

September 19, 2005

**Plan of Study**

**For**

**Frenchman Valley Appraisal Study**

**DRAFT**

**Nebraska-Kansas Area Office**

**Great Plains Region**

**U.S. Bureau of Reclamation**

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# PLAN OF STUDY

## I Purpose and Scope

The purpose and scope of the Frenchman Valley Appraisal Study (Study) is to evaluate: (1) alternative program activities; (2) structural measures or incentives that can assist in optimizing existing facilities; (3) lake level benefits by providing stable water levels; and (4) recharge facilities for Enders Reservoir and the irrigated area it serves.

The Study will review the existing data and information, qualitatively identify some improvement needs of the area, identify possible constraints and opportunities to more efficiently manage water supplies in the Frenchman River Valley including Enders Reservoir, and determine the advisability of proceeding to a feasibility study.

The Study will focus on problems and opportunities for the area that has experienced dramatically reduced ground and surface water supplies, including reduced inflows at Enders Reservoir.

The Study will identify whether there is a Federal interest in intensive management of interrelated groundwater and surface water supplies to meet Compact requirements as well as for meeting other economic and environmental needs. The study will be coordinated with the State, irrigation districts, and natural resources districts.

## II Authority

The Frenchman Valley Appraisal Study is authorized under Federal Reclamation Laws (Act of June 17, 1902, 32 Stat. 388, and acts amendatory thereof and supplementary thereto). This study is programmed and funded from the Nebraska Investigations Program.

## III Study Partners and MOU

Study participants include representatives from the following agencies: Bureau of Reclamation, Frenchman Valley and H&RW Irrigation Districts, Nebraska Department of Natural Resources, Middle and Upper Republican Natural Resource Districts, and Nebraska Game and Parks Commission.

A draft Memorandum of Agreement (MOA) has been developed that will outline each agencies support and/or study requirements and is included in appendix XX.

## IV Description of the Study Area and Background

The study area has been defined as the entire drainage basin of the Frenchman Valley and extending east to the project area of the H & RW Irrigation Districts, which ends just east of McCook, Nebraska. (See Appendix XX)

The Frenchman-Cambridge Division, a project of the Bureau of Reclamation's Pick Sloan Missouri Basin Project, encompasses the Frenchman-Cambridge, Frenchman Valley, and H&RW Irrigation Districts. Facilities to serve these three irrigation district include four storage dams and reservoirs, four diversion dams, and the distribution systems to deliver project water to 54,680 acres of irrigable land in Chase, Hitchcock, Hayes, and Red Willow Counties as shown on Exhibit \_\_\_\_\_. The Frenchman-Cambridge Division contains the Frenchman Unit, the Meeker Driftwood Unit, the Red Willow Unit, and the Cambridge Unit. The Frenchman Unit includes Enders Dam and Reservoir, Culbertson Diversion Dam, Culbertson Canal, Culbertson Extension Canal, and a system of laterals.

The Frenchman-Cambridge Division was authorized for initial construction in Senate Document 191, as approved in the Flood Control Act of 1944. The Frenchman Valley Irrigation District, organized in 1911, was incorporated into the development plan through the purchase of its supply canal in 1956. The H&RW Irrigation District was organized in 1955. The construction of Enders Dam and Reservoir started in January 1947 and was completed in 1951. Storage of water began in October 1950 and the irrigation pool first filled in January 1952. The first irrigation water was delivered to the Frenchman Valley and H&RW Irrigation Districts in May 1958 and April 1961, respectively.

The drainage area above Enders Reservoir is 950 square miles, but the drainage area contributing inflows directly into Enders Reservoir is approximately 790 square miles. A majority of the inflow into Enders Reservoir is derived from groundwater discharge into Frenchman Creek. Enders Reservoir provides off-season storage for Frenchman Valley and H&RW Irrigation Districts. Water stored in Enders Reservoir, along with flows from the Frenchman and Stinking Water Creeks, provides water for the Culbertson Canal and the Culbertson Extension Canal systems, which serve 9,600 acres in the Frenchman Valley Irrigation District and 11,490 acres in the H&RW Irrigation District.

The conservation pool in Enders Reservoir begins at elevation 3082.4 and extends to elevation 3112.3 and totals 34,512 acre-feet (Figure \_\_\_\_). A decreasing water supply for Enders Reservoir is show on the graphs depicting historic inflows and reservoir levels (see Appendix XX). The last time Enders Reservoir reached the top of conservation level (elevation 3112.30 feet) was in 1968. Flows in the Frenchman Creek exhibit less variability than in many of the other drainage basins within the Republican River Basin. Since the 1950's, the streamflow into Enders has been showing a progressive decline, and there is no indication that the decline is leveling off. The cause of the decline appears to be mainly the result of a high degree of well development above Enders Reservoir.

Historic mean annual inflow for 1929-50	63,100 acre-feet
Historic mean annual inflow for 1980-93	23,600 acre-feet
Change in mean annual inflow	- 39,500 acre-feet
Historic mean annual inflow for 1929-50	63,100 acre-feet
Historic mean annual inflow for 1994-2004	13,600 acre-feet
Change in mean annual inflow	- 49,500 acre-feet

Ground water in the area generally flows eastward, converging toward the Republican River. Irrigation wells are the primary groundwater users, with relatively smaller amounts used for municipal, industrial, domestic, and stock watering purposes. In 1996, a total of 12,246 wells were registered with some of the heaviest concentrations of wells near (within 12 miles of Frenchman Creek above Enders Reservoir, near Beaver and Sappa Creeks (above Harlan County Lake and near the Republican River below Harlan County Lake to Guide Rock.

This level of development was not anticipated when the Definite Plan Report (DPR) for the Frenchman-Cambridge Division was prepared. The DPR recorded a historic annual average flow of 60,700 acre-feet for the period of 1929 to 1947. The DPR made estimates of future depletions due to additional private irrigation and on-farm pond development upstream of Enders, but considered additional groundwater development would only take place to a "limited extent." Hence, the DPR estimated the future annual average depleted flows for the 1929 to 1947 hydrologic cycle to be 55,100 acre-feet. That depleted flow estimate is over two times the 1980-93 average flows of 23,600 acre-feet and is over \_\_\_\_\_ times the 1994-2004 average flows of 13,600 acre-feet.

The Frenchman Valley Appraisal Study will evaluate the water supply problems facing the Frenchman Unit. The Frenchman Valley and H&RW Irrigation Districts are dependent on Enders Reservoir for storing surface water supplies. The primary problem facing the Frenchman Unit is the continuing decline of the water supply from Enders Reservoir. Existing data indicate that the installation of conservation measures and the intensive private irrigation well development upstream has caused depletion of the base flow of the Frenchman River.

The Frenchman Valley Basin is a sub basin of the Republican River Basin, which is governed by the 1942 Republican River Compact (Compact), entered by the States of Colorado, Kansas, and Nebraska. This study also meets the States (Colorado, Kansas, and Nebraska) responsibilities of the Compact "... to provide for the most efficient use of the water of the Basin for multiple purposes ..."

In May of 1998, the State of Kansas filed a motion with the U. S. Supreme Court alleging that Nebraska violated the Compact by allowing the proliferation and use of groundwater wells hydraulically connected to the Republican River and its tributaries, and by failing to protect the surface flows from other unauthorized appropriations.

In December, 2001 the Special Master assigned to the case agreed to postpone the progression of the case in order to allow the three compact States of Colorado, Kansas, and Nebraska to engage in settlement negotiations. These negotiations culminated in a settlement package that was approved by the Governors and Attorneys General of all three states in December 2002. The States agreed to resolve the pending litigation regarding the Republican River Compact by means of a Final Settlement Stipulation and a Proposed Consent Judgment. More efficient management of Republican River can help extend water supplies and meet interstate compact needs as addressed in the Compact Settlement.

## V Previous Investigations and Reports

Numerous investigations have been completed in the study area to address the depletions occurring in the upper Republican River Basin. A study entitled "Groundwater Geology and Pump Irrigation in Frenchman Creek Basin above Palisade, Nebraska" (Water Supply Paper No. 1577) was published in 1963. At the request of Reclamation, the U.S. Geological Survey (USGS) included a study to determine the extent in which future pumping of ground water for irrigation might deplete streamflow in the Frenchman River and in Stinking Water Creek.

The Conservation and Survey Division, Institute of Agriculture and Natural Resources, University of Nebraska, Lincoln, in cooperation with the Southwest Nebraska Groundwater Conservation District, prepared a report entitled "Groundwater Geology of Southwest Nebraska Ground Water Conservation District" (Nebraska Water Survey Paper Number 37) which was published in May 1974. The purpose of this report was to provide geohydrologic data that could be used as a base for assessing the impacts of future ground-water withdrawals in the Frenchman Unit.

In January 1977 Reclamation published the "Frenchman Unit Nebraska Appraisal Report" which evaluated the water supply problems facing the Frenchman Unit of the Frenchman-Cambridge Division, which includes the Frenchman Valley and H&RW Irrigation Districts. At that time the report stated that, "The primary problem facing the Frenchman Unit is the continuous decline of the water supply from Enders Reservoir. The results of the 1977 appraisal study indicate that intensive private irrigation well development upstream has caused depletion of the base flow of the Frenchman River." Additional conclusions included in the report:

- That extensive ground water development upstream of Enders Reservoir has depleted the surface flows of the Frenchman River at a faster rate than was anticipated when the Frenchman Unit was constructed.
- That the average depletions of surface flows into Enders Reservoir are expected to increase to 24,000 acre-feet by 2010 without additional upstream ground-water development over 1972 levels.
- That the water supply for the Frenchman Unit by 2000, considering additional upstream ground water development, would provide a full supply for only about 10,250 acres.
- That unless the State of Nebraska provides measures to protect surface water rights from depletions caused by ground water development, the depletion of the surface water supply for the unit will continue.
- That the socio-economic well-being within the unit area would be significantly impaired by the gradual decrease in surface water supplies and related crop production.
- That certain measures can be implemented to temporarily supplement and conserve the depleting surface water supplies. The most favorable of these measures, based on engineering and economic analysis, appears to be (1) installation of ground water wells within the irrigation districts, and (2) canal lining. The benefit-cost ratio of these two features is 3.30 to 1.00 and 1.91 to 1.00, respectively.
- That the other structural measures investigated, construction or additional storage facilities and a lateral improvement program, cannot be economically justified.

- That the lack of a protection of surface water right from depletion by ground water development in this area would limit Federal participation in structural solutions to situations where repayment could be accomplished within the life of the projected water supply.

In July 1996 Reclamation published the "Resource Management Assessment Republican River Basin" for renewing the water service contracts of the irrigation districts in the Republican River Basin. The report looked at surface water supply (historic and present) and ground water supply within the Basin and concluded that "In general, inflows to all the reservoirs have been declining at a significant rate since pre-development. The cause of those declines appears to be a combination of reduce streamflow due to effects from surface water diversions, irrigation well pumpage, conservation practices, upstream reservoir development, and what appears to be a reduction in annual precipitation variability."

The appraisal study will conform to Reclamation's standard planning process thru at least one iteration:

1. Specify problems and opportunities
2. Inventory and forecast conditions
3. Formulate alternative plans
4. Evaluate effects of alternative plans
5. Compare alternative plans
6. Select recommended plan

If the appraisal study finds that one or more plans are viable, as well as strong non-Federal support for those plans, then a recommendation can be made to proceed to the feasibility study. In order for the plans to qualify for further study, they are formulated to meet objectives and avoid constraints, are likely to be economically and financially feasible, and be relatively environmentally friendly. A complete list of the reports available for use in this study is shown in Appendix A.

## VI Problems and Opportunities

Problems and opportunities are statements of conditions that exist and/or are expected to exist in the Basin. "Problems" indicate what is wrong, and "opportunities" indicate what the desired future condition should be. The following problem and opportunity statements will be further refined using extensive input from the study partners.

**Problems** – The problems affecting the Frenchman Valley and H&RW Irrigation Districts are:

1. The water supply in the upper end of the basin is depleted – both Districts are dependent on Enders Reservoir for stored water. The water released for irrigation is delivered through the Culbertson Diversion Dam, the Culbertson Canal, and the Culbertson Extension Canal. Intensive ground water development above Enders Reservoir and the installation of conservation measures have resulted in the subsequent depletion of surface flows of the Frenchman River, which has reduced the water supply to the irrigators in the Frenchman Unit.

The greatest concentration of wells that affect inflows to Enders Reservoir is in Chase County along both sides of the Frenchman River from Enders Reservoir to the Colorado State line and extending several miles onto the upland area. In addition, wells in Colorado have caused significant long-term stream depletions. Irrigation wells in Chase County have increased from 20 in 1950 to 1,488 in 2005.

The flows originating in Spring Creek and Stinking Water Creek are also diverted during the irrigation season. Ground water development has also depleted these flows. The irrigation wells below Enders Reservoir and in the Spring Creek and Stinking Water Creek drainage are concentrated mainly in the alluvium along the stream valleys; however, there are also \_\_\_\_\_ wells located on the upland between the valleys.

Estimated depletion of the surface flows into Enders Reservoir, attributed to upstream ground water development, was about 10,000 ac-ft in 1972. This figure was estimated to have increased to \_\_\_\_\_ ac-ft in 2005.

2. Republican River Compact lawsuit – A dispute between Kansas and Nebraska resulted in a Motion for Leave to File a Bill of Complaint being filed on May 26, 1998. The complaint states that Nebraska had breached the terms of the Republican River Compact by allowing the proliferation and use of groundwater wells hydraulically connected to the Republican River and its tributaries, and by failing to protect surface flows from other unauthorized appropriations. A Final Settlement Stipulation was filed with the Special Master on December 15, 2002. In this Stipulation the States agree to resolve the currently pending litigation by means of the Stipulation and the Proposed Consent Judgment.

3. Scio-Economic Problems -

4. Recreation

**Opportunities** – There may be opportunities to:

1.

## VII Planning Objectives and Constraints

Input on planning objectives and constraints will be solicited from the study partners along with individuals. Planning objectives, for which alternatives will be developed to address the problems include:



- Consider all reasonable solutions
- Obtain input from the study partners
- Provide for an acceptable allowance for shortages for the Districts
- Economic feasibility
- Financial feasibility (ability to repay construction costs and annual OM&R)
- Acceptable environmental impacts

Planning constraints, for which alternatives will be developed to address the problems include:

- Conform to the Final Settlement Stipulation and Proposed Consent Judgment
- Conform to the Republican River Compact
- Conform to the State and NRD regulations

## **VIII Plan Formulation and Alternatives**

A multi-disciplinary planning team will be organized by Reclamation and the study partners. This team will consist of experienced individuals representing major functional disciplines important to the study process, i.e. hydrology (surface and groundwater), engineering (water supply), economics, environmental, technical writing, etc. Some of the disciplines will only provide cursory input and review to assure the study methodology, procedure, and results are reasonable and to raise concerns, if there are any.

For this study the 1993 level flow condition as identified in the Republican River Basin RMA and FEIS will be considered the "Future Without Condition." If other flow conditions become available from additional groundwater modeling efforts, the information will be included in this study.

The team will follow the planning process and formulate plans that meet the planning objectives and avoid constraints. Plan formulation requires the views of stakeholders and others outside Reclamation to provide different perspectives. Plans (e.g. reasonable alternatives) will be composed of management measures which could either be structural or nonstructural.

Initial Alternatives identified that may be considered in the study include:

- Future Without Condition (40 years out)
- Optimize irrigation benefits of the current project
- Provide Lake level benefits at Enders Reservoir
- Provide groundwater recharge benefits below Enders Reservoir.

## **IX Evaluation of Effects, Plan Comparison, and Recommendations**

Evaluation is a two-step process, e.g. assessment (quantification) and appraisal (judgment). Only the best of the reasonable alternatives formulated need to be evaluated in more detail, but all measures and plans will receive some level of evaluation.

Like the other planning steps, the evaluation phase is an iterative process. It begins with the first screening of plans and the level of detail increases as the process moves closer to a final decision. There are five evaluation tasks for the team to perform: (1) forecast a without project condition; (2) compare with- and without project conditions for each plan; (3) describe important differences between the two conditions; (4) evaluate the plan's effects, and (5) qualify the plan for further consideration or delete it. The result of the evaluation process is that a plan's effects are identified, measured, and weighed.

During the evaluation process, the significant contributions or "effects" of an individual plan are quantified and judged by the team for two reasons. First, the evaluation allows planners to determine whether or not the plan qualifies to advance and be compared against other plans that have been independently qualified. Second, specific criteria will be used during the evaluation phase to compare those plans that qualify and advance them to the comparison step.

In the "comparison" step different contributions of the alternative plans to the planning objectives and constraints, benefits and costs, environmental compliance requirements impacts, and other plan impacts that are important to stakeholders, and the screening criteria of completeness, effectiveness, efficiency, and acceptability are measured. The team will determine the attributes to be compared and measured, i.e. impacts that will affect the decision-making. The team will display the differences among plans and indicate in the report which plans appear worthy of further analysis in the feasibility study.

## **X Scope of Work**

The Scope of Work (SOW) defines the products and tasks to be accomplished. The following SOW provides specific descriptions of the organizational elements responsible for the tasks (who), the tasks to be accomplished (what), the timing and schedule (when), the reasons for the tasks (why), the techniques, models, and procedures to be used to accomplish the tasks (how), and the costs of the tasks (how much).

- A. Plan Formulation and Evaluation – A primary objective of the appraisal study is to (1) assess the alternatives and recommend a plan(s) which should proceed to a feasibility investigation or terminate the study and (2) present a draft plan of study (DPOS) for the feasibility study, if recommended.

The study team will consist of principals from each discipline involved in the study. The team leader will review information provided by the study team and lead the plan formulation process. The team leader will provide an account of this process in the Appraisal Report. The study team will:

- be made up of personnel from Reclamation, Nebraska Department of Natural Resources, Upper and/or Middle Republican Natural Resource Districts, Frenchman Valley and H&RW Irrigation Districts, and Nebraska Game and Parks Commission.

- Utilize technical experts such as modelers, hydrologists, economist, natural resource specialist, engineers, planners, recreation specialists, cost estimators, and others.
- Identify specific problems and opportunities to be addressed by the study and causes of the problems will be discussed and documented. Final planning goals will be established, final objectives developed, and final constraints identified.
- Identify water supply resources and facilities in the upper Republican River Basin which will influence the success of any proposed effort, as well as information to be collected, techniques and qualitative and/or quantitative measurements to be used during the study.
- Analyze existing water and related infrastructure and characterize the existing and future condition of resources, facilities, and problems, and opportunities.

B. Public Involvement – The public involvement process will be the responsibility of Reclamation. The study participants will be kept informed through written progress reports, meetings, and/or conference calls. Two public meetings will be conducted, one early in the study process and the other near the completion of the study to present results and to seek input on a recommendation, i.e. to proceed with a feasibility study or to terminate it.

C. Hydrologic Investigations

D. Drafting – Prepare electronic drawings, maps, overlays, and other requested exhibits that is needed for the meetings and draft and final reports.

E. Environmental Evaluation – Provide consultation during the study and review alternatives and advice on possible environmental consequences that need to be considered. Provide input on the decision as to whether or not there is a need for further Federal involvement and identify environmental needs that will be included in the Feasibility POS, if one is prepared.

## **XI Study Costs and Cost Sharing Agreement**

There are no costs sharing requirements for an Appraisal Study. The cooperating agencies will be providing in-kind services for the study. The MOU for the Appraisal Study will outline the roles and responsibilities of each agency.

If there is any transfer of funding between agencies in order to accomplish specific study tasks, a cooperative or grant agreement will be required.

## **XII Study Schedule and Milestones**

**To be developed**