 Key Personnel

Relevant project experience for the key personnel proposed for the Arkansas River Basin John Martin Wetlands and Neenoshe Reservoir Nonconsumptive Needs Quantification are discussed in this section.

Arkansas Basin Roundtable and Nonconsumptive Use Needs Assessment Subcommittee – Project oversight and Facilitation

The NCNA Subcommittee will hold primary responsibility for the oversight and progress of this project. The Subcommittee and Chair will meet or otherwise communicate on a regular basis with the Project Manager to ensure timely compliance with the Scope and schedule. The Subcommittee will review drafts of the Report, and report regularly to the Basin Roundtable as a whole, including a presentation of the final results.

Nicole Rowan, P.E. –Project Management

Ms. Rowan has over 15 years of water resources engineering experience and is a senior project manager who focuses on water supply, watershed management, and natural resources projects. She was the project manager for the Statewide Water Supply Initiative (SWSI) and is the project manager for CDM's current contract with the Colorado Water Conservation Board to provide technical support to the Interbasin Project Compact process.

Ted Johnson, P.E. – Hydrology and Hydraulics

Mr. Johnson has more than 20 years of experience in environmental engineering, specializing in the planning, design and construction of storm drainage, flood control, channel stability, and ecologic enhancement of stormwater and river systems. Mr. Johnson also has developed expertise in regulatory coordination including Clean Water Act, Endangered Species Act, NEPA and CEQA requirements; the use of GIS in analyses of project criteria and requirements; hydrology and hydraulics analyses; sediment transport and scour and deposition analyses; erosion control BMPs; and, habitat analyses.

Tricia Reed – Biology

Ms. Reed is an environmental scientist with over eight years experience in the natural resources field. Her work has focused on regulatory compliance; field surveys and research; and literature research, analysis, and synthesis. She is also skilled in experimental design and implementation, database development, presentations, and classroom and field instruction.

Larry Schwartz – Wetland Science

Dr. Schwartz is a certified Professional Wetland Scientist (PWS) and an environmental scientist with more than 23 years of experience addressing a wide range of environmental

issues. His technical expertise is in wetland systems ecology, wetland treatment system design, and ecosystem restoration. He has a diverse background in the regulation of water resources, wetland design and permitting, mitigation and ecosystem restoration projects, and in addressing biological and water quality issues.

Tim Cox, Ph.D., P.E. – Hydrologic Modeling

Dr. Cox has a diverse background in water supply planning and water quality management planning. He has broad skills in applying mathematical programming, water quality models, and water supply allocation models in addressing western water resources issues. Dr. Cox has used the CDSS model in examining water allocation and environmental flow need as part of the SWSI project.

Section 3 Budget and In-kind Services

A detailed breakdown of the estimated labor and other direct costs for the proposed project is presented in the following pages.

In-kind services, totaling $41,250.00 will be provided for preparation of a river restoration plan for 44 miles of Fountain Creek including land use mapping for the entire stretch. The goals of the restoration plan include:

- Improve watershed health by reducing erosion, sedimentation and flooding and improving water quality
- Create stable riparian and ecosystems to attract and support native wildlife and vegetation
- Sustain productive agricultural lands along corridor
- Lay-out trail from Colorado Springs to Pueblo with recreational and educational opportunities
- Gain public and private support through partnerships to facilitate implementation and future funding

The river restoration plan will include approximately 44 miles of Fountain Creek. The reach extends from the southern city limits of Colorado Springs south to the confluence with the Arkansas River in Pueblo. Plans will be prepared for the entire reach that reflects the engineering techniques used to restore Fountain Creek. Quantities of wetlands, wildlife habitats, stream bank stabilization, and flood water side detention will be estimated.

Current land use mapping for the entire 44 mile reach. Proposed future land use for approximately 8 miles of the reach will also be developed. These 8 miles include four demonstration projects that will be developed and planned to reflect the future land use adjacent to the creek. These 8 miles will be studied in greater detail, including public involvement. This effort will provide make land use assumptions for the future of the entire 44 mile reach. Quantities of land use type will be provided to assist with the non-consumptive use needs assessment.

In addition to the Fountain Creek restoration plan, in-kind services in the form of technical support to the project will be provided by Colorado Division of Wildlife and Audubon Colorado. Both organizations have committed 20 hours of staff time to participate in the project for an estimate of $2,000 in services. Letters committing to this level of effort are

attached to this scope of work. Also, the Arkansas Valley Audubon Society has committed $1,000 in cash funds for the project. This is reflected in the project budget.

Section 4 Project Schedule

The proposed project schedule is presented on the following page. It is anticipated that the project will be completed within 12 months.