US Army Corps
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Memphis District
Mississippi River Comission

# GRAND PRAIRIE REGION AND BAYOU METO BASIN, ARKANSAS PROJECT

## GRAND PRAIRIE AREA DEMONSTRATION PROJECT

## ENGINEERING REVIEW OF WATER SOURCES

January 2001

GRAND PRAIRIE AREA DEMONSTRATION PROJECT
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# PURPOSE AND SCOPE

The purpose of this study and report is to reexamine the water sources used for supplying supplemental irrigation water to the Grand Prairie Region for the purposes of aquifer protection, agricultural water supply, and waterfowl conservation. This study effort reviewed the prior studies and reports to determine if previous findings and recommendations concerning the use of the White River as a source for supplemental water for the Grand Prairie are valid under current conditions and to examine the Arkansas River as a potential source. Figure 1 illustrates the project area and location of the rivers.

An engineering review of the water sources was agreed upon as a provision of a compromise to allow for initiation of construction of the project at a meeting held on April 11, 2000, in the office of Congressman Jay Dickey of Arkansas. Attending the meeting were representatives of the project sponsor, project opponents, and the US Army Corps of Engineers. A joint statement released by Congressman Dickey's office is quoted as follows:

"After a lengthy dialogue regarding the Grand Prairie and White River Irrigation Project, we as a group, have come to a compromise for this coming fiscal year in order to move together in an effort to conserve groundwater and wildlife resources.

We will ask for funding this year, only for designated on-farm storage of water and to facilitate International Paper Company in withdrawing from the Arkansas River. We will seek a law that will state that not one penny will be spent for pumping water from the White River in FY 2001.

As this irrigation project moves forward, the future of the project will be studied and re-evaluated by all of the interested parties."

Wording was also inserted in the US House of Representatives Report 106-693 which accompanies the Fiscal Year 2001 Energy and Water Appropriations bill and directs the Corps to perform an engineering review of the water sources and is quoted as follows:

"*Grand Prairie Region, Arkansas* – The Committee has provided $22,800,000 for the Grand Prairie Region, Arkansas, project, the same as the budget request. Within the amount provided, the committee directs the Corps of Engineers to use $2,000,000 for an engineering review of additional water sources. None of the funds provided for the project may be used for construction of features to withdraw water from the White River until the engineering review of other water sources is completed and a specific appropriation of funds is made by Congress for construction of those features. In addition, the Committee directs the Corps of Engineers to work with large industrial users of groundwater to develop alternative sources of water, including the Arkansas River."

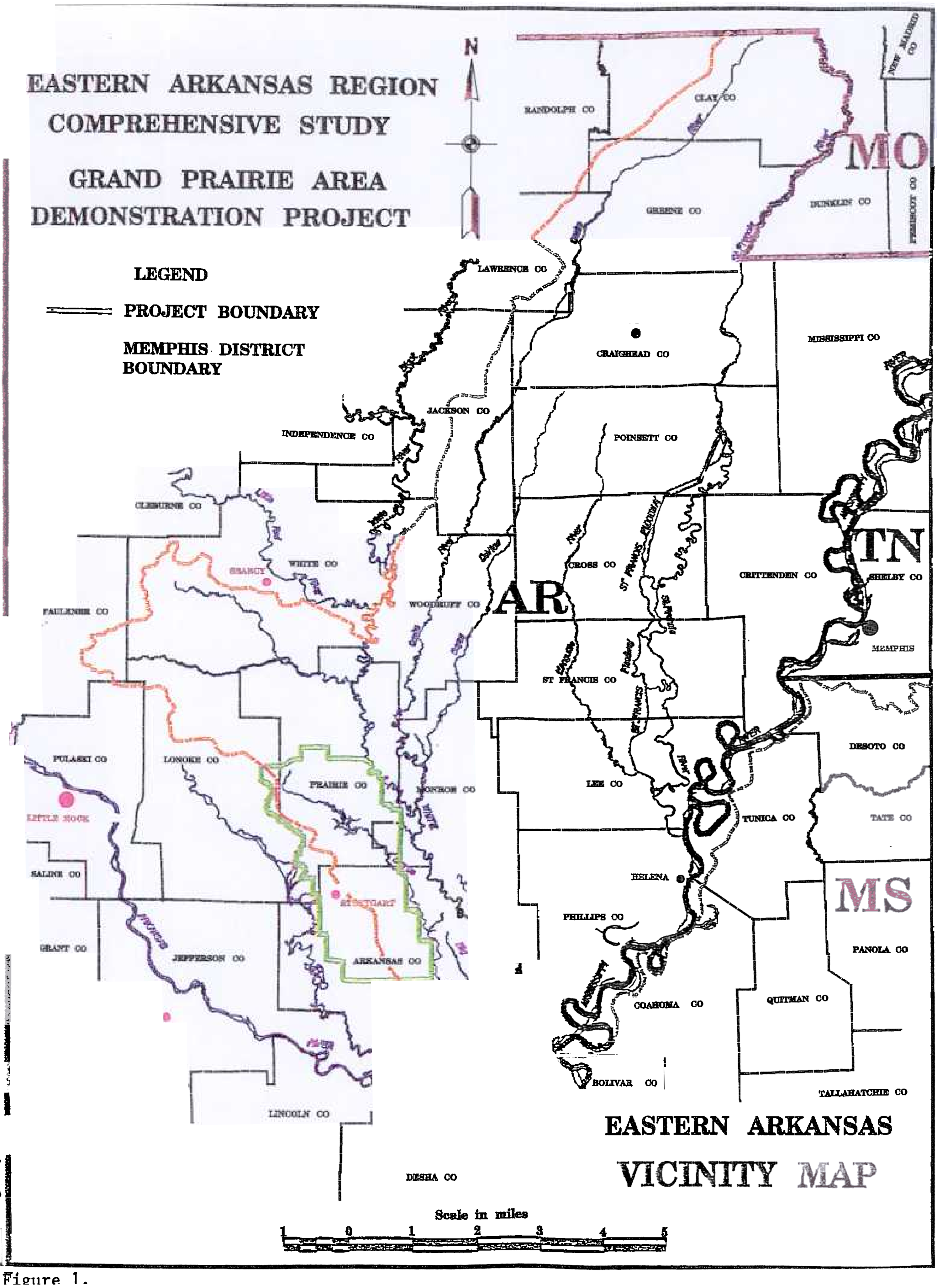
Prior studies and reports were reviewed to examine rationale and decisions for selection of the White River as a water source. The reliability of the Arkansas River to supply the water needs of the area will be examined. The ground water model prepared by the United States Geological Survey (USGS) will be updated to verify assumptions for the alluvial aquifer and the depletion of the Sparta aquifer. Possible water sources will again be considered. A cost-benefit analysis and impact assessment was conducted for the Arkansas River as a water source to determine the economic and engineering feasibility as compared to the White River.

# REVIEW OF PRIOR STUDIES

Prior studies and projects were reviewed to determine the rationale for the use of the White River as the project import water source. The area has been studied several times since the ground water depletion problems were first identified. The studies and analyses, alternatives formulated, and conclusions and recommendations were reviewed.

## ARKANSAS AND WHITE RIVERS AND TRIBUTARIES, GRAND PRAIRIE REGION

Studies were conducted in response to a resolution of the Committee on Flood Control of the House of Representatives, adopted December 18, 1945, requesting the Chief of Engineers to review the report on the White River, Missouri and Arkansas, contained in House Document No. 308, Seventy-fourth Congress, first session; and subsequent reports on the Arkansas and White Rivers and their tributaries with a view to determining (a) the feasibility of flood control on Bayou Meto with particular reference to the elimination of pooling of the Bayou Meto headwaters behind the Arkansas River levee when it becomes necessary to close the floodgates at the mouth of Bayou Meto (b) the need for and possible sources of irrigation water for this region including estimates of future needs and estimates of cost for the development of sources of supply, and (c) methods and costs for the solution of local drainage problems including the additional problems which may be created by the importation of an adequate irrigation water supply. The report was published in House Document 255, dated July 12, 1949.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DESHA CO
SEARCY
STUTTGART
ST FRANCIS
EASTERN ARKANSAS
VICINITY MAP
Scale in miles
1 0 1 2 3 4 5

Figure 1.

## Studies

The House Document 255 identified areas in the Grand Prairie totaling 155,000 acres where water in the alluvial aquifer was critically scarce. The report cited studies by the USGS in 1928 and 1929 identifying a canoe-shaped cone of depression from a point 5 miles northeast of Stuttgart to a point 10 miles southeast. Annual studies since that date showed that this depression progressively deepened and widened until the water surface in the alluvial aquifer had been lowered over almost all of the principle rice-growing area. Studies indicated that the yearly withdrawal from the alluvial aquifer was 241,000 acre-feet and the natural recharge was 135,000 acre-feet annually.

## Water sources

The plans considered for supplying agricultural water to the Grand Prairie fell into three general groups as follows:

a) Further development of existing sources of supply:
   (1) Local surface reservoirs
   (2) Pumping from local streams
   (3) Deep wells
   (4) Recharging the alluvial aquifer
b) Storage in large reservoirs within the Grand Prairie region:
   (1) Halls Hill Reservoir
   (2) Stuttgart Reservoir
   (3) Wattensaw Bayou Reservoir
c) Importing from outside sources
   (1) Diversion from the Little Red River
   (2) Pumping from the Arkansas River
   (3) Pumping from the White River

All alternatives for further development of the existing sources of supply and for storage in large reservoirs in the Grand Prairie were eliminated. The import from outside sources used a system capacity of 2,200 cfs to supply 170,000 acre-feet annually. The plans did not include any storage features. The Little Red River diversion was eliminated due to the costs. The Arkansas River alternative would only be practical with completion of the Arkansas River navigation project. Even with completion of the navigation project, the White River alternative was slightly less costly. The project would serve 190,000 acres of which, due to crop rotations, 50,000 would be in rice, 70,000 in other crops and irrigated, and 70,000 fallow or in forage crops.

### Recommendations

The House Document recommended that the flood control measures in the Bayou Meto basin be constructed along with a diversion from the White River for water supply in the Grand Prairie. The overall benefit-to-cost ratio was 2.51 to 1. The letter report is quoted as follows; "The need for an additional water supply for agricultural use on the Grand Prairie terrace is borne out by investigations of the United States Geological Survey, the University of Arkansas, and others, which indicate clearly that the water table in the underlying Pleistocene sand is being lowered progressively each year and that there is at present time a substantial water deficiency. Further extensive lowering will so exhaust the ground-water supply upon which the cultivation of a large area of ricelands in the region is dependent, as to necessitate the abandonment of this major enterprise with resultant serious deterioration in the economy of the vicinity. The securing of additional water from present sources of supply is not practical and the construction of reservoirs on existing streams in the region involves excessive costs. A number of alternative plans for the importation of water from outside the region were considered. The one selected involves pumping from the White River into a canal and distribution system traversing the terrace."

## EASTERN ARKANSAS REGIONAL COMPREHENSIVE STUDY

### Authorization

Responding to the concerns of state agencies, local officials, and individuals, the Committee on Public Works and Transportation of the United States House of Representatives adopted a resolution on 23 September 1982, which directed the Corps of Engineers to study the feasibility of developing water conservation and water supply projects in eastern Arkansas. The resolution, sponsored by former Congressman Bill Alexander, is quoted as follows:

"Resolved by the Committee on Public Works and Transportation of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report of the Chief of Engineers on the Mississippi River and Tributaries Project, published as House Document Numbered 308, 88th Congress, and other pertinent reports, with a view to determining whether any modification of the recommendations contained therein are advisable at this time, with particular reference to the need and feasibility of improvements in the Bayou Meto, L'Anguille, St. Francis, Cache, and Lower White River Basins including their tributaries in the Alluvial Valley of Eastern Arkansas, in the interest of water conservation and water supply of both surface and subsurface water for municipal, industrial and agricultural purposes. These investigations will be fully coordinated with the State of Arkansas, appropriate local government entities, and interested Federal agencies."

As a result of this legislation, the Corps of Engineers conducted the *Eastern Arkansas Region Comprehensive Study*, which identified five potential project areas. The Grand Prairie Area was included as one of these project areas. The study was conducted in two phases, a reconnaissance phase and a feasibility phase.

## Reconnaissance Phase

Studies conducted for the reconnaissance phase culminated with completion of a Reconnaissance Report dated March 1985. The reconnaissance phase is the first phase of the Corps' two phased study process. The purpose of the reconnaissance study is to determine if the problems warrant Federal participation and assesses the non-Federal interest and support. The feasibility phase determines the plan of improvement which best meets the identified problems and opportunities of the project area based on economic, environmental, and other social effects. The feasibility report provided the decision document for Congressional authorization

### Studies

Studies conducted include examination of resources in the area including water quality and suitability of surface water for irrigation. The studies showed that all surface water sources in the area were considered excellent to good for the purposes of irrigation with the exception of the Arkansas River. The Arkansas River exceeded the total dissolved solids values considered practical for agricultural use (500 mg/l), however, studies of land irrigated from the Arkansas River from three years as a sole source and 20 years as a supplemental source found no detrimental effects.

A water balance for the eastern Arkansas region was developed as a tool to identify water supply problems. This balance described the current and future use of water resources through a systematic presentation of data on supply and demand for surface and subsurface water within the study area over the 50-year period of analyses from 1980 to 2030. The water balance identified areas that would be water deficient by 2030. These included the Eastern Grand Prairie (essentially the current Grand Prairie Area) and the western Grand Prairie (essentially the current Bayou Meto area). Alternative levels of import were considered to include providing enough import water to meet the demands that exceed available recharge, providing enough import water to meet the total ground water demand, and providing enough import water to meet the demand if all land were placed in production at its maximum potential.

### Alternatives Considered

No Federal Action
Conservation and Management Plans
Municipal and Rural Domestic Conservation Measures
Irrigation Conservation Measures
Industrial Conservation
Fish and Wildlife Management Conservation

Aquacultural Conservation
Thermoelectric Power Conservation
Surface Water Diversion – Interbasin Transfers
New Reservoirs
Conjunctive Use – Sustained Yield Pumping Strategies
Artificial Recharge
Reallocation of supply in existing reservoirs

**Recommendations**: The alternative analyzed for the Grand Prairie area included using the White River for approximately the current Grand Prairie area (East Grand Prairie) and the Arkansas River for approximately the current Bayou Meto area (West Grand Prairie). Both of these areas, along with three other areas, were found to be feasible for water supply projects. The report recommended proceeding to feasibility studies.

## Feasibility Phase

Cost shared feasibility studies identified 5 feasible areas in eastern Arkansas for water supply projects. These included the Grand Prairie and the Bayou Meto Basin. Alternatives were examined and the White River selected as a water source for the Grand Prairie and the Arkansas River selected for the Bayou Meto Basin.

### Studies

A digital flow model of the alluvial aquifer was developed. The model consisted of a three-mile by three-mile grid overlay of the study area. The outer limits of the model included the Mississippi River on the east, the Arkansas River on the south, the Ozark Escarpment on the west, and the Missouri border on the north. The model was used to predict the impact of increased future demands on the alluvial aquifer and to develop a conjunctive use (i.e. agricultural, municipal, industrial) sustained-yield pumping strategy. Projected irrigation water needs by decade for a period of analysis of 1990 through 2040 were used as inputs to the ground water digital flow model and the conjunctive use-sustained yield model. Model outputs identified areas with insufficient ground water to meet projected irrigation water needs and changing aquifer saturated thickness during the 50 year planning horizon. Water use was classified into one of seven categories: municipal, rural domestic and livestock, industrial, irrigation, commercial fisheries, fish and wildlife management, and thermoelectric power generation. Water supplies were grouped into four categories: shallow subsurface, deep subsurface, streamflow, and lakes and reservoirs. Estimates of minimum acceptable streamflow at selected river locations were made for the purposes of the study using the greatest requirement for water quality, fish and wildlife, navigation, interstate components, or aquifer recharge. Ground water availability was determined by the digital flow model. The conjunctive use-sustained yield model was utilized to optimize the use of ground water given a defined management strategy which takes into account conjunctive surface water use.

Projections for the year 2030 indicated that even with additional conservation measures in place, demand would be nearly three times the safe yield of the aquifer in eastern Arkansas.

**Alternatives considered**

Problems identified in the study included: water supply and conservation, flood control, water quality, and recreation and fish and wildlife. Alternatives considered include the following:

Conjunctive use-sustained yield ground water management strategies
Conservation measures
Channel improvement, construction of levees
Surface water diversions
Storage reservoirs and reservoir reallocations
Ground water artificial recharge
Deeper aquifers

Conjunctive use-sustained yield management strategies would result in a large shift to dry-land agriculture with adverse effects to the economy. Conservation measures were included to reduce demand. Suitable sites for large reservoirs do not exist in the project area and new large reservoir sites on the Ozark Plateau were not considered environmentally acceptable. Reallocation of storage of existing reservoirs was considered to be a viable means to provide additional surface water to supplement existing streamflows. On-farm storage reservoirs offered the most practical means of capturing and storing additional surface water for irrigation purposes. Artificial recharge was considered and not found practical. Studies concluded that tertiary aquifers did not provide long term solutions. For the surface water diversions, the Arkansas, White, and Black Rivers were examined to meet needs in the Grand Prairie area, and Bayou Meto, Cache, Bayou Deview, and L'Anguille basins. Based on the examinations of the flows and areas that had needs, the water sources for the areas were selected.

**Draft conclusions**

A draft report was submitted to Corps' higher authority. However, no action was taken on the report because agricultural water supply was not considered a high priority output based on Corps policy at that time. The report identified five areas where improvements for irrigation water supply were feasible including the Grand Prairie Region and the Bayou Meto Basin. All plans included a diversion, conservation measures and additional storage. The White River was selected as the water source for the Grand Prairie after the comprehensive examination of the White, Black, and Arkansas Rivers and the water needs of the five feasible areas for supplemental irrigation water.

## GRAND PRAIRIE AREA DEMONSTRATION PROJECT GENERAL REEVALUATION

With processing of the feasibility study halted, Congress directed that one area be selected and developed as a demonstration project. The Grand Prairie Area was selected because of the severe ground water depletion and prior establishment of conservation and storage features and a general reevaluation was initiated.

### Authorization

The Energy and Water Development Appropriations Act of 1992 directed the Corps of Engineers to continue the *Eastern Arkansas Region Comprehensive Study* and to "select and develop implementation plans for one area to serve as a demonstration project. The language is quoted as follows:

"Eastern Arkansas Region Comprehensive Study, Arkansas.--The bill includes $420,000 for the Corps of Engineers to continue preconstruction engineering and design of the Eastern Arkansas Region Comprehensive Study authorized by the Committee on Public Works and Transportation of the House of Representatives on September 23, 1982. The Committee expects the Corps to use the funds to refine plans for agricultural water supply, groundwater management and conservation for the Grand Prairie, White River, Little Red River, Bayou Meto and Cross, Craighead, Poinsett, Jackson, St. Francis, Lee and Woodruff County areas in Arkansas. Further, the Committee directs the Secretary of the Army to select and develop implementation plans for one area to serve as a demonstration project."

The Grand Prairie area was selected for the demonstration project and a general reevaluation was initiated with development of an initial project management plan. Congressional direction and funding continued in the 1993, 1994, and 1995 Appropriations Acts. Funds were included in the FY 1996 and FY 1997 budgets to continue and complete the general reevaluation.

In 1996, Congress reauthorized the original Grand Prairie Region and Bayou Meto Basin flood control project with a broadened scope of work. Section 363(a), Project Reauthorizations, of the Water Resources Development Act (WRDA) of 1996, Public Law 104-303, is quoted as follows:

"Grand Prairie Region and Bayou Meto Basin, Arkansas.--The project for flood control, Grand Prairie Region and Bayou Meto Basin, Arkansas, authorized by section 204 of the Flood Control Act of 1950 (64 Stat. 174) and deauthorized pursuant to section 1001(b) of the Water Resources Development Act of 1986 (33 U.S.C. 579a(b)), is authorized to be carried out by the Secretary; except that the scope of the project includes ground water protection and conservation, agricultural water supply, and waterfowl management if the Secretary determines that the change in the scope of the project is technically sound, environmentally acceptable, and economic, as applicable."

## Studies

Ground water model – The ground water model was updated and refined including reducing grid size to 1 mile by 1 mile. The model was used to compute a safe yield of 38,500 acre-feet per year assuming that once a cell was depleted to less than 20 feet of saturated thickness a well could not be developed for the life of the project. A detailed water budget was developed based on the 10-day water demands of the crops. Following the selection of the White River as the water source, the 46-year period of record for the White River under current operating conditions of the reservoirs was developed. The 10-day demands and water availability were compared in a detailed water budget that calculated the reliability of the system including the storage and use of available ground water. The effects of the demands on the White River for each individual year of the period of record was determined. Various environmental studies were conducted by the Corps and by other agencies to evaluate potential impacts.

## Alternatives investigated

Detailed studies and analyses indicated that the existing water resources in the Grand Prairie Region, groundwater and surface water, cannot meet the current or future needs of the area. Therefore, alternative sources of water must be developed to sustain the economic viability of the region and preserve the groundwater resource critical to the region's economy, social well being of the people, natural environment, and fish and wildlife resources. The use of the Sparta aquifer as a source for water supply was investigated. However, due to the limited capacity and recharge rate, it could provide only limited supplies for a short term before being depleted. Artifical recharge methods were determined not to be feasible due to the geohydraulic conditions of the area and cost of induction. Storage and conservation measures were considered individually and with various sizes of import systems to develop a range of alternatives to optimize each project component.

The recommended plan for the Grand Prairie as presented in the Grand Prairie Area Demonstration Project General Reevaluation Report utilizes all existing water to the optimum level. Conservation measures and storage were maximized to the extent practical to achieve the greatest level of water use efficiencies and decrease the demand for water. Groundwater was utilized at a "safe yield" to sustain and protect the aquifer. The projected volume of water that could not be met with existing resources (groundwater, surface water, rainfall, storage, etc.) after implementation of projected conservation and lowering groundwater pumpage to the sustainable level is the unmet need that must come from outside sources.

Various sources of import water and withdrawal points were examined for the Grand Prairie Project during the general reevaluation. The sources included the Arkansas and White Rivers. The limiting factors are the availability of water, the topography, environmental impacts and costs. The White River was selected to provide water for the Grand Prairie because the White River is positioned to allow for gravity flow of the required amount of water for the project to the project area. Use of the Arkansas River would require construction of cost-prohibitive long canals and pumping stations outside of the area where water was to be delivered.

One of the major initial determinations was how to divert and transport the needed volume of water from the White River to the water depleted areas of the Grand Prairie Region. Numerous alternative sites and combinations were investigated and analyzed to determine the most engineeringly and economically feasible and environmentally acceptable alternative. An investigation of potential diversion sites for single and multiple diversions was conducted. Three sites north of DeValls Bluff (Pfennighausen Ridge, Red Bluff, and north of the old railroad bridge), two sites immediately south of DeValls Bluff near Arkapola Bluff and Worshams Bluff, one site just north of Slaughter's Lake, one site south of Hwy 146, and other sites along the river were investigated. Potential sites for such diversions are very limited along the White River due to topographical and environmental considerations. All the sites investigated had varying problems and issues. Areas immediately south of DeValls Bluff were not engineeringly acceptable and would have substantial environmental impacts. Others sites further south along the river were either engineeringly difficult and economically infeasible and/or would present tremendous environmental problems with the White River National Wildlife Refuge, wetlands, and bottomland hardwoods along the lower White River. Two of the three areas north of DeValls Bluff were considered unacceptable by resource agencies. Based on field investigations, coordination with Federal, state, and local interests, and preliminary study findings, it did not appear feasible or prudent to pursue a multiple diversion project. The diversion north of DeValls Bluff as presented in the recommended plan was considered to be the best alternative based on engineering considerations, and economic feasibility, environmental acceptability, and desirability.

The final array of alternatives were as follows:

ALTERNATIVE 1 - NO ACTION

This alternative is the set of conditions that are expected to occur in the absence of a project. Supply of irrigation water is expected to decrease significantly. With no increased demand or change in land use only about 22% of what is currently irrigated would remain in irrigated agriculture. This alternative was carried through detailed hydrologic and economic analyses and used as a base by which to compare the effects of all other alternatives.

ALTERNATIVE 2 -ADDITIONAL STORAGE

An alternative to construct additional on-farm storage reservoirs without an import system or conservation measures was evaluated. Initial modeling indicated that irrigation water available for use on a farm might actually decrease if additional reservoirs were built without any source for additional supply. This analysis showed that farmers in the Grand Prairie are currently capturing a very high percentage of rainfall physically possible without the implementation of other measures. Simply building more reservoirs would not allow existing reservoirs to be filled to capacity and would increase evaporation and infiltration losses as the water is spread out over more surface acreage. Since additional reservoirs could only be filled in wet years without import water and since this alternative does not meet the planning goals and objectives, it was deleted from further study.

ALTERNATIVE 3 - CONSERVATION WITH STORAGE

This alternative consists of conservation measures without any import water. Conservation measures would be implemented to maximize the use of existing water resources to the extent practical. The current 60% efficiency rate would be increased to 70% through installation of conservation measures. With this alternative the availability of existing runoff for capture would limit new reservoir construction to 1,379 acres and conservation measures could only be placed on about 31% of the area's current irrigated acreage. This alternative would result in only 31% of the area remaining in irrigated agriculture. Table 1 illustrated the effects of the conservation with storage alternative in comparison with the future without project conditions and the authorized project.

Table 1. Plan Comparison

| | Future Without Project Conditions | Conservation With Storage | Recommended Alternative |
|---|---|---|---|
| Average Acres with water available for irrigated agriculture | 54,648 | 63,756 | 211,735 |
| Acres without water available for irrigated agriculture | 187,129 | 178,021 | 30,042 |
| | | | |
| Economic Benefits | | $4,714,000 | $36,132,000 |
| Excess Benefits | | $2,757,000 | $6,876,000 |
| Water Demand | 481,195 acre-feet | 463,068 acre-feet | 412,453 acre-feet |
| Import Water | | 0 acre-feet | 243,900 acre-feet |
| Safe yield of alluvial aquifer | | 35,574 acre-feet | 35,574 acre-feet |
| Surface water | | 73,188 acre-feet | 73,188 acre-feet |
| Unmet Need | | 354,306 acre-feet | 59,791 acre-feet |
| Aquifer Protection at current recharge 100,000 to 130,000 ac-ft per year for alluvial aquifer | No | No | Yes |

ALTERNATIVE 4 - IMPORT SYSTEM & CONSERVATION WITHOUT ADDITIONAL STORAGE

This alternative includes the conservation features in alternative 3 without additional reservoirs in conjunction with an import system which diverts water from the White River. Studies conducted by NRCS showed that the desired conservation efficiencies could not be achieved without additional storage. This alternative was dropped from further consideration since previous studies and analyses have shown that conservation is the measure that yields the most return for the dollar invested and should be included in any plan developed. Neither conservation nor an import system works well without additional storage.

ALTERNATIVE 5 - COMBINATION CONSERVATION, STORAGE AND IMPORT WATER

This alternative combines conservation measures, increased on-farm storage and an 1,800 cfs import system. This alternative calls for 8,849 additional storage acres supplying 88,493 acre-feet of storage, plus increasing the on-farm efficiencies to 70%. This alternative was originally analyzed using different stop pump levels on the White River but since the Arkansas State Water Plan establishes minimum stream flows, these minimum flows were used to limit withdrawals.

ALTERNATIVE 6 - COMBINATION ALTERNATIVE 5 PLUS ADDITIONAL STORAGE

This alternative was the same as alternative 5 but included adding another 25% of storage. According to studies conducted by NRCS, increased levels of on-farm storage above the optimum level were not economically feasible. Any increased benefit provided by additional storage was more than offset by the added cost of building the storage.

ALTERNATIVE 7 was the combination alternative of conservation, storage, and import water used to optimize the import system size using the current stop pump criteria (see Appendix C – Environmental Summary of Current Project, for the stop pump criteria and effects to the White River). Pumping stations of various sizes were examined with the size of 1640 cfs pumping station being selected as the optimum from an economic standpoint.

## Recommendations

The general reevaluation report recommended proceeding with construction of ALTERNATIVE 7 to provide aquifer protection and irrigation water supply in addition to the environmental features included in the plan.

## Description of the Recommended Plan

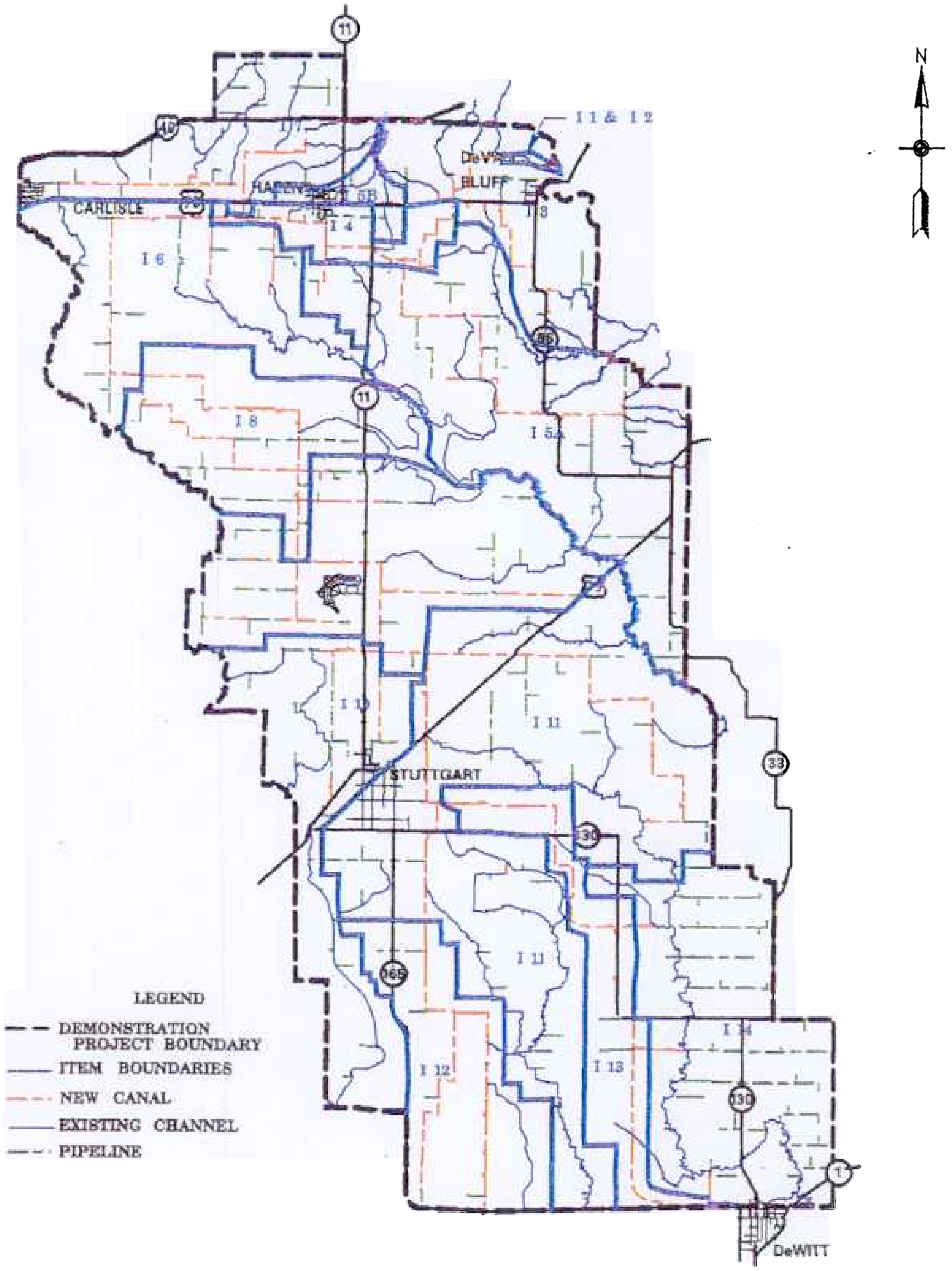
The demonstration project consists of four major components for supplying supplemental irrigation water to the project area and preserving existing water resources. The identified irrigation water supply components are (1) conservation -

increased irrigation efficiencies, (2) groundwater, (3) additional on-farm storage reservoirs, and (4) an import water system. Environmental features are also an integral part of the selected plan. Figure 2 provides a general layout and boundary for the system. The components of the selected plan are discussed in the following paragraphs.

**Conservation – Increased irrigation efficiencies**

The first component of the selected plan is implementation of conservation measures. Conservation measures are improvements in the on-farm water distribution system and/or changes in farm management practices such as irrigation application methods and soil moisture monitoring that result in increased irrigation efficiencies. Irrigation or system efficiency is defined as the percentage of water ultimately utilized by the plants as compared to the amount obtained at the source. It is a measurement of not only the effectiveness of the irrigation delivery system itself, but also of farm management practices employed. Conservation measures outlined within this report and recommended for implementation on a project-wide basis are presently employed to various extents within the region. Based on historical data analyzed by the NRCS, the average irrigation efficiency of existing farming operations within the project area is 60 percent. Though this level of efficiency indicates that no economic benefits are derived from 40 percent of the water, the 60 percent level is considered to be well within regional and national averages for similar operations.

Significant factors contributing to the 40 percent inefficiencies within the system are application of water in excess of plant needs, evaporation and seepage losses from open distribution systems and the lack of tailwater recovery systems. Within the scope of the selected plan the NRCS will develop a comprehensive "Water Management Plan" for each farm serviced. At present the NRCS has selected approximately 15 % of the farms within the project area and developed specific management plans for projecting costs and determining the maximum achievable efficiency level. These analyses along with extensive field tests show that the average efficiency can be increased to 70%. This 10 % increase in efficiency is equivalent to a 14.3 % (68,742) reduction in the annual water demand for the project area. Key features of the farm management plans are closed distribution systems (underground pipelines), tailwater recovery systems and monitoring of soil moisture. Approximately 630 miles of new underground pipeline with appurtenances will be installed to replace open canals and inadequate on-farm distribution systems. Utilization of pipelines will allow for better management and control of water at the farm level and will minimize losses from evaporation and seepage.




US Army Corps of Engineers
Memphis District

EASTERN ARKANSAS REGION
COMPREHENSIVE STUDY
GRAND PRAIRIE AREA DEMONSTRATION PROJECT

# ITEM BOUNDARIES

Scale in miles

4 0 2 4 6

Figure 2.

Tailwater recovery systems will be an integral part of the water management plan developed for each farm. These systems are in essence a method of "recycling" water. Tailwater is a term applied to the free standing water within the fields that is drained by gravity into a system of collection ditches. These ditches in turn lead to pumps where the water is placed back into on-farm storage reservoirs. Alternatively, the water may be directly routed to another area for field application. With the selected plan it is estimated that an additional 675 miles of tailwater recovery ditches will be required to collect, transport and store rainfall, runoff, and tailwater. This system of shallow collection ditches is also an integral aspect of the on-farm storage system discussed in subsequent paragraphs. Associated with the collection system are roughly 560 water control structures necessary to control runoff rates and to provide pools for pumping back into reservoirs or for field applications. In addition to these structures approximately 700 pumps or relifts will be required to move water through the tailwater recovery systems. Only estimated quantities for the water control structures and pumps can be provided prior to completion of all Water Management Plans.

**Ground water**

Underlying the Grand Prairie is the alluvial aquifer that historically served as an abundant source of relatively cheap water. The aquifer is composed of predominantly medium to fine-grained clean sands within the upper zone and grades to a gravelly sand with depth. Though aquifer thickness is variable, well logs indicate that it generally ranges from 25 to 140 feet. The alluvial aquifer is overlain with a silt and clay unit with thicknesses in the range of 10 to 50 feet. This top unit is nearly impervious and is the reason that this area is conducive to rice production. Contained within the older strata underlying the alluvial aquifer is a water bearing stratum known as the Sparta sand. In recent years there has been development of this deeper aquifer, particularly in those areas where the shallow aquifer has experienced its greatest declines. Placement of these "deep" wells has been considered as a last resort due to the depths of the wells (excess of 800 feet) and the high energy costs required to recover the water. As a note the hydraulic conductivity, which can be thought of as a measurement of the aquifers capability to recharge itself, of this deeper aquifer is much less than the "shallow" or alluvial aquifer. The deep wells that have been installed to date are already creating significant declines in the water levels within the aquifer. In fact, USGS estimates that at current pumping rates for the deep or Sparta aquifer there will be an 80 foot decline in the water level by the year 2002. Obviously this deep aquifer which serves as the municipal water supply within this region, can not be viewed as a solution to the declining ground water levels within the alluvial aquifer.

As important as the alluvial aquifer is to the economy of the Grand Prairie, it unfortunately has been mined for agricultural practices at a rate that far exceeds its capacity to replenish itself. Prior to development of the aquifer for rice production at the turn of the century, flows within the aquifer served as a source to adjacent rivers such as the White and Arkansas. However, as irrigated acreage increased, the demands placed on the aquifer also increased. Eventually, the demands placed upon the aquifer became such that it no longer served as a source to the rivers. Instead of being a source the alluvial aquifer is now recharged by these rivers. Though the alluvial aquifer is being recharged by the adjacent rivers, it is being done so at a rate much lower than withdrawals are occurring. Current estimates are that recharge into the alluvial aquifer is at a rate of between 100,000 and 130,000 acre-feet per year for the Grand Prairie project area. This recharge rate is not constant with time since it is directly related to the declines within the alluvial aquifer itself. As long as the average annual withdrawals continue at a rate in excess of 400,000 acre-feet per year there will be a continual decline in the aquifer water table. This decline will continue until the saturated thickness of the aquifer reaches the point that it can no longer support well development.

Implementation of the selected plan will sustain the alluvial aquifer by establishing a "safe yield" for the aquifer. By definition "safe yield" is a yield that will not result in any additional decline of water levels within the aquifer. Groundwater modeling conducted by Dr. Peralta at the University of Arkansas estimated that the portion of the aquifer underlying the Grand Prairie could sustain a "safe yield" of approximately 35,000 to 40,000 acre-feet annually. The water balance model for the selected plan calls for the alluvial aquifer to provide approximately 8% of the projected future needs. This equates to approximately 36,000 acre-feet of water.

**On-farm Storage**

The on-farm storage system consists of above or below ground earthen reservoirs and tailwater recovery ditches used to capture and store runoff for irrigation. Sources of water in order of preference for use in filling the on-farm storage systems are rainfall runoff, tailwater recovery and groundwater with the preference being established by economic factors. On-farm storage provides a reliable source for the large volumes of water that are required for the initial flooding of the rice fields and irrigation of other crops at critical times during the growing season. Presently there are 15,556 acres dedicated to storage in the project area. Individual reservoirs vary in areal extent from 25 acres to in excess of 500 acres with the 40 to 60 acre size being the more prevalent. Existing reservoirs have a storage capacity of approximately 84,525 acre-feet of water; however, it is estimated that only about 73,188 acre-feet is recoverable or available for use. With the selected plan an additional 8,849 acres of cropland will be converted to on-farm storage reservoirs. These new reservoirs will provide 88,493 acre-feet of storage capacity. The new reservoirs will be constructed to an average depth of 10 feet to increase the storage relative to the surface area of existing reservoirs and are equally distributed throughout the project area. Reservoir sites will be identified in the water management plans developed by the NRCS. Additionally, the reservoirs will be located at the higher elevations within a farm so as to maximize gravity flow and avoid impacts to wetlands. These new reservoirs, when combined with existing storage, will provide approximately 31 percent of the with-project decreased needs for an average year. The reduction in with-project needs are due to implementation of the previously described conservation measures. Though assumptions were made in developing the selected plan as to the operation of the reservoirs, the reservoirs will remain in private ownership and the daily management will be at the owner's discretion. Assumptions made regarding the operation of the reservoirs, such as the filling schedule, were made to minimize the risk of having an inadequate supply of irrigation water at critical times during the growing season.

Additional on-farm storage was only considered in conjunction with the implementation of conservation measures. Storage reservoirs were not considered without conservation measures since it was demonstrated that conservation measures provide the greatest return on the investment. Additionally, the construction of new reservoirs cannot meet the total water needs without an additional source of water. Even with the proposed conservation measures there is not an adequate supply of rainfall runoff, tailwater recovery or groundwater to economically justify the construction of all of the new on-farm storage. Existing water sources and implementation of conservation measures can only support the construction of approximately 1,379 acres of new reservoirs. With this maximum level of reservoirs, implementation of conservation measures, and withdrawals of groundwater at a safe yield, only 31 percent of the existing cropland can remain in irrigation. The remaining area would be required to convert to less profitable dryland farming.

**Import water**

The import system consists of all features necessary to import water from the White River northeast of DeValls Bluff and deliver it to each tract of land within the project area. Major features comprising the system are a 1,640 cfs pumping station, earthen distribution canals, gated hydraulic control structures, reinforced concrete pipeline, PVC pipeline, canal turnouts, pumps, existing streams, and rock weirs within existing streams. The proposed import system will also require an extensive monitoring and control system for directing flows within the system and to prevent the diversion of excessive amounts into natural streams. Numerous structures referred to as siphons will also be utilized to maintain existing drainage patterns that are impacted by construction of the distribution system.

**Environmental features**

The environmental benefits or features of the project are either a result of project design, specific restoration, or mitigation. Environmental project features will restore native prairie vegetation, enhance stream fisheries, and provide waterfowl habitat to the project area.

Under the auspices of the North American Waterfowl Management Plan, harvested rice fields will be flooded annually from 1 November to 28 February to benefit waterfowl. The selected plan would flood 38,529 acres of harvested rice fields on an average annual basis; this would provide 22,385,349 duck-use-days (DUDs) annually. A DUD is defined as the capacity of available forage to meet the energy needs of one duck for one day. In comparison to future without-project conditions, this represents an annual increase of 21,129 acres of cropland flooded and 12,275,949 DUDs.

Weirs will be constructed in existing streams at locations throughout the project area. The purpose of these weirs is to provide a minimum pool in the streams for irrigation withdrawals. Streams within the project area generally experience extremely low flows or in most cases no flow at all during the summer months. Studies conducted by the U. S. Army Corps of Engineers, Waterways Experiment Station concluded that these pooled areas and the increased velocities over the weirs will significantly improve fishery habitat.

A proposed environmental project feature of the selected plan is to restore native prairie grasses within the project area. A unique opportunity to establish native prairie vegetation within the rights-of-way of the proposed irrigation canals exists. Approximately 184 miles of new canal are included in the distribution system. These canal levees and berms provide the opportunity to significantly increase the amount of tallgrass prairie within the project area and vegetatively connect existing prairie remnants. The existing 650 acres of prairie scattered throughout the Grand Prairie region would be increased by some 3,000 acres. These established corridors of native grasses would provide passageways for movement for many grassland wildlife species.

Mitigation features are best described as “on-site” established fish and wildlife resources management procedure, activity, or technique that is designed to offset construction and/or associated impacts. Numerous mitigation features that will partially offset terrestrial and aquatic losses have been incorporated into the project design.

A wide range of alternatives were considered for mitigating the unavoidable wildlife habitat losses associated with project construction. Mitigation needs for the project were determined based on project impacts assessed from a Habitat Evaluation System (HES) Analysis. Approximately 243 acres of cleared land will be acquired and restored to bottomland hardwood forest to mitigate wetland losses. This acreage will be either prior converted or farmed wetland. Identification of the lands in these categories within the project area will be accomplished by the NRCS. Approximately 193 acres of cleared upland property will be obtained and reforested to offset impacts to upland hardwoods.

A study of additional features for aquifer protection, waterfowl conservation, and ecosystem restoration is currently underway. This study is scheduled to be complete in March 2001. Features under study include reestablishing areas of the unique Grand Prairie ecosystem (prairie, wetland prairie, savanna, slash, bottomland hardwood, and upland hardwood habitats), providing moist soil units with dedicated water source to provide waterfowl foraging and resting areas, and additional features for habitat restoration, aquifer protection, and recreation.

## CONCLUSIONS OF THE REVIEW OF PREVIOUS STUDIES

The selection of water sources for the project were validated by the review of the previous studies. No omissions or errors that would have changed the selection of water sources for the project were identified and the reasoning for the selection appeared valid under today's conditions. Over 50 years have passed since the authorization of the Grand Prairie Region and Bayou Meto Basin Project and nearly 20 years have passed since the initiation of recent studies leading to the definition of the Grand Prairie Area Demonstration Project. The choice of the White River was first made in the original project studies, and made again during the reconnaissance and feasibility studies leading to the general reevaluation. A factor in the decision and in the optimizing of project areas for the Grand Prairie and Bayou Meto area was the cost of importing water. Areas better served by the Arkansas were placed in Bayou Meto, areas better served from the White were included in the Grand Prairie. To verify decisions, costs of import systems from the Arkansas River were updated and compared with costs from the White River.

# UPDATE OF DESIGN AND COST OF POSSIBLE WATER SOURCES

Previous efforts demonstrated the need for an import system and allocated areas served by various surface water sources based on needs, surface water availability, topography, estimated costs, and other factors. To ensure that the decisions based on costs were still valid, potential sources were again identified and examined. Costs were updated for methods to withdraw water from the Arkansas River.

## POTENTIAL SOURCES FOR THE GRAND PRAIRIE AREA DEMONSTRATION PROJECT

Potential water sources identified for the project include the White River, the Arkansas River, the alluvial aquifer, the Sparta Aquifer, additional storage, increased irrigation efficiencies, and a combination of the Arkansas and White Rivers.

### Sources Identified

Potential sources of water for the project were examined considering current conditions.

**White River -** The White River is the source of import water for the Grand Prairie project as authorized. Start and stop pump criteria were evaluated in the GRR. These criteria are based on the Clarendon gage and vary according to the maximum of the needs for navigation, fish and wildlife, and water quality. Table 2 illustrates the water availability during peak irrigation season. Figure 3 illustrates the available water from the White River. This figure contains minimum instream flow requirement, the mean minimum flow and the mean monthly flow. On an average year, the excess water would be the difference between the mean monthly flow and the minimum instream flow requirements. The mean minimum flow is the minimum flow that you can reasonably expect for that month.

**Arkansas River** - The Arkansas River is a series of pools controlled by dams for the purpose of navigation. The pools themselves do not contain storage available for purposes other than navigation. Navigation needs dictate the minimum flows. Table 2 and Figure 4 illustrate the availability of water from the Arkansas River. Compared to the White River, the flow in the Arkansas River varies more from day to day with a higher mean monthly flow (except in August) and lower mean minimum flows.

Table 2. Comparison of Water Availability During the Peak Irrigation Season

| | | | Arkansas River | White River |
|---|---|---|---|---|
| June | Mean Flow | | 63,441 cfs | 30,320 cfs |
| | Mean Minimum Flow | | 2,865 cfs | 8,100 cfs |
| | Minimum Streamflow/Pump Cutoff | | 4,645 cfs | 21,220 cfs |
| | | | | |
| July | Mean Flow | | 31,791 cfs | 21,340 cfs |
| | Mean Minimum Flow | | 576 cfs | 8,200 cfs |
| | Minimum Streamflow/Pump Cutoff | | 4,645 cfs | 10,670 cfs |
| | | | | |
| August | Mean Flow | | 15,106 cfs | 18,180 cfs |
| | Mean Minimum Flow | | 407 cfs | 6,300 cfs |
| | Minimum Streamflow/Pump Cutoff | | 4,645 cfs | 9,650 cfs |

Table 2 illustrates the difference in availability of water during the peak irrigation season. Figures provide information on the river during all months.

The White River is controlled by upstream reservoirs. Flows differ from natural ecosystem conditions in that the flood peaks are stored for later release making for decreased flows in the spring and slightly higher flows in the summer. The minimum stream flows reflect the fish and wildlife needs for higher water levels in the winter and spring for waterfowl and fish spawning. For example, to have excess water in the White River for pumping station operation and water withdrawals in April and May, the White River must be out of banks.

The Arkansas River has more available water than the White River except during the peak irrigation months. In June, on average, the Arkansas has more available water but flows can be expected to drop well below the minimum requirements. In July, the mean flow is still higher for the Arkansas River, but minimum flows under 600 cfs can be expected. In August, the White River has a greater mean flow and much higher mean minimum flow (the Arkansas River can expect to have flows of less than 500 cfs), though the Arkansas River still has a slightly greater excess flow.

Figure 3.

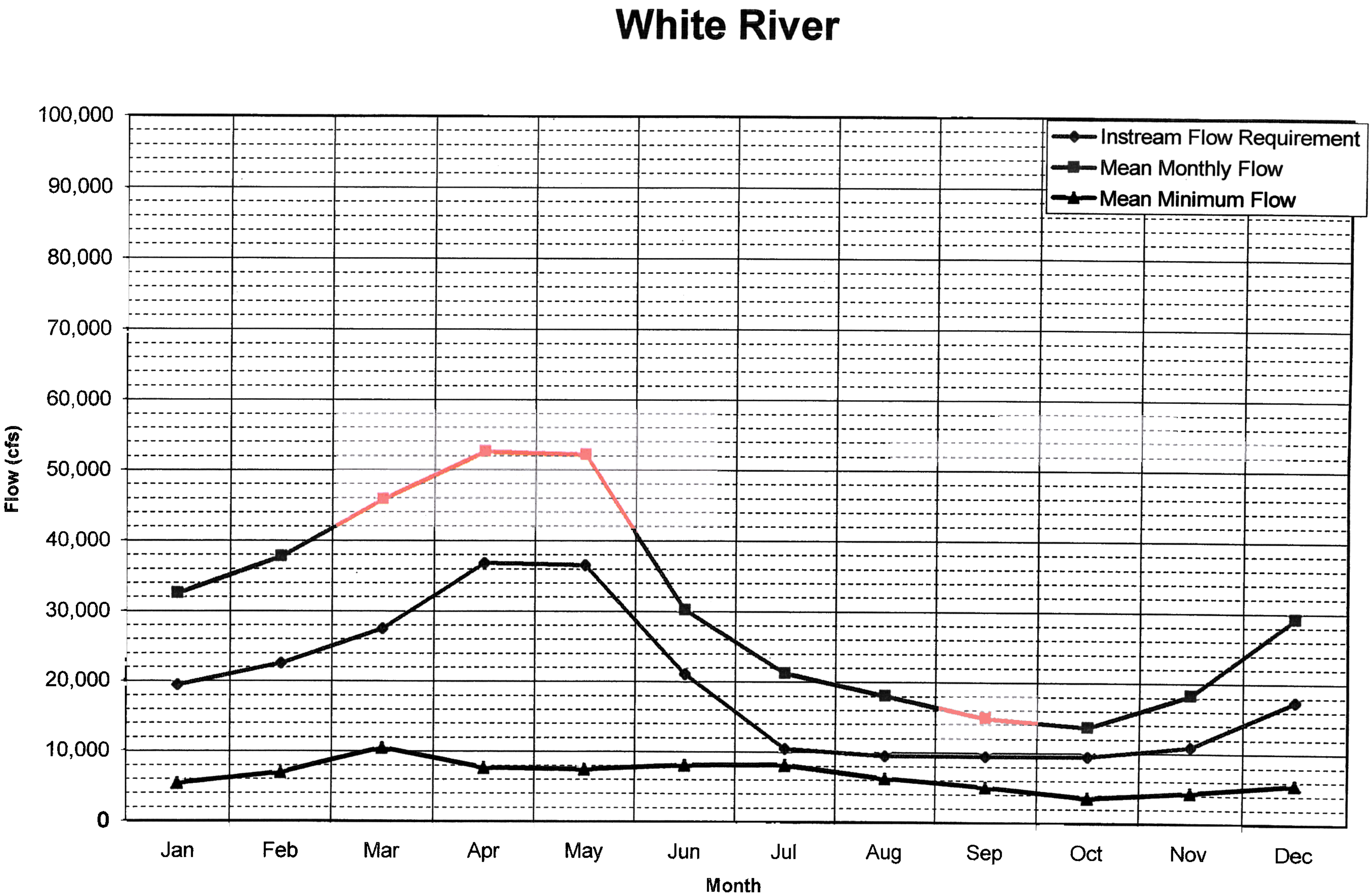



Figure 3.

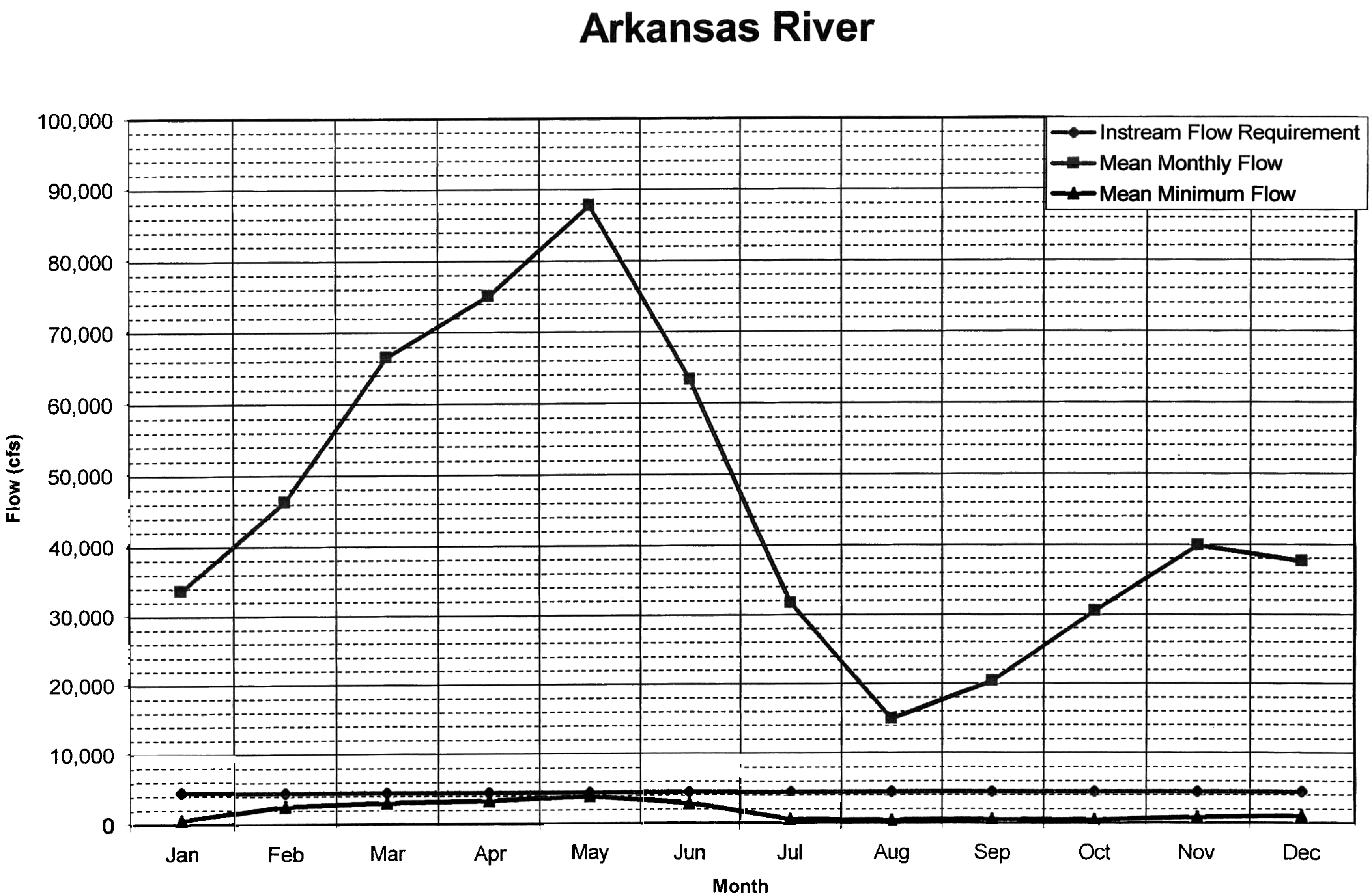



Figure 4.

Figure 4.

**Alluvial Aquifer** - The USGS in cooperation with the Memphis District Corps of Engineers, and the Arkansas Soil and Water Conservation Commission (ASWCC) is in the process of recalibrating a ground-water flow model of the Alluvial Aquifer documented in USGS Water Resources Investigation Report 92-4106. A new ground-water/surface-water conjunctive use optimization model will be developed based upon this flow model. The cell size in the model grid is a uniform 1x1 mile (1 square mile). The model will include a limiting criteria (constraint) on pumpage from the Alluvial Aquifer. That constraint will be defined as minimal water levels and will be equal to the altitude of 50% of the original saturated thickness of the formation. This constraint is consistent with a primary criteria used by ASWCC to designate a Critical Ground-Water Area for unconfined aquifer conditions. As cells in the aquifer model are pumped the water level will drop. Pumpage will be optimized so that constraints are not violated. In the model, 50% of the original saturated Alluvial thickness ranges from less than 20 feet to 97 feet. In only a small percentage of the model cells are values less than or equal to 20 feet. The majority ranges between 30 and 97 feet.

Earlier models of the north Alluvial Aquifer developed in the 1980s used a grid cell size of 3x3 miles (9 square miles) and the constraint on the aquifer pumpage was a uniform 20 feet of remaining saturated thickness. In other words, the aquifer could be pumped in each cell as long as a minimum of 20 feet of saturated thickness could be maintained in that and adjacent cells.

Preliminary flow model recalibration runs indicate that no changes in aquifer model parameterization will result in greater yields from the aquifer than was simulated in the 1980s models. Because the constraint on pumpage in the models under development is significantly greater throughout much of the modeled area, it is anticipated that "optimal ground-water pumpage" in any given scenario will be less than predicted by the 1980s models. Consequently "unmet demand" for any given scenario will probably be higher.

**Sparta Aquifer** – There is no basis for changing of the conclusions regarding the Sparta aquifer. It should not be considered as a long term water source for the project.

**Additional storage** – Increased storage did not provide for the water needs of the area. Nearly all of the recoverable rainfall will be collected with the storage planned for the authorized project. Increasing storage would essentially redistribute rainfall and not provide a solution to the problems. Existing water sources and implementation of conservation measures can only support the construction of approximately 1,400 acres of new reservoirs.

Increasing on-farm reservoirs – Significant increases in on-farm storage above the amount planned for the authorized project would not eliminate the need for supplemental import water.

Creating large lakes on the natural streams – Increasing storage by any method would not eliminate the need for a supplemental import system. Using reservoirs on natural streams would destroy the few remaining natural wetlands and was not considered acceptable.

Increasing aquifer recharge for storage – Using the alluvial aquifer for storage by artificial mechanical recharge would not eliminate the need for an import system. With the demonstration project in place, the feasibility of large scale recharge by pits or reservoirs that penetrate the clay layer and expose, but do not penetrate, the aquifer could be tested. This may provide a method to increase long term aquifer recharge without constructing wells which were not found to be feasible. The natural filtering of the aquifer could then be utilized and removal and replacement of upper layers of the aquifer may be a practical means of maintenance. However, an import system is necessary to provide supplemental water with which to recharge the aquifer.

**Increase irrigation efficiencies** – The currently authorized project provided for increased irrigation efficiencies to the extent practical. Large increases in efficiencies are not possible with current methods and technologies. An alternative for increasing irrigation efficiencies and storage was analyzed for the GRR. Review of this alternative applied to the current project area did not alter the conclusions that this did not provide a complete solution to the problems.

**Combination of Arkansas and White Rivers -** Based on examining the availability of water in the Arkansas and White Rivers, the peak irrigation seasons, and the key concerns on the White River, a combination of the Arkansas and White Rivers could be used to supply water from the Arkansas during the waterfowl and fish spawning season and the White solely could be used for the Grand Prairie during the peak irrigation season.

Based on a review of past studies and additional aquifer studies, a supplemental source of water for the project area is needed and the only potential sources identified are the White and Arkansas Rivers. No major omissions or errors were identified in previous studies of the water sources. Major changes since the identification of water sources for the Grand Prairie project include authorization of studies for water supply and aquifer protection of the Boeuf Tensas area and development of additional detail for both the Grand Prairie and Bayou Meto areas. Costs and benefits and impacts were examined for various methods of bringing water from the Arkansas River to the Grand Prairie.

## UPDATE TO CURRENT CONDITIONS OF USING THE ARKANSAS RIVER AS A WATER SOURCE

### Comparison of Arkansas and White River

The two main factors in the suitability of a water source for irrigation are quality and availability. Current studies for the Bayou Meto project indicate that the Arkansas River is adequate for irrigation. Studies have shown the water quality in the White River is excellent. Both the White and Arkansas Rivers have excess water as defined by the State of Arkansas during all months of the year. The Arkansas has an abundance of water in the winter and spring when not as much excess water is available in the White River. The White River has higher flows in August, but minimum stream flows result in lower excess flows. Analyses of the reliability yielded that, with current demands, the Arkansas River would result in a slightly higher reliability of 90% compared to current reliability of 87%. These analyses excluded future demands of Boeuf Tensas. The combination yielded the greatest reliability with an increase to 95%.

### Determination of Costs for Using the Arkansas River

Several methods of transporting water from the Arkansas River were examined to provide supplemental water for the Grand Prairie area.

**Carlisle Canal.** This method consists of an import system from the Arkansas River near Scott, Arkansas, with the same alignment as the Bayou Meto import system. In addition to the general features required for the Bayou Meto import system, a large canal and pumping station is included to lift water onto the Grand Prairie. A pumping station located on the Arkansas River would import water into a large canal. A second pumping station would be required south of Lonoke, Arkansas. A large canal would connect into the existing Grand Prairie distribution system near Carlisle. This method of import was referred to as the "Carlisle Canal." A significant consideration of this method is moving the water across the low areas of Two-Prairie Bayou. A leveed canal with levee heights up to approximately 30 feet is required along with pipelines to move the water across the low area. Costs were computed for two variations of the Carlisle Canal. The first is in the absence of the Bayou Meto Basin Project, called Carlisle Canal without Bayou Meto. The second variation evaluated Grand Prairie as an added increment to the Bayou Meto Basin Project, called Carlisle Canal with Bayou Meto.

**Carlisle Canal without Bayou Meto**. This method consists of a 1,780-cfs pumping station on the Arkansas River (Bayou Meto Pumping Station), a 1,700-cfs pumping station south of Lonoke (Lonoke Pumping Station), discharge pipes, outlet structures, 26.5 miles of canals, and other associated structures.

**Carlisle Canal with Bayou Meto**. This method consists of a 3,460-cfs pumping station on the Arkansas River (Bayou Meto Pumping Station), a 2,719-cfs pumping station south of Lonoke (Lonoke Pumping Station), discharge pipes, outlet structures, canals, and other associated structures. Of the 3,460-cfs capability for the Bayou Meto Pumping Station, 1,680-cfs would be devoted to supplying the Bayou Meto Project Area. Of the 2,719-cfs capability at the Lonoke Pumping Station, 1,019-cfs would be devoted to supplying the Bayou Meto Project needs. The parametric costs of the features common to both the Grand Prairie and Bayou Meto projects were then determined assuming the features were sized for the Bayou Meto Project alone. Parametric costs will then be determined for the features necessary to supply both projects. The difference in costs, plus the costs of the features for Grand Prairie alone were the incremental costs assigned to Grand Prairie. The sizes of the Grand Prairie canals 1000 and 2000 will be reduced due to the reduction in flows from the DeVall's Bluff Pumping Station as compared to the flows necessary to supply the northeast portion of the Grand Prairie project. In times of inadequate flow to meet all demands from the Arkansas River, the highest priority of needs would be assigned to the Bayou Meto area because the operational costs of delivering water to the Bayou Meto project would be less than relifting the water onto the Grand Prairie. Therefore, supplying needs in Bayou Meto has more economic utility than supplying needs in Grand Prairie.

**Mill Bayou Pipeline with Carlisle Canal** - Water to supply the Arkansas County portion of the project would be pumped from the backwater of Pool No. 4 of the Arkansas River through a pipeline generally parallel to Mill Bayou. The remainder of the project will be supplied by a canal from Carlisle (smaller than the one discussed above) in combination with the Bayou Meto Project. This method will be referred to as the "Mill Bayou Pipeline". For this method, the Bayou Meto Pumping Station would be sized for 2,644 cfs and the Lonoke Pumping Station sized for 1,903 cfs. Again, only the incremental costs in addition to the Bayou Meto project would be assigned to Grand Prairie. A pumping station just north of Lumsden's reservoir (Mill Bayou Pumping Station) would have a capacity of 816 cfs. The Mill Bayou Pipeline would extend to just south of the Arkansas-Prairie County line and would consist of a single 10-foot diameter pipe.

**Mill Bayou Backflow with Carlisle Canal** - Water to supply the Arkansas County portion of the project would be pumped from the backwater of Pool No. 4 of the Arkansas River through a system of weirs and pools on Mill Bayou. The remainder of the project will be supplied by a canal from Carlisle (the same size as in Mill Bayou Pipeline with Carlisle Canal) in combination with the Bayou Meto Project. For this method, the Bayou Meto Pumping Station would be sized for 2,644 cfs and the Lonoke Pumping Station sized for 1,903 cfs. Again, only the incremental costs in addition to the Bayou Meto project would be assigned to Grand Prairie. Several weirs and pumps would be required for this alternative to form pools that extend to just south of the Arkansas-Prairie County line.

**Seasonal Supplementation with Carlisle Canal** - Current costs of supplying water from the Arkansas River to supply the needs of the project area in the waterfowl and fish spawning season were also developed as an added increment to the Grand Prairie Project. Though scientific analyses presented in the approved final EIS indicate that impacts to the White River would be insignificant, some within the environmental community have still expressed concern over the use of the White River. A summary of these studies is presented in Appendix C. Because of the construction of the dams on the upper White River, flows are generally lower during the winter and spring as flood water is stored and generally higher during the summer and early fall. The use of the Arkansas River to provide supplemental water during the times that the White River under natural ecosystem conditions was generally at its higher stages would provide the potential to ensure that the project has no effects on the spring and winter flows. The project would use the White River when the river was generally lower during natural ecosystem conditions than the current reservoir regulated stages. Water demands during the winter and spring are relatively small and the seasonal supplementation method from the Arkansas River would be in conjunction with the Bayou Meto Basin Project. The size of the import would be such that the demands during this low use time could be met without increasing the size of the Bayou Meto Pumping Station and main canals, though some adjustments are necessary at the ends of the canal. The Bayou Meto Pumping Station would be sized as necessary to supply the Bayou Meto Project during peak demands (1,680-cfs) as would the Lonoke Pumping Station (1,019-cfs). Thus incremental costs would be kept to a minimum. A supplemental import of 460 cfs could supply the average water demands for Grand Prairie from August until the last two, 10-day periods in May. These 10-day periods have demands of 600 and 1,116 cfs respectively. This method would require construction of the Bayou Meto Project essentially as is currently being formulated, construction of the Grand Prairie Area Demonstration Project as authorized, and construction of a connection. The major feature of the connection would be a crossing of Two-Prairie Bayou, essentially the dividing line between the Grand Prairie area and the Bayou Meto project area. This method will be called "seasonal supplementation."

**Seasonal Supplementation by Carlisle Canal** - This method would carry the flow from the Bayou Meto project area across Two-Prairie Bayou by an elevated canal. This would be much less costly than the pipeline alternative. Potentially, this method could allow for transfer of White River water to the Bayou Meto area.

**Seasonal Supplementation by Carlisle Canal with Pipeline** - This method would provide for a pump and pipeline crossing of Two-Prairie Bayou to provide the benefits of seasonal supplementation.

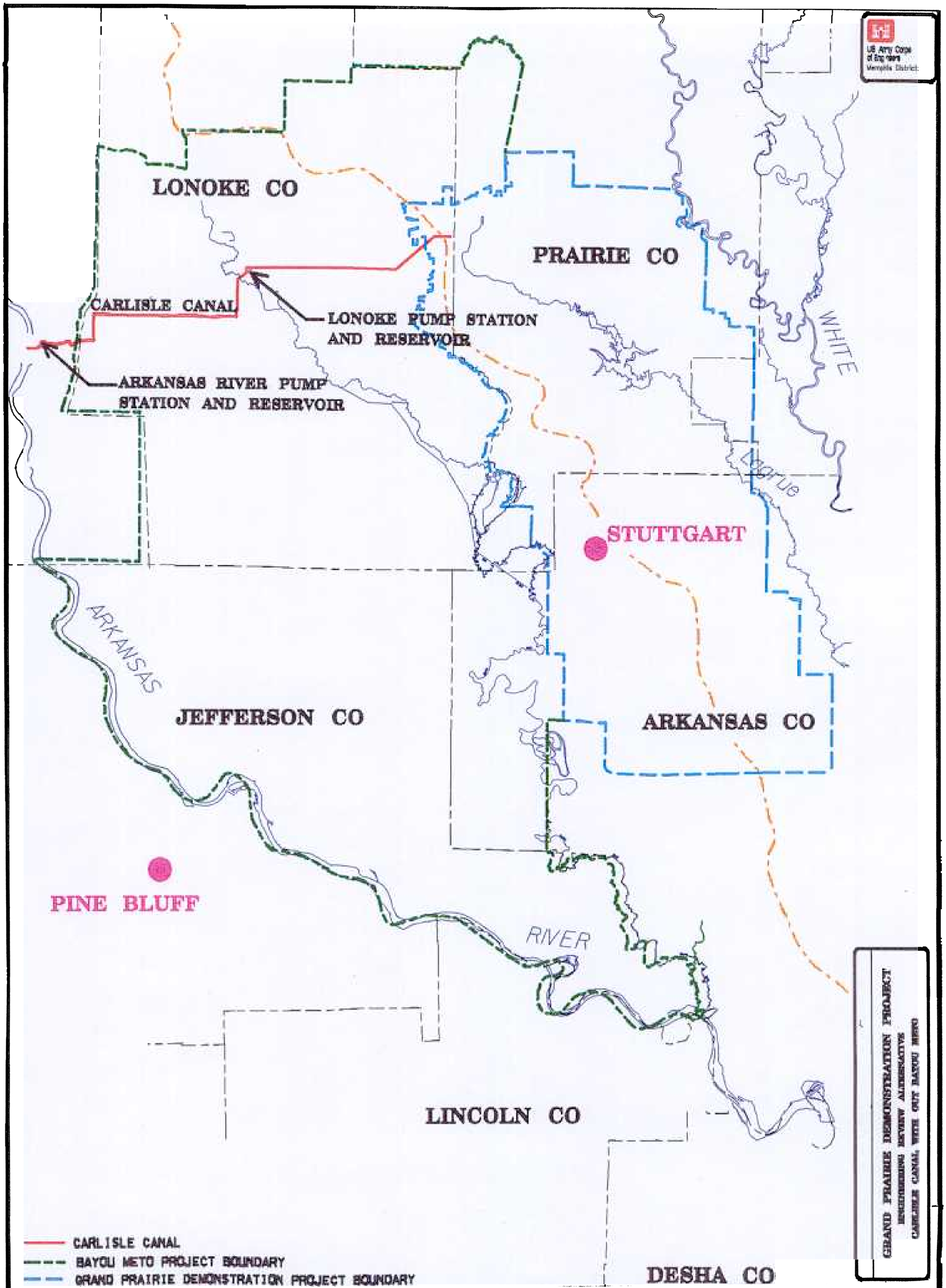
The Grand Prairie delivery system, for the most part, would not be altered except for the method of bringing water to the current western-most point of the main canal. Tables 3-8 describe the major components and costs that would change in the system for each method of bringing import water in from the Arkansas River and Figures 5-8 provide a layout of the methods. The cost of the Grand Prairie features that would be common was computed, and the costs of the delivery system from the Arkansas River was added to the common features. The cost comparisons are presented in Table 9. October 1999 price levels were used in the report to allow for comparison.

**Table 3. Carlisle Canal without the Bayou Meto Irrigation Project**

| | |
|---|---|
| Pump Stations | 1-1,780 and 1-1,700 cfs stations w/ 20-foot of lift |
| Discharge Pipe | 2-10' diameter, 5,000 feet total (2,000' and 3,000') |
| Reservoirs | 2,160 ac |
| Canal Design | 50' BW canal, 26.5 miles |
| | Downsize Canal 1000/2000/3000 to 20' BW canal, canal excavation from 3.5 million cu yd to 1.2 million cu yd of excavation |
| Check Structures | 10-3 gate structures, 14'x13.5', stilling basin length-40', end sill-3' high |
| | 1-3 gate structure, 14'x13.5', stilling basin length-38', end sill-3' high |
| | Downsize C3000.01 to a gated conduit check, 2-5.0' diameter, 50' long, 5' gate size, check riser 7.5' diameter riser-11.5' high |
| Turnout Structure | 4-36" conduits, 50' long, 54" diameter riser-9.5' high, 36" gates |
| Inverted Siphons | 13, 1-72" RCP, 250' long; 2,5-96" RCP, 470' long |
| Road Crossings | 18 bridges, spanning 50' BW canal, some highways, mostly gravel roads |

**Cost estimate**

| | |
|---|---|
| Costs of features to import water to point south of Carlisle | $176.2 million |
| Common costs with the authorized Grand Prairie project | $249.6 million |
| Total costs | $425.8 million |
| **Total incremental costs of feature applying common costs to Bayou Meto to compare with authorized project** | **$425.8 million** |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Memphis District
LONOKE CO
PRAIRIE CO
CARLISLE CANAL
LONOKE PUMP STATION AND RESERVOIR
ARKANSAS RIVER PUMP STATION AND RESERVOIR
WHITE
LaGrue
STUTTGART
ARKANSAS
JEFFERSON CO
ARKANSAS CO
PINE BLUFF
RIVER
LINCOLN CO
DESHA CO
GRAND PRAIRIE DEMONSTRATION PROJECT
ENGINEERING REVIEW ALTERNATIVE
CARLISLE CANAL WITH OUT BAYOU METO
CARLISLE CANAL
BAYOU METO PROJECT BOUNDARY
GRAND PRAIRIE DEMONSTRATION PROJECT BOUNDARY

**Figure 5.**

**Table 4. Carlisle Canal with the Bayou Meto Irrigation Project**

| | |
|---|---|
| Pump Stations | 1-3,640 and 1-2,719 cfs stations w/ 20-foot of lift |
| Discharge Pipe | 2-10' diameter, 5,000 feet total (2,000' and 3,000') |
| Reservoirs | 2 , 160 ac |
| Canal Design | 69' down to 50' BW canal, 26.5 miles |
| | Downsize Canal 1000/2000/3000 to 20' BW canal, canal excavation from 3.5 million cu yd to 1.2 million cu yd of excavation |
| Check Structures | 4-5 gate structures, 14'x13.5', stilling basin length-40', end sill-3' high |
| | 3-4 gate structures, 14'x13.5', stilling basin length-40', end sill-3' high |
| | 3-3 gate structures, 14'x13.5', stilling basin length-40', end sill-3' high |
| | 1-3 gate structure, 14'x13.5', stilling basin length-38', end sill-3' high |
| | Downsize C3000.01 to a gated conduit check, 2-5.0' diameter, 50' long, 5' gate size, check riser 7.5' diameter riser-11.5' high |
| Turnout Structure | 4-36" conduits, 50' long, 54" diameter riser-9.5' high, 36" gates |
| Inverted Siphons | 13, 1-72" RCP, 250' long; 2, 5-96" RCP, 470' long |
| Road Crossings | 18 bridges, spanning, some highways, mostly gravel roads |

**Cost estimate**

| | |
|---|---|
| Costs of features to import water to point south of Carlisle | $250.8 million |
| Common costs with the authorized Grand Prairie project | $249.6 million |
| Total costs | $500.4 million |
| **Total incremental costs of feature applying common costs to Bayou Meto to compare with authorized project** | **$367.3 million** |

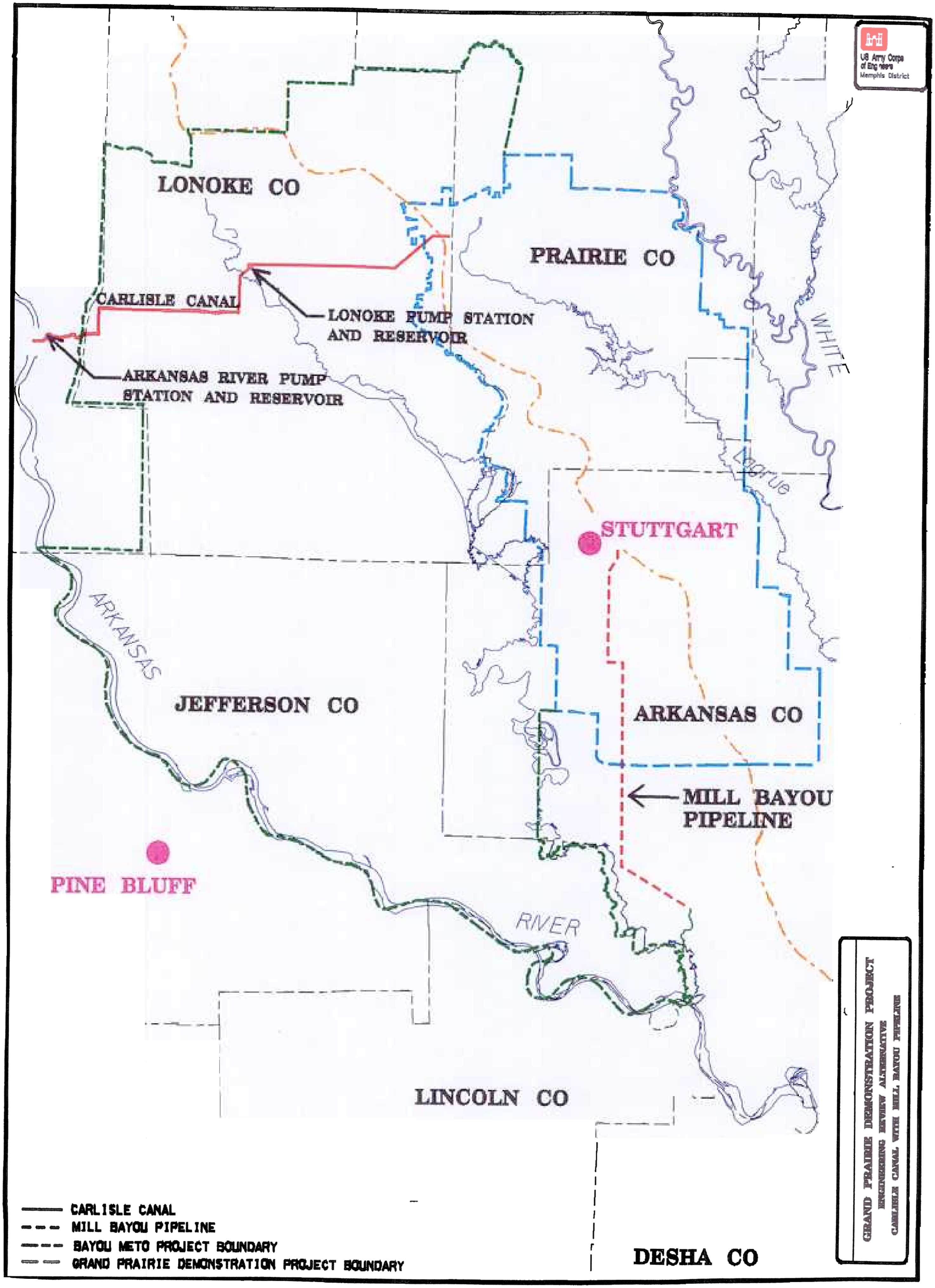
US Army Corps of Engineers Memphis District
LONOKE CO
PRAIRIE CO
CARLISLE CANAL
LONOKE PUMP STATION AND RESERVOIR
ARKANSAS RIVER PUMP STATION AND RESERVOIR
WHITE
STUTTGART
ARKANSAS
JEFFERSON CO
ARKANSAS CO
MILL BAYOU PIPELINE
PINE BLUFF
RIVER
LINCOLN CO
DESHA CO
CARLISLE CANAL
MILL BAYOU PIPELINE
BAYOU METO PROJECT BOUNDARY
GRAND PRAIRIE DEMONSTRATION PROJECT BOUNDARY
GRAND PRAIRIE DEMONSTRATION PROJECT
ENGINEERING REVIEW ALTERNATIVE
CARLISLE CANAL WITH MILL BAYOU PIPELINE

**Table 5. Mill Bayou Pipeline with the Carlisle Canal**

| | |
|---|---|
| Pump Stations | 1-2,644 and 1-1,903 cfs stations w/ 20-foot of lift, 1-816 cfs station w/ 50' pumping head |
| Discharge Pipe | 2-10' diameter, 5,000 feet total (2,000' and 3,000'), 1-10' diameter, 126,720 feet |
| Reservoirs | 2 , 160 ac |
| Canal Design | 57' down to 35' BW canal, 26.5 miles |
| | Downsize Canal 1000/2000/3000 to 20' BW canal, canal excavation from 3.5 million cu yd to 1.2 million cu yd of excavation |
| | Remove Canal 6000 from Junction to Canal 6200 (approximately 12 miles) |
| Check Structures | 4-4 gate structures, 14'x13.5', stilling basin length-40', end sill-3' high |
| | 6-3 gate structures, 14'x13.5', stilling basin length-40', end sill-3' high |
| | 1-3 gate structure, 14'x13.5', stilling basin length-38', end sill-3' high |
| | Downsize C3000.01 to a gated conduit check, 2-5.0' diameter, 50' long, 5' gate size, check riser 7.5' diameter riser-11.5' high |
| Turnout Structure | 4-36" conduits, 50' long, 54" diameter riser-9.5' high, 36" gates |
| Inverted Siphons | 13, 1-72" RCP, 250' long; 2, 5-96" RCP, 470' long |
| Road Crossings | 18 bridges, spanning, some highways, mostly gravel roads |

**Cost estimate**

| | |
|---|---|
| Costs of features to import water to point south of Carlisle | $378.4 million |
| Common costs with the authorized Grand Prairie project | $249.6 million |
| Total costs | $628.0 million |
| **Total incremental costs of feature applying common costs to Bayou Meto to compare with authorized project** | **$494.9 million** |

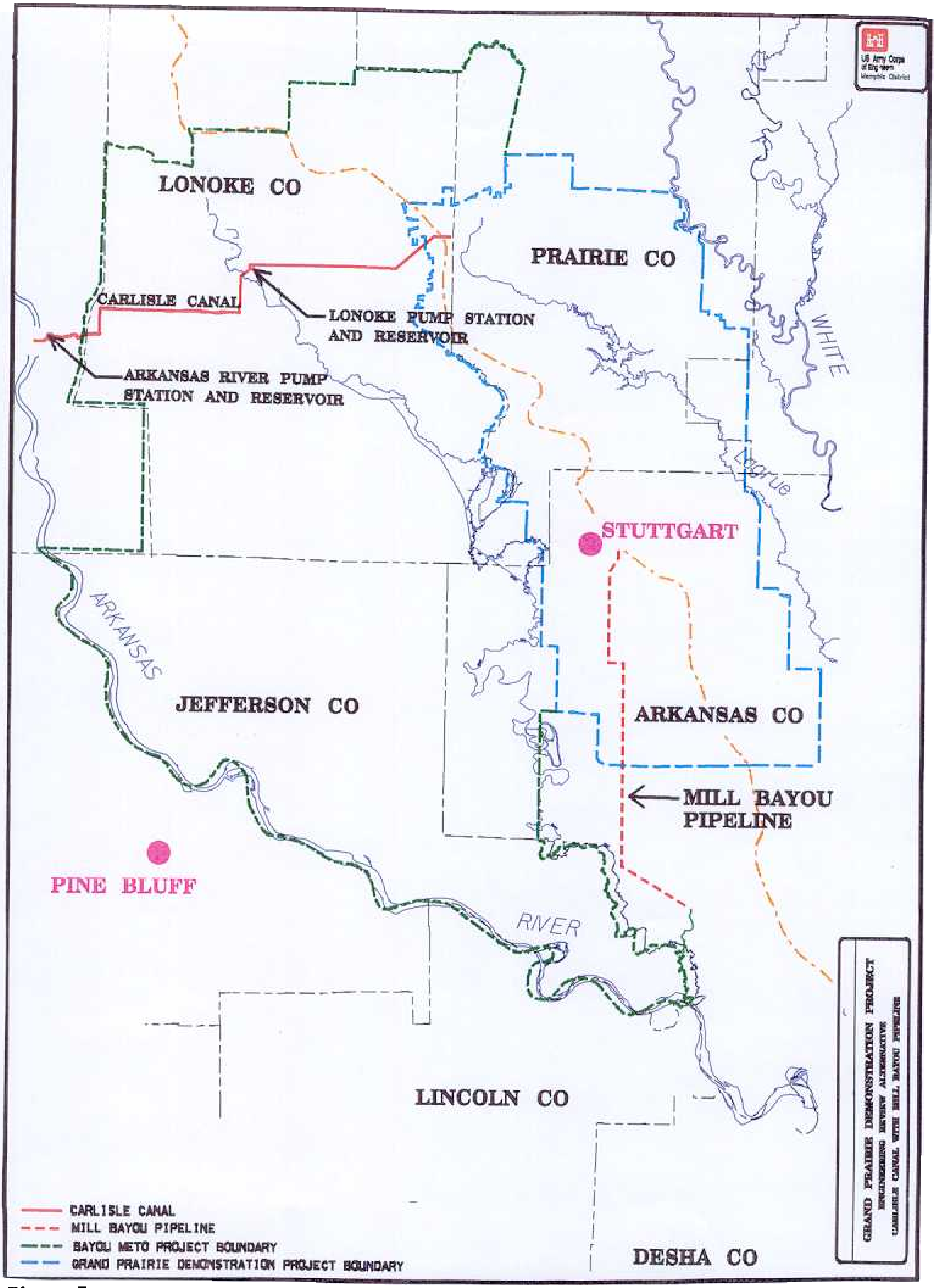
US Army Corps of Engineers
Memphis District
LONOKE CO
PRAIRIE CO
CARLISLE CANAL
LONOKE PUMP STATION AND RESERVOIR
ARKANSAS RIVER PUMP STATION AND RESERVOIR
WHITE
LaGrue
STUTTGART
ARKANSAS
JEFFERSON CO
ARKANSAS CO
MILL BAYOU PIPELINE
PINE BLUFF
RIVER
LINCOLN CO
DESHA CO
CARLISLE CANAL
MILL BAYOU PIPELINE
BAYOU METO PROJECT BOUNDARY
GRAND PRAIRIE DEMONSTRATION PROJECT BOUNDARY
GRAND PRAIRIE DEMONSTRATION PROJECT
ENGINEERING REVIEW ALTERNATIVE
CARLISLE CANAL WITH MILL BAYOU PIPELINE

Figure 7.

**Table 6. Carlisle Canal used for Seasonal Supplementation**

| | |
|---|---|
| Pump Stations | 1-1,680 and 1-1,019 cfs stations w/ 20-foot of lift |
| Discharge Pipe | 2-10’ diameter, 5,000 feet total (2,000’ and 3,000’) |
| Reservoirs | 2 , 160 ac |
| Canal Design | 50’ down to 25’ BW canal, 26.5 miles |
| Check Structures | 6-3 gate structures, 14’x13.5’, stilling basin length-40’, end sill-3’ high |
| | 3-2 gate structures, 14’x13.5’, stilling basin length-38’, end sill-3’ high |
| | 2-1 gate structures, 14’x13.5’, stilling basin length-38’, end sill-3’ high |
| Inverted Siphons | 7, 1-72” RCP, 250’ long; 3, 1-72’ RCP, 200’ long; 3, 1-72” RCP, 100’ long; 2,5-96” RCP, 470’ long |
| Road Crossings | 18 bridges, spanning canal, some highways, mostly gravel roads |

**Cost estimate**

| | |
|---|---|
| Costs of features to import water to point south of Carlisle | $149.4 million |
| Common costs with the authorized Grand Prairie project | $249.6 million |
| Total costs | $456.4 million |
| **Total incremental costs of feature applying common costs to Bayou Meto to compare with authorized project** | **$323.3 million** |

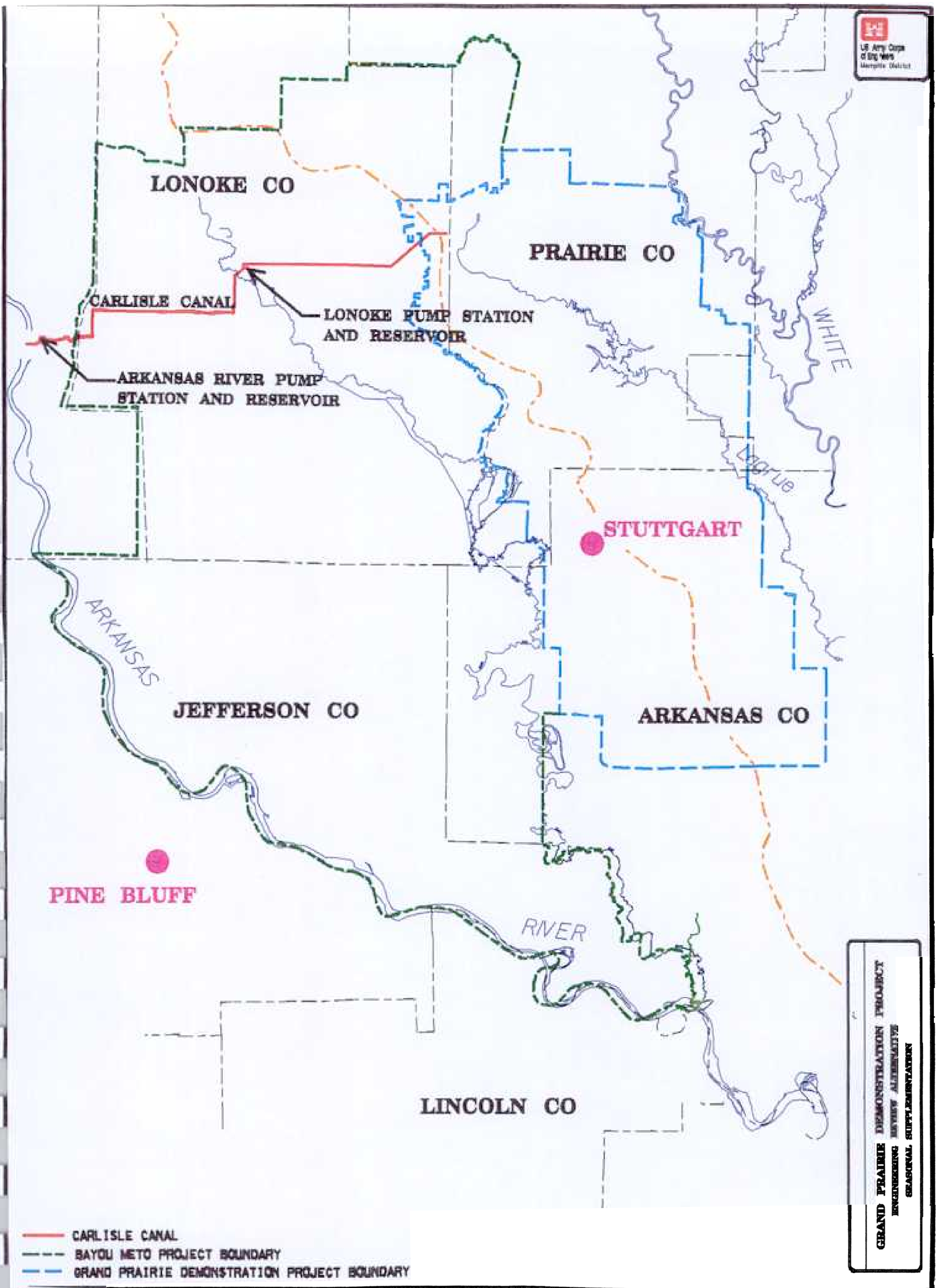
LONOKE CO
PRAIRIE CO
CARLISLE CANAL
LONOKE PUMP STATION AND RESERVOIR
ARKANSAS RIVER PUMP STATION AND RESERVOIR
WHITE
STUTTGART
ARKANSAS
JEFFERSON CO
ARKANSAS CO
PINE BLUFF
RIVER
LINCOLN CO
GRAND PRAIRIE DEMONSTRATION PROJECT
SEASONAL SUPPLEMENTATION
CARLISLE CANAL
BAYOU METO PROJECT BOUNDARY
GRAND PRAIRIE DEMONSTRATION PROJECT BOUNDARY

Figure 8.

**Table 7. Carlisle Canal/Pipeline used for Seasonal Supplementation**

| | |
|---|---|
| Pump Stations | 1-1,680 and 1-1,019 cfs station w/ 20-foot of lift, and 1-460 cfs station w/ 0-foot of lift |
| Discharge Pipe | 2-10’ diameter, 5,000 feet total (2,000’ and 3,000’), 1-5’ diameter, 34,320 feet |
| Reservoirs | 2-160 ac, 2- 25 ac |
| Canal Design | 50’ down to 25’ BW canal, 20 miles |
| Check Structures | 6-3 gate structures, 14’x13.5’, stilling basin length-40’, end sill-3’ high<br>2-2 gate structures, 14’x13.5’, stilling basin length-38’, end sill-3’ high<br>1-1 gate structures, 14’x13.5’, stilling basin length-38’, end sill-3’ high |
| Inverted Siphons | 7, 1-72” RCP, 250’ long; 3, 1-72’ RCP, 200’ long; 3, 1-72” RCP, 100’ long |
| Road Crossings | 18 bridges, spanning canal, some highways, mostly gravel roads |

**Cost estimate**

| | |
|---|---|
| Costs of features to import water to point south of Carlisle | $166.1 million |
| Common costs with the authorized Grand Prairie project | $249.6 million |
| Total costs | $473.4 million |
| **Total incremental costs of feature applying common costs to Bayou Meto to compare with authorized project** | **$340.3 million** |

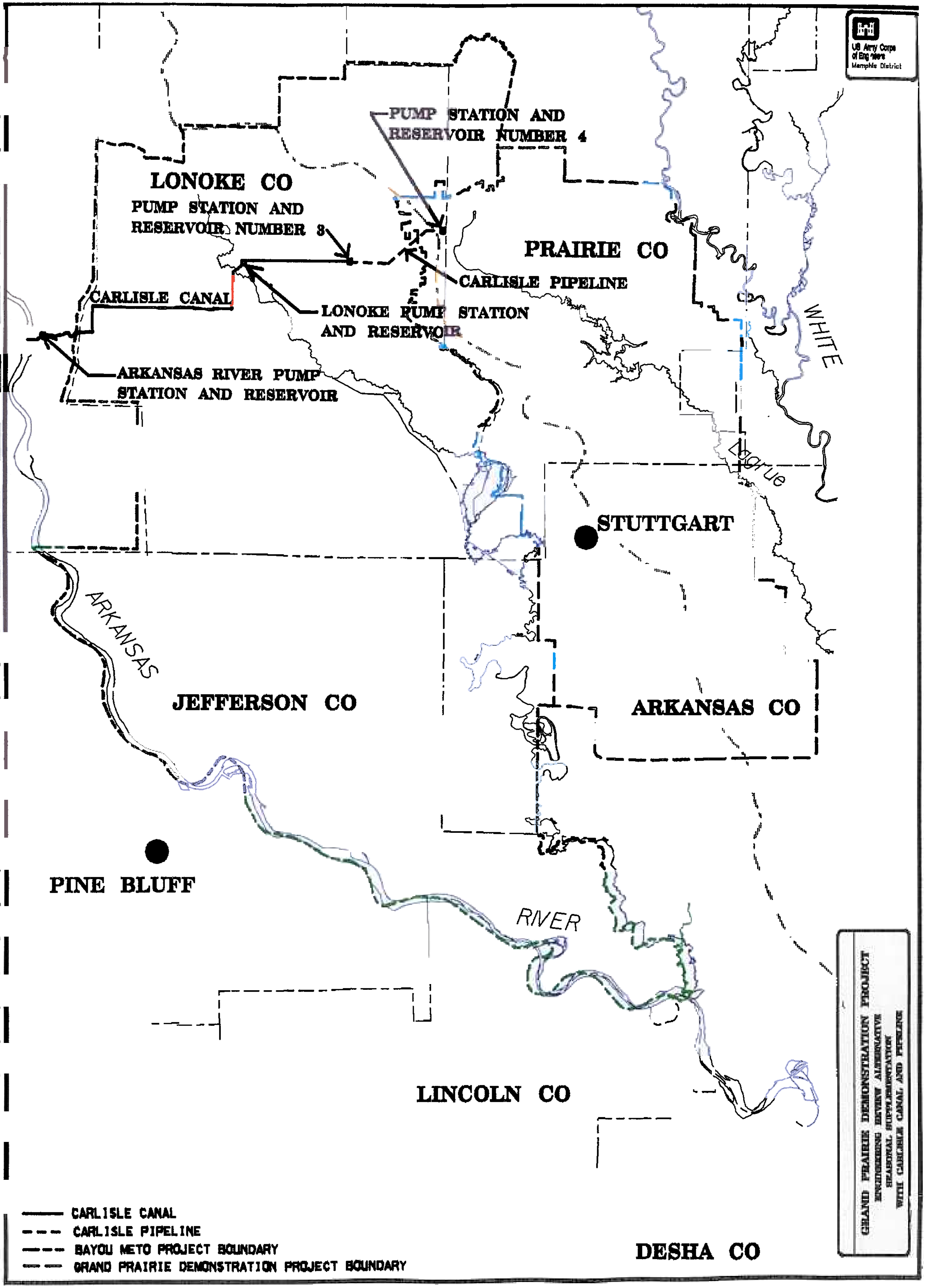
US Army Corps of Engineers
Memphis District
PUMP STATION AND RESERVOIR NUMBER 4
LONOKE CO
PUMP STATION AND RESERVOIR NUMBER 3
PRAIRIE CO
CARLISLE PIPELINE
CARLISLE CANAL
LONOKE PUMP STATION AND RESERVOIR
WHITE
ARKANSAS RIVER PUMP STATION AND RESERVOIR
STUTTGART
ARKANSAS
JEFFERSON CO
ARKANSAS CO
PINE BLUFF
RIVER
LINCOLN CO
DESHA CO
GRAND PRAIRIE DEMONSTRATION PROJECT
ENGINEERING REVIEW ALTERNATIVE
SEASONAL SUPPLEMENTATION
WITH CARLISLE CANAL AND PIPELINE
CARLISLE CANAL
CARLISLE PIPELINE
BAYOU METO PROJECT BOUNDARY
GRAND PRAIRIE DEMONSTRATION PROJECT BOUNDARY

Figure 9

**Table 8. Mill Bayou Backflow with Carlisle Canal**

| | |
|---|---|
| Pump Stations | 1-2,644 and 1-1,903 cfs stations w/ 20-foot of lift, 3-1,060 cfs stations w/ 10' of lift, 1-760 cfs station w/ 10' of lift, 1-475 cfs station w/ 10' of lift |
| Discharge Pipe | 2-10' diameter, 5,000 feet total (2,000' and 3,000'), 1-10' diameter, 1,000 feet |
| Weirs/Levees | 4 miles total, 14' high w/ overflow capability |
| Reservoirs | 2 , 160 ac |
| Canal Design | 57' down to 35' BW canal, 26.5 miles<br>Downsize Canal 1000/2000/3000 to 20' BW canal, canal excavation from 3.5 million cu yd to 1.2 million cu yd of excavation<br>Remove Canal 6000 from Junction to Canal 6200 (approximately 12 miles) |
| Check Structures | 4-4 gate structures, 14'x13.5', stilling basin length-40', end sill-3' high<br>6-3 gate structures, 14'x13.5', stilling basin length-40', end sill-3' high<br>1-3 gate structure, 14'x13.5', stilling basin length-38', end sill-3' high<br>Downsize C3000.01 to a gated conduit check, 2-5.0' diameter, 50' long, 5' gate size, check riser 7.5' diameter riser-11.5' high |
| Turnout Structure | 4-36" conduits, 50' long, 54" diameter riser-9.5' high, 36" gates |
| Inverted Siphons | 13, 1-72" RCP, 250' long; 2, 5-96" RCP, 470' long |
| Road Crossings | 18 bridges, spanning, some highways, mostly gravel roads |

**Cost estimate**

| | |
|---|---|
| Costs of features to import water | $313.5 million * |
| Common costs with the authorized Grand Prairie project | $249.6 million |
| Total costs | $562.9 million * |
| **Total incremental costs of feature applying common costs to Bayou Meto to compare with authorized project** | **$429.8 million *** |

* Does not include rights-of-way or mitigation costs

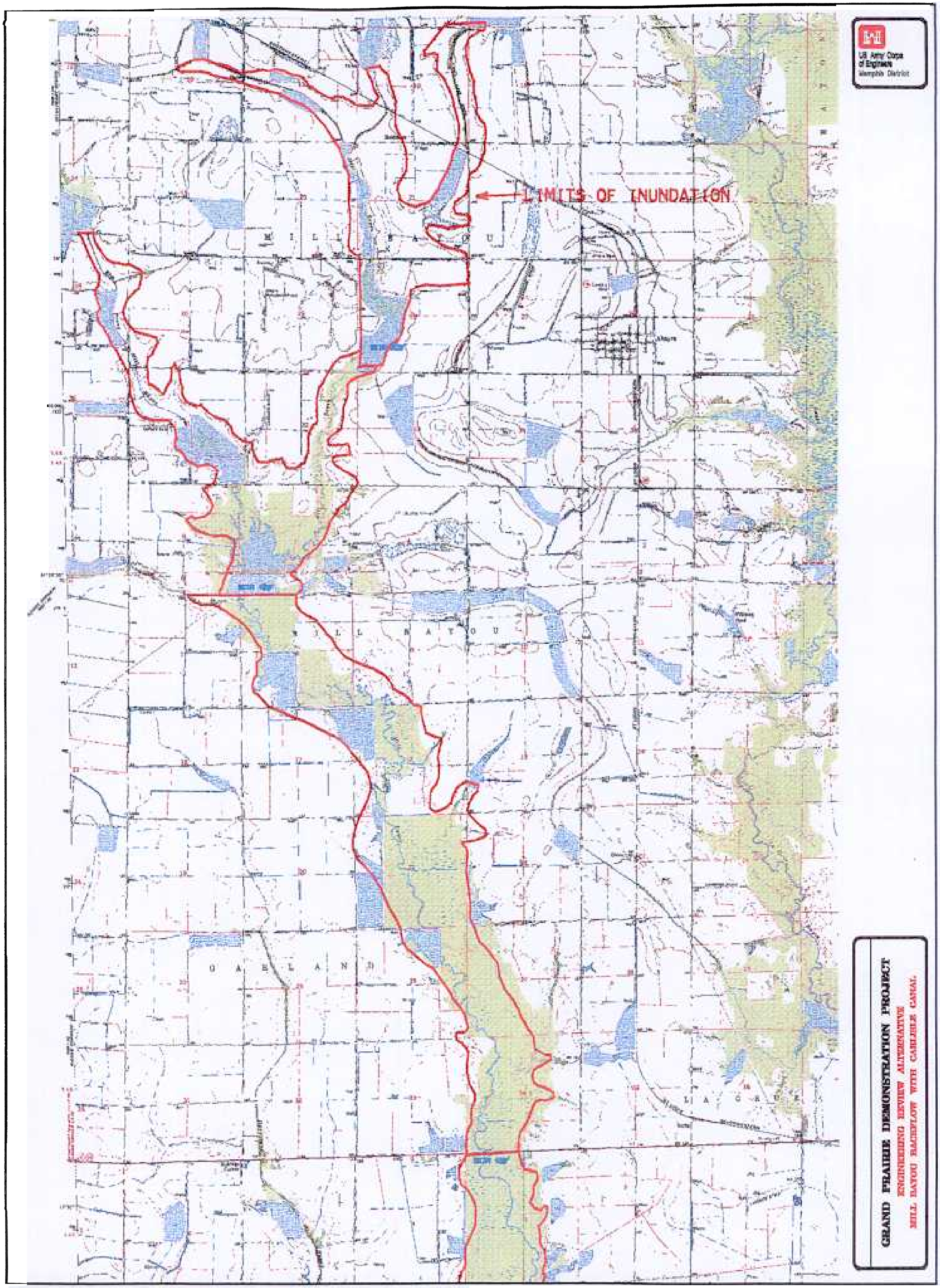
US Army Corps of Engineers Memphis District
LIMITS OF INUNDATION
MILL BAYOU
GARLAND
GRAND PRAIRIE DEMONSTRATION PROJECT
ENGINEERING REVIEW ALTERNATIVE
MILL BAYOU BACKFLOW WITH CARLISLE CANAL

Figure 10a.

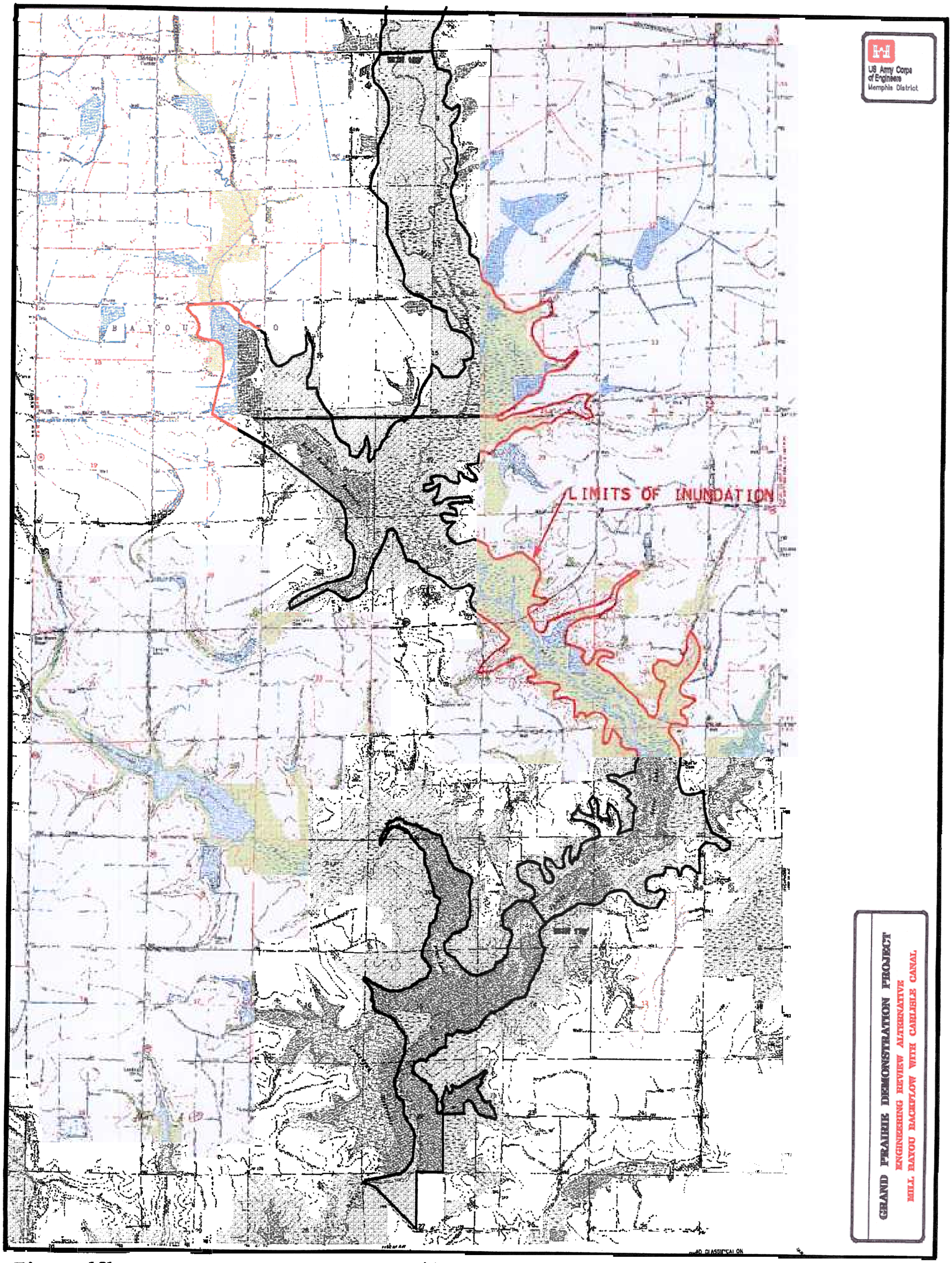
US Army Corps of Engineers
Memphis District
LIMITS OF INUNDATION
GRAND PRAIRIE DEMONSTRATION PROJECT
ENGINEERING REVIEW ALTERNATIVE
MILL BAYOU BACKFLOW WITH CARLISLE CANAL

Figure 10b.

**Costs Comparisons**

Table 9. Cost comparison in million of dollars (October 99 price levels).

| Cost Comparison | Estimated Costs for Withdrawal Components | Total Estimated Costs for Complete Project | Incremental Costs with Bayou Meto | Cost increase over White River |
|---|---|---|---|---|
| Carlisle Canal without Bayou Meto Basin Project | $176.2 | $425.8 | $425.8 | $118.4 |
| Carlisle Canal with the Bayou Meto Basin Project | $250.8 | $500.4 | $367.3 | $59.9 |
| Mill Bayou Pipeline with Carlisle Canal | $378.4 | $628.0 | $494.9 | $187.5 |
| Mill Bayou Backflow with Carlisle Canal | $313.5 * | $562.9 * | $429.8 * | $122.4 * |
| Seasonal Sup by Pipeline | $166.1 | $473.4 | $340.3 | $32.9 |
| Seasonal Sup by Canal | $149.4 | $456.4 | $323.3 | $15.9 |
| Using White River | $57.8 | $307.4 | $307.4 | - |
| | | | | |

* Does not include Real Estate Costs or mitigation costs for the area of Mill Bayou

Comparison of Costs – In order to compare the costs of each method of providing water to the Grand Prairie, the total costs of each were computed. October 1999 price levels were used to compute cost. The authorized project cost in October 1999 price levels is $307.4 million. Every method of delivery had common costs of $249.6 million for the delivery system from a point near Carlisle to where components to remove water from the Arkansas River would tie into the existing project design. (Eliminating the pumping station and downsizing main canal would reduce costs by $57.8 million.) The estimated cost of the Bayou Meto components that would be modified to increase capacity is $133.1 million. All costs common with the Bayou Meto project were applied to the Bayou Meto project to determine incremental costs.

This comparison is made to determine incremental costs. If the water source for the Grand Prairie is altered, a cost allocation would be made based on benefits received by each project to determine cost contributions of each project area to construct the common features to remove water from the Arkansas River. The incremental costs underestimate to some degree the costs that would be assigned to Grand Prairie with a true cost allocation.

Rapid construction of the project is necessary to protect the aquifer and provide benefits to the area. Table 10 indicates the effects of possible recommendations on concerns expressed by the Governor's Oversight Committee.

Table 10. Effects of implementation of various methods to supply water to the Grand Prairie on items of concern identified by the Governor's Oversight Committee

| | **Carlisle Canal W/ Bayou Meto** | **Mill Bayou Pipeline with Carlisle Canal** | **Seasonal Supplementation** | **Mill Bayou Backflow with Carlisle Canal** |
|---|---|---|---|---|
| **Implementation method** | General reevaluation and supplemental EIS | Reevaluation, supplemental EIS | Post authorization change report and supplemental EIS | Reevaluation and supplemental EIS. |
| **Grand Prairie construction time** | Large time delays resulting in benefits foregone | Large time delays resulting in benefits foregone | Could construct Grand Prairie while performing planning activities to add seasonal supplementation features | Large time delays resulting in benefits foregone, significant concerns about implementability because of environmental impacts |
| **Bayou Meto General Reevaluation Completion** | Delay to incorporate increased pumping station and canal sizes | Delay to incorporate increased pumping station and canal sizes | No delay, pumping station and main canal sizes would not change | Delay to incorporate increased pumping station and canal sizes |
| **Bayou Meto ROW** | Large Increase | Increase | Minor increase | Increase |
| **Beuf Tensas water availability** | Probable impacts during August | Probable impacts during August | No impact | Probable impacts during August |
| **White River** | No use | No use | No use during waterfowl or fish spawning season. Use during growing season still would slightly move the expected river stages to more natural conditions | No use of White River. This method has potential for significant impacts to wetlands and bottomland hardwoods adjacent to the Arkansas River |

## Economic Comparisons

Major factors effecting the feasibility of the project include reliability of the water source, first costs, and operation and maintenance costs. The time to initial operation also plays a major role determining the feasibility because of the large initial capital outlays. Though major components of the Bayou Meto project are necessary for all means of providing water from the Arkansas River to the complete project area, the same construction schedule was assumed for the methods. Because of the large increases in costs for the other methods of using the Arkansas River, complete economic analysis was only performed for the Carlisle Canal with Bayou Meto and for seasonal supplementation by canal. The Carlisle Canal with Bayou Meto had the lowest incremental costs for the same reliability as other methods of using the White River. Even assuming 100% reliability, other alternatives would not have been economically justified because of the high initial costs. Economic analyses were also performed on the seasonal supplementation method. This method offered the highest increase in reliability. Economic analyses were only performed on using the canal for seasonal supplementation because of the costs of the pipeline. Costs were converted to October 1996 price levels for ease of computation of benefits and comparison. Economic analyses are previewed in Appendix A – Economic.

### Assumptions

Basic economic assumptions were made to match expected conditions and simplify economic analyses. If the Arkansas River could not supply both the demands of the Grand Prairie and Bayou Meto project, 100% of the demand for Bayou Meto would be supplied prior to supplying water to the Grand Prairie. This is technically correct from an economic standpoint because the most effective use of the water would be at the closest location to the source to minimize losses. Additionally, this would account for any impacts on the Bayou Meto irrigation project. Another assumption is that features for the removal of water using the Arkansas River would be operational at the same time as the Grand Prairie's scheduled initiation of operation. This allows for accrual of partial benefits prior to completion of construction as in the current analyses. This assumption likely increases the benefit to cost ratio of importing water from the Arkansas River because construction, and thus accrual of benefits, to the Grand Prairie project would be delayed. The Grand Prairie project could not be supplied until the major features of the Bayou Meto project are constructed.

The project benefits for the currently authorized Grand Prairie Area Demonstration Project are $36.1 million annually with remaining benefits possible of approximately $5 million. The reliability of the project is 87%. The largest possible increase in benefits for any method is $5 million if 100% reliability is achieved.

Economic factors that were not considered were the opportunity costs if water from the Arkansas River is used. These costs would include decreases in reliability for other irrigation projects in service or planned for the Arkansas River and for the benefits foregone due to delays in both Grand Prairie and Bayou Meto projects caused by changing the source of supplemental water. The most significant could be losses to the aquifer due to delays in providing supplemental water. Based on projected demands with optimum storage, the best estimates for peak demands from Boeuf Tensas is 4,460 cfs. The use of the Arkansas River for Grand Prairie could have an effect on the reliability of this project. Other projects, including Plum Bayou (peak demand 155 cfs) and Point Remove (peak demand 220 cfs), are so small that the effects of using Arkansas River water for Grand Prairie would not likely have significant impacts.

**Results of Economic Analyses**

The detailed results are presented in the Economics Appendix, Appendix A. Table 11 indicates that the use of the Arkansas River would provide a slightly higher reliability. However, the costs of this additional reliability far exceeds the economic benefits and this method is not incrementally justified. The costs are so much greater than the additional benefits, the overall project is not economically justified, though the margin is slim. The results are presented in Table 12. The combined use of the Arkansas and White Rivers through seasonal supplementation would provide a much higher reliability. Though the additional reliability is not economically justified, the overall project is still feasible and the unmet demand in the project area is greatly reduced.

Table 11. Supply, demand, and reliability of methods of supplying water

| Item | White River | | White River with SS from Arkansas River | | Arkansas River | |
|---|---|---|---|---|---|---|
| | Acre-Feet | Percent of Demand Before Conservation | Acre-Feet | Percent of Demand Before Conservation | Acre-Feet | Percent of Demand Before Conservation |
| | | | | | | |
| **In-Season Demand** | | | | | | |
| Before Conservation | 481,195 | | 481,195 | | 481,195 | |
| Reduction due to Conservation | 68,742 | 14.29% | 68,742 | 14.29% | 68,742 | 14.29% |
| After Conservation | 412,453 | | 412,453 | | 412,453 | |
| | | | | | | |
| **In-Season Sources** | | | | | | |
| Existing Sources | 108,762 | 22.60% | 108,762 | 22.60% | 108,762 | 22.60% |
| Groundwater | 35,574 | 7.39% | 35,574 | 7.39% | 35,574 | 7.39% |
| Existing Storage and Recovery | 73,188 | 15.21% | 73,188 | 15.21% | 73,188 | 15.21% |
| Water Supplied by Project | 243,900 | 50.69% | 279,192 | 58.02% | 256,616 | 53.33% |
| Total Sources | 352,662 | 73.29% | 387,954 | 80.62% | 365,378 | 75.93% |
| | | | | | | |
| **Un-Met In-Season Demand** | 59,791 | 12.43% | 24,499 | 5.09% | 47,075 | 9.78% |
| | | | | | | |
| **In-Season Demand Met** | | 87.57% | | 94.91% | | 90.22% |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

Table 12. Benefit Cost Comparisons

Benefit Cost Comparisons
Grand Prairie Demonstration Project
October 1996 Price Levels, 7.375% ($000)

| Item | Source of Irrigation Water | | |
|---|---|---|---|
| | White River | White River with SS from Arkansas River | Arkansas River |
| | | | |
| Benefits | | | |
| Irrigation Benefits | 35,659 | 38,809 | 36,840 |
| Waterfowl Benefits | 473 | 473 | 473 |
| Total | 36,132 | 39,282 | 37,313 |
| | | | |
| First Cost | 270,512 | 284,500 | 323,200 |
| | | | |
| Annual Cost | | | |
| Interest | 23,781 | 24,977 | 28,973 |
| Sinking Fund | 697 | 731 | 848 |
| Operation and Maintenance | 4,639 | 6,641 | 8,040 |
| Navigation Impacts | 127 | 127 | 0 |
| Induced Flooding | 12 | 12 | 12 |
| Total | 29,256 | 32,488 | 37,873 |
| | | | |
| Excess Benefits | 6,876 | 6,794 | -560 |
| | | | |
| BCR | 1.24 | 1.21 | 0.99 |

## Environmental Comparisons

Studies conducted by the Corps and by others indicate that the withdrawals from the White River would have no significant negative impacts on the river or surrounding ecosystem. Withdrawals adjust the river hydrograph slightly toward a more natural or pre-dam condition in the growing season. Though the impacts have been scientifically analyzed, concerns have still been raised by some in the environmental community about using the river as a water source. However, no scientific studies indicated significant impacts. Eliminating the use of the White River would not provide significant environmental benefits. A significant monitoring effort will be made to ensure that the impacts are reasonably within the limits disclosed in the final environmental impact statement.

Withdrawal from the Arkansas River has not been analyzed in the detail necessary to draw conclusions. However, it is not likely that the withdrawal would have significant impacts because the river is now a series of pools controlled by dams. Detailed studies are underway for the Bayou Meto Basin Project and additional studies and National Environmental Policy Act (NEPA) compliance activities would be necessary for the Grand Prairie project if the Arkansas River is used as a water source. While water quality in the Arkansas River is not nearly as high as the water quality of the White River, the Arkansas River is acceptable for irrigation. At this time, there are no indications that using the Arkansas River as a water source would be environmentally unacceptable.

Adding Arkansas River as a potential water source during the winter and spring could potentially provide more flexibility, but impacts of introducing water from the Arkansas River system would have to be fully analyzed. The main concern would likely be the introduction of Arkansas River water into natural streams in the Grand Prairie area.

## Results of Comparisons

The use of the White River as a water source proved much less expensive than the use of the Arkansas River. The Arkansas River would provide a slightly higher reliability, but not enough to offset the higher costs. The combined use of the Arkansas and White Rivers would greatly increase the reliability and still result in an economically justified project, though the use of the Arkansas River would not be incrementally justified. No significant impacts to the White River were found during studies by the Corps and others, though some remain concerned. The seasonal supplementation method could be used to eliminate any potential impacts during fish spawning and waterfowl seasons.

# CONCLUSIONS AND RECOMMENDATIONS OF ENGINEERING REVIEW

## CONCLUSIONS AND RECOMMENDATION OPTIONS CONSIDERED

The purpose of the engineering review was to examine the water sources considered for the project and determine if the correct choices were made during the development of the Grand Prairie Area Demonstration Project. The project team has reexamined previous work and updated work as necessary to reflect current conditions. Additional storage and conservation features alone will not solve the problems and needs of the Grand Prairie, will not halt the expected catastrophic economic losses to the area, and will not protect either the alluvial or the Sparta aquifers. A supplemental water source is needed for the project. The only practical sources are the White and Arkansas Rivers.

The use of the White River for the project area is by far the most economic water source. The Environmental Impact Statement (EIS) for the project has been completed and processed and a record of decision executed. The EIS found no significant impacts to the White River. Commitments have been made to develop monitoring plans for the project. If the monitoring results indicate that the impacts are greater than anticipated, the seasonal supplementation method could be used to reduce impacts during all but the peak irrigation demand season. Using the Arkansas River without the Bayou Meto Project in place is not feasible using any method. With the Bayou Meto project in place, using the Arkansas River as a sole source is still not incrementally justified or economically feasible, though the benefit-to-cost ratio is near unity. Using the Arkansas River during peak irrigation season has the potential to negatively impact the Boeuf Tensas Project, though off-season use would not likely have an effect. Switching water sources to the Arkansas River as a sole source would also delay both the Grand Prairie and Bayou Meto projects. Examining these conclusions, the following possible recommendations were developed.

**No change in authorized project –** This option would provide for construction of the project as currently authorized without changing the water source. All NEPA processing for the authorized project has been completed and the project is ready for initiation of construction on the first delivery system item of work. The engineering review of water sources indicated that the Arkansas River was not a superior choice from an engineering and economic standpoint. The environmental impacts of using the White River have been evaluated and found to be insignificant, though some have continued to express concerns. A plan will be developed by an interagency team and implemented to ensure that the critical environmental parameters are monitored.

**Perform a General Reevaluation eliminating the White River as a water source –** The engineering review indicated that using the Arkansas River is technically possible, though the costs were higher than using the White River as a source. The cost of using the Arkansas River is greater than the benefits from the project. The Arkansas River would provide a higher degree of reliability and also provide aquifer protection benefits. Opportunity costs for delays of both Grand Prairie and Bayou Meto with potential harm to the alluvial and Sparta aquifers and reductions in the reliability of the South East Arkansas (Boeuf Tensas) Project would be realized but have not been computed.

**Construct Grand Prairie as authorized, add seasonal supplementation through a post authorization change report –** Seasonal supplementation could be added to the authorized project without delays to either the Grand Prairie or Bayou Meto projects. The costs of diverting water are slightly greater than the benefits, but additional reliability and additional aquifer protection benefits would be gained. Though scientific analyses have indicated that the impacts are insignificant, concerns by some in the environmental community regarding impacts to fish spawning, larval fish entrainment, and waterfowl could be further minimized.

**Construct Grand Prairie as authorized, monitor White River to determine if the project has adverse impacts. If so, add seasonal supplementation and/or other methods to address these impacts through a post authorization change report –** Studies for the Grand Prairie Area Demonstration Project have concluded that the project will not have significant impacts to the White River ecosystem. Studies have also concluded that the project will stabilize the aquifer. A monitoring plan will be developed during project construction to ensure these results. If the monitoring plan indicates that the conclusions of the project were not correct, the seasonal supplementation features could be added to the project as a post authorization change. Any potential impacts during the spring and winter (though shown by scientific studies by the Corps and others to not be significant) could then be further minimized. Additional water and increased project reliability would improve aquifer protection and additional water would be available for waterfowl flooding. Other methods to minimize impacts would be analyzed in addition to seasonal supplementation to provide the most effective and efficient plan to address any unexpected impacts from the project. These analyses would be conducted in full compliance with NEPA.

## RECOMMENDATIONS

I have carefully considered the many significant factors related to the selection of the White River to supply water to the Grand Prairie Area Demonstration Project. The impacts of using the White River have been fully disclosed. In reviewing the decisions made to use the White River, I cannot find any valid reasons to conclude that the choice of water source was not appropriate. In comparing the costs and benefits of using the White River to using the Arkansas River, the White River yields a feasible project with excess benefits while use of the Arkansas River, even in conjunction with the Bayou Meto Basin Project, is not economically justified. Analyses did not indicate any significant impacts to the White River from its use as a water source. However, many remain concerned about its use. The seasonal supplementation using the Arkansas River as a source for water during the winter and spring has merit in eliminating any potential impacts to the river during waterfowl and spawning season. This method, though not incrementally justified, provided increased project reliability and increased aquifer protection and as a whole is economically justified.

As a result of this engineering review of water sources, I recommend no changes to the authorized Grand Prairie Area Demonstration Project. The construction of the authorized Grand Prairie Area Demonstration Project and reevaluation of the Bayou Meto Project should proceed. Studies have indicated that the impacts to the White River will be insignificant, and I have committed to the development of monitoring plans to examine actual project impacts. If project monitoring indicates the need, studies should be undertaken to determine the most efficient and effective methods to address unforeseen impacts. Measures including seasonal supplementation from the Arkansas River could then be added as a post authorization change to improve project reliability, to provide greater water availability for irrigation and waterfowl flooding, and to further minimize the effects on the White River.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified during the review and approval process. However, the sponsor, the state of Arkansas, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

Daniel W. Krueger
Colonel, Corps of Engineers
District Engineer

## CERTIFICATION OF LEGAL REVIEW

The Engineering Review of Water Sources for the Grand Prairie Region and Bayou Meto Basin, Arkansas Project, Grand Prairie Area Demonstration Project has been fully reviewed by the Office of Counsel, Memphis District, and is approved as legally sufficient.

1/29/01
Date

DAVID E. SIRMANS
District Counsel

# APPENDICES

# APPENDIX A

# ECONOMICS

# APPENDIX A - ECONOMIC APPENDIX

## A-1. INTRODUCTION.

This Appendix presents information concerning the potential use of the Arkansas River as an alternate or supplementary source of irrigation water for the Grand Prairie Area Demonstration Project. The plan selected in the Grand Prairie Area Demonstration Project, General Reevaluation Report (GRR) relies solely on the White River as the source of imported irrigation water. This analysis is based on supplying irrigation water to 238,700 acres of cropland and 3,070 acres of fish ponds in Arkansas, Monroe, and Prairie counties in eastern Arkansas that were identified in the GRR. The demands (water uses) of the individual farms were aggregated and modeled against historical White River and Arkansas River flows to determine the amount of irrigation water that could be supplied.

This appendix relies on the methodology and many of the results presented in the GRR to compare using the Arkansas River as an alternative to the White River. The price level and interest rate used in this analysis is the same used in the GRR to facilitate direct comparison with the analyses and calculations presented in the GRR. This evaluation uses (1996) agricultural land use and price levels. The costs of individual construction items are assumed to be end of year values. The benefits associated with each item are assumed to occur 1 year after the item's cost. The reference point for calculating present values of benefits and costs is the beginning of 2008, the first year after project completion. All costs and benefits prior to 2008 are compounded forward and all costs and benefits after 2008 are discounted backward at a discount rate of 7.375 percent. The total present values are amortized over a 50-year project life to obtain average annual equivalent benefits and costs. The benefits accruing to each alternative are comprised of irrigation benefits and waterfowl benefits.

## A-2. AREA DESCRIPTION.

The area that would benefit from project construction consists of approximately 363,000 acres located in Arkansas, Lonoke, Monroe, and Prairie Counties in Arkansas. The area is predominately agricultural with scattered rural development. A total of 251,000 acres is in agricultural production and subject to irrigation in any one year. Approximately 9,000 acres would be converted to on-farm storage reservoirs under with-project conditions. An average of 94 percent of the cropland in the area is irrigated during any one year. The remaining 6 percent of cropland not irrigated is usually due to farm programs or ongoing improvement operations such as land leveling. However, recent changes in farm programs and government subsidies will probably reduce the acreage idled during any one year. For this reason, the without- and with-project comparisons were conducted under the assumption that all of the area will be irrigated during an average year.

## PLANS OF IMPROVEMENT.

Three plans of improvement were evaluated in this section. The size, scope, and optimization of the individual features are unchanged from the GRR. The only change analyzed in the analysis is the potential source of the imported irrigation water. The three alternatives analyzed are:

1. The Grand Prairie using the White River as the source. This is the same as presented in the GRR.
2. Grand Prairie using the White River as the primary source with seasonal supplementation from the Arkansas River.
3. Carlisle Canal with the Bayou Meto Project. This alternative uses the Arkansas River as the sole source of imported irrigation water and it assumes that the Bayou Meto project is in place since it is a currently authorized project.

## A-4. DEMAND AND SUPPLY OF IRRIGATION WATER.

The current demand for irrigation water in the area is estimated to be 481,200 acre-feet (Table A-1). This estimate is based on a 60% conservation level. This means that of all the water drawn from the area's sources, only 60% actually gets to the fields and is used by the crops. This demand can effectively be cut to 412,400 acre-feet using additional conservation features that could be implemented as part of each alternative listed above. This optimum conservation level is 70% efficiency. Detailed analysis regarding its identification can be found in the GRR.

The without-project supply of irrigation water is expected to shrink considerably in the near future. Existing on-farm storage reservoirs and in-season recovery of irrigation water and rainfall are projected to remain unchanged. The decrease will come from groundwater as the area's aquifers are exhausted. By the turn of the century the water available for irrigation of crops is estimated to be down by 204,000 acre-feet, a 43% reduction. By 2015 groundwater's yield is expected to approach its recharge level of 35,600 acre-feet per year. The total shortfall at 2015 is estimated to be 372,400 acre-feet, a 77% reduction.

Table A-1 also shows the amount of irrigation water that can be supplied by each alternative. These figures include the effective amounts supplied by the conservation features. The White River alternative can provide a total of 421,400 acre-feet per year. This level will provide approximately 87.6% of an average year's crop-season need. Even with this project in place there will be an unmet need or shortage of 59,791 acre-feet, which will mean a portion of the area will convert to dryland practices. Seasonal supplementation will provide 456,700 acre-feet yielding approximately 94.9% of an average year's crop-season need. The Carlisle Canal alternative will provide 434,100 acre-feet supplying 90.2% of an average year's need.

**Table A-1**
**Present (1996) and Projected Demand and Supply for Irrigation Water**
**With and Without-Project Conditions**
**(Acre-Feet)**

| Item/Condition | Year | | | | |
|---|---|---|---|---|---|
| | 1996 | 2000 | 2007 | 2015 | 2056 |
| Demand | | | | | |
| Without-Project | 481,195 | 481,195 | 481,195 | 481,195 | 481,195 |
| Reduced for Conservation Savings | 481,195 | 481,195 | 412,453 | 412,453 | 412,453 |
| Supply | | | | | |
| Without Project | 481,195 | 277,192 | 198,591 | 108,762 | 108,762 |
| Grand Prairie using White River 1/ | 481,195 | 277,192 | 481,195 | 421,404 | 421,404 |
| Grand Prairie using White River with Seasonal Supplementation 1/ | 481,195 | 277,192 | 481,195 | 456,696 | 456,696 |
| Carlisle Canal with Bayou Meto Project 1/ | 481,195 | 277,192 | 481,195 | 434,120 | 434,120 |
| Shortfall | | | | | |
| Without Project | 0 | 204,003 | 282,604 | 372,433 | 372,433 |
| Grand Prairie using White River | 0 | 204,003 | 0 | 59,791 | 59,791 |
| Grand Prairie using White River with Seasonal Supplementation | 0 | 204,003 | 0 | 24,499 | 24,499 |
| Carlisle Canal with Bayou Meto Project | 0 | 204,003 | 0 | 47,075 | 47,075 |

1/ Supply includes conservation savings (i.e. moving from 60% efficiency without-project to 70% efficiency with-project).

## A-5. LAND USE.

The land use is based on 1996 levels as presented in the GRR. Table A-2 shows the acreage of each crop grown in the area. All crops are currently subject to irrigation. Soybeans is predominate crop grown in the area followed by rice, grain sorghum, and corn. Aquaculture, or the production of catfish and baitfish, is also a significant contributor to the area's economy. The expected reduction in available irrigation water, without a supplemental source, translates into a substantial reduction in irrigated acreage. By 2015 irrigated crops are expected to decline to 54,648 acres, a 77% reduction. The remaining 187,129 acres will be shifted to dryland practices, which will be comprised of 130,772 acres of single cropped soybeans, 44,046 acres of double cropped soybeans, 5,602 acres of grain sorghum, and 4,333 acres of corn. Without-project land use by crop is presented in Table A-3 for both irrigated and dryland crops.

Table A-3 also presents the expected irrigated and dryland acreage by crop for future with-project conditions. The Grand Prairie using the White River project will provide adequate irrigation water for 211,735 acres with 30,042 acres converting to dryland practices. Seasonal supplementation will allow the irrigation of 229,467 acres. The Carlisle Canal project will irrigate 218,124 acres.

## A-6. CROP DATA.

The base crop data used for 1996 conditions is presented in Table A-2. Table A-2 presents data for agricultural prices received, crop yields, production costs, and returns per acre. Table A-4 presents projected crop data for irrigated crops under without-project conditions. The calculation of future crop budgets was accomplished by projecting both crop yields per acre and levels of crop production inputs per acre. The price levels for both crops and production costs were held constant at 1996 price levels. The methodology used to project crop yields and levels of production inputs is presented in the GRR. Table A-5 presents projected crop data for the dryland crops used for both without- and with-project conditions. Table A-6 presents projected crop data for irrigated crops under with-project conditions. The crop data per acre is essentially the same as for existing conditions with one exception. There will be as an added beneficial effect a reduction in the on-farm pumping cost of irrigation water. Presently, approximately 85% of irrigation water comes from groundwater with 15% from surface water. With the any of the projects analyzed in this appendix, over 90% of the water will come from surface water with less than 10% from groundwater. Groundwater is pumped from depths of 200 feet or more. Surface water is pumped an average of 15 feet. Because of this, surface water requires significantly lower energy, maintenance, and equipment costs to apply to the area's fields than does groundwater. The capital investment of deep wells is also much greater than surface water relift pumps.

**Table A-2**
**Present (1996) Land Use**
**Grand Prairie Area Demonstration Project**
**(October 1996 Price Levels)**

| Item | Percent Dist. | Acres 1/ | Water Used | Unit | Price | Yield | Gross Revenues | Production Cost 2/ | Net Return | Weighted Net Return |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | (ac-ft) | | ($) | | ($) | ($) | ($) | ($) |
| Rice | 36.3% | 87,833 | 223,900 | cwt. | 6.90 | 65.25 | 450.23 | 331.27 | 118.96 | 43.21 |
| Soybeans | 33.6% | 81,129 | 142,100 | bu. | 5.94 | 45 | 267.30 | 206.51 | 60.79 | 20.40 |
| Double-Crop | 23.5% | 56,909 | | | | | 372.15 | 284.33 | 87.82 | 20.67 |
| Soybeans | | | 77,500 | bu. | 5.94 | 40 | | | | |
| Wheat | | | 0 | bu. | 2.99 | 45 | | | | |
| Grain Sorghum | 3.0% | 7,238 | 12,000 | cwt. | 3.90 | 70 | 273.00 | 210.27 | 62.73 | 1.88 |
| Corn | 2.2% | 5,598 | 11,300 | bu. | 2.38 | 175 | 416.50 | 312.09 | 104.41 | 2.31 |
| Aquaculture | 1.3% | 3,070 | 14,400 | lb. | 0.7936 | 4,750 | 3,769.60 | 2,947.29 | 822.31 | 10.44 |
| Total | 100.0% | 241,777 | 481,200 | | | | | | | 98.92 |

1/ Cleared acres subject to irrigation.
2/ Excludes charges for land and management.

## Table A-3
## Projected Land Use, 2015 and Beyond
## (Acres)

| Item | Without-Project | Grand Prairie using White River | Grand Prairie using White River with Seasonal Supplementation | Carlisle Canal with Bayou Meto Project |
|---|---|---|---|---|
| **Irrigated Cropland** | | | | |
| Rice | 19,853 | 76,919 | 83,361 | 79,240 |
| Soybeans Single-Cropped | 18,337 | 71,048 | 76,997 | 73,192 |
| Soybeans Double-Cropped | 12,863 | 49,838 | 54,012 | 51,342 |
| Grain Sorghum | 1,636 | 6,339 | 6,870 | 6,530 |
| Corn | 1,265 | 4,902 | 5,313 | 5,050 |
| Aquaculture | 694 | 2,689 | 2,914 | 2,770 |
| Total | 54,648 | 211,735 | 229,467 | 218,124 |
| **Dryland Cropland** | | | | |
| Soybeans Single-Cropped | 130,772 | 20,995 | 8,604 | 16,530 |
| Soybeans Double-Cropped | 44,046 | 7,071 | 2,897 | 5,567 |
| Grain Sorghum | 5,602 | 899 | 368 | 708 |
| Corn | 4,333 | 696 | 285 | 548 |
| Abondoned Fish Ponds | 2,376 | 381 | 156 | 300 |
| Total | 187,129 | 30,042 | 12,310 | 23,653 |
| **Total Cropland** | 241,777 | 241,777 | 241,777 | 241,777 |

## Table A-4
## Present (1996) and Projected Crop Yields, Gross Returns, Production Costs, and Net Returns per Acre
## Irrigated Crops, Without-Project Conditions
## (October 1996 Price Levels)

| Item | Year | | | | |
|---|---|---|---|---|---|
| | 1996 | 2000 | 2007 | 2015 | 2056 |
| **Rice** | | | | | |
| Yield (bu) | 146.64 | 153.18 | 165.40 | 180.57 | 283.12 |
| Price ($/cwt) | 6.90 | 6.90 | 6.90 | 6.90 | 6.90 |
| Gross Return ($) | 455.30 | 475.62 | 513.57 | 560.67 | 879.09 |
| Production Cost ($) | 332.72 | 338.54 | 348.98 | 361.31 | 431.69 |
| Net Return ($) | 122.58 | 137.08 | 164.59 | 199.36 | 447.40 |
| **Soybeans Single-Cropped** | | | | | |
| Yield (bu) | 45.51 | 47.54 | 51.33 | 56.04 | 87.87 |
| Price ($/bu) | 5.94 | 5.94 | 5.94 | 5.94 | 5.94 |
| Gross Return ($) | 270.32 | 282.39 | 304.90 | 332.88 | 521.95 |
| Production Cost ($) | 207.42 | 211.04 | 217.55 | 225.24 | 269.11 |
| Net Return ($) | 62.90 | 71.35 | 87.35 | 107.64 | 252.84 |
| **Soybeans Double-Cropped** | | | | | |
| Wheat | | | | | |
| Yield (bu) | 45.51 | 47.54 | 50.37 | 56.04 | 95.11 |
| Price ($/bu) | 2.99 | 2.99 | 2.99 | 2.99 | 2.99 |
| Soybeans | | | | | |
| Yield (bu) | 40.45 | 42.26 | 44.78 | 49.81 | 84.55 |
| Price ($/bu) | 5.94 | 5.94 | 5.94 | 5.94 | 5.94 |
| Gross Return ($) | 376.35 | 393.17 | 416.60 | 463.43 | 786.61 |
| Production Cost ($) | 285.58 | 290.57 | 299.53 | 310.12 | 370.52 |
| Net Return ($) | 90.78 | 102.60 | 117.07 | 153.31 | 416.09 |
| **Grain Sorghum** | | | | | |
| Yield (cwt) | 70.79 | 73.95 | 79.85 | 87.17 | 136.68 |
| Price ($/cwt) | 3.90 | 3.90 | 3.90 | 3.90 | 3.90 |
| Gross Return ($) | 276.08 | 288.41 | 311.42 | 339.96 | 533.05 |
| Production Cost ($) | 211.19 | 214.88 | 221.51 | 229.34 | 274.01 |
| Net Return ($) | 64.89 | 73.53 | 89.91 | 110.62 | 259.04 |
| **Corn** | | | | | |
| Yield (bu) | 176.97 | 184.87 | 199.62 | 217.93 | 341.70 |
| Price ($/bu) | 2.38 | 2.38 | 2.38 | 2.38 | 2.38 |
| Gross Return ($) | 421.20 | 439.99 | 475.10 | 518.67 | 813.25 |
| Production Cost ($) | 313.46 | 318.94 | 328.78 | 340.39 | 406.70 |
| Net Return ($) | 107.74 | 121.05 | 146.32 | 178.28 | 406.55 |
| **Aquaculture** | | | | | |
| Yield (lbs) | 4,803.56 | 5,017.81 | 5,418.29 | 5,915.27 | 9,274.71 |
| Price ($/lb) | 0.79 | 0.79 | 0.79 | 0.79 | 0.79 |
| Gross Return ($) | 3,812.11 | 3,982.13 | 4,299.95 | 4,694.36 | 7,360.41 |
| Production Cost ($) | 2,960.22 | 3,011.95 | 3,104.87 | 3,214.58 | 3,840.72 |
| Net Return ($) | 851.88 | 970.18 | 1,195.08 | 1,479.78 | 3,519.69 |

## Table A-5
## Present (1996) and Projected Crop Yields, Gross Returns, Production Costs, and Net Returns per Acre Dryland Crops, Without- and With-Project Conditions (October 1996 Price Levels)

| Item | Year | | | | |
|---|---|---|---|---|---|
| | 1996 | 2000 | 2007 | 2015 | 2056 |
| Soybeans Single-Cropped | | | | | |
| Yield (bu) | 22.25 | 23.24 | 25.10 | 27.40 | 42.96 |
| Price ($/bu) | 5.94 | 5.94 | 5.94 | 5.94 | 5.94 |
| Gross Return ($) | 132.15 | 138.05 | 149.09 | 162.76 | 255.18 |
| Production Cost ($) | 135.25 | 137.61 | 141.86 | 146.87 | 175.48 |
| Net Return ($) | -3.10 | 0.44 | 7.23 | 15.89 | 79.70 |
| Soybeans Double-Cropped | | | | | |
| Wheat | | | | | |
| Yield (bu) | 45.51 | 47.54 | 51.33 | 56.04 | 87.87 |
| Price ($/bu) | 2.99 | 2.99 | 2.99 | 2.99 | 2.99 |
| Soybeans | | | | | |
| Yield (bu) | 20.23 | 21.13 | 22.81 | 24.91 | 39.05 |
| Price ($/bu) | 5.94 | 5.94 | 5.94 | 5.94 | 5.94 |
| Gross Return ($) | 256.21 | 267.66 | 288.97 | 315.53 | 494.69 |
| Production Cost ($) | 229.80 | 233.82 | 241.03 | 249.55 | 298.16 |
| Net Return ($) | 26.41 | 33.84 | 47.94 | 65.98 | 196.53 |
| Grain Sorghum | | | | | |
| Yield (cwt) | 45.51 | 47.54 | 51.33 | 56.04 | 87.87 |
| Price ($/cwt) | | 3.90 | 3.90 | 3.90 | 3.90 |
| Gross Return ($) | | 185.41 | 200.19 | 218.56 | 342.69 |
| Production Cost ($) | 127.13 | 129.35 | 133.34 | 138.05 | 164.94 |
| Net Return ($) | | 56.06 | 66.85 | 80.51 | 177.75 |
| Corn | | | | | |
| Yield (bu) | 85.96 | 89.79 | 96.96 | 105.85 | 165.97 |
| Price ($/bu) | 2.38 | 2.38 | 2.38 | 2.38 | 2.38 |
| Gross Return ($) | 204.58 | 213.70 | 230.76 | 251.92 | 395.01 |
| Production Cost ($) | 201.13 | 204.64 | 210.96 | 218.41 | 260.95 |
| Net Return ($) | 3.45 | 9.06 | 19.80 | 33.51 | 134.06 |

## Table A-6
**Present (1996) and Projected Crop Yields, Gross Returns, Production Costs, and Net Returns per Acre**
**Irrigated Crops, With-Project Conditions**
**(October 1996 Price Levels)**

| Item | Year | | | | |
|---|---|---|---|---|---|
| | 1996 | 2000 | 2007 | 2015 | 2056 |
| Rice | | | | | |
| Yield (bu) | 146.64 | 153.18 | 165.40 | 180.57 | 283.12 |
| Price ($/cwt) | 6.90 | 6.90 | 6.90 | 6.90 | 6.90 |
| Gross Return ($) | 455.30 | 475.62 | 513.57 | 560.67 | 879.09 |
| Production Cost ($) | 282.36 | 287.08 | 295.93 | 306.38 | 366.06 |
| Net Return ($) | 172.94 | 188.54 | 217.64 | 254.29 | 513.03 |
| Soybeans Single-Cropped | | | | | |
| Yield (bu) | 45.51 | 47.54 | 51.33 | 56.04 | 87.87 |
| Price ($/bu) | 5.94 | 5.94 | 5.94 | 5.94 | 5.94 |
| Gross Return ($) | 270.32 | 282.39 | 304.90 | 332.88 | 521.95 |
| Production Cost ($) | 178.50 | 181.49 | 187.08 | 193.70 | 231.42 |
| Net Return ($) | 91.82 | 100.90 | 117.82 | 139.18 | 290.53 |
| Soybeans Double-Cropped | | | | | |
| Wheat | | | | | |
| Yield (bu) | 45.51 | 47.54 | 50.37 | 56.04 | 95.11 |
| Price ($/bu) | 2.99 | 2.99 | 2.99 | 2.99 | 2.99 |
| Soybeans | | | | | |
| Yield (bu) | 40.45 | 42.26 | 44.78 | 49.81 | 84.55 |
| Price ($/bu) | 5.94 | 5.94 | 5.94 | 5.94 | 5.94 |
| Gross Return ($) | 376.35 | 393.17 | 416.60 | 463.43 | 786.61 |
| Production Cost ($) | 257.22 | 261.59 | 269.65 | 279.19 | 333.56 |
| Net Return ($) | 119.14 | 131.58 | 146.95 | 184.24 | 453.05 |
| Grain Sorghum | | | | | |
| Yield (cwt) | 70.79 | 73.95 | 79.85 | 87.17 | 136.68 |
| Price ($/cwt) | 3.90 | 3.90 | 3.90 | 3.90 | 3.90 |
| Gross Return ($) | 276.08 | 288.41 | 311.42 | 339.96 | 533.05 |
| Production Cost ($) | 191.07 | 194.32 | 200.31 | 207.40 | 247.79 |
| Net Return ($) | 85.01 | 94.09 | 111.11 | 132.56 | 285.26 |
| orn | | | | | |
| Yield (bu) | 176.97 | 184.87 | 199.62 | 217.93 | 341.70 |
| Price ($/bu) | 2.38 | 2.38 | 2.38 | 2.38 | 2.38 |
| Gross Return ($) | 421.20 | 439.99 | 475.10 | 518.67 | 813.25 |
| Production Cost ($) | 278.07 | 282.77 | 291.50 | 301.79 | 360.58 |
| Net Return ($) | 143.13 | 157.22 | 183.60 | 216.88 | 452.67 |
| Aquaculture | | | | | |
| Yield (lbs) | 4,803.56 | 5,017.81 | 5,418.29 | 5,915.27 | 9,274.71 |
| Price ($/lb) | 0.79 | 0.79 | 0.79 | 0.79 | 0.79 |
| Gross Return ($) | 3,812.11 | 3,982.13 | 4,299.95 | 4,694.36 | 7,360.41 |
| Production Cost ($) | 2,842.62 | 2,842.62 | 2,842.62 | 2,842.62 | 2,842.62 |
| Net Return ($) | 969.49 | 1139.51 | 1457.33 | 1851.74 | 4517.79 |

## A-7. IRRIGATION BENEFITS.

All project benefits are based on 1996 price levels, estimated over a 50-year project life plus the installation period, and discounted to the end of the project installation period using a discount rate of 7.375%. The irrigation benefits consist of the difference between with- and without-project revenue streams. They are comprised of the increased crop production of maintaining irrigation practices versus dryland practices plus any efficiencies or cost savings of using surface water in place of groundwater. Irrigation benefits are the difference in total net revenues between the with- and without-project conditions. Table A-7 presents the revenue streams expected over the life of the Grand Prairie with White River alternative for without- and with project conditions. A summary of the irrigation benefits by alternative is presented in Table A-8.

## A-8. WATERFOWL BENEFITS.

Waterfowl benefits accrue to the project from the preparation of 45,000 acres of rice fields for winter waterfowl use. Detailed modeling of the Grand Prairie with White River alternative revealed that if 45,000 acres are prepared each year, on average 38,500 acres can be flooded on an annual basis. This figure includes approximately 17,400 acres flooded under without-project conditions and 21,100 under with-project conditions. Benefits are claimed only on the 21,100 acre figure. Table A-9 presents a summary of the annual waterfowl benefits. This benefit category accounts for only 1 percent of the project benefits. The other two alternatives are expected to only slightly increase the waterfowl benefits. Since any changes are expected to be insignificant when compared to total benefit levels, the waterfowl benefits were held constant for all alternatives.

## A-9. COSTS.

The project annual costs like the annual benefits are based on 1996 price levels, estimated over a 50-year project life plus the installation period, and discounted to the end of the project installation period using a discount rate of 7.375%. The annual costs consist of interest, sinking fund, operation, maintenance, and replacement charges. Also included in the annual costs are negative effects on navigation on the White River and potential induced flooding effects on existing streams in the project area which are used to convey irrigation flows.

a. First Costs. Project costs for the off-farm component of the Grand Prairie using White River alternative total $201,928,000 and are presented in Table A-10. The largest part of the cost is the cost associated with the canals which account for approximately 46% of the off-farm cost. This cost includes the excavation of the canals plus the structures necessary to carry the water underneath existing roads and streams where necessary. The remaining off-farm costs are for the pumping plant, relocations, lands and damages, diversion structures, cultural resources, mitigation, contingencies, engineering and design, and construction management. Total project costs for the on-farm component are $68,584,000 (Table A-10). The largest component of these costs is for the storage reservoirs which accounts for approximately 45% of the on-farm cost. The remaining on-farm costs are for pipelines, pumps, water control structures, tailwater recovery system, and technical assistance. All costs are based on October 1996 price levels and are assumed to be end of year expenditures.

**Table A-7**
**Present (1996) and Projected Irrigation Benefits**
**Grand Prairie using White River**
**(October 1996 Price Levels, 7.375% Discount Rate)**

| Year | Without-Project ($000) | With-Project ($000) | Benefit ($000) |
|---|---|---|---|
| 1996 | 23,941 | 23,941 | 0 |
| 2000 | 17,087 | 17,087 | 0 |
| 2001 | 17,069 | 17,598 | 528 |
| 2002 | 17,039 | 18,118 | 1,080 |
| 2003 | 16,990 | 18,644 | 1,654 |
| 2004 | 16,923 | 19,173 | 2,250 |
| 2005 | 16,840 | 26,798 | 9,959 |
| 2006 | 16,734 | 27,432 | 10,698 |
| 2007 | 16,616 | 43,327 | 26,711 |
| 2008 | 16,473 | 44,264 | 27,791 |
| 2009 | 16,313 | 45,215 | 28,902 |
| 2010 | 16,130 | 46,175 | 30,045 |
| 2011 | 15,930 | 47,147 | 31,217 |
| 2012 | 15,712 | 48,143 | 32,431 |
| 2013 | 15,464 | 46,873 | 31,408 |
| 2014 | 15,202 | 45,784 | 30,582 |
| 2015 | 14,917 | 45,716 | 30,799 |
| 2016 | 15,414 | 46,672 | 31,257 |
| 2026 | 20,813 | 56,937 | 36,124 |
| 2036 | 26,996 | 68,605 | 41,609 |
| 2046 | 34,065 | 81,852 | 47,787 |
| 2056 | 42,136 | 96,868 | 54,732 |
| Average Annual Equivalent Values @ 7.375% Discount Rate | | | |
| | 30,317 | 65,976 | 35,659 |

**Table A-8**
**Summary of Annual Irrigation Benefits**
**(October 1996 Price Levels, 7.375% Discount Rate)**

| Alternative | ($000) |
|---|---|
| Grand Prairie using White River | 35,659 |
| Grand Prairie using White River with Seasonal Supplementation | 38,809 |
| Carlisle Canal with Bayou Meto Project | 36,840 |

**Table A-9**
**Average Annual Equivalent Waterfowl Benefits**
**All Alternatives**
**(October 1996 Price Levels, 7.375% Discount Rate)**

| Year | Benefit ($) |
|---|---|
| 2005 | 150,576 |
| 2006 | 150,576 |
| 2007 | 449,480 |
| 2016 | 449,480 |
| 2026 | 449,480 |
| 2036 | 449,480 |
| 2046 | 449,480 |
| 2056 | 449,480 |
| Average Annual Equivalent @ 7.375 | 473,000 |

## Table A-10
## First Costs and Average Annual Equivalent Interest and Sinking Fund Costs
## Grand Prairie using White River
## (October 1996 Price Levels, 7.375% Discount Rate)

| FY | First Costs: Off-Farm Cost | First Costs: On-Farm Cost | First Costs: Total Cost | Present Value Factor @ 7.375% | Present Value of First Cost |
|---|---|---|---|---|---|
| 2001 | 1,607,000 | 9,797,000 | 11,404,000 | 1.532570 | 17,477,000 |
| 2002 | 5,508,000 | 9,797,000 | 15,305,000 | 1.427300 | 21,845,000 |
| 2003 | 18,528,000 | 9,798,000 | 28,326,000 | 1.329270 | 37,653,000 |
| 2004 | 43,779,000 | 9,798,000 | 53,577,000 | 1.237970 | 66,327,000 |
| 2005 | 76,696,000 | 9,798,000 | 86,494,000 | 1.152940 | 99,722,000 |
| 2006 | 44,845,000 | 9,798,000 | 54,643,000 | 1.073750 | 58,673,000 |
| 2007 | 10,965,000 | 9,798,000 | 20,763,000 | 1.000000 | 20,763,000 |
| | 201,928,000 | 68,584,000 | 270,512,000 | | 322,460,000 |
| Average Annual Equivalent Costs | | | | | |
| Interest | | | | 0.07375 | 23,781,000 |
| Sinking Fund (50 Year Life) | | | | 0.00216 | 697,000 |
| Total | | | | | 24,478,000 |

b. Annual Interest and Sinking Fund Costs. The annual interest and sinking fund costs for both the off-farm and the on-farm components of the Grand Prairie using White River alternative are presented in Table A-10. All annual costs are based on a reference point at the end of year 2007, a discount rate of 7.375 percent, and a 50 year period of analysis. Annual interest charges are approximately $23.8 million. Annual sinking fund charges are slightly less than $0.7 million.

c. Annual Operation and Maintenance Costs. Annual off-farm operation, maintenance, and replacement costs for the Grand Prairie using White River alternative are presented in Table A-11. Annual on-farm costs for all three alternatives are presented in Table A-12. Both use the end of 2007 as the reference point for discounting, a discount rate of 7.375 percent, and a 50 year period of analysis. Annual costs are $3,729,000 and $910,000 for the off-farm and on-farm components, respectively. Approximately 85% of the off-farm costs are for energy followed by labor at 14% and maintenance and replacements at slightly over 1%. The annual on-farm costs are comprised of operation and maintenance of the new features of the project which includes reservoirs (43%), pumps (24%), pipelines (23%), tailwater recovery (6%), and water control structures (4%).

d. Induced Crop Damage. Induced flooding effects have been quantified using traditional methodologies used for Corps flood control projects. These methodologies include the use of partial duration stage frequency curves, stage area curves, area frequency curves, and the Corps CACFDAS program. All potential flood effects are agricultural. Only minor (almost insignificant) effects on Mill Bayou and Little Lagrue Bayou have been identified. Since the increases are only between 2 and 4 tenths of a foot, minor modifications could be made to offset these effects. Also, the operation plan could be developed in such a way as to stop the additional flows during rainy periods, alleviating any potential increases in flooding. However, for this analysis, worst case scenarios were assumed in that nothing would be done to offset the potential increases. The potential increase in flood damage for Mill Bayou is approximately $8,000 annually. The potential increase in damage for Little Lagrue Bayou is approximately $4,000 annually. Total annual increases are presented in Table A-13. The expected damages will be the same regardless of the source of the irrigation water and are therefore held constant for all three alternatives.

e. Navigation Impacts. This section presents the effects to navigation of the alternatives importing irrigation water from the White River. A detailed description of the methodology used to estimate these effects is presented in the GRR. Since this impact is insignificant as compared to the total annual costs, a detailed description of this effect was not included in this analysis. The effect of both alternatives using the White River as a source is presented in Table A-14 for selected years over the life of the project. The annual impact to White River navigation is expected to be $127,000.

## Table A-11
### Average Annual Equivalent Off-Farm Operation, Maintenance, and Replacement Costs
### Grand Prairie using White River
### (October 1996 Price Levels, 7.375% Discount Rate)

| Fiscal Year | Number of Years Discounted | Large Pumping Station | Small Pumping Stations | Structures | Canals | Total | Present Value Factor @ 7.375% | Present Value of Total |
|---|---|---|---|---|---|---|---|---|
| 2005 | | 1,473,761 | 184,991 | 138,525 | 33,750 | 1,831,026 | 1.07375 | 1,966,923 |
| 2006 | | 1,473,761 | 185,391 | 138,525 | 33,750 | 1,831,426 | 1.00000 | 1,833,027 |
| 2007 | | 2,885,969 | 314,008 | 175,298 | 33,750 | 3,409,025 | 0.93132 | 3,177,128 |
| 2008 | 2 | 2,885,969 | 314,408 | 175,298 | 33,750 | 3,409,425 | 0.86735 | 2,959,940 |
| 2009 | 3 | 2,885,969 | 314,808 | 175,298 | 33,750 | 3,409,825 | 0.80778 | 2,757,620 |
| 2010 | 4 | 2,885,969 | 315,208 | 175,298 | 33,750 | 3,410,225 | 0.75229 | 2,569,089 |
| 2011 | 5 | 2,885,969 | 315,608 | 175,298 | 33,750 | 3,410,625 | 0.70062 | 2,393,475 |
| 2012 | 6 | 2,885,969 | 316,008 | 175,298 | 33,750 | 3,411,025 | 0.65250 | 2,229,870 |
| 2013 | 7 | 2,885,969 | 316,408 | 175,298 | 33,750 | 3,411,425 | 0.60768 | 2,077,430 |
| 2014 | 8 | 2,885,969 | 316,808 | 175,298 | 33,750 | 3,411,825 | 0.56595 | 1,958,089 |
| 2015 | 9 | 2,885,969 | 317,208 | 175,298 | 33,750 | 3,412,225 | 0.52707 | 1,803,120 |
| 2016 | 10 | 2,885,969 | 317,608 | 175,298 | 33,750 | 3,412,625 | 0.49087 | 1,679,867 |
| 2017 | 11 | 2,885,969 | 318,008 | 175,298 | 33,750 | 3,413,025 | 0.45716 | 1,565,051 |
| 2018 | 12 | 2,885,969 | 318,408 | 175,298 | 33,750 | 3,413,425 | 0.42576 | 1,458,068 |
| 2019 | 13 | 2,885,969 | 318,808 | 175,298 | 33,750 | 3,413,825 | 0.39651 | 1,358,373 |
| 2020 | 14 | 2,885,969 | 319,208 | 175,298 | 33,750 | 3,414,225 | 0.36928 | 1,265,532 |
| 2021 | 15 | 2,885,969 | 319,608 | 175,298 | 33,750 | 3,414,625 | 0.34392 | 1,179,034 |
| 2022 | 16 | 2,885,969 | 320,008 | 175,298 | 33,750 | 3,415,025 | 0.32029 | 1,098,410 |
| 2023 | 17 | 2,885,969 | 320,408 | 175,298 | 33,750 | 3,415,425 | 0.29830 | 1,023,356 |
| 2024 | 18 | 3,156,104 | 320,808 | 175,298 | 33,750 | 3,685,960 | 0.27781 | 1,039,552 |
| 2025 | 19 | 2,885,969 | 321,208 | 175,298 | 33,750 | 3,416,225 | 0.25873 | 888,227 |
| 2026 | 20 | 2,885,969 | 321,608 | 175,298 | 33,750 | 3,416,625 | 0.24096 | 827,510 |
| 2027 | 21 | 2,885,969 | 322,008 | 175,298 | 33,750 | 3,417,025 | 0.22441 | 770,944 |
| 2028 | 22 | 2,885,969 | 322,408 | 175,298 | 33,750 | 3,417,425 | 0.20899 | 718,220 |
| 2029 | 23 | 2,885,969 | 322,808 | 175,298 | 33,750 | 3,417,825 | 0.19464 | 669,138 |
| 2030 | 24 | 2,885,969 | 323,208 | 175,298 | 33,750 | 3,418,225 | 0.18127 | 623,391 |
| 2031 | 25 | 2,885,969 | 323,608 | 175,298 | 33,750 | 3,418,625 | 0.16882 | 580,779 |
| 2032 | 26 | 2,885,969 | 324,008 | 175,298 | 33,750 | 3,419,025 | 0.15722 | 541,061 |
| 2033 | 27 | 2,885,969 | 324,408 | 175,298 | 33,750 | 3,419,425 | 0.14642 | 504,068 |
| 2034 | 28 | 2,885,969 | 324,808 | 175,298 | 33,750 | 3,419,825 | 0.13637 | 475,088 |
| 2035 | 29 | 2,885,969 | 325,208 | 175,298 | 33,750 | 3,420,225 | 0.12700 | 437,519 |
| 2036 | 30 | 2,885,969 | 325,608 | 175,298 | 33,750 | 3,420,625 | 0.11828 | 407,619 |
| 2037 | 31 | 2,885,969 | 326,008 | 175,298 | 33,750 | 3,421,025 | 0.11015 | 379,735 |
| 2038 | 32 | 2,885,969 | 326,408 | 175,298 | 33,750 | 3,421,425 | 0.10259 | 353,794 |
| 2039 | 33 | 3,397,584 | 326,808 | 175,298 | 33,750 | 3,933,440 | 0.09554 | 378,477 |
| 2040 | 34 | 2,885,969 | 327,208 | 175,298 | 33,750 | 3,422,225 | 0.08898 | 307,073 |
| 2041 | 35 | 2,885,969 | 327,608 | 175,298 | 33,750 | 3,422,625 | 0.08287 | 286,085 |
| 2042 | 36 | 2,885,969 | 328,008 | 175,298 | 33,750 | 3,423,025 | 0.07718 | 266,535 |
| 2043 | 37 | 2,885,969 | 328,408 | 175,298 | 33,750 | 3,423,425 | 0.07188 | 248,318 |
| 2044 | 38 | 3,381,774 | 328,808 | 175,298 | 33,750 | 3,919,630 | 0.06694 | 267,199 |
| 2045 | 39 | 2,885,969 | 329,208 | 175,298 | 33,750 | 3,424,225 | 0.06234 | 215,510 |
| 2046 | 40 | 2,885,969 | 329,608 | 175,298 | 33,750 | 3,424,625 | 0.05806 | 200,786 |
| 2047 | 41 | 2,885,969 | 330,008 | 175,298 | 33,750 | 3,425,025 | 0.05407 | 187,052 |
| 2048 | 42 | 2,885,969 | 330,408 | 175,298 | 33,750 | 3,425,425 | 0.05036 | 174,277 |
| 2049 | 43 | 2,885,969 | 330,808 | 175,298 | 33,750 | 3,425,825 | 0.04690 | 162,359 |
| 2050 | 44 | 2,885,969 | 331,208 | 175,298 | 33,750 | 3,426,225 | 0.04368 | 151,264 |
| 2051 | 45 | 2,885,969 | 331,608 | 175,298 | 33,750 | 3,426,625 | 0.04068 | 140,925 |
| 2052 | 46 | 2,885,969 | 332,008 | 175,298 | 33,750 | 3,427,025 | 0.03788 | 131,270 |
| 2053 | 47 | 2,885,969 | 332,408 | 175,298 | 33,750 | 3,427,425 | 0.03528 | 122,303 |
| 2054 | 48 | 2,885,969 | 332,808 | 175,298 | 33,750 | 3,427,825 | 0.03286 | 115,266 |
| 2055 | 49 | 2,885,969 | 333,208 | 175,298 | 33,750 | 3,428,225 | 0.03060 | 106,151 |
| 2056 | 50 | 2,885,969 | 332,808 | 175,298 | 33,750 | 3,427,825 | 0.02850 | 98,833 |
| | | 148,523,537 | 16,559,973 | 9,041,933 | ,755,000 | 175,880,444 | | 49,129,730 |
| Total Annual Cost (50 Year Life) | | | | | | | 0.07591 | 3,729,000 |

# APPENDIX B-3

# COST ESTIMATES

| ALTERNATIVE | | TOTAL PROJECT COSTS |
|---|---|---|
| Bayou Meto Irrigation Project | | $ 133,112,000 |
| Carlisle Canal Used for Seasonal Supplementation | | $ 149,429,000 |
| Carlisle Canal/Pipeline Used for Seasonal Supplementation | | $ 166,069,000 |
| Carlisle Canal (without the Bayou Meto Irrigation Project) | | $ 176,210,000 |
| Carlisle Canal (with the Bayou Meto Irrigation Project) | | $ 250,842,000 |
| Mill Bayou Backflow with the Carlisle Canal | (No Land Costs Evaluated) | $ 313,530,000 |
| Mill Bayou Pipeline with the Carlisle Canal | | $ 378,420,000 |

| Corps of Engineers, Memphis District<br>Grand Prairie Revaluation Report<br>Carlisle Canal (without the Bayou Meto Irrigation Project)<br>20-Oct-00 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **ITEM DESCRIPTION** | **QUANTITY** | **UNIT** | **UNIT PRICE** | **AMOUNT** | **CONTINGENCY** | **TOTAL** | **COMMENT** |
| 01 LANDS AND DAMAGES (w/ contin.) | | | | | | | |
| Lands and Damages (ROW) | 1,644 | AC | $ 1,615 | $ 2,655,060 | | | |
| Acquisition (No. of Tracts) | 81 | EA | $ 6,000 | $ 486,000 | | | |
| Mitigation Acres | 131 | AC | $ 1,615 | $ 211,565 | | | |
| Total 01 | | | | $ 3,352,625 | $ 716,500 | $ 4,069,000 | |
| | | | | | | | |
| 02 RELOCATIONS (w/contin., 20%) | | | | | | | |
| Roads & Bridges | 1 | LS | $ 6,521,484 | $ 6,521,484 | | | |
| Utilities | 1 | LS | $ 720,000 | $ 720,000 | | | |
| Total 02 | | | | $ 7,241,484 | $ 1,810,000 | $ 9,051,000 | |
| | | | | | | | |
| 063 Wildlife Facilities and Sanctuaries | | | | | | | |
| Tree Planting | 131 | AC | $ 200 | $ 26,200 | $ 7,000 | $ 33,000 | |
| | | | | | | | |
| 13 PUMPING PLANTS | | | | | | | |
| Arkansas River Pump Station 1780 CFS | 1 | EA | $ 26,500,000 | $ 26,500,000 | | | 20-foot lift, See pumping station cost curve. |
| Discharge Pipe, 2-10' Diameter | 2,000 | LF | $ 1,600 | $ 3,200,000 | | | Based upon Grand Prairie Discharge Pipes, includes installation. |
| Lonoke Relift Pump Station 1700 CFS | 1 | EA | $ 25,500,000 | $ 25,500,000 | | | 20-foot lift, See pumping station cost curve. |
| Discharge Pipe, 2-10' Diameter | 3,000 | LF | $ 1,600 | $ 4,800,000 | | | Based upon Grand Prairie Discharge Pipes, includes installation. |
| Total 13 | | | | $ 60,000,000 | $ 15,000,000 | $ 75,000,000 | |
| | | | | | | | |
| 09 CHANNELS AND CANALS | | | | | | | |
| Clearing & Grubbing | 1,143 | AC | $ 200 | $ 228,571 | | | Mostly farmland. Includes borrow areas and canal ROW. |
| Arkansas River Reservoir | 1 | EA | $ 3,280,767 | $ 3,280,767 | | | 160 Acre Reservoir. Includes all costs except outlet check structure. |
| Lonoke Reservoir | 1 | EA | $ 2,791,600 | $ 2,791,600 | | | 160 Acre Reservoir. Includes all costs except outlet check structure. |
| Canal Embankment | 7,500,000 | ECY | $ 2.60 | $ 19,500,000 | | | 50' BW canal, 26.5 miles. Canal Excavation = 2,900,000 BCY used to construct embankment, 1000 foot average one-way haul. 4,978,261 ECY from borrow, 2 mile average one-way haul. 20% of the canal will require a clay lining. |
| Aggregate Surfacing | 111,936 | TN | $ 15 | $ 1,679,040 | | | Canal access roads, each side, 53 mi., 12' wide, 6" compacted. |
| Turfing | 472 | AC | $ 1,000 | $ 472,000 | | | Bermuda grass. |
| Check Structures, 3 Gates x 40 LF | 10 | EA | $ 1,200,000 | $ 12,000,000 | | | Three gate structures-14' x 13.5' x 40 LF Basin Length |
| Check Structures, 3 Gates x 38 LF | 1 | EA | $ 1,180,000 | $ 1,180,000 | | | Three gate structures, 14' x 13.5' x 38 LF |
| Check Structure, 2-5' Conduit x 50 LF | 1 | EA | $ 150,000 | $ 150,000 | | | Two 5' diameter conduit check structures, 50' long, 5' gates, 7.5' check riser dia, 11.5' high. |
| Turnout Structure, 4- 3' Dia. RCP x 50 LF | 1 | EA | $ 110,000 | $ 110,000 | | | 4-36" diameter x 50' long conduit, 54" diameter riser, 9.5' high, 4-36" gates |
| Inverted Siphons, 1-72" RCP x 250 LF | 13 | EA | $ 125,000 | $ 1,625,000 | | | 1-72" RCP x 250' long |
| Inverted Siphon, 5-96" RCP x 470 LF | 2 | EA | $ 1,300,000 | $ 2,600,000 | | | Pass flows from Two Prairie Bayou, 5-96" barrels x 470 LF |
| Total 09 | | | | $ 45,616,978 | $ 11,404,000 | $ 57,021,000 | |
| | | | | | | | |
| 30 PLANNING, E&D (12% of 02, 13 & 09) | 1 | LS | 12% | $ 13,543,015 | $ 3,386,000 | $ 16,929,000 | |
| | | | | | | | |
| 31 CONSTRUCTION MANAGEMENT ( 10% of 02, 13 & 09) | 1 | LS | 10% | $ 11,285,846 | $ 2,821,000 | $ 14,107,000 | |
| | | | | | | | |
| **TOTAL PROJECT COSTS** | 1 | LS | | $ 141,065,500 | $ 35,144,500 | **$ 176,210,000** | |
| | | | | | 25% | | |

Jerry R. Welch, CCC.

**Corps of Engineers, Memphis District**
Grand Prairie Revaluation Report
Carlisle Canal (with the Bayou Meto Irrigation Project)
19-Oct-00

| ITEM DESCRIPTION | QUANTITY | UNIT | UNIT PRICE | AMOUNT | CONTINGENCY | TOTAL | COMMENT |
|---|---|---|---|---|---|---|---|
| 01 LANDS AND DAMAGES (w/ contin.) | | | | | | | |
| Lands and Damages | 1,734 | AC | $ 1,614 | $ 2,798,676 | | | |
| Acquisition (No. of Tracts) | | | | | | | |
| Mitigation Acres | | | | [illegible] | | | |
| Total 01 | | | | $ 3,552,600 | $ 767,000 | $ 4,320,000 | |
| | | | | | | | |
| | | | | | | | |
| | | | [illegible]3,140 | $ 7,106,140 | | | |
| | | | [illegible],000 | $ 720,000 | | | |
| **Total 02** | | | | $ 7,826,140 | $ 1,957,000 | $ 9,783,000 | |
| | | | | | | | |
| 063 Wildlife Facilities and Sanctuaries | | | | | | | |
| Tree Planting | 166 | AC | $ 200 | $ | $ 8,000 | $ 41,000 | |
| | | | | | | | |
| 13 PUMPING PLANTS | | | | | | | |
| Arkansas River Pump Station 3640 CFS | 1 | EA | $ 54,000,000 | $ 54,000,000 | | | 20-foot lift, See pumping station cost curve. |
| Discharge Pipe, 2-10' Diameter | | | | | | | Based upon Grand Prairie Discharge Pipes, includes installation. |
| Lonoke Relift Pump Station 2719 CFS | | | | | | | 20-foot lift, See pumping station cost curve. |
| Discharge Pipe, 2-10' Diameter | | | | $ 4,800,000 | | | Based upon Grand Prairie Discharge Pipes, includes installation. |
| Total 13 | | | | $ 102,500,000 | $ 25,625,000 | $ 128,125,000 | |
| | | | | | | | |
| 09 CHANNELS AND CANALS | | | | | | | |
| Clearing & Grubbing | 1,231 | AC | $ 200 | $ 246,221 | | | Mostly farmland. Includes borrow areas and canal ROW. |
| Arkansas River Reservoir | 1 | EA | $ 3,280,767 | $ 3,280,767 | | | 160 Acre Reservoir. Includes all costs except outlet check structure. |
| Lonoke Reservoir | 1 | EA | $ 2,791,600 | $ 2,791,600 | | | 160 Acre Reservoir. Includes all costs except outlet check structure. |
| Canal Embankment | 7,960,000 | ECY | $ | $ 20,696,000 | | | 69' down to 50' BW canal, 26.5 miles. Canal Excavation = 3,887,000 BCY used to construct embankment, 1000 foot average one-way haul. 4,580,000 ECY from borrow, 2 mile average one-way haul. 20% of the canal will require a clay lining. |
| Aggregate Surfacing | 111,936 | TN | $ 15 | $ 1,679,040 | | | Canal access roads, each side. |
| Turfing | | | | | | | Bermuda grass. |
| Check Structures, 5 Gates x 44 LF | | | [illegible] | [illegible] | | | Five gate structures-14' x 13.5' x 44 LF Basin Length |
| Check Structures, 4 Gates x 42 LF | | | [illegible] | [illegible] | | | Four gate structures-14' x 13.5' x 42 LF Basin Length |
| Check Structures, 3 Gates x 40 LF | | | | | | | Three gate structures-14' x 13.5' x 40 LF Basin Length |
| Check Structure, 3 Gates x 38 LF | | | | | | | Three gate structures-14' x 13.5' x 38 LF Basin Length |
| Check Structure, 2-60" Dia. Conduit x 50 LF | 1 | EA | $ 150,000 | | | | Two 5' diameter conduit check structures, 50' long, 5' gates, 7.5' check riser dia, 11.5' high. |
| Turnout Structure, 4-36" Dia x 50 LF | 1 | EA | $ 110,000 | $ | | | 4-36" diameter x 50' long conduit, 54" diameter riser, 9.5' high, 4-36" gates |
| Inverted Siphons, 1-72" RCP x 250 LF | 13 | EA | $ | | | | 1-72" RCP x 250' long |
| Inverted Siphon, 5-96" RCP x 470 LF | | | | | | | Pass flows from Two Prairie Bayou, 5-96" barrels x 470 LF |
| Total 09 | | | | $ 51,299,628 | $ 12,825,000 | $ 64,125,000 | |
| | | | | | | | |
| 30 PLANNING, E&D (12% of 02, 13 & 09) | 1 | LS | 12% | $ 19,395,092 | $ 4,849,000 | $ 24,244,000 | |
| | | | | | | | |
| 31 CONSTRUCTION MANAGEMENT (10% of 02, 13 & 09) | 1 | LS | 10% | $ 16,162,577 | $ 4,041,000 | $ 20,204,000 | |
| | | | | | | | |
| **TOTAL PROJECT COSTS** | 1 | LS | | $ 200,770,000 | $ 50,072,000 | **$ 250,842,000** | |
| | | | | | 25% | | |

B-3-3

Jerry R. Welch, CCC.

**Corps of Engineers, Memphis District**
**Grand Prairie Revaluation Report**
**Mill Bayou Pipeline with the Carlisle Canal**
**19-Oct-00**

| ITEM DESCRIPTION | QUANTITY | UNIT | UNIT PRICE | AMOUNT | CONTINGENCY | TOTAL | COMMENT |
|---|---|---|---|---|---|---|---|
| 01 LANDS AND DAMAGES (w/ contin.) | | | | | | | |
| Lands and Damages | 2,412 | AC | $ 1,255 | $ 3,026,809 | | | |
| Acquisition (No. of Tracts) | 152 | EA | $ 6,000 | $ 912,000 | | | |
| Mitigation Acres | 118 | AC | $ 1,255 | $ 148,341 | | | |
| Total 01 | | | | $ 4,087,150 | $ 794,000 | $ 4,881,000 | |
| 02 RELOCATIONS (w/contin., 20%) | | | | | | | |
| Roads & Bridges | 1 | LS | $ 6,461,718 | $ 6,461,718 | | | |
| Utilities | 1 | LS | $ 1,090,000 | $ 1,090,000 | | | |
| Total 02 | | | | $ 7,551,718 | $ 1,888,000 | $ 9,440,000 | |
| 063 Wildlife Facilities and Sanctuaries | | | | | | | |
| Tree Planting | 118 | AC | $ 200 | $ 23,640 | $ 6,000 | $ 30,000 | |
| 13 PUMPING PLANTS | | | | | | | |
| Pump Station 2644 CFS | 1 | EA | $ 39,500,000 | $ 39,500,000 | | | 20-foot lift, See pumping station cost curve. |
| Pump Station 1903 CFS | 1 | EA | $ 28,500,000 | $ 28,500,000 | | | 20-foot lift, See pumping station cost curve. |
| Pump Station 816 CFS | 1 | EA | $ 12,750,000 | $ 12,750,000 | | | 50-foot lift, See pumping station cost curve. |
| Discharge Pipe, 2-10' Diameter | 2,000 | LF | $ 1,600 | $ 3,200,000 | | | Based upon Grand Prairie Discharge Pipes, includes installation. |
| Discharge Pipe, 2-10' Diameter | 3,000 | LF | $ 1,600 | $ 4,800,000 | | | Based upon Grand Prairie Discharge Pipes, includes installation. |
| Discharge Pipe, 1-10' Diameter | 126,720 | LF | $ 800 | $ 101,376,000 | | | Based upon Grand Prairie Discharge Pipes, includes installation. |
| Total 13 | | | | $ 190,126,000 | $ 47,532,000 | $ 237,658,000 | |
| 09 CHANNELS AND CANALS | | | | | | | |
| Clearing & Grubbing | 1,149 | AC | $ 200 | $ 229,756 | | | Mostly farmland. Includes borrow areas and canal ROW. |
| Arkansas River Reservoir | 1 | EA | $ 3,280,767 | $ 3,280,767 | | | 160 Acre Reservoir. Includes all costs except outlet check structure. |
| Lonoke Reservoir | 1 | EA | $ 2,791,600 | $ 2,791,600 | | | 160 Acre Reservoir. Includes all costs except outlet check structure. |
| Canal Embankment | 7,504,000 | ECY | $ 2.60 | $ 19,510,400 | | | 57' down to 35' BW canal, 26.5 miles. Canal Excavation = 2,860,000 BCY used to construct embankment, 1000 foot average one-way haul. 5,769,600 ECY from borrow, 2 mile average one-way haul. 20% of the canal will require a clay lining. |
| Aggregate Surfacing | 111,936 | TN | $ 15 | $ 1,679,040 | | | Canal access roads, each side. |
| Turfing | 485 | AC | $ 1,000 | $ 485,000 | | | Bermuda grass. |
| Check Structures, 4 Gates x 40 LF | 4 | EA | $ 1,600,000 | $ 6,400,000 | | | Four gate structures-14' x 13.5' x 40 LF Basin Length |
| Check Structures, 3 Gates x 40 LF | 6 | EA | $ 1,200,000 | $ 7,200,000 | | | Three gate structures-14' x 13.5' x 40 LF Basin Length |
| Check Structure, 3 Gates x 38 LF | 1 | EA | $ 1,180,000 | $ 1,180,000 | | | Three gate structures-14' x 13.5' x 38 LF Basin Length |
| Check Structure, 2-60" Dia. Conduit x 50 LF | 1 | EA | $ 150,000 | $ 150,000 | | | Two 5' diameter conduit check structures, 50' long, 5' gates, 7.5' check riser dia, 11.5' high. |
| Turnout Structure, 4-36" Dia x 50 LF | 1 | EA | $ 110,000 | $ 110,000 | | | 4-36" diameter x 50' long conduit, 54" diameter riser, 9.5' high, 4-36" gates |
| Inverted Siphons, 1-72" RCP x 250 LF | 13 | EA | $ 125,000 | $ 1,625,000 | | | 1-72" RCP x 250' long |
| Inverted Siphon, 5-96" RCP x 470 LF | 2 | EA | $ 1,300,000 | $ 2,600,000 | | | Pass flows from Two Prairie Bayou, 5-96" barrels x 470 LF |
| Total 09 | | | | $ 47,241,562 | $ 11,810,000 | $ 59,052,000 | |
| 30 PLANNING, E&D (12% of 02, 13 & 09) | 1 | LS | 12% | $ 29,393,150 | $ 7,348,000 | $ 36,741,000 | |
| 31 CONSTRUCTION MANAGEMENT ( 10% of 02, 13 & 09) | 1 | LS | 10% | $ 24,494,292 | $ 6,124,000 | $ 30,618,000 | |
| TOTAL PROJECT COSTS | 1 | LS | | $ 302,918,000 | $ 75,502,000 | $ 378,420,000 | |
| | | | | | 25% | | |

Jerry R. Welch, CCC.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Corps of Engineers, Memphis District** | | | | | | | |
| **Grand Prairie Revaluation Report** | | | | | | | |
| **Mill Bayou Backflow with the Carlisle Canal** | | | | | | | |
| **08-Nov-00** | | | | | | | |
| **ITEM DESCRIPTION** | **QUANTITY** | **UNIT** | **UNIT PRICE** | **AMOUNT** | **CONTINGENCY** | **TOTAL** | **COMMENT** |
| 01 LANDS AND DAMAGES (w/ contin.) | | | | | | | |
| Lands and Damages | 0 | AC | $ 1,255 | $ - | | | Not evaluated. |
| Acquisition (No. of Tracts) | 0 | EA | | $ - | | | |
| Mitigation Acres | 0 | AC | | $ - | | | |
| | | | | $ - | $ - | $ - | |
| 02 RELOCATIONS (w/contin., 20%) | | | | | | | |
| Roads & Bridges | 1 | LS | $ 6,461,718 | $ 6,461,718 | | | Assume same as Mill Bayou Pipeline with Carlisle Canal |
| Utilities | 1 | LS | $ 1,090,000 | $ 1,090,000 | | | |
| Total 02 | | | | $ 7,551,718 | $ 1,888,000 | $ 9,440,000 | |
| 063 Wildlife Facilities and Sanctuaries | | | | | | | |
| Tree Planting | 0 | AC | $ 200 | $ - | $ - | $ - | |
| 13 PUMPING PLANTS | | | | | | | |
| Pump Station 2644 CFS | 1 | EA | $ 39,500,000 | $ 39,500,000 | | | 20-foot lift, See pumping station cost curve. |
| Pump Station 1903 CFS | 1 | EA | $ 28,500,000 | $ 28,500,000 | | | 20-foot lift, See pumping station cost curve. |
| Pump Station 1060 CFS | 3 | EA | $ 17,000,000 | $ 51,000,000 | | | 10-foot lift, See pumping station cost curve. |
| Pump Station 760 CFS | 1 | EA | $ 12,000,000 | $ 12,000,000 | | | 10-foot lift, See pumping station cost curve. |
| Pump Station 475 CFS | 1 | EA | $ 8,000,000 | $ 8,000,000 | | | 10-foot lift, See pumping station cost curve. |
| Discharge Pipe, 2-10' Diameter | 2,000 | LF | $ 1,600 | $ 3,200,000 | | | Based upon Grand Prairie Discharge Pipes, includes installation. |
| Discharge Pipe, 2-10' Diameter | 3,000 | LF | $ 1,600 | $ 4,800,000 | | | Based upon Grand Prairie Discharge Pipes, includes installation. |
| Discharge Pipe, 1-10' Diameter | 1,000 | LF | $ 800 | $ 800,000 | | | Based upon Grand Prairie Discharge Pipes, includes installation. |
| Total 13 | | | | $ 147,800,000 | $ 36,950,000 | $ 184,750,000 | |
| 09 CHANNELS AND CANALS | | | | | | | |
| Clearing & Grubbing | 1,149 | AC | $ 200 | $ 229,756 | | | Mostly farmland. Includes borrow areas and canal ROW. |
| Arkansas River Reservoir | 1 | EA | $ 3,280,767 | $ 3,280,767 | | | 160 Acre Reservoir. Includes all costs except outlet check structure. |
| Lonoke Reservoir | 1 | EA | $ 2,791,600 | $ 2,791,600 | | | 160 Acre Reservoir. Includes all costs except outlet check structure. |
| Canal Embankment | 7,504,000 | ECY | $ 2.60 | $ 19,510,400 | | | 57' down to 35' BW canal, 26.5 miles. Canal Excavation = 2,860,000 BCY used to construct embankment, 1000 foot average one-way haul. 5,769,600 ECY from borrow, 2 mile average one-way haul. 20% of the canal will require a clay lining. |
| Levees 14' High | 1 | LS | $ 3,000,000 | $ 3,000,000 | | | 4 miles in length, assumed proportional to canal cost for embank. |
| Aggregate Surfacing | 111,936 | TN | $ 15 | $ 1,679,040 | | | Canal access roads, each side. |
| Turfing | 485 | AC | $ 1,000 | $ 485,000 | | | Bermuda grass. |
| Check Structures, 4 Gates x 40 LF | 4 | EA | $ 1,600,000 | $ 6,400,000 | | | Four gate structures-14' x 13.5' x 40 LF Basin Length |
| Check Structures, 3 Gates x 40 LF | 6 | EA | $ 1,200,000 | $ 7,200,000 | | | Three gate structures-14' x 13.5' x 40 LF Basin Length |
| Check Structure, 3 Gates x 38 LF | 1 | EA | $ 1,180,000 | $ 1,180,000 | | | Three gate structures-14' x 13.5' x 38 LF Basin Length |
| Check Structure, 2-60" Dia. Conduit x 50 LF | 1 | EA | $ 150,000 | $ 150,000 | | | Two 5' diameter conduit check structures, 50' long, 5' gates, 7.5' check riser dia, 11.5' high. |
| Turnout Structure, 4-36" Dia x 50 LF | 1 | EA | $ 110,000 | $ 110,000 | | | 4-36" diameter x 50' long conduit, 54" diameter riser, 9.5' high, 4-36" gates |
| Inverted Siphons, 1-72" RCP x 250 LF | 13 | EA | $ 125,000 | $ 1,625,000 | | | 1-72" RCP x 250' long |
| Inverted Siphon, 5-96" RCP x 470 LF | 2 | EA | $ 1,300,000 | $ 2,600,000 | | | Pass flows from Two Prairie Bayou, 5-96" barrels x 470 LF |
| Total 09 | | | | $ 50,241,562 | $ 12,560,000 | $ 62,802,000 | |
| 30 PLANNING, E&D (12% of 02, 13 & 09) | 1 | LS | 12% | $ 24,671,194 | $ 6,168,000 | $ 30,839,000 | |
| 31 CONSTRUCTION MANAGEMENT ( 10% of 02, 13 & 09) | 1 | LS | 10% | $ 20,559,328 | $ 5,140,000 | $ 25,699,000 | |
| **TOTAL PROJECT COSTS** | 1 | LS | | $ 250,824,000 | $ 62,706,000 | $ 313,530,000 | |
| | | | | | 25% | | |

Jerry R. Welch, CCC.

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**Corps of Engineers, Memphis District**

**Grand Prairie Revaluation Report**

Carlisle Canal Used for Seasonal Supplementation

26-Oct-00

| ITEM DESCRIPTION | QUANTITY | UNIT | UNIT PRICE | AMOUNT | CONTINGENCY | TOTAL | COMMENT |
|---|---|---|---|---|---|---|---|
| 01 LANDS AND DAMAGES (w/ contin.) | | | | | | | |
| Lands and Damages (ROW) | 1,603 | AC | $ 1,615 | $ 2,588,845 | | | |
| Acquisition (No. of Tracts) | 81 | EA | $ 6,000 | $ 486,000 | | | |
| Mitigation Acres | 115 | AC | $ 1,615 | $ 185,725 | | | |
| Total 01 | | | | $ 3,260,570 | $ 693,500 | $ 3,954,000 | |
| 02 RELOCATIONS (w/contin., 20%) | | | | | | | |
| Roads & Bridges | 1 | LS | $ 6,115,244 | $ 6,115,244 | | | |
| Utilities | 1 | LS | $ 720,000 | $ 720,000 | | | |
| Total 02 | | | | $ 6,835,244 | $ 1,709,000 | $ 8,544,000 | |
| 063 Wildlife Facilities and Sanctuaries | | | | | | | |
| Tree Planting | 115 | AC | $ 200 | $ 23,000 | $ 6,000 | $ 29,000 | |
| 13 PUMPING PLANTS | | | | | | | |
| Arkansas River Pump Station 1680 CFS | 1 | EA | $ 25,000,000 | $ 25,000,000 | | | 20-foot lift, See pumping station cost curve. |
| Discharge Pipe, 2-10' Diameter | 2,000 | LF | $ 1,600 | $ 3,200,000 | | | Based upon Grand Prairie Discharge Pipes, includes installation. |
| Lonoke Relift Pump Station 1019 CFS | 1 | EA | $ 16,000,000 | $ 16,000,000 | | | 20-foot lift, See pumping station cost curve. |
| Discharge Pipe, 2-10' Diameter | 3,000 | LF | $ 1,600 | $ 4,800,000 | | | Based upon Grand Prairie Discharge Pipes, includes installation. |
| Total 13 | | | | $ 49,000,000 | $ 12,250,000 | $ 61,250,000 | |
| 09 CHANNELS AND CANALS | | | | | | | |
| Clearing & Grubbing | 1,103 | AC | $ 200 | $ 220,600 | | | Mostly farmland. Includes borrow areas and canal ROW. |
| Arkansas River Reservoir | 1 | EA | $ 3,280,767 | $ 3,280,767 | | | 160 Acre Reservoir. Includes all costs except outlet check structure. |
| Lonoke Reservoir | 1 | EA | $ 2,791,600 | $ 2,791,600 | | | 160 Acre Reservoir. Includes all costs except outlet check structure. |
| Canal Embankment | 6,756,000 | ECY | $ 2.60 | $ 17,565,600 | | | 50' to 25' BW canal, 26.5 miles. Canal Excavation = 2,254,000 BCY used to construct embankment, 1000 foot average one-way haul. 4,796,000 ECY from borrow, 2 mile average one-way haul. 20% of the canal will require a clay lining. |
| Aggregate Surfacing | 111,936 | TN | $ 15 | $ 1,679,040 | | | Canal access roads, each side, 53 mi., 12' wide, 6" compacted. |
| Turfing | 467 | AC | $ 1,000 | $ 467,000 | | | Bermuda grass. |
| Check Structures, 3 Gates x 40 LF | 6 | EA | $ 1,200,000 | $ 7,200,000 | | | Three gate structures-14' x 13.5' x 40 LF Basin Length |
| Check Structures, 2 Gates x 38 LF | 3 | EA | $ 800,000 | $ 2,400,000 | | | Two gate structures, 14' x 13.5' x 38 LF |
| Check Structure, 1 Gate x 38 LF | 1 | EA | $ 400,000 | $ 400,000 | | | One gate structures, 14' x 13.5' x 38 LF |
| Turnout Structure, 4- 3' Dia. RCP x 50 LF | 1 | EA | $ 110,000 | $ 110,000 | | | 4-36" diameter x 50' long conduit, 54" diameter riser, 9.5' high, 4-36" gates |
| Inverted Siphons, 1-72" RCP x 250 LF | 7 | EA | $ 125,000 | $ 875,000 | | | |
| Inverted Siphons, 1-72" RCP x 200 LF | 3 | EA | $ 100,000 | $ 300,000 | | | |
| Inverted Siphons, 1-72" RCP x 100 LF | 1 | EA | $ 50,000 | $ 50,000 | | | |
| Inverted Siphon, 5-96" RCP x 400 LF | 2 | EA | $ 1,100,000 | $ 2,200,000 | | | Pass flows from Two Prairie Bayou, 5-96" barrels x 400 LF |
| Total 09 | | | | $ 39,539,607 | $ 9,885,000 | $ 49,425,000 | |
| 30 PLANNING, E&D (12% of 02, 13 & 09) | 1 | LS | 12% | $ 11,444,982 | $ 2,861,000 | $ 14,306,000 | |
| 31 CONSTRUCTION MANAGEMENT ( 10% of 02, 13 & 09) | 1 | LS | 10% | $ 9,537,485 | $ 2,384,000 | $ 11,921,000 | |
| TOTAL PROJECT COSTS | 1 | LS | | $ 119,640,500 | $ 29,788,500 | $ **149,429,000** | |
| | | | | | 25% | | |

Jerry R. Welch, CCC.

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| Corps of Engineers, Memphis District | | | | | | | |
|---|---|---|---|---|---|---|---|
| Grand Prairie Revaluation Report | | | | | | | |
| Carlisle Canal/Pipeline Used for Seasonal Supplementation | | | | | | | |
| 01-Nov-00 | | | | | | | |
| **ITEM DESCRIPTION** | **QUANTITY** | **UNIT** | **UNIT PRICE** | **AMOUNT** | **CONTINGENCY** | **TOTAL** | **COMMENT** |
| 01 LANDS AND DAMAGES (w/ contin.) | | | | | | | |
| Lands and Damages (ROW) | 1,528 | AC | $ 1,621 | $ 2,476,888 | | | |
| Acquisition (No. of Tracts) | 81 | EA | $ 6,000 | $ 486,000 | | | |
| [illegible] | 211 | AC | $ 1,621 | $ 342,031 | | | |
| | | | | $ 3,304,919 | $ 705,000 | $ 4,010,000 | |
| [illegible] | | | | | | | |
| [illegible] | 1 | LS | $ 5,361,386 | $ 5,361,386 | | | |
| | II | LS | $ 580,000 | $ 720,000 | | | |
| [illegible] | | | | $ 6,081,386 | $ 1,520,000 | $ 7,601,000 | |
| 063 Wildlife Facilities and Sanctuaries | | | | | | | |
| Tree Planting | 211 | AC | $ 200 | $ 42,200 | $ 11,000 | $ 53,000 | |
| 13 PUMPING PLANTS | | | | | | | |
| Arkansas River Pump Station 1680 CFS | 1 | EA | $ 25,000,000 | $ 25,000,000 | | | 20-foot lift, See pumping station cost curve. |
| Discharge Pipe, 2-10' Diameter | 2,000 | LF | $ 1,600 | $ 3,200,000 | | | Based upon Grand Prairie Discharge Pipes, includes installation. |
| Lonoke Relift Pump Station 1019 CFS | 1 | EA | $ 16,000,000 | $ 16,000,000 | | | 20-foot lift, See pumping station cost curve. |
| Discharge Pipe, 2-10' Diameter | 3,000 | LF | $ 1,600 | $ 4,800,000 | | | Based upon Grand Prairie Discharge Pipes, includes installation. |
| Pipeline Pump Station 460 CFS | 1 | EA | $ 7,500,000 | $ 7,500,000 | | | 0-foot lift, See pumping station cost curve. |
| Total 13 | | | | $ 56,500,000 | $ 14,125,000 | $ 70,625,000 | |
| 09 CHANNELS AND CANALS | | | | | | | |
| Clearing & Grubbing | 902 | AC | $ 200 | $ 180,411 | | | Mostly farmland. Includes borrow areas and canal ROW. |
| Arkansas River Reservoir | 1 | EA | $ 3,280,767 | $ 3,280,767 | | | 160 Acre Reservoir. Includes all costs except outlet check structure. |
| Lonoke Reservoir | 1 | EA | $ 2,791,600 | $ 2,791,600 | | | 160 Acre Reservoir. Includes all costs except outlet check structure. |
| Pipeline Reservoir 1 | 1 | EA | $ 3,466,000 | $ 3,466,000 | | | |
| Pipeline Reservoir 2 | 1 | EA | $ 1,572,000 | $ 1,572,000 | | | |
| Canal Embankment | 4,853,000 | ECY | $ 2.60 | $ 12,617,800 | | | 50' to 25' BW canal, 20 miles. Canal Excavation = 1,985,000 BCY used to construct embankment, 1000 foot average one-way haul. 3,595,950 ECY from borrow, 2 mile average one-way haul. 20% of the canal will require a clay lining. |
| Aggregate Surfacing | 84,480 | TN | $ 15 | $ 1,267,200 | | | Canal access roads, each side, 20 mi., 12' wide, 6" compacted. |
| Turfing | 402 | AC | $ 1,000 | $ 402,000 | | | Bermuda grass. |
| Pipeline, 5' dia RCP | 34,320 | LF | $ 220 | $ 7,550,400 | | | |
| Check Structures, 3 Gates x 40 LF | 6 | EA | $ 1,200,000 | $ 7,200,000 | | | Three gate structures-14' x 13.5' x 40 LF Basin Length |
| Check Structures, 2 Gates x 38 LF | 2 | EA | $ 800,000 | $ 1,600,000 | | | Two gate structures, 14' x 13.5' x 38 LF |
| Check Structure, 1 Gate x 38 LF | 1 | EA | $ 400,000 | $ 400,000 | | | One gate structures, 14' x 13.5' x 38 LF |
| Inverted Siphons, 1-72" RCP x 250 LF | 7 | EA | $ 125,000 | $ 875,000 | | | |
| Inverted Siphons, 1-72" RCP x 200 LF | 3 | EA | $ 100,000 | $ 300,000 | | | |
| Inverted Siphons, 1-72" RCP x 100 LF | 3 | EA | $ 50,000 | $ 150,000 | | | |
| Total 09 | | | | $ 43,653,177 | $ 10,913,000 | $ 54,566,000 | |
| 30 PLANNING, E&D (12% of 02, 13 & 09) | 1 | LS | 12% | $ 12,748,148 | $ 3,187,000 | $ 15,935,000 | |
| 31 CONSTRUCTION MANAGEMENT ( 10% of 02, 13 & 09) | 1 | LS | 10% | $ 10,623,456 | $ 2,656,000 | $ 13,279,000 | |
| TOTAL PROJECT COSTS | 1 | LS | | $ 132,952,000 | $ 33,117,000 | $ 166,069,000 | |
| | | | | | 25% | | |

Jerry R. Welch, CCC.

| Corps of Engineers, Memphis District<br>Grand Prairie Revaluation Report<br>Bayou Meto Irrigation Project<br>01-Nov-00 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **ITEM DESCRIPTION** | **QUANTITY** | **UNIT** | **UNIT PRICE** | **AMOUNT** | **CONTINGENCY** | **TOTAL** | **COMMENT** |
| 01 LANDS AND DAMAGES (w/ contin.) | | | | | | | |
| Lands and Damages (ROW) | 1,402 | AC | $ 1,617 | $ 2,267,034 | | | |
| Acquisition (No. of Tracts) | 60 | EA | 6,000 | $ 360,000 | | | |
| [illegible] | | AC | $ [illegible] | [illegible] | | | |
| | | | | | 614,000 | $ 3,430,000 | |
| 02 RELOCATIONS (w/contin., 20%) | | | | | | | |
| Roads & Bridges | | LS | $ 4,709,277 | $ 4,709,277 | | | |
| Utilities | 1 | | $ 378,000 | $ 720,000 | | | |
| Total 02 | | | | | 1,357,000 | $ 6,786,000 | |
| 063 Wildlife Facilities and Sanctuaries | | | | | | | |
| Tree Planting | 117 | AC | $ 200 | $ 23,400 | $ 6,000 | $ 29,000 | |
| 13 PUMPING PLANTS | | | | | | | |
| Arkansas River Pump Station 1680 CFS | | EA | $ 25,000,000 | $ 25,000,000 | | | 20-foot lift, See pumping station cost curve. |
| Discharge Pipe, 2-10' Diameter | 2,000 | LF | $ 1,600 | $ 3,200,000 | | | Based upon Grand Prairie Discharge Pipes, includes installation. |
| Lonoke Relift Pump Station 1019 CFS | 1 | EA | $ 16,000,000 | $ 16,000,000 | | | 20-foot lift, See pumping station cost curve. |
| Discharge Pipe, 2-10' Diameter | 3,000 | LF | $ 1,600 | $ 4,800,000 | | | Based upon Grand Prairie Discharge Pipes, includes installation. |
| Total 13 | | | | $ 49,000,000 | $ 12,250,000 | $ 61,250,000 | |
| 09 CHANNELS AND CANALS | | | | | | | |
| Clearing & Grubbing | 902 | AC | $ 200 | $ 180,411 | | | Mostly farmland. Includes borrow areas and canal ROW. |
| Arkansas River Reservoir | 1 | EA | $ 3,280,767 | $ 3,280,767 | | | 160 Acre Reservoir. Includes all costs except outlet check structure. |
| Lonoke Reservoir | 1 | EA | $ 2,791,600 | $ 2,791,600 | | | 160 Acre Reservoir. Includes all costs except outlet check structure. |
| Canal Embankment | 4,853,000 | ECY | $ 2.60 | $ 12,617,800 | | | 50' to 25' BW canal, 20 miles. Canal Excavation = 1,985,000 BCY used to construct embankment, 1000 foot average one-way haul. 3,595,950 ECY from borrow, 2 mile average one-way haul. 20% of the canal will require a clay lining. |
| Aggregate Surfacing | 84,480 | TN | $ 15 | $ 1,267,200 | | | Canal access roads, each side, 20 mi., 12' wide, 6" compacted. |
| Turfing | 402 | AC | 1,[illegible] | [illegible] | | | Bermuda grass. |
| Check Structures, 3 Gates x 40 LF | 6 | EA | $ | | | | Three gate structures-14' x 13.5' x 40 LF Basin Length |
| Check Structures, 2 Gates x 38 LF | 2 | EA | | [illegible] | | | Two gate structures, 14' x 13.5' x 38 LF |
| | 7 | EA | [illegible] | [illegible] | | | |
| | 6 | [illegible] | [illegible] | $ [illegible] | | | |
| | | | | $ 30,589,777 | $ 7,647,000 | $ 38,237,000 | |
| | 1 | LS | 12% | $ 10,202,287 | $ 2,551,000 | $ 12,753,000 | |
| 31 CONSTRUCTION MANAGEMENT ( 10% of 02, 13 & 09) | 1 | LS | 10% | $ 8,501,905 | $ 2,125,000 | $ 10,627,000 | |
| **TOTAL PROJECT COSTS** | 1 | LS | | $ 106,562,000 | $ 26,550,000 | **$ 133,112,000** | |
| | | | | | 25% | | |

Jerry R. Welch, CCC.

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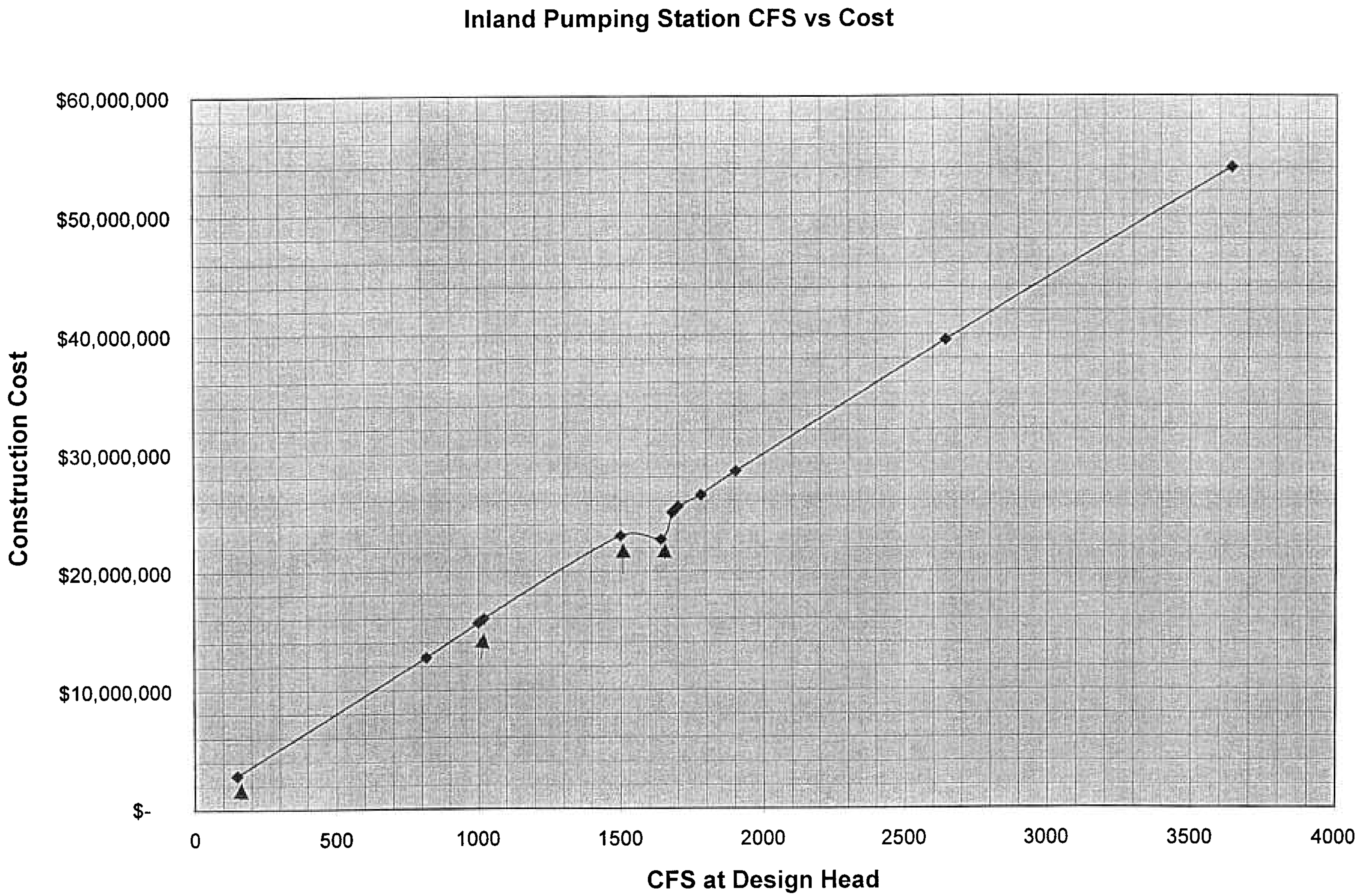
# *Grand Prairie Engineering Review*




B-3-9

# APPENDIX C

# ENVIRONMENTAL SUMMARY OF CURRENT PROJECT

**Grand Prairie Area Demonstration Project**
**Environmental Summary**
13 September 1999

**Purpose** - Provide a brief summary of environmental coordination, impacts, and benefits

**Existing Conditions** - The project area was historically tall grass prairie but because of its clay cap was uniquely suited for rice production. Only about 650 acres of native prairie remain of the original 500,000. A genetic study conducted by Southern Illinois University at Carbondale indicates that native prairie grasses are genetically different than commercially available cultivars. Approximately 17,400 acres of harvested crop fields are flooded each winter to provide a high quality food source for waterfowl. Stuttgart has become known as the rice and duck capitol of the world. The project area is underlain by a shallow (alluvial) aquifer and a deep (Sparta) aquifer. Both aquifers in the entire project area have been declared a critical ground water area by the state of Arkansas because of the severe ground water depletion. A large cone of depression in the alluvial aquifer is located under the Stuttgart area. The aquifers historically interacted with streams and wetlands in the area. Farmers are switching to surface water and have installed dams and pit reservoirs to irrigate from natural streams. Water levels in many streams are severely depleted during the irrigation season.

**Future Without-Project Conditions** - The alluvial aquifer will no longer be able to sustain irrigated agriculture by 2015. Rice production will drop to 23% of current levels and agriculture will switch to soybean production. The aquifer as a resource could sustain damage, a high quality food source (rice) for waterfowl will be lost, and the natural streams will continue to be depleted during the irrigation season. The aquifer's natural interaction with the wetlands and streams will be lost.

**Environmental Coordination** - A project team was established that included the U.S. Fish and Wildlife Service (USFWS), Natural Resources Conservation Service (NRCS), Arkansas Game and Fish Commission (AGFC), Arkansas Natural Heritage Commission (ANHC), and Arkansas Soil and Water Conservation Commission. This team participated in all aspects of project planning and were provided all project data. All study proposals were coordinated with these agencies, and study results were provided to them. A multi-agency team led by the ANHC and NRCS, with participation by the AGFC, USFWS, Corps, and Arkansas Highway and Transportation Department (AHTD), conducted a study that assessed potential impacts to White River floodplain wetlands. The USFWS conducted a mussel survey on tributary streams within the project area. A nationally recognized fisheries biologist from the U.S Army Waterways Experiment Station (WES) led the fisheries investigations.

**Project Environmental Features** -

- No land will be converted to cropland.

Roll (to increase macroinvertebrate production and accelerate stubble decay) and flood 38,529 acres of harvested rice fields for waterfowl.

- Provide fisheries in canals.
- Provide an additional 8,000 surface acres of reservoirs (these reservoirs will provide habitat for fish, shorebirds, and waterfowl).
- Construct weirs to maintain minimum water levels in tributary streams and prevent desiccation during the summer months.
- Plant prairie grasses on as much as 3,000 acres of canal right-of-way (seeds from native prairie grasses will be use to preserve genetic integrity).
- Preserve and sustain the aquifer.

**Additional Environmental Features -** A study to examine additional environmental features has been initiated. This study is focusing on additional measures for aquifer protection, waterfowl conservation, and wetland restoration (including wetland prairie restoration). The study is scheduled for completion in March 2001.

**Potential Project Impacts -** Scientific investigations were conducted on White River floodplain wetlands and on fisheries in the river as well as tributary streams. Potential impacts associated with withdrawals from the White River will occur downstream of DeVall's Bluff. The maximum impacts of the pumping station on White River stages will be about one foot at the lowest river stages before pump cutoff in the lowest possible pumping conditions. The impacts decrease at higher flows and cutoff levels and are essentially immeasurable at stages above bankfull. The impacts of these changes on both fish and wetlands were found to be minimal.

The operation of the pump station will be governed by the operations plan that will be referenced in the project cooperation agreement (PCA). The withdrawals must be limited to the withdrawals specified in the general reevaluation report. The withdrawals were based on the draft Arkansas State Water Management Plan for the White River, with varying withdrawals in different months. Environmental criteria were considered by the state, and the state will issue a permit for water withdrawal to the sponsor. Any change in the operation would require a supplement to the EIS.

Fisheries Impacts - **Dr. Jack Killgore (WES) led the fisheries studies. It was concluded that larval fish entrainment at the pump station should not negatively affect the White River fishery; however, larval fish entrainment will be monitored following project construction.** It was also determined that withdrawals from the river will not significantly impact littoral area habitat of fish and invertebrates. Four oxbow lakes were identified that could possibly have changes in connectivity with the river. The duration of the changes will be minor and were not considered significant, but a post-construction monitoring program for the lakes will be established.

Tributary Stream Impacts - **The project does not include any channel enlargements of tributary streams.** The project does use tributary streams to transport irrigation water and will place weirs in these streams. The location of the weirs will be determined with consideration given for sensitive environmental areas and plant communities. Currently, most tributary streams in the project area are used for irrigation; and water levels are greatly reduced during the summer months. The project will maintain water in the tributary streams to the level of weirs. This will provide a significant increase in fish habitat.

Water Quality Impacts - The increased farm efficiencies include tail water recovery to capture and reuse irrigation water. **The farm runoff will decrease with the project.**

Mussels - **Malacologists, Dr. John Harris (AHTD), Dr. Paul Heartfield (USFWS), and Dr. Andrew Miller (WES) were consulted regarding potential impacts to mussels within the White River and the need for a quantitative impact study. It was concluded that the minor reductions in surface water elevations of the White River should not cause significant impacts to mussels and that no quantitative impact assessment was necessary.**

A major concern raised by natural resource agencies was the potential impact that zebra mussels (introduced from the White River) could have on native mussels in the tributary streams. A reconnaissance mussel survey of LaGrue Bayou was conducted by the USFWS in order to determine the need for more intensive surveys. The USFWS, led by Dr. Heartfield, conducted the reconnaissance survey on LaGrue Bayou because it was thought to be the stream most likely to contain at least a moderate mussel population. However, the survey revealed only low-density mussel populations. The USFWS attributed the scarcity of mussels to channel modification, agricultural runoff, and irrigation withdrawals. Based on the reconnaissance survey, the USFWS informed the Corps that more intensive surveys were not needed. Moreover, if zebra mussels proliferate in the White River, their introduction into the smaller tributary streams is likely inevitable, with or without the project.

Wetland Impacts - **A scientific investigation, led by the ANHC and NRCS, was conducted to determine the impacts on White River wetlands.** The White River is controlled by a series of reservoirs. The reservoirs provide more stable flow conditions and much higher than natural or pre-dam flows in the summer months. **The investigations concluded that the effects would be to move the river conditions to slightly more natural or historical conditions.**

Waterfowl Impacts - **Since the effect of the pumping station would be essentially immeasurable during flooding conditions on the White River, the project would have no impacts on the area or duration of the floods used by waterfowl.** The project would provide significantly more waterfowl habitat in the Grand Prairie and reliably provide this habitat sooner in the waterfowl season. Without the project, much of the flooded rice fields currently used by waterfowl in the Grand Prairie would be lost.

Cumulative Impacts - The final environmental impact statement assesses the cumulative impacts of other potential projects in the White River basin. The other irrigation projects that would rely on the White River are neither authorized nor funded for study. The Grand Prairie Project has minimal impacts and significant environmental benefits, and it is needed now to save the aquifer. Waiting to initiate construction would place the start of project operation dangerously close to the predicted depletion of the aquifer in 2015.

Mitigation - Canal and pipeline alignments were determined considering environmental impacts. **Unavoidable impacts will be fully mitigated.** The mitigation includes not only wetlands mitigation but also mitigation for upland hardwoods. The mitigation necessary for on-farm features was also estimated and will be included with project mitigation in manageable blocks.

**Benefits -**

Aquifer Protection Benefits - The project will provide the water necessary to save the aquifers (both alluvial and Sparta). Without the project, the aquifers will be depleted.

Fishery Benefits - The new irrigation canals and reservoirs will provide additional fisheries to the project area. The pooling effect of weirs and maintenance of year-round minimum water levels will improve the quality of habitat in tributary streams.

Waterfowl Flooding in the Grand Prairie - The goals of the waterfowl plan were established with assistance from waterfowl biologists with the AGFC and the USFWS. The flooding will be part of the operation plan for the PCA and the on-farm plans for the individuals. The White River Irrigation District requested that waterfowl conservation be made part of the authorized project.

Prairie Grass Restoration - The prairie grasses will not be planted in a large contiguous block. However, the native genotypes will be preserved and expanded to up to five times their current area. Much publicity has been given to the railroad prairie, a strip of prairie along an abandoned railroad. Like the railroad prairie, prairie restoration areas will be linearly configured. These strips of prairie should still restore much-needed habitat for certain prairie wildlife species. Additionally, the on-going prairie grass research should enhance the chances for successful establishment of prairie grasses; this could, in turn, encourage the planting of native prairie grasses by others in similar situations.

## Significant Resources

- It is unlikely that water withdrawals associated with this project could adversely impact White River floodplain wetlands. Moreover, the drying up (desiccation) of groundwater wetlands along portions of the White River could possibly be halted or slowed by implementing this project.
- It is unlikely that water withdrawals associated with this plan could adversely impact bottomland hardwoods along the White River. Furthermore, the project could slow or prevent desiccation of botttomland hardwoods along the White River that are influenced by groundwater.
- No significant impacts to upland hardwoods are anticipated.
- This project would provide an additional source of irrigation water. At year 2015 and beyond, annual aquifer withdrawals would be limited to the long-term sustained yield (35,574 acre-feet) which would allow the aquifer to recharge.
- This project should not induce any significant sedimentation in tributary streams. The use of White River water for irrigation purposes should have positive effects on farmland and tributaries.
- Impacts to the White River fishery as a result of pump entrainment and reductions in surface water elevations are projected to be relatively minor. The minor changes in river surface water elevations should not impact mussels. Overall, mussels in the tributary streams should benefit from this plan.
- This project could increase the amount of prairie vegetation by establishing it in canal rights-of-way.
- Habitat losses would be offset by the acquisition and reforestation of 436 acres of cleared land. Flooding 38,529 acres of harvested rice fields on an average annual basis would provide additional 12,275,949 duck-use-days (DUDs) per year. Drying of wetlands along the river could be halted or slowed, benefiting certain wildlife species.
- No people will be displaced if this project is implemented. In fact, the area's income would be greatly enhanced over the levels expected without the project which would prevent the loss of area employment.
- This project would significantly reduce or halt the erosion of property values and tax base.
- This project would maintain the area's agriculture and agricultural related production, farms and businesses, income, employment, tax base, public services, and urban and rural population necessary to maintain the area's economy at present levels.

# Grand Prairie Irrigation Project White River Withdrawals

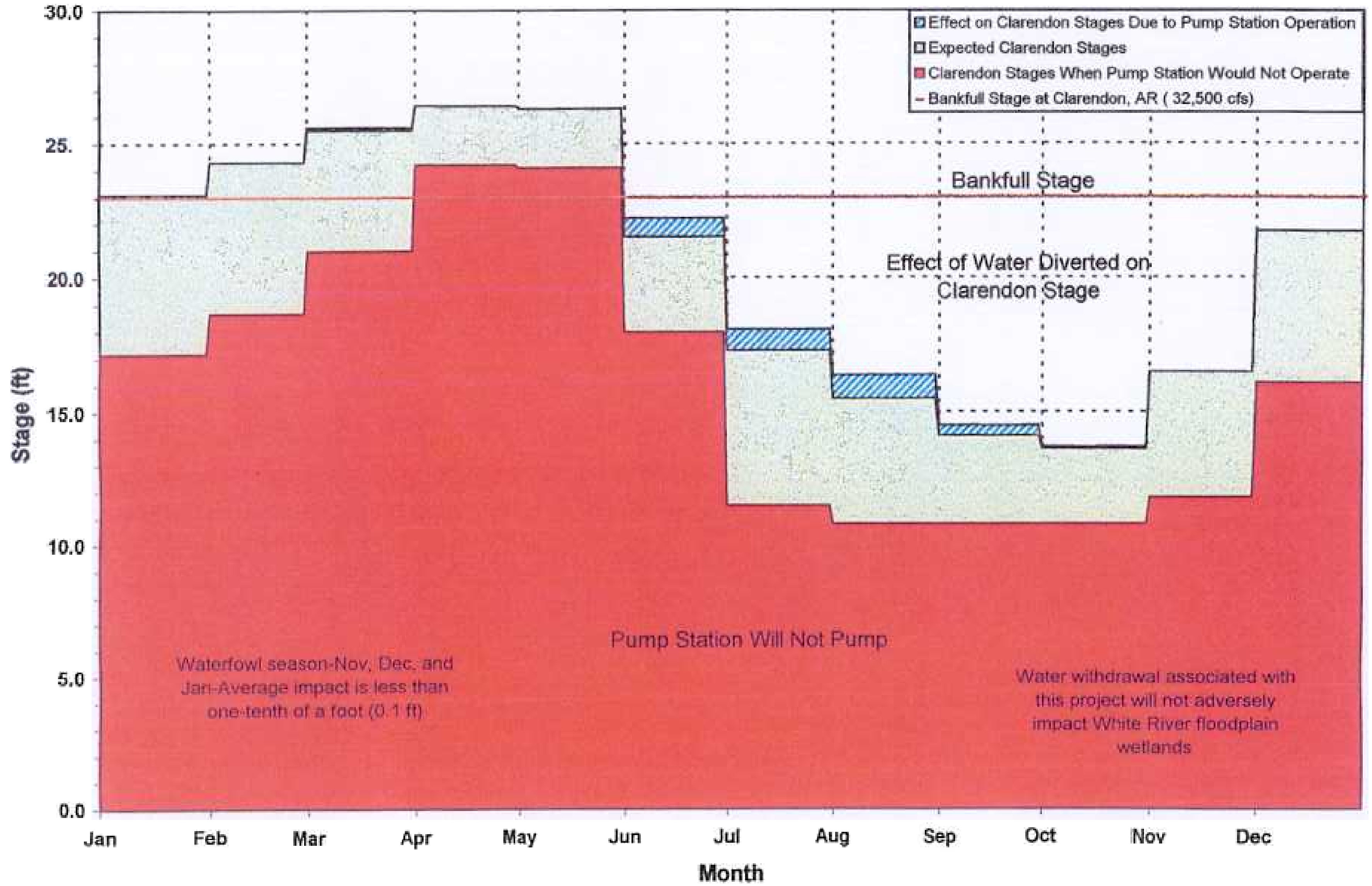
The withdrawals from the White River are governed by a plan developed by the state of Arkansas that establishes minimum stream flows, though this plan has not been established in law. The plan examined the minimum flows needs for water quality, fish and wildlife , and navigation for each month of the year. The requirement for water quality is 5,250 cubic feet per second (cfs) and the requirement for navigation is 9,650 cfs. The fish and wildlife minimum requirement ranges from a high of 36,940 cfs in April to a low of 6,920 cfs in October. The minimum stream flows were the highest of the minimum requirements. The project would only withdraw water above the minimum stream flow. The requirement for water quality never controls the cutoff because the minimum navigation and fish and wildlife requirements are always higher. The navigation requirement controls during August, September, and October. The following table provides the mean monthly flow at Clarendon and the corresponding gage reading along with the minimum instream flow and corresponding gage reading. The maximum capacity of the pumping station is 1,640 cfs, but the demand is usually much less. The average monthly demand is given in the next column and finally the effect of the demand on the mean monthly flow.

| Grand Prairie Effects on the White River | | | | | | |
|---|---|---|---|---|---|---|
| | Mean | Stage | Minimum | | Average | Effect of Demand on |
| Month | Monthly | Clarendon | Instream | | Monthly | Mean Monthly |
| | Flow | Gage | Flow | Gage | Demand | Stage |
| | (cfs) | (Feet) | (cfs) | (Feet) | (cfs) | (Feet) |
| January | 32680 | 23.1 | 19610 | 17.2 | 277 | 0.1 |
| February | 37840 | 24.3 | 22700 | 18.7 | 279.3333 | 0 |
| March | 46010 | 25.6 | 27610 | 21 | 259.3333 | 0.1 |
| April | 52770 | 26.4 | 36940 | 24.2 | 389.6667 | 0 |
| May | 52340 | 26.3 | 36640 | 24.1 | 669.6667 | 0 |
| June | 30320 | 22.2 | 21220 | 18 | 1504.333 | 0.7 |
| July | 21340 | 18.1 | 10670 | 11.5 | 1638.333 | 0.8 |
| August | 18180 | 16.4 | 9650 | 10.8 | 1455.667 | 0.9 |
| September | 15040 | 14.5 | 9650 | 10.8 | 496.3333 | 0.4 |
| October | 13840 | 13.7 | 9650 | 10.8 | 58 | 0.1 |
| November | 18420 | 16.5 | 11050 | 11.8 | 22 | 0 |
| December | 29310 | 21.7 | 17590 | 16.1 | 0 | 0 |

The chart on the next page graphically illustrates this with the red area being the stages when no pumping is allowed. The top of the green and blue area represents the mean annual stages with the blue representing the reduction on stages due to pumping to satisfy the demand. Withdrawals from the White River will have no measurable effect on flood flows.

## Clarendon Stages

### Based on White River Flow Information and Analyses

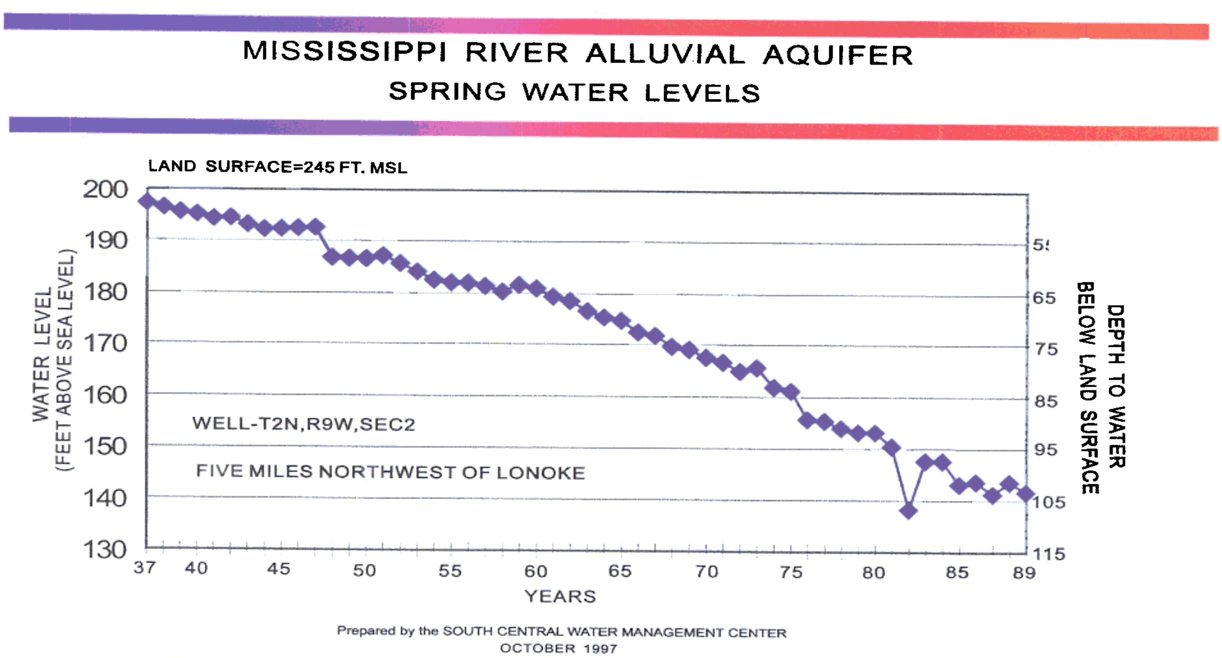



Changes in stages during months restore the in-bank flood hydrograph pre-dam conditions

# GRAND PRAIRIE
# GROUNDWATER PROBLEMS

The Grand Prairie Region is located primarily in Arkansas, Lonoke and Prairie Counties of Eastern Arkansas. Historically, the Grand Prairie is bordered by the White River to the east, the Arkansas River on the West and Wattensaw to the North. Rice production began as early as 1904 in the area. The fairly level, treeless prairie, impermeable subsoil, abundant groundwater supplies, and tillable topsoil made the area ideal for rice production. More than 90% of the irrigation water was being withdrawn from the shallow Mississippi River Alluvial Aquifer. By 1915 more water was being withdrawn from the aquifer than was being recharged . This resulted in declines in the water table of the aquifer and a greater depth to water.

Rice production, groundwater overdraft and declines in the water table have continued to this day with a continual decrease in aquifer storage. This dewatering of the aquifer creates an unsaturated zone in the aquifer that is often referred to as a cone of depression. The cone of depression that resembles an elongated trough began around Stuttgart and DeWitt and has enlarged northward to encompass Hazen, Carlisle and Lonoke and is now moving onward toward England. The depth to water in this trough is over 120 feet in some locations. The change in the water table fluctuates seasonally with the irrigation season and the recharge season. The lowering of water levels has not been uniform over the Grand Prairie. Some areas in the Grand Prairie are yet to be seriously affected or inconvenienced by the lowering of water levels while others have been forced to drill deep wells into the Sparta Sand to have the dependable supply of irrigation water that rice requires. It should be apparent that as long as more water is withdrawn for irrigation than is recharged to the aquifer, the lowering of water levels in the future will continue.



Recharge to the aquifer is from several sources. Groundwater is being recharged by the White River on the eastern border, the Arkansas River to the west and south, and from the northern border, (Fall line or Wattensaw Bayou). Approximately 15% or 18,400 acre feet per year is being recharged along the northern border, and 18% or 22,600 acre feet per year seeps through the clay cap and percolates down into the aquifer. The aquifer today relies on remote sources (Arkansas and White Rivers) for 67% of the total recharge or about 83,000 acre feet per year. Recharge is moving from all borders toward the trough of depression but recharge cannot keep up with groundwater usage. Recharge is variable, fluctuating with rainfall, river levels, acres of land flooded and withdrawals. The total recharge can also be thought of as the safe yield of an aquifer, or the quantity of water than can be withdrawn from the aquifer on an annual basis without a declining water table. The safe yield of the Grand Prairie has been estimated from as low as 38,000 acre feet per year to 140,000 acre feet per year. More commonly, safe yield estimates range from 115,000 to 137,000 acre feet per year. (more data on the safe yield will be available in mid 1997). Withdrawals from the aquifer in the Grand Prairie are approximately 400,000 acre feet per year. With a safe yield of 125,000 acre feet per year, overdraft of the aquifer is about 275,000 acre feet per year. This overdraft quantity is removed from storage in the aquifer annually and lower water levels is the result. As long as this imbalance continues, the lowering of water levels and loss of storage will continue to occur in the Grand Prairie.

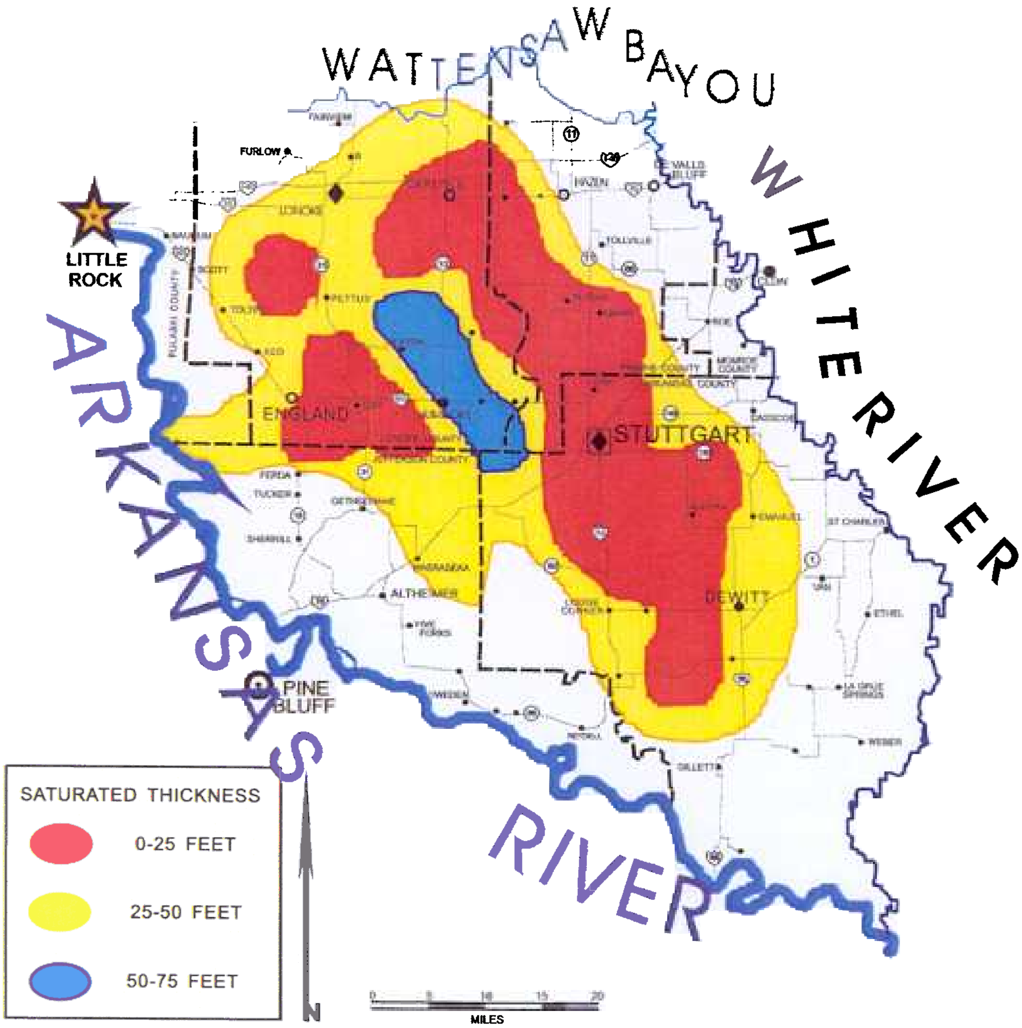
Areas within the Grand Prairie have low saturated thicknesses remaining. Water levels in the remaining waterbearing portions of the aquifer respond quickly to changes in the pumping pattern, cropping patterns, precipitation etc. Variability in water levels is expected. Some areas have a rebounding water table for a year or two and then experience a period of decline. Overall, the rate of decline will be *greatest* in those areas furthest from the recharge areas, (White, Arkansas, Wattensaw-Fall Line). The rate of decline will be the *least* in those areas adjacent to the White and Arkansas Rivers, Bayou Meto and Wattensaw Bayou. Storage will continue to decline in the aquifer. Estimates of current day storage amount to 16 million acre feet of water. Overdraft, or withdrawals exceeding recharge, amounts to 275,000 acre feet per year. However, the decrease in storage is not equal across the area, but varies greatly. Saturated thickness patterns are similar to the depth to water patterns. In the trough of depression, a broken band from 2 to 6 miles wide stretching from west of DeWitt to Hazen has less than 20 feet of aquifer material that contains water, (spring 1992 data). A wider band (8 to 12 miles wide) from southwest of DeWitt to Hazen contains less than 50 % of the original aquifer thickness that is saturated which fits critical groundwater area criteria as defined by Arkansas Groundwater Law.

The future of the Grand Prairie for rice production with current water resources does not look good. Projections for the area show large areas with less than 20 feet saturated thickness. A large band (8 to 15 miles wide) from south of DeWitt to Carlisle and Hazen is depicted as having less than 20 feet saturated aquifer by the year 2020. The area shown will not be able to support withdrawals for rice irrigation from the alluvial aquifer.

In recent years, the Sparta Sand has been referred to as the long term groundwater alternative to the Mississippi River Alluvial Aquifer, however, nothing could be further from the truth. Most public water supply systems rely on the Sparta Sand for drinking water and they have priority rights above irrigation in state law. The Sparta Sand Aquifer does not have the same hydrologic and hydraulic properties as the Mississippi River Alluvial Aquifer. The Sparta Sand has a specific yield of .01 compared to .30 for the alluvium. In other words, one foot of saturated aquifer material, one acre in size, from the alluvial aquifer contains 13,000 cubic feet of water. The Sparta Sand, for the same dimensions only contains 430 cubic feet of water. Declines in the water table (potentiometric surface) of the Sparta Sand Aquifer have already reached one foot per year for a five year period (1986-1993) in the Grand Prairie Region which exceeds the critical levels as defined by state law. Both, the Alluvial Aquifer and the Sparta Sand Aquifer fit the definition of "CRITICAL GROUNDWATER AREAS" by state law.

One alternative would be to increase recharge so more water could be withdrawn without declining water levels. Artificial recharge by the use of injection wells has been investigated over the decades with an intense effort in the 1950's. The main problem was clogging of the aquifer at the point of injection caused by; air entrainment, turbidity (silt) and microorganisms. Conclusions from these efforts were that water used for injecting back into an aquifer would have to be treated to drinking water standards to avoid the clogging problems. The cost of injected water was $50 per acre foot in 1962 dollars, and treatment costs accounted for 70% of total costs. Artificial recharge was not considered to be feasible, following this analysis.

# MISSISSIPPI RIVER ALLUVIAL AQUIFER
## PROJECTED SATURATED THICKNESS
## YEAR 2022




SOURCE: MODIFIED FROM USGS PROFESSIONAL PAPER 1416-D
Prepared by the SOUTH CENTRAL WATER MANAGEMENT CENTER
SEPTEMBER 1997

# STATE OVERSIGHT COMMITTEE ACTIONS

**STATE OF ARKANSAS**
**OFFICE OF THE GOVERNOR**
*State Capitol*
*Little Rock 72201*

Mike Huckabee
*Governor*

March 6, 2001

Colonel Daniel W. Krueger
Commander, Memphis District Corps of Engineers
167 North Main Street
Memphis, Tennessee 38103-1894

Dear Colonel Krueger:

The Water Resources Task Force has submitted recommendations to me concerning the Grand Prairie Area Demonstration Project, and many other water related issues. I am writing to let you know my position on the project.

The Grand Prairie Area Demonstration Project involves several resources critical to the future of Arkansas including the alluvial and Sparta aquifers in the area, the Grand Prairie's heritage and tremendous agricultural production, and the White River. The Corps' engineering review provided the opportunity to re-examine these resources in light of current conditions. I have carefully considered the report of the task force. The engineering review of water sources met the intent of the compromise to allow the project to move forward.

I concur that the White River is the appropriate source of water for the project, that the project's effects must be monitored, and that measures should be taken if the impacts are greater than expected. I am pleased that one alternative has been identified that, if there are indeed impacts to the White River during waterfowl season, the use of the river could be supplemented or eliminated during this time. This would be accomplished by a modification of the Bayou Meto project, which would allow use of Arkansas River water as a supplement source through interconnection of the projects. I concur that project construction should proceed as authorized.

Since both the Sparta and alluvial aquifers continue to decline, I urge the Corps to proceed as rapidly as possible with continued construction of the on-farm features for the project as well as construction of the delivery system. We must act now to preserve the aquifers, to maintain irrigated agriculture, and to increase the waterfowl habitat in the Grand Prairie.

I am proud that Arkansas can work through the Soil and Water Conservation Commission with the local citizens represented by the White River Regional Irrigation Water Distribution District, and with the Federal Government to accomplish this important project. I look forward to a continued excellent working relationship with you on the Grand Prairie Area Demonstration Project and other projects in Arkansas. Please contact Mr. Randy Young on this or any other matters in the future.

Sincerely yours,

Mike Huckabee

MH:dc:ps

# CHARTER
# FOR
# OVERSIGHT COMMITTEE
17 August 2000

1. **Mission Statement:** The mission of the Oversight Committee is to act in an advisory capacity to the Governor's Water Resource Task Force and to the Soil and Water Conservation Commission (Commission) concerning the engineering review of the water sources for the Grand Prairie Area Demonstration Project. We are committed to providing the task force and the Commission with a quality review in a timely manner. We will work as a team and speak as one voice.

2. **Objectives:** We support this mission statement through our voluntary and enthusiastic commitment to subscribe to the following objectives:

A. To develop a clear understanding of the concerns of all parties.

B. To maintain an atmosphere conducive to free and open communication.

C. To develop answers to the following three questions:
(1) Are the water needs/shortages/time tables identified in the General Re-evaluation Report accurate?
(2) Are the water source alternatives accurately identified?
(3) Are the water source alternatives adequately evaluated?

D. To provide a timely and cost-effective review.

E. To continue the partnership process for the duration of the engineering review.

F. To communicate to the task force and the Commission in a single voice through a brief letter report on the results of the review.

G. To recommend to the task force and the Commission a course of action.

## 3. Membership:

A. Oversight Committee: The appointed members of the committee are listed as follows:

| | |
|---|---|
| Randy Young, Chairman | ASWCC |
| John Terry | USGS |
| Jerry Lee Bogard | Arkansas County Landowner |
| Robert Hankins | ASWCC |
| Dennis Kamper | Corps of Engineers |
| Alan Perkins | Hill, Gilstrap, Perkins, Trotter & Warner |
| Bill Bush | Arkansas Geological Commission |
| Sherrel Johnson | El Dorado Chamber of Commerce |
| Tommy Hillman | WRID |
| Nancy Delamar | The Nature Conservancy |
| Allen Mueller | US Fish & Wildlife Service |
| Kalven Trice | USDA-NRCS |

## 4. Committee Meeting Conduct:

A. The committee will meet at the call of the chairman. He will schedule meetings with two week's notice whenever possible.

B. Press releases, if any, will be written in committee and reviewed by all members prior to release by the chairman.

C. The chairman will be the spokesperson for the committee to the press and general public. Individual committee members will refrain from individual interviews and statements.

D. Committee members will address issues, data or information, and will refrain from personal attack/criticism.

E. Material(s) will be furnished in advance of scheduled meetings to facilitate discussion.

5. **Engineering Review Input:** Committee input and comments on the engineering review will be provided to the Corps of Engineers. Input will be limited to the Grand Prairie Project and the engineering review of water sources.

6. **Review Time:** The engineering review is expected to take five months. The committee will conclude its efforts, consistent with its establishment by January 2001.

7. **Signatures:** We agree with the Oversight Committee's Mission Statement, subscribe to the Committee Objectives, and are committed to the Committee Conduct outlined above.

Mr. J. Randy Young, Chairman
ASWCC

John Terry
USGS

Jerry Lee Bogard
Arkansas County Landowner

Robert Hankins, Commissioner
ASWCC

Dennis Kamper
Memphis District
Corps of Engineers

Alan Perkins, Attorney
Hill, Gilstrap, Perkins, Trotter & Warner

Bill Bush
Arkansas Geological Commission

Sherrel Johnson
El Dorado Chamber of Commerce

Tommy Hillman
WRID

Nancy Delamar
The Nature Conservancy

Allen Mueller
U.S. Fish & Wildlife Service

Kalven Trice
USDA-NRCS

David Carruth
Attorney

Gary Canada
Bayou Meto Regional Irrigation Water District

**T. David Carruth, Attorney at Law**

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152 Madison Street
Clarendon, Arkansas 72029

Phone (870) 747-3839
Fax (870) 747-5695
E-mail: dcarruth@futura.net

January 18, 2001

Mr. Randy Young
Arkansas Soil and Water Commission
101 East Capitol, Ste. 350
Little Rock, AR 72203

RE: Oversight Committee - comments

Dear Randy:

This letter will memorialize my comments made at the December 19th meeting as you requested.

As I stated in the meeting, the "review" that the Corps conducted was completely devoid of any consideration of non-stream diversion options. We did not consider using CRP or WRP programs to remove lands from irrigation thereby reducing the amount of demand on the aquifer. For example, using a 1.5 acre feet average demand, if 20,000 acres were enrolled in a CRP or WRP program the effect would be a reduction of 30,000 acre feet of water demand. This coupled with more conservative use of the available water may totally eliminate the need for a stream diversion system or at least greatly reduce the size of such a system.

Likewise, a program similar to Georgia's would be another alternative that should be examined. Under that program, the state purchases the landowner's rights to irrigate the land for a fee. In essence purchasing the irrigation rights from the landowner. The landowner can still farm the land but can only produce crops that do not require irrigation.

While we discussed aquifer recharge, all I recall hearing about it was that it was not cost effective. I do not recall ever seeing any data or cost analysis. If it was not a viable option then certainly the data would support that conclusion. I believe we should include the data supporting the conclusion in our work. I believe I should make my decisions based on factual information as opposed to conclusory opinions. As a committee member, I would like to see the data on aquifer recharge so I can make my own decision.

We did have a discussion of the Arkansas River as a source in the event stream diversion was necessary. One statement made by the Corps that confused me was that the White had more water flowing in it than the Arkansas. Looking at the Corps own data from their web page shows something totally different. One today's page it shows the flow of the Arkansas River at the Murry Lock and Dam as being 36,200 cfs for January 8, 2001. On that same page it shows the flow at Clarendon, i.e. the White River as being 11,598 cfs for the same date. It occurs to me by looking at the two rivers that the Arkansas is a larger river as far as size. How could it be that a larger river, with a higher flow rate has less water? The Corps did not answer this question.

There was a discussion about the Corps being reluctant to take water out of the Arkansas River for fear it would have a negative impact on the Beuff-Tensas Project. I asked the question regarding cumulative impacts of all the planned irrigation projects on the White River given this same rational. I made a motion to the effect that no other projects should be built on the White River until (1) the total effects of the Grand Prairie Project were known and (2) a comprehensive study was conducted of the River. My motion died for lack of a second but the group did agree to support a comprehensive study of the White River basin. I submit that the Grand Prairie project should not be built until such time as the comprehensive study is completed.

In summary, as no data was submitted in support thereof, I believe that the information provided the Oversight Committee regarding aquifer recharge was conclusory. I believe that the Corp's statement that there is more water in the White River than the Arkansas River is suspect if not wholly incredible. I believe that the Oversight Committee has not finished its work as we have not seen or discussed any data, models or scenarios with CRP, WRP or purchase of irrigation rights included. Given their statements regarding Beuff-Tensas, I believe the Corps is aware that the Grand Prairie Project will have a negative impact on the White River, either standing alone or in conjunction with the 4 other projects they recommend on the White or tributaries.

For these reasons and, in conformity with my no vote, I do not support the recommendation made by the Oversight Committee to the Governor's Task Force. I am also of the opinion that the "Dickey Compromise" has not yet been complied with in regard to the "review" aspects called for therein.

Thank you for allowing me to submit these comments and being part of the Oversight Committee.

Very truly yours,

T. David Carruth

cc/ Governor Mike Huckabee
Mr. Allan Mueller, USF&WS
Mr. Tommy Hillman, WRID
Mr. Dennis Kamper, USACOE
Mr. Alan Perkins
Mr. Kalven Trice, NRCS

## Response to Comments by David Carruth

These are responses to comments submitted to the Chairman of the Oversight Committee by David Carruth in the form of e-mail dated January 18, 2001.

**Comment 1.** As I stated in the meeting (Referring to the December 19, 2000, oversight Committee Meeting), the "review" that the Corps conducted was completely devoid of any consideration of non-stream diversion options. We did not consider using CRP or WRP programs to remove lands from irrigation thereby reducing the amount of demand on the aquifer. For example, using a 1.5 acre feet average demand, if 20,000 acres were enrolled in a CRP or WRP program the effect would be a reduction of 30,000 acre feet of water demand. This coupled with more conservative use of the available water may totally eliminate the need for a stream diversion system or at least greatly reduce the size of such system.

**Response 1.** This concern was not raised during the opportunities for comment when the committee was asked at numerous meetings for input regarding any other water sources that should be considered. WRP and CRP were not appropriate programs to address the ground water depletion problems in the Grand Prairie because these programs were designed for other purposes and because the vast majority of the farmland in the Grand Prairie is not wetlands nor highly erodable. The WRP and CRP programs are not of the magnitude necessary to address the significant aquifer problems.

Purchase of land or interest in land to reduce water demand has been considered. The amount of required to reduce the demand to a sustainable level is extremely high. To protect the aquifers even with the maximum economic application of conservation measures, over 178,000 of the area's current 241,000 acres of irrigated cropland could no longer be irrigated. This 73% reduction in irrigated cropland would be a large loss to the national economy and would devastate the regional economy, regardless of compensation to landowners, because of the loss of continued production and processing by agribusiness.

As presented in Table 1. Plan Comparison, on page 12 of the draft Engineering Review Report, current water demand is over 480,000 acre-feet per year. This table indicates with maximum economic application of conservation measures applied to the land that could remain in production, the unmet water need would be over 350,000 acre-feet. To effectively protect the aquifers, purchase of land or water rights on 178,000 acres of the irrigated cropland would be required. This would not be attainable without the extensive use of condemnation, and would result in a significant adverse impact on the human and socio-economic environment.

Protection of the aquifers by purchase of land or water rights would not preserve irrigated agriculture, maintain the agricultural outputs, or be implementable. An import system would preserve the aquifers, provide national economic development benefits, provide fish and wildlife benefits, and has insignificant adverse impacts. Condemnation of extensive amounts of land is not acceptable and protection of the aquifers by purchase of land or waters rights has no Federal interest.

**Comment 2**. Likewise, a program similar to Georgia's would be another alternative that should be examined. Under that program, the state purchases the landowner's rights to irrigate the land for a fee. In essence purchasing the irrigation rights from the landowner. The landowner can still farm the land but can only produce crops that do not require irrigation.

**Response 2**. See response 1. The same amount of land would be removed from production to achieve aquifer protection. Additionally, Arkansas law ties water rights to the land creating legal implementation questions. Again, protection of the aquifers by purchase of land or water rights would not preserve irrigated agriculture, maintain the agricultural outputs, or likely be implementable. An import system would preserve the aquifers, provide national economic development benefits, provide fish and wildlife benefits, and has insignificant adverse impacts. Condemnation of extensive amounts of land is not acceptable and protection of the aquifers by purchase of land or waters rights has no Federal interest.

**Comment 3**. While we discussed aquifer recharge, all I recall hearing about it was that it was not a viable option then certainly the data would support that conclusion. I believe we should include the data supporting the conclusion in our work. I believe I should make my decisions based on factual information as opposed to conclusory opinions. As a committee member, I would like to see the data on aquifer recharge so I can make my own decision.

**Response 3**.. This concern was not raised during the opportunities for comment when the committee was asked if any other water sources should be considered at numerous meeting or after discussions on artificial recharge had concluded it was not a viable option. Bill Bush, the Arkansas State Geologist, reported in an Oversight Committee meeting that aquifer recharge was not practical without a source of water. To continue irrigated agriculture and artificially recharge the aquifer, water must be imported.

Page 3 of the draft report states that this was considered during the studies for House Document 255, dated July 12, 1949. Page 6 and page 7 of the draft report state that this was considered in both the reconnaissance and feasibility studies leading to the project and not found practical. This same conclusion was reached numerous times by various groups. During the review, the Oversight Committee did not request additional study, nor would additional studies be a wise investment of funds, since the overwhelming body of evidence concluded that artificial recharge is not practical because of maintenance considerations, potential aquifer contamination concerns, and the need for import water to use for artificial recharge.

**Comment 4**. We did have a discussion of the Arkansas River as a source in the event stream diversion was necessary. One statement made by the Corps that confused me was that the White River had more water flowing in it than the Arkansas. Looking at the Corps own data from their web page shows something totally different. One today's page it shows the flow of the Arkansas River at the Murry Lock and Dam as being 36,200 cfs for January 8, 2001. On the same page it shows the flow at Clarendon, i.e. the White River as being 11,598 cfs for the same date. It occurs to me by looking at the two rivers that the Arkansas is a larger river as far as size. How could it be that a larger river, with a higher flow rate has less water? The Corps did not answer the question.

**Response 4**. Opportunity was provided to all Oversight Committee members to resolve questions. The statement made by Corps members was that during the month of August the White River has a higher mean flow and higher mean minimum flows during the peak irrigation season. as shown in Table 2 on page 22 of the draft report. Statements were made numerous times during meetings that the Arkansas River has much greater flows in the winter and spring. Figures 3 and 4 on page 22 and 23 respectively were presented to the Oversight Committee and clearly show that the mean monthly and mean minimum flows of the rivers for all months. It is also stated on page 27 that the use of the Arkansas River would increase project reliability over the use of the White River and that the highest reliability could be achieved with a combination of the White and Arkansas. Please refer to the section titled **Comparison of the Arkansas and White River** on page 27 of the draft report.

Using a one-time gage reading is not appropriate for examining the expected flows in a river over time.

**Comment 5**. There was a discussion about the Corps being reluctant to take water out of the Arkansas River for fear it would have a negative impact on the Beuff-Tensas Project. I asked the question regarding cumulative impacts of all the planned irrigation projects on the White River given this same rational. I made a motion to the effect that no other projects should be built on the White River until (1) the total effects of the Grand Prairie Project were known and (2) a comprehensive study was conducted of he river. My motion died for lack of a second but the group did agree to support a comprehensive study of the White River basin. I submit that the Grand Prairie project should not be built until such time as the comprehensive study is completed.

**Response 5**. Members of the Oversight Committee specifically asked of the impacts of taking water out of the Arkansas River on projects that use the river. Specifically, the impacts on the existing Plum Bayou and planned Point Remove and Beuf-Tensas. The last paragraph beginning on page 45 and continuing on page 46 of the draft report state that the opportunity costs for using this water were not considered in the economic analyses. The report states that the significant losses would be due to the delays in the providing supplemental water for aquifer protection.

When planning projects, the Corps assumes projects authorized for construction are in place and impacts must be considered under those conditions. For planning of future projects on the White River, the Grand Prairie project must be assumed to be in place. Other projects must be justified and analyzed based on these conditions. The Beuf-Tensas project is not authorized for construction though it is currently being planned. Therefore, potential economic impacts to Beuf-Tensas were noted, they were not calculated. The potential impacts to Bayou Meto were considered by supplying water to the Bayou Meto area first, as would likely happen since the pumping stations and main canals would be located in Bayou Meto, and comparing the incremental benefits to the incremental costs with Bayou Meto assumed in-place. No other irrigation projects using the White River are authorized by the Corps for construction.

Meeting notes indicate that the motion that died for lack of a second was that no further irrigation projects following Grand Prairie using the White River should be built until a comprehensive study is completed. The impacts of the Grand Prairie have been disclosed in the Environmental Impact Statement meeting the requirements of the Nation Environmental Policy Act including the cumulative impacts of potential projects on the White River. The Record of Decision for the project was completed in February 2000. The Grand Prairie project has been planned in compliance with law. The impacts of delaying the projects on both the Sparta and Alluvial aquifers, and to the people who depend on irrigated agricultural production and processing, are significant.

**Comment 6**. In summary, as no data was submitted in support thereof, I believe that the information provided the Oversight Committee regarding aquifer recharge was conclusory. I believe that the Corps' statement that there is more water in the White River than the Arkansas is suspect if not wholly incredible. I believe that the Oversight Committee has not finished its work as we have not seen or discussed any data, models, or scenarios with CRP, WRP or purchase of irrigation rights included. Given their statements regarding Beuf-Tensas, I believe the Corps is aware that the Grand Prairie Project will have a negative impact on the White River, either standing alone or in conjunction with the 4 other project they recommend on the White of Tributaries.

For these reasons and, in conformity with my no vote, I do not support the recommendation made by the Oversight Committee to the Governor's Task Force. I am of the opinion that the "Dickey Compromise" has not yet been complied with in regard to the "review" aspects called for therein.

**Response 6**. Please see responses 1 – 5. Studies conducted by the Corps and by others concluded that impacts to the White River from the Grand Prairie are insignificant. The impacts are disclosed in the project EIS. The Corps is aware of no other impacts. The review has complied with the requirements from the compromise, Congressional direction and with the directions of the Oversight Committee. The press release stemming from the compromise and the language of the appropriations bill are included in the final version of the report.

Oversight Committee Members

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Gary Canada
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Postmarked Aug 30
Rec'd Sep 1

Oversight Committee Minutes
9:00 AM - August 17, 2000

Conference Room
Arkansas Soil and Water Conservation Commission

Members: J. Randy Young, Chairman; Jerry Bogard, Bill Bush, Leslie Spraggins for Nancy Delamar, Joe Krystofik for Allan Mueller, Robert Hankins, Tommy Hillman, Dennis Kamper, John Terry, and Kalven Trice.

Guests/Staff: Jim Bodron, Dennis Carmen, Dotson Collins, Tracy James, Robert Tisdale, Belinda Duke, H. Hernadez, Ken Brazil, Jon Sweeney, Earl Smith and Laura Brown.

Chairman Young welcomed all in attendance then called the meeting to order. The agenda was revised to allow *Committee Operating Procedures* to follow *Review of Committee Charge*. Mr. Young reviewed the history that led to the Oversight Committee.

Bill Bush reviewed a draft charter. Discussion followed in relation to the main focus of the committee (alternative water sources), accelerating the committee goals in relation to the next legislative session, alternates for committee members, alternate's authority, and signing the charter.

It was decided the members were to send any comments on the charter to Chairman Young by August 24th and to be prepared to sign the charter at the next meeting.

Dennis Kamper, Corps of Engineers, made a presentation on The Grand Prairie Area Demonstration Project.

In regard to pending construction of "on-farm features", Chairman Young stressed that state money would not be wasted and farm features would provide positive benefit cost ratios. The first priority being to finance farm features at sites with opportunity to capture ground/surface water.

There was concern that the public judges the credibility of such committee work and it was necessary to keep the public aware of the progress of the Oversight Committee.

Discussion continued on: monies available, the Dickey compromise, prioritization, and additional construction costs.

It was noted that the Corps design was being finished along with specifications, however the design was to be placed on the shelf tentatively.

Dennis Kamper provided a presentation on the Engineering Review of Water Sources for the Grand Prairie Demonstration Project.

Bill Bush reported that he did not find it physically or economically feasible to artificially recharge aquifers using shafts or injections.

Jim Bodron advised that operation and maintenance on farm features would be a requirement of the project and that the local sponsor must commit to this. The individual landowner will in turn be required to verify that maintenance will be done.

Chairman Young stressed that the Corps of Engineers has advised him that federal support for the on-farm features is contingent upon importing a portion of the water demand from a surface source.

Discussion followed concerning modifications to the Corps plan and time restraints.

There being no further business, the meeting was adjourned at noon.

**The next meeting of the Oversight Committee is scheduled for August 29th at 1:00 PM and will be held at the office of the Arkansas Soil and Water Conservation Commission.**

DRAFT
Oversight Committee Minutes
1:00 PM - August 29, 2000

Conference Room
Arkansas Soil and Water Conservation Commission

Members: J. Randy Young, Chairman; Bill Bush, Nancy Delamar, Tommy Hillman, Lester McKinley for Jerry Bogard, Allan Mueller, Robert Hankins, Tommy Hillman, Dennis Kamper, John Terry, and Kalven Trice.

Guests/Staff: Jim Bodron, Dennis Carmen, Tracy James, Jim Lloyd, Jon Sweeney, Earl Smith and Laura Brown.

Chairman Young welcomed all in attendance then called the meeting to order. The agenda was reviewed and no changes were found necessary.

Chairman Young advised that he was to meet with the Governor at 2:00 PM and Mr. Jon Sweeney would preside over the meeting in his absence.

Dennis Kamper made a motion to approve the minutes of the August 17, 2000 meeting with one change (delete "or NRCS" page 2). Allan Mueller seconded the motion. The motion carried.

Chairman Young advised that David Carruth an attorney from Clarendon accepted an invitation to membership and the Charter signature page was changed to reflect the addition of his name.

The charter was discussed and circulated for signatures. Chairman Young will contact Alan Perkins and Sherrel Johnson.

Chairman Young announced the formation of an Advisory Committee for the Grand Prairie Area Demonstration Project to provide additional input, the ten-person committee will meet on September 1, 2000 to make recommendations about a process and procedure on setting priorities of on-farm plans.

Kalven Trice distributed an illustration of Grand Prairie Irrigation Project, Farm Plan Map. He stated each cell represented a farm. Approximately 10 farm plans have been completed of the estimated 1000 plans needed for the project.

Tracy James, Hydraulic Engineer with the Corps of Engineers presented an Engineering Review of Alternate Water Sources. The Arkansas River, White River or a combination are the sources being considered.

Oversight Committee Minutes
1:00 PM - November 13, 2000

Conference Room
Arkansas Soil and Water Conservation Commission

Members: J. Randy Young, Chairman; Jerry Bogard, William V. Bush, Gary Canada, David Carruth, Cathy Slater for Nancy Delamar, Robert Hankins, Tommy Hillman, Dennis Kamper, John Terry, and David Weeks for Kalven Trice.

Guests/Staff: Jim Bodron, Tracy James, Joseph Krystofik, Earl Smith and Laura Brown.

Chairman Young welcomed all in attendance then called the meeting to order.

Tommy Hillman made a motion to approve the September 25 minutes and Bill Bush seconded the motion. The motion carried and the minutes were approved as mailed.

Jim Bodron and Tracy James presented an update of the Engineering Review by the Corps of Engineers, (Attachment.) Mr. Bodron advised that operation and maintenance costs were not included at this time.

*Discussion was held pertaining to conjunctive use of waters and instream verses minimum flow waters.*

Chairman Young advised that the committee needed to make a recommendation to the Task Force on the Engineering Review Report. In turn, the Task Force needed to meet in order to comment on the Engineering Review Report to the Corps of Engineers.

Dennis Kamper advised that a draft Engineering Review would be available December 8, 2000 and will be distributed to members for review.

Chairman Young stated that the Governor released four million dollars to the escrow account for the Grand Prairie Project.

**The next meeting of the Oversight Committee was scheduled for Tuesday, December 19 at 1:00 PM and will be held in the Arkansas Soil and Water Conservation Commission Room.**

There being no further business, the meeting was adjourned.

J. Randy Young
ASWCC
Oversight Subcommittee Chairman
101 East Capitol, Suite 350
Little Rock, AR 72201

DRAFT
Oversight Committee Minutes
1:00 PM - December 19, 2000

Conference Room
Arkansas Soil and Water Conservation Commission

Members: J. Randy Young, Chairman; William V. Bush, Gary Canada, David Carruth, Nancy Delamar, Robert Hankins, Tommy Hillman, Alan Perkins, Allan Mueller, Sherrel Johnson, Dennis Kamper, John Terry, and Kalven Trice.

Guests/Staff: Dotson Collins, Jim Bodron, Dennis Carmen, Tracy James, Joseph Krystofik, Cathy Slater, Robert Tisdale, Craig Uyeda, David Weeks, Ken Brazil, Earl Smith and Laura Brown.

**Call to Order**
Chairman Young welcomed all in attendance then called the meeting to order. The agenda was presented and reviewed, no changes were made. He advised that the Task Force would meet and review the Committee's report on January 5.

**Minutes - November 13, 2000**
Bill Bush made a motion to approve the November 13 minutes with the addition "Discussion was held on instream verses minimum flow, and conjunctive use of water." Allan Mueller seconded the motion. The motion carried and the minutes were approved (corrected minutes attached.)

**Presentation of Engineering Review Draft Report**
Dennis Kamper advised that the Engineering Review Draft Report was mailed to the committee members directly following the November 13 meeting.

Dennis Kamper reviewed the conclusions, recommendations and options found on pages 50-52 of the draft report.

1 No change to the authorized project. This option provides for construction of the project as developed over the last few years.

2. Perform a general reevaluation of the project - illuminating the White River source, noting the Arkansas River reliability and aquifer protection benefits and costs from delays to the Grand Prairie and Bayou Meto projects.

3. Constructing the Grand Prairie Project as authorized - with the addition of seasonal supplementation.

4. Construct the Grand Prairie as authorized. Monitor the White River to determine impact of the project. Add seasonal supplementation as impact is identified.

**Recommendation to Task Force**

Bill Bush made a motion that the Oversight Committee report to the Task Force that it has reviewed The Corps of Engineers Engineering Review of the water sources for the Grand Prairie Demonstration Project and recommends that the Task Force support the Corps efforts to proceed with the authorized construction of the Grand Prairie Area Demonstration Project and the reevaluation of the Bayou Meto Project and that the Corps consider comments and concerns raised by committee members that are outlined in the record. Gary Canada seconded the motion.

Discussion followed pertaining to a comprehensive study of the White River.

Mr. Bush advised that the issues, comments and recommendations raised by the Oversight Subcommittee will be presented in a report to the Task Force. The Task Force is to meet January 5 and develop a recommendation for the Governor.

Randy Young requested the committee members provide their comments in written form.

The motion carried with one opposing vote by David Carruth.

Allan Mueller made a motion to recommend to the Governor that the state support financially the White River Basin study and Alan Perkins seconded the motion. The motion carried.

Randy Young is to prepare a press release to include members concerns such as the impacts to the White River ecological system.

There being no further business, the Oversight Subcommittee was adjourned.

# United States Department of the Interior

FISH AND WILDLIFE SERVICE
1500 Museum Road, Suite 105
Conway, Arkansas 72032
Tel.: 501/513-4470 Fax: 501/513-4480

IN REPLY REFER TO:

January 2, 2001

Mr. J. Randy Young, Executive Director
Arkansas Soil and Water Conservation Commission
101 E. Capitol Ave., Suite 350
Little Rock, AR 72201

Dear Mr. Young:

I am providing you with written Fish and Wildlife Service (Service) concerns regarding the Grand Prairie Area Demonstration Project (GPADP) and engineering review of water sources draft report, which was discussed at the meeting of the Oversight Subcommittee, December 19, 2000. It is our understanding at the meeting that committee members' concerns would be provided to the Corps of Engineers and also included in the subcommittee's report to the Governor's Task Force with the recommendation that they be passed on to the Governor.

The concerns we would like included in the report are:

The Service believes that other alternatives besides seasonal supplementation should be evaluated if impacts to the White River ecosystem are greater than anticipated. Page 52 of the draft report includes a recommendation by Colonel Krueger, District Engineer, that states, "If project monitoring indicates the need, feasibility level studies should be undertaken to add seasonal supplementation from the Arkansas River as a post authorization change to improve project reliability... " This sentence could be reworded to state: "If project monitoring indicates the need, feasibility level studies should be undertaken to evaluate other alternatives, including seasonal supplementation from the Arkansas River as a post authorization change to improve project reliability, to reduce impacts to the White River ecosystem."

2 The Service supports monitoring the effects of the irrigation project on the White River ecosystem. The details of the monitoring plan including design, criteria, and reporting method are key issues that need to be addressed as soon as possible. We are pleased that feasibility studies are recommended if monitoring shows impacts to the White River ecosystem are greater than anticipated; however, we continue to be concerned about what level of impacts beyond those cited in the General Reevaluation Report will trigger initiation of feasibility level studies and what criteria will be used to implement remedial actions. It is probably not possible to set criteria that will trigger the feasibility studies at this time, but we should be working toward identifying and coming to agreement on how we will address this situation if it should arise.

3 The Grand Prairie Area Demonstration Project and the engineering review are both based on the premise that the solution to the problem is in obtaining sufficient quantities of water to maintain our current level and type of land use. Solutions to the problem of aquifer depletion should include consideration of issues that go beyond the concept of locating and tapping other sources to get enough water to maintain the status quo. These solutions should pose questions such as, what is the appropriate use of the land considering the finite resources available; and, how do we equitably meet the demands for this resource by other water users in the basin while still maintaining the natural systems that are dependent upon this water?

4. The GPADP is but one of several irrigation projects in the White River basin identified in the Eastern Arkansas Comprehensive study. Additionally, withdrawal of water for agricultural irrigation is but one of many demands being placed upon the resource. Because there is growing demand for this finite resource, effects on the White River ecosystem have not yet been measured. Impacts from the many water development projects are cumulative; consequently, it is essential that a comprehensive study of the White River basin be conducted. Congress has provided initial funding for this study, and the Corps is currently in the initial stages of developing a study plan and locating potential local sponsors. It is incumbent upon this committee to support the comprehensive study and ask the Governor's Task Force to recommend that the Governor support and participate in the comprehensive study.

Thank you for the opportunity to participate in this endeavor and provide comments.

Sincerely,

Allan J. Mueller
Field Supervisor

cc: Mr. Larry Mallard, White River NWR, DeWitt, AR
Mr. Dennis Widner, Cache River NWR, Augusta, AR
Dr. Scott Yaich, Arkansas Game and Fish Commission, Little Rock, AR
Mr. Craig Uyeda, Arkansas Game and Fish Commission, Little Rock, AR
Mr. Tom Foti, Arkansas Natural Heritage Commission, Little Rock, AR
Ms. Barbara Keeler, USEPA, Region VI, Dallas, TX

**Response to U.S. Fish and Wildlife Service Comments**
**On the Grand Prairie Area Engineering Review Report**

Comment 1: The Service believes that other alternatives besides seasonal supplementation should be evaluated if impacts to the White River ecosystem are greater than anticipated. Page 52 of the draft report includes a recommendation by Colonel Krueger, District Engineer, that states, "If project monitoring indicates the need, feasibility level studies should be undertaken to add seasonal supplementation from the Arkansas River as a post authorization change to improve project reliability..." This sentence could be reworded to state: "If project monitoring indicates the need, feasibility level studies should be undertaken to evaluate other alternatives, including seasonal supplementation from the Arkansas River as a post authorization change to improve project reliability, to reduce impacts to the White River ecosystem."

Response 1: Any additional studies to address impacts would examine alternatives to address the needs and opportunities and would be done in compliance with NEPA. The wording has been changed to reflect your concerns.

Comment 2: The Service supports monitoring the effects of the irrigation project on the White River ecosystem. The details of the monitoring plan including design, criteria, and reporting methods are key issues that need to be addressed as soon as possible. We are pleased that feasibility studies are recommended if monitoring shows impacts to the White River ecosystem are greater than anticipated; however, we continue to be concerned about what level of impacts beyond those cited in the General Reevaluation Report will trigger initiation of feasibility level studies and what criteria will be used to implement remedial actions. It is probably not possible to set criteria that will trigger the feasibility studies at this time, but we should be working toward identifying and coming to agreement on how we will address this situation if it should arise.

Response 2: The Monitoring Plan Development Team, which has already been established, will prepare the monitoring plan. This plan will include criteria to judge the effectiveness of the project and project impacts and will then be periodically evaluated to determine if the impacts on the White River ecosystem are greater than those cited in the General Reevaluation Report. If project monitoring indicates the need, studies should be undertaken to determine the most efficient and effective methods to address unforeseen impacts.

Comment 3: The Grand Prairie Area Demonstration Project and the engineering review are both based on the premise that the solution to the problem is in obtaining sufficient quantities of water to maintain our current level and type of land use. Solutions to the problem of aquifer depletion should include consideration of the issues that go beyond the concept of locating and tapping other sources to get enough water to maintain the status quo. These solutions should pose questions such as, what is the appropriate use of the land considering the finite resources available; and, how do we equitably meet the demands for this resource by other water users in the basin while still maintaining the natural systems that are dependent upon this water?

Response 3: The amount of land removed from irrigated agricultural production to reduce the demand to a sustainable level without an import system is extremely high. To protect the aquifers even with the maximum economic application of conservation measures, over 178,000 of the area's current 241,000 acres of irrigated cropland could no longer be irrigated. This 73% reduction in irrigated cropland would be a large loss to the national economy and would devastate the regional economy because of the loss of continued production and processing by agribusiness. This would not be attainable without the extensive use of condemnation, and would result in a significant adverse impact on the human and socio-economic environment.

Features of the Additional Environmental Features Study, scheduled for completion of the draft report in March 2001, addresses the unmet water needs through ecosystem restoration of natural habitats in the project area. This provided the opportunity to reduce the demands and restore the unique prairie/savanna/slash habitats. Any necessary land acquisition would be from willing sellers. Other major features being examined in detail include moist soil units with dedicated storage filled from the delivery system to provide habitat for waterfowl, and prairie and bottom land hardwood buffer strips. The Corps will continue to work with interested agencies and groups during completion of this effort and identification of potential cost sharing sponsors.

Comment 4: The GPADP is but one of several irrigation projects in the White River basin identified in the Eastern Arkansas Comprehensive study. Additionally, withdrawal of water for agricultural irrigation is but one of many demands being placed upon the resource. Because there is growing demand for this finite resource, effects on the White River ecosystem have not yet been measured. Impacts from the many water development projects are cumulative; consequently, it is essential that a comprehensive study of the White River basin be conducted. Congress has provided initial funding for this study, and the Corps is currently is in the initial stages of developing a study plan and locating potential local sponsors. It is incumbent upon this committee to support the comprehensive study and ask the Governor's Task Force to recommend that the Governor support and participate in the comprehensive study.

Response 4: The U.S. Army Corps of Engineers supports the White River Basin Comprehensive Study.