ADAIR COUNTY RURAL WATER DISTRICT NO. 5
WATER SUPPLY ALTERNATIVES
CONCEPT DESIGN

PLANNING ASSISTANCE TO STATES PROGRAM

Prepared For
Adair County Rural Water District No. 5
Adair County, Oklahoma

Through
The Oklahoma Water Resources Board

By

U.S. Army Corps of Engineers
Tulsa District
1645 S. 101st E. Ave.
Tulsa, OK 74128

June 2003

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ALTERNATIVE SOURCES FUTURE DEMAND

INTRODUCTION

The U.S. Army Corps of Engineers (COE), Tulsa District conducted this study for the Oklahoma Water Resources Board (OWRB) and Adair County Rural Water District No. 5 (RWD5) under the authority of Section 22 of the Water Resources Development Act of 1974. The study explores alternatives for supplying water to the expanding population served by RWD5. Recent and expected changes to the area and population served by RWD5 require new water sources. The ultimate goal is to provide a dependable, high quality water supply for the 21st century for communities and individuals served by RWD5.

Elements of the study include gathering existing water system information, evaluating existing facilities, projecting future needs, formulating alternatives, and developing conceptual designs and cost estimates, including an estimate of real estate costs. The study also includes an analysis of potential environmental and cultural resources issues.

STUDY AUTHORITY

The COE, Tulsa District conducted the study for RWD5 acting through the Oklahoma Water Resources Board under authority of Section 22 of the Water Resources Development Act of 1974 (Public Law 93-251), also known as the Planning Assistance to States Program. This authority establishes cooperative assistance to states for preparation of comprehensive water plans.

Section 319 of the Water Resources Development Act of 1990 (Public Law 101-640) provides authority for cost sharing of the Planning Assistance to States Program. The cost-sharing ration for this study is 50% Federal and 50% non-Federal. A Letter Agreement between

the COE, Tulsa District and the OWRB for this study was signed on July 17, 2001. Supplements to the original agreement were signed on June 28, 2002,and January 2, 2003. The Letter Agreement and supplements are included as Appendix 1.

PURPOSE

This study was conducted to find potential sources of water to meet the projected water demand for 2050. Conceptual level design and cost data were developed for three alternatives. RWD5 will use this information to determine how to meet the future needs of their customers.

PROJECT LOCATION AND DESCRIPTION

The study area is located in eastern Oklahoma in Adair County and part of Cherokee County. The existing treatment plant is on the Baron Fork River, a tributary to the Illinois River. The Baron Fork watershed is located in northeast Oklahoma and northwest Arkansas. The basin is approximately 26 miles long and 10 miles wide. The river originates in the southeast part of Washington County, Arkansas, and flows generally west through Adair County, Oklahoma, toward the Illinois River. The study area is shown in Figure 1.

ADAIR COUNTY WATER DISTRICT 5
WATER SUPPLY STUDY

FIGURE 1

STUDY MAP

WATER NEEDS ASSESSMENT

SOURCES

Currently, RWD5 collects and treats a maximum of 200 gallons per minute (gpm) of water from the Baron Fork River. The treated water is then distributed to users. According to the 2001 Water Use Report that RWD5 submitted to the OWRB, the district serves a population of approximately 1,000. There are 396 residential connections, 6 commercial connections, and 4 fire department connections. Environmental concerns about minimum flows in the Baron Fork River have made expanding the current system a problem. The alternatives developed for this report are constrained by a 35 cubic feet per second (cfs) minimum flow requirement for the Baron Fork River. This minimum flow requirement is required to maintain the aquatic habitat in the river.

Other potential sources of water for RWD5 include purchase of water from the Tenkiller Utilities Authority and pumping water from the Illinois River. The Illinois River is classified as an Oklahoma Scenic River for the 70-mile reach upstream of its confluence with the Baron Fork. Any water supply intake would be located downstream of the confluence to avoid any impact on the reach classified as an Oklahoma Scenic River.

WATER QUALITY

Historically, water quality in the Baron Fork River has been characterized by low water temperature; exceptional water clarity; and relatively low concentrations of nutrients, pesticides, and other contaminants. Exceptional historical water quality and aesthetic value have resulted in the classification of a 35-mile section of the Baron Fork upstream of its confluence with the Illinois River as an Oklahoma Scenic River and outstanding resource water in Oklahoma's Water Quality Standards. However, water quality degradation has been noted in the Baron Fork River in recent years. Water quality impairment caused by pesticides, nutrients, siltation, and organic matter/dissolved oxygen problems have been reported in Oklahoma's 2003 integrated list of waters. Potential sources for these problems may include non-irrigated agriculture, animal

management/holding facilities, construction activities, range and pasture, silviculture, riparian zone removal, and stream bank erosion.

WATER USE PROJECTIONS

To determine treatment plant and conveyance line sizing of the system proposed in this study, accurate average daily use data are essential. Water use projections are typically developed based on the Oklahoma Comprehensive Water Plan. However, the Water Plan is currently under revision. Future use data for this report were based on population projections developed by the Oklahoma Department of Commerce using 2000 census data and input from the OWRB. Population projections for RWD5 also reflect future expansion of the area served as projected by RWD5 staff. The current water usage was taken from RWD5's 2001 OWRB Water Use Report and the peak daily use as found in Rural Water Systems in Oklahoma, published in 1998 by the OWRB. Future requirements were developed by multiplying current water usage by the projected percent change in population (see Table 1). The base year service population is 1,000. Alternatives were developed to provide the maximum projected water need for the year 2050.

TABLE 1

WATER USE PROJECTIONS
(Million Gallons Per Day [MGD])

Percent Change in RWD5 Service Population	Year	Average Daily Use (MGD)	Peak Daily Use (MGD)	Average Annual Use (Acre-Feet)
Base Year	2002	0.164	0.210	19.514
100	2005	0.328	0.420	39.029
13.1	2010	0.371	0.475	44.145
11.6	2020	0.414	0.530	49.262
2.1	2030	0.423	0.541	50.333
2.0	2040	0.431	0.552	51.285
4.0	2050	0.448	0.574	53.308

PLAN FORMULATION

OBJECTIVES AND CONSTRAINTS

The Oklahoma Water Resources Board, Adair County Rural Water District No. 5, and the U.S. Army Corps of Engineers, Tulsa District established planning objectives and constraints for the study.

The planning objective for this study is to develop at least three alternatives that would supply the projected water needs for RWD5 through 2050.

The planning constraints are:

1. Pumping from the Baron Fork is not allowed when flows are less than 35 cfs, and pumping cannot reduce the flows to below 35 cfs. Flows below 35 cfs would have a negative impact on the aquatic habitat in the river. There are no other restrictions on pumping from the Baron Fork.

2. No dams will be allowed on any tributary of the Baron Fork, since that would reduce flows on the Baron Fork.

3. Water cannot be pumped from the Illinois River upstream of the confluence with the Baron Fork because that reach is designated as an Oklahoma Scenic River.

The study team along with RWD5 and the OWRB agreed that three alternatives be studied. A general description of those three alternatives is provided below. More design information and plan drawings for each alternative are provided in Appendix 2.

ALTERNATIVES

Alternative 1. This alternative involves connecting the existing facility, by pipeline, to the Tenkiller Utilities Authority proposed water system at a location south of the city of Tahlequah. This line would be designed to supply 400 gpm of potable water. The existing system could remain in use to reduce the amount purchased from the Tenkiller Utilities Authority. The existing collection and treatment facilities would not need expansion.

Alternative 2. This alternative will connect, by pipeline, the existing facility with the Illinois River at a location downstream of the confluence with the Baron Fork. This alternative will provide raw water to the existing facility at a maximum rate of 400 gpm. The existing treatment facility will need upgrading to process an additional 200 gpm.

Alternative 3. This alternative will collect water from the Baron Fork River and store it in a detention site. The water from the detention site will be used to supply raw water to the existing site when collection on the Baron Fork is prohibited. This will require that the existing treatment be upgraded from 200 gpm to 400 gpm.

PRELIMINARY DESIGNS

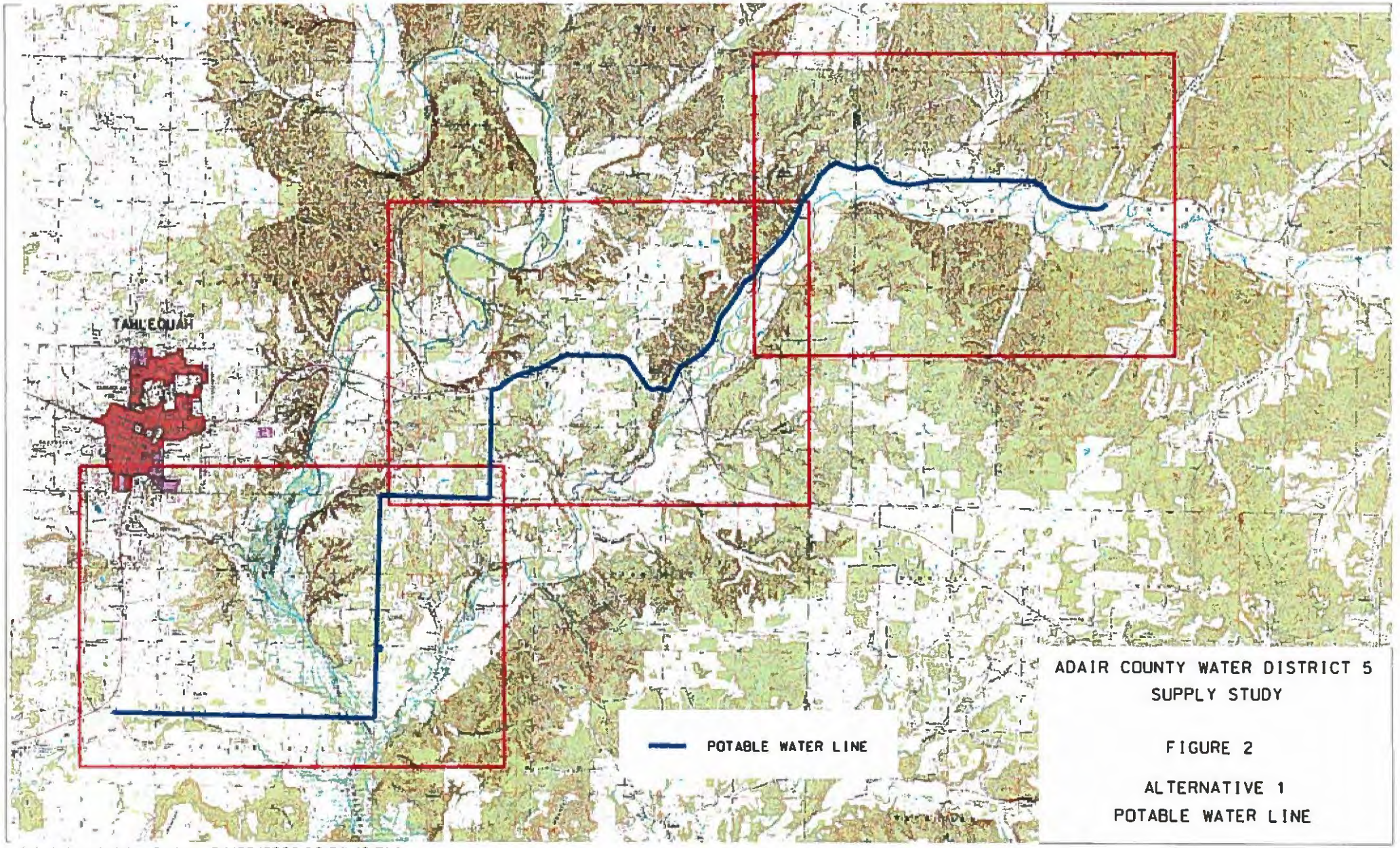
DESIGN CONSIDERATIONS

Conceptual level designs were developed for each alternative. The designs included sizing and locating treatment plants, detention areas, booster pump stations, and conveyance lines. The hydraulic analysis for sizing the piping was performed using the KYPIPE computer program developed by the University of Kentucky. Piping was sized based on the 24-hour average flow required to meet the projected peak daily demand in 2050. Appendices 2, 3, and 4 contain more detailed information on the conceptual design, hydrologic and hydraulic analyses, and cost estimates.

Alternative 1. This alternative includes a potable water pipeline extending from a point of connection to the Tenkiller Utilities Authority proposed water system to an existing water main owned by RWD5. Information on the Tenkiller Utilities Authority proposed water system was obtained from the Tenkiller Wholesale Water Treatment and Conveyance System Study prepared by the U.S. Army Corps of Engineers in January 2001. The pipeline is sized for a peak water usage rate of 574,000 gallons per day in 2050.

The pipeline routing was chosen to take maximum advantage of existing easements located along county and state roadways. The pipeline routing is shown on Figure 2. The total pipeline length is approximately 20.5 miles.

The pipeline will require a booster pump station. The booster pump station will include a primary pump and a backup pump. The booster pumps will be capable of filling the existing water storage tank.



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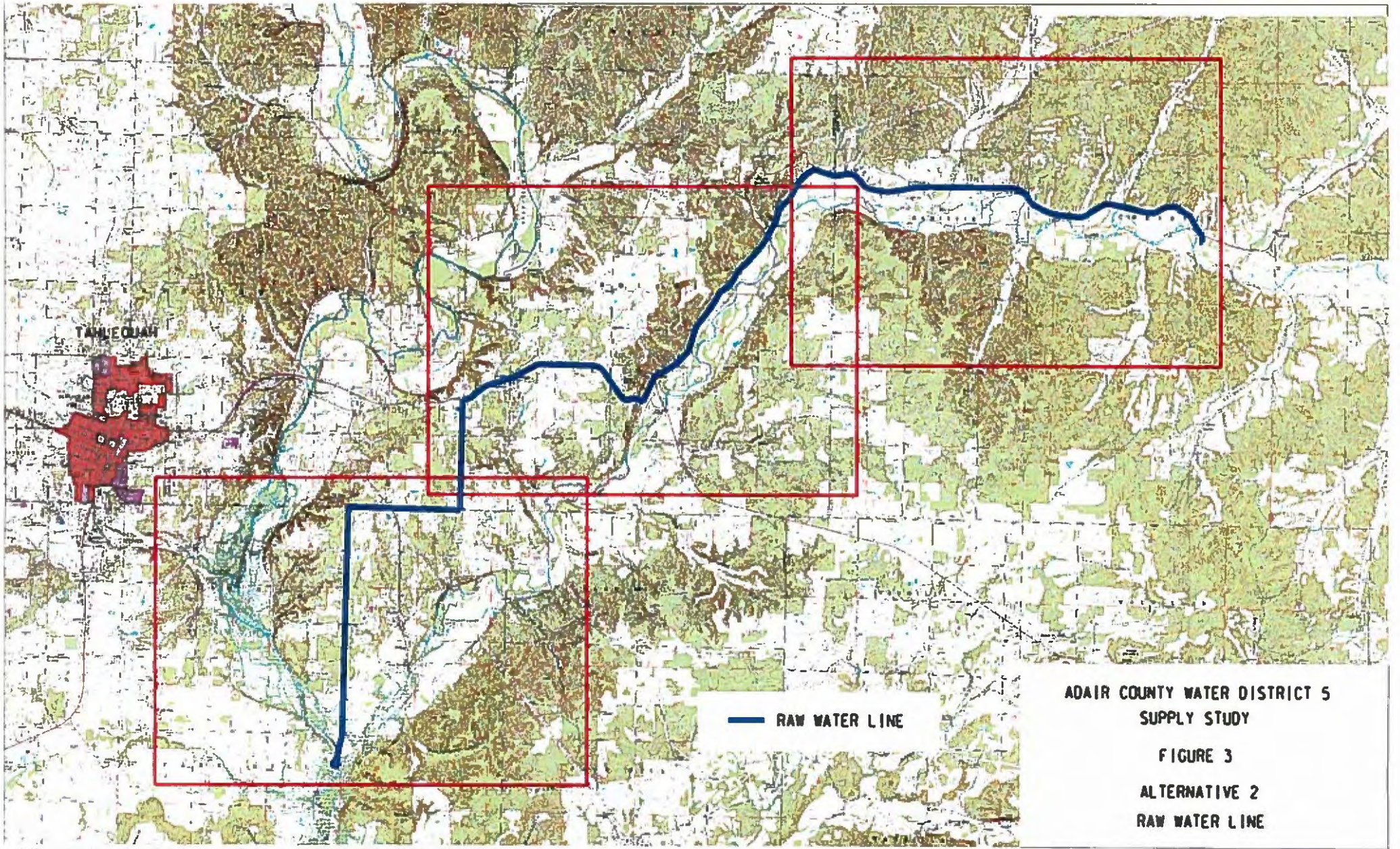
Alternative 2. This alternative includes a raw water pipeline extending from a water collection point located on the Illinois River, downstream of the mouth of the Baron Fork, to the existing treatment plant owned by RWD5. The pipeline is sized for a peak water usage rate of 574,000 gallons per day in 2050.

The pipeline routing was chosen to take maximum advantage of existing easements located along county and state roadways. The pipeline routing is shown on Figure 3. The total pipeline length is approximately 19.4 miles. The pipeline will require a water intake pump station. The pump station will include a primary pump and a backup pump.

Alternative 3. This alternative includes a retention pond located near the existing RWD5 treatment plant. The retention pond is sized to provide all the water supply for the district for 204 days during a period from July to January. The 204-day interval was chosen from historical data, which indicated that 204 days is the longest period of consecutive days in which the flows in the Baron Fork did not exceed 35 cfs. The projected average daily water requirement for 2050 during January to July is 308 acre-feet for 204 days. Adding 20 acre-feet for evaporation comes to a total of 328 acre-feet for the pond capacity. The pond area shown in Figure 4 is based on an average pond depth of 10 feet. The pond has been located outside the 100-year floodplain.

The pond will be filled by a new water intake station located upstream of the current water intake station. At the sponsor's request, the intake will be located in an area of the Baron Fork with a deep pool. The intake pumps were sized based on two pumps operating 24-hours per day for 90 days. Historical data indicate that there would be at least 90 days to fill the pond in the driest year. The intake pump station will include two primary pumps and one backup pump. A gravity pipeline will connect the pond to the current intake pump station where it will be pumped to the treatment facility.



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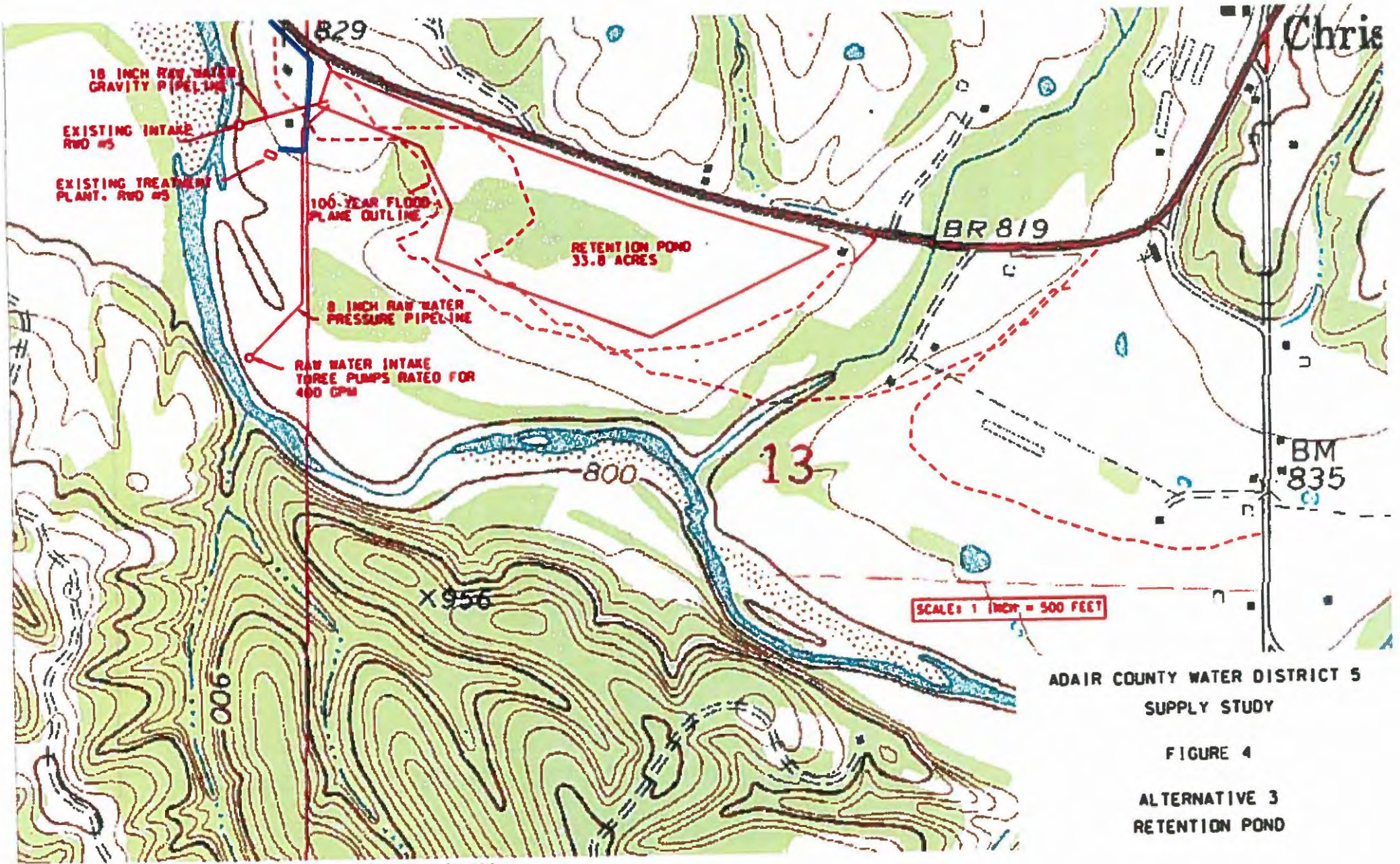

ADAIR COUNTY WATER DISTRICT 5

SUPPLY STUDY

FIGURE 4

ALTERNATIVE 3

RETENTION POND

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HYDROLOGIC AND HYDRAULIC ANALYSES

The Baron Fork River is a left bank tributary to the Illinois River. The Baron Fork watershed is located in northeast Oklahoma and northwest Arkansas. The river originates in the southeast part of Washington County in northwest Arkansas and flows generally west through Adair County, Oklahoma, toward the Illinois River. The basin is about 26 miles long and 10 miles wide. The upper portions of the basin are comprised mainly of deciduous forest and cropland. The lower portion of basin is generally undeveloped mixed forest. The average streambed slope of the Baron Fork River is about 26 feet per mile. Basin topography is very hilly with forest cover and river valley floodplains. The area has an average yearly precipitation of about 37 inches. The study consists of analyzing existing flow data along the Baron Fork River to support water supply for Adair County RWD5. Minimum flow requirements for the river were included in the analysis.

Water supply availability at the existing intake structure was assessed based on pumping restrictions required to support minimum flow levels. This study considered threshold flow values of 20, 35, 50, and 80 cfs. The period of record discharges were evaluated to determine how often RWD5 would not be able to extract water. The results of this analysis are shown in Table 2. The 50 years of data were queried to determine how many times the flow in the river was less than or equal to the threshold flow for 10 or more consecutive days. Then the longest period was used to determine how much water storage would be needed to supply projected water requirements without pumping from the river.

TABLE 2

OCCURRENCES BELOW THRESHOLD FLOW

Threshold Flow (Mean daily in cfs)	* Number of Occurrences	Longest Occurrence (Consecutive days below threshold flow in days)
20	54	167
35	100	204
50	117	220
80	149	294

* Discharge values that were less than or equal to the mean daily flow occurring consecutively equal to or greater than 10 times.

The needed water storage is shown in Table 3. The storage is based on the July to January average daily use projected for 2050, which corresponds to the projected low flow period for the river.

TABLE 3

REQUIRED WATER SUPPLY STORAGE
PROJECTED 2050 USAGE JULY TO JANUARY PERIOD

Threshold Flow (cfs)	Consecutive Days	Avg Daily Use (ac-ft)	Consecutive Storage (ac-ft)	Evap Loss (ac-ft)	Required Storage (ac-ft)	Peak Daily Use (ac-ft)	Consecutive Storage (ac-ft)	Evap Loss (ac-ft)	Required Storage (ac-ft)
20	167	1.509	252	20	272	1.8	294	20	314
35	204	1.509	308	20	328	1.8	359	20	379
50	220	1.509	332	20	352	1.8	388	20	408
80	294	1.509	444	20	464	1.8	518	20	538

COST ESTIMATE

Table 4 is a summary of the cost estimates prepared for each alternative, showing the main items of work. The estimates have a 20% contingency imbedded in the cost of each work item. The costs are December 2002 price levels. The treatment plant cost is based on the price provided by RWD5 personnel for the price paid for the current plant. This cost was updated from 1996 price levels to 2002 price levels.

It is important to note that the cost of purchasing water from the Tenkiller Utilities Authority water system is not included in the cost shown for alternative 1. The additional cost for potable water should be considered when evaluating the alternatives. The Tenkiller Wholesale Water Treatment and Conveyance System Study that was referenced earlier developed wholesale costs for three alternatives. Those costs ranged from $1.10 per 1,000 gallons to $1.70 per 1,000 gallons of water.

TABLE 4

PROJECT COST
(DECEMBER 2002 PRICE LEVELS)

	Alternative 1	Alternative 2	Alternative 3
Lands and Rights-of-Way	$ 153,400	$ 117,900	$ 111,500
8-inch Pipeline and Booster Pump	$2,182,000	$2,084,000	$ 90,000
Pumps and Sump	N/A	$ 54,000	$ 47,000
Treatment Plant	N/A	$1,083,000	$1,083,000
Detention Site	N/A	N/A	$1,630,000
Potable Water Cost	Unknown	N/A	N/A
Engineering & Construction Management (15%)	$ 350,310	$ 500,835	$ 444,225
Total	$2,685,710	$3,839,735	$3,405,725

REAL ESTATE

The purpose of this reconnaissance level evaluation study is to estimate the market value and acquisition costs of the real estate interest that would be required to implement each of the alternatives developed for this study. The estimated value for the real estate interests and damages is based upon an assumption that county road rights-of-way will provide adequate spacing and will always be available and used. In addition, it is assumed that all private lands would be acquired by negotiation or condemnation at some fair market related value. The normal practice for many rural water districts is to receive donated land in consideration of the net benefit of system access to the landowner. The real estate costs are for lands needed for the primary distribution system and pump stations. No secondary system elements were evaluated. The fieldwork for the land values was completed December 18, 2002. Contingencies represent the risks of condemnation and negotiation. The real estate cost summary is shown in Table 5.

TABLE 5

SUMMARY OF REAL ESTATE COSTS

	Alternative 1	Alternative 2	Alternative 3
Lands & Damages	$ 9,400	$ 9,900	$ 63,500
Relocation Assistance	$ 0	$ 0	$ 0
Minerals	$ 0	$ 0	$ 0
Contingencies	$ 24,000	$ 18,000	$ 8,000
Administrative	$120,000	$ 90,000	$ 40,000
Total:	$153,400	$117,900	$111,500

The estate for the pipeline would be a standard perpetual right-of-way easement. A fee estate with mineral subordination would be recommended for the lake (Alternative 3). A fee estate would be appropriate for the pump stations. No navigation servitude is located in the subject study area.

ESTIMATED NUMBER OF OWNERSHIPS

Alternative 1: For this alternative, 10 private ownerships, 2 county ownerships, and 1 Federal ownership would need to be acquired.

Alternative 2: For this alternative, 8 private ownerships, 1 county ownership, and 1 Federal ownership would need to be acquired.

Alternative 3: Four private ownerships are involved in this alternative.

ENVIRONMENTAL CONSIDERATIONS

Existing environmental conditions were determined from investigations to identify potential environmental concerns or issues, such as endangered species, cultural resources, wetlands, and water quality. The scope of this investigation does not include documentation consistent with the National Environmental Policy Act of 1969, but does identify potentially

significant environmental issues that would need to be addressed prior to any construction. More detail can be found in Appendix 5.

ENVIRONMENTAL SETTING

The proposed project area lies within the Ozark Highlands of the Eastern Broadleaf Forest Province (Bailey 1980). Most of the area is rolling, but some of the area is nearly flat. The majority of this dissected limestone plateau is forested; oak-hickory is the predominant type, but stands of oak and pine are also common. Less than one-fourth of this region has been cleared for pasture and cropland. Average annual precipitation is about 37 inches per year and falls mainly during the growing season (April-October). The average annual temperature is 40° to 65° Fahrenheit.

Land use is varied consisting of developed, recreational, residential, agricultural, and pasturelands, all of which are heavily influenced by recreational activities associated with the scenic Illinois and Baron Fork rivers and Tenkiller Ferry Lake.

ENDANGERED SPECIES

A number of Federally-listed threatened and/or endangered species are present in the project area. There is no designated critical habitat for listed species in Cherokee County. Federally-listed threatened bald eagles, endangered American burying beetles, endangered Ozark big-eared bat, endangered Gray bat, threatened Ozark cavefish, and endangered piping plover may be found in the study area. Several other species of concern are found within the area and include the Eastern small-footed bat, Southeastern bat, Southeastern big-eared bat, Ozark cave crayfish, Bowman's cave amphipod, Ozark cave amphipod, Bat cave isopod, and Ozark chinquapin. They are not afforded protection under the Endangered Species Act at this time, but should be considered in any planning activities.

CULTURAL RESOURCES

Archaeological sites representative of the Early Archaic Period through the Middle and Late Archaic, Woodland, Caddoan, and Historic Periods are known in the larger vicinity of the Baron Fork and Illinois rivers and in Adair County. There are hundreds of archaeological sites and historic standing structures in the larger Adair-Cherokee County project area vicinity that are on record with the Oklahoma State Historic Preservation Office (SHPO) and the Oklahoma Archeological Survey (OAS).

Any of the three proposed Adair County Rural Water District No. 5 alternatives has the potential to impact cultural resources. Sections 106 and 110 of the National Historic Preservation Act (NHPA) of 1966 (as amended) require agencies to evaluate the impacts of Federal undertakings on historic properties, which include prehistoric and historic archaeological sites and historic standing structures. Section 106 requires the identification of all historic properties, which emphasizes an evaluation of eligibility for listing on the National Register of Historic Places (NRHP). Agencies must then determine which historic properties (those eligible for listing on the NRHP) will be adversely impacted. Sections 106 and 110 require that agencies resolve adverse effects to these properties. Plans for resolving adverse effects will be determined through consultation with the Oklahoma SHPO, the OAS, potentially the Advisory Council on Historic Preservation (ACHP), and appropriate and interested Native American tribes and other interested parties.

Prior to construction, archaeological reconnaissance investigations, to include archival research, will be necessary to identify archaeological sites and standing structures that exist within the proposed project area. Each site and structure will require National Register evaluation; some will require sub-surface evaluation, detailed archival research, or architectural documentation. Sites that are eligible for listing on the NRHP and structures that will be adversely impacted by the undertaking will require mitigation, which will be determined through formal consultation with the SHPO and the OAS, and potentially the ACHP.

WATER QUALITY

The Baron Fork River is an Ozark-type stream and a tributary to the Illinois River and ultimately flows into Tenkiller Lake, Oklahoma. Historically, water quality has been characterized by low water temperature, exceptional water clarity, and relatively low concentrations of nutrients, pesticides, and other contaminants. Exceptional historical water quality and aesthetic value have resulted in classification of a 35-mile section of the Baron Fork upstream of its confluence with the Illinois River as an Oklahoma Scenic River and outstanding resource water in Oklahoma's Water Quality Standards (http://www.okcc.state.ok.us/Water Quality Web/WP113.pdf).

Water quality degradation has been noted in the Baron Fork River in recent years. As a result of these problems, the Baron Fork River is on the 2003 State of Oklahoma integrated list of waters. Input from the Baron Fork have also been identified as contributing to unacceptably high nutrient loading to the Illinois River and Tenkiller Lake, Oklahoma.

WETLANDS

Wetlands and deepwater habitats are essential for many species of fish and wildlife. In addition to providing habitat for fish and wildlife, they also perform important roles and function in controlling floods and pollution abatement. The USFWS developed and adopted a classification system to be used for classifying wetlands and conducted a national inventory of wetland habitats (National Wetland Inventory Maps [NWI]). The three alternatives were evaluated for the presence of wetlands based on the NWI maps. Numerous wetland types were found to be present in the delineated project area. The majority of wetlands appear to be small farm ponds or impoundments. All the proposed water facilities and the retention pond should be carefully evaluated to avoid wetland habitats and adverse impacts associated with construction in wetlands. More detailed evaluation can be found in Appendix 5.

SECTION 404, CLEAN WATER ACT

Construction and placement of water pipelines and related water facilities would be subject to Section 404 of the Clean Water Act permitting activities. The construction of an intake structure should fall within the scope of a Nationwide permit or a General permit, and the placement of water pipelines should fall within the scope of Nationwide Permit No. 12, Utility Line Discharges. Prior to construction, a Section 404 (Clean Water Act) determination should be requested from the U.S. Army Corps of Engineers, Tulsa District (Regulatory Branch) to assure compliance with Federal law.

NATIONAL FORESTS AND OTHER PUBLIC USE AREAS

The proposed project area is not located within any national forests, national parks, or national monuments. However, a public review and comment period just closed on an environmental assessment, land protection plan, and conceptual management plan prepared by the U.S. Fish and Wildlife Service (USFWS) for a proposed expansion of the Ozark Plateau National Wildlife Refuge. The USFWS proposes to expand the refuge to include units in Cherokee, Craig, Mayes, and Sequoyah counties. The proposed waterline project appears to fall within a primary focus area on the Baron Fork River where there are known cave concentrations or where caves are more apt to be found. The proposed project is definitely located within the proposed refuge expansion secondary focus area where geological formations indicate caves are likely to occur, and there is potential for future cave discoveries. A map and more detailed information are available in Appendix 5.

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

Should Federal funds be expended for construction of any part of the proposed alternatives and/or should the proposed facilities be constructed on Federal property, appropriate NEPA documentation and coordination would be required. Documentation required by NEPA would consist of either an Environmental Assessment and signed Finding of No Significant Impact or an Environmental Impact Statement and signed Record of Decision. Public

involvement is an important component to the NEPA process. It requires full disclosure of project purpose(s), design, alternatives, and environmental impacts. The public should be given an opportunity to comment on the proposed action early in the planning process through a "Scoping Process", which includes public meetings or workshops. If warranted, an additional public meeting(s) could be required at the time the NEPA documentation is released for public review and comments. The public should be given at least 2 weeks' notice prior to all public meetings or workshops, which should be held at a time of convenience to the public (Monday-Friday). Notification should be made by purchasing an advertisement in local newspapers and through the use of public service announcements on local radio and television stations. Since the project is regional in scope, several community newspapers should be used for notification purposes.

CONCLUSIONS

Conceptual designs and cost estimates were presented for a water supply system for Adair County Rural Water Supply District No. 5. Three alternatives were considered. Treatment plant capacities, conveyance line sizes, pump station and booster station capacities, estimated construction costs, and expected real estate costs were determined for each alternative. The initial cost estimate for Alternative 1 (excluding cost to buy water) is $2.69 million. The initial cost estimate for Alternative 2 is $3.84 million. The initial cost estimate for Alternative 3 is $3.41 million. All three alternatives will meet RWD5 projected needs for 2050. In comparing alternative 1 with the other alternatives, the OWRB and RWD5 should consult with the Tenkiller Utilities Authority for a cost of potable water.

A cursory examination of possible environments concerns was performed for this report. Consultation with the U.S. Fish and Wildlife Service may be required regarding the presence of endangered species in the project area. Archaeological reconnaissance investigations, to include archival research, will be necessary to identify archaeological sites in the project area. Appendix 5 provides more detail on the recommended actions needed to avoid possible environmental impacts.

APPENDIX 1

LETTER AGREEMENTS

PLANNING ASSISTANCE TO STATES
SUPPLEMENTAL AGREEMENT NO. 2

Adair County RWD 5 Water Supply Alternatives Study,
Adair County, Oklahoma

THIS SUPPLEMENTAL AGREEMENT, for convenience of reference dated as of this 2nd day of January, 2003, by and between the United States of America (hereinafter called the "Government"), represented by the Contracting Officer executing this Agreement, and the Oklahoma Water Resources Board (hereinafter called the "Sponsor"),

WITNESSETH, that

WHEREAS, on the 17th day July 2001, the Government and the Sponsor entered into PLANNING ASSISTANCE TO STATES LETTER AGREEMENT (Hereinafter referred to as LETTER AGREEMENT), for the Adair County RWD 5 Water Supply Alternatives Study, Adair County, Oklahoma; and,

WHEREAS, on the 28th day of June 2002, the Government and the Sponsor entered into Supplemental Agreement No. 1 which extended the LETTER AGREEMENT through June 30, 2003; and,

WHEREAS, Paragraph 2 of the LETTER AGREEMENT specifies that: "...total study cost is **$117,000 (One Hundred Seventeen Thousand Dollars)**...The Sponsor shall provide funds in the amount of **$58,500 (Fifty-eight Thousand Five Hundred Dollars)**..."; and,

WHEREAS, Appendix A, Scope of Studies, did not include supplemental supply from the Tenkiller Utility Authority as an alternative; and,

WHEREAS, the Sponsor will approve the additional scope modifications and the increase in cost

NOW THEREFORE, Paragraph 2 of the said LETTER AGREEMENT is hereby amended to read "...total study cost is **$129,000 (One hundred Twenty Nine Thousand Dollars)**...The Sponsor shall provide funds in the amount of **$64,500 (Sixty Four Thousand Five Hundred Dollars)**...";

ADDITIONALLY, all other provisions of the LETTER AGREEMENT are likewise renewed and incorporated by reference herein.

ADDITIONALLY, the attached APPENDIX A AMENDED SCOPE OF STUDY and attached APPENDIX B AMENDED TIME AND COST ESTIMATE is incorporated in this SUPPLEMENTAL AGREEMENT NO. 2 AND THE LETTER AGREEMENT. Any future changes to the Amended Scope of Study and Amended Time and Cost estimate must be by a supplemental agreement to the Planning Assistance to States LETTER AGREEMENT.

THIS supplemental agreement shall become effective following the signatures of both parties.

IN WITNESS WHEREOF, the parties hereto have executed the supplemental agreement as of the day and year first above written.

Oklahoma Water Resources Board

By: Grady Grandstaff
Grady Grandstaff,
Chairman

Date: 12-10-2002

Tulsa District, U.S. Army
Corps of Engineers

By: Robert L. Suthard, Jr.
Robert L. Suthard, Jr.
Colonel, U.S. Army
District Commander

Date: [illegible]

Attest:

Ervin Mitchell
Ervin Mitchell, Secretary

Date: 12-10-2002

(Seal)

APPENDIX A

AMENDED SCOPE OF STUDY
PLANNING ASSISTANCE TO STATES

ADAIR COUNTY RWD 5 WATER SUPPLY ALTERNATIVES STUDY
ADAIR COUNTY, OKLAHOMA.

1. GENERAL. The Corps will conduct the Adair County RWD 5 Water Supply Alternatives Study under authority given in Section 22 of the 1974 Water Resources Development Act, Planning Assistance to States program. The Sponsor will use the information to examine alternatives for water supply for Adair County RWD 5.

2. WORK TO BE PERFORMED.

a. DEVELOP ALTERNATIVES. Three alternatives will be developed with the input of the Sponsor that address the present and future water supply needs of Adair County RWD 5. Alternatives may include off-stream storage, supplemental supply, or new reservoir. The Corps will also include using supplemental supply from the Tenkiller Utility Authority as an alternative. The Corps will include pumping water from Illinois River at the confluence with the Baron Fork. Tasks necessary to develop the alternatives include:

(1) Gather information. Information pertaining to Adair County RWD 5 and other water providers in the vicinity will be gathered.

- Name and service area
- Location, capacity, and description of treatment facilities, raw water intakes, and storage facilities
- Cost of water, price to consumers (Note: The Tenkiller Utility Authority alternative will include only costs for pipeline equipment and land.)
- Quantity of water used

(2) Evaluate existing facilities. An evaluation of existing facilities serving consumers will be made that describes service deficiencies, physical condition and state-of-repair, quality of water delivered, and regulatory compliance.

(3) Project future water needs. Based on existing conditions and in coordination with the Sponsor, projections will be made of future water demand. Categories for users may be residential, municipal, industrial, and other but other categories may be developed as required during the conduct of the

study.

b. EVALUATE ALTERNATIVES.

(1) Hydrologic & hydraulic analyses. Hydrologic & Hydraulic (H&H) analyses will be performed on an as-needed basis depending on the alternatives chosen for study in conjunction with the Sponsor. Analyses may include:

(a) Low flow analysis. A low flow analysis of the Baron Fork Creek will be performed to determine amount of storage or additional water supply needed by Adair County RWD 5. This analysis will be based on ceasing diversions when the flow in the Baron Fork Creek drops below 35 cfs for more than five (5) consecutive days as measured at the U.S. Geological Survey's Eldon gauge.

(b) Reservoir yield analysis. Yields will be determined for any reservoir considered as an alternative in the study.

(2) Preliminary designs. The Corps will use available topographic mapping to provide preliminary designs for up to three alternatives. The Corps and the Sponsor will work together to select the alternatives. The designs will include site selection, location and sizing of all necessary facilities, storage sites, reservoirs, and equipment. Sizing will be based on providing supply for projected water needs and keeping a minimum flow of 35cfs in the Baron Fork Creek.

(3) Environmental studies.

(a) Endangered species coordination. The Corps will coordinate the study with the United States Fish and Wildlife Service and the Oklahoma Department of Wildlife Conservation to determine the impacts, if any, on any listed endangered species. If endangered species are found in the project area, the Corps will recommend that the Sponsor conduct a biological assessment and possibly formal consultation.

(b) NEPA and other environmental requirements. The Corps will discuss, in narrative format, National Environmental Policy Act (NEPA) and other environmental requirements that the Sponsor will need to address prior to development of detailed designs and construction. The Corps will also prepare discussion concerning the requirements for future coordination with Federal, State, and local agencies having legislative and administrative responsibilities for environmental protection.

(4) Real estate studies.

(a) Real estate activities necessary for the project consist of all tasks related to determining real estate requirements and identifying and providing real estate cost estimates.

(b) The Corps will conduct a gross appraisal of each alternative to estimate real estate costs and real estate purchase requirements such as fee simple or easement. The Corps will obtain maps of the study area that contain sufficient detail, to identify the types of land and improvements that the proposed project would affect. The Corps will research the local real estate market to gather data concerning recent sales of improved and unimproved properties comparable to the right-of-way required. The research will involve searching deed records and contacting local appraisers, brokers, attorneys, central appraisal district, and others knowledgeable of the local real estate market. The Corps will use the market information as a basis for the values of the various types of properties within the proposed project. Cost information will be incorporated into the MCACES cost estimate.

(c) After all field work is completed, the Corps will prepare narrative for a written report.

(5) Cost estimates. Cost estimates will be provided that include preliminary designs, real estate costs, and operations and maintenance costs. The Corps will use the Microcomputer-Aided Cost Estimating System (MCACES) Gold computer program for all study-related cost estimates.

(6) Project/study management.

(a) This work item will include all scheduling and organizing of the study; regular periodic meetings with technical elements to review progress; preparing budget documentation; monitoring and managing all funds being obligated and expended; preparing project-related correspondence; coordinating with Federal, State, and local agencies; and providing guidance and support as required to ensure that they have answered all questions and they have solved all study-related problems. The Corps will perform this task for the duration of the study.

(b) The Corps will manage the tasks associated with overall coordination of the various study work items including funds management and work item scheduling. The overall purpose of this work item is to ensure that the study will accomplish the goals established, maintain schedule and cost estimates, and address all items in the Scope of Study.

(7) Data processing. The Corps will use automatic data processing capability including micro-, mini-, and mainframe computers to manage various data and accounting requirements generated by the study. This is an existing resource that was previously acquired and is amortized through overhead charges.

(8) Report preparation.

(a) Report preparation will consist of preparing a draft report, duplicating and distributing the draft report, reviewing and editing the draft report to final form, and then duplicating and distributing the final report. The report will be direct, concise, and written in a style that is easy to understand and may include graphics, illustrations, and photographs. The report will also include the study findings and recommendations.

(b) The Corps will document the study results in report form. The Corps will base the report on all studies and investigations conducted and on published reports applicable to the study area. The Corps will prepare report originals on 8-1/2 inches by 11 inches plain white bond paper, one side only. Plates will be 8-1/2 inches by 11 inches or 11 inches high and folded to conform with the 8-1/2 inches width of the main document. The Corps will submit draft and final reports to the Sponsor in one and one-half spaced text. **Five copies** each of the draft and final report will be provided to the Sponsor. One compact disc with a printable version of the report, in PDF format, will be provided to the Sponsor.

3. DELIVERY AND SCHEDULE.

a. DRAFT DOCUMENT. The Corps will provide a draft copy of the report to the Sponsor. The report will include discussion concerning methodology, data sources, findings, and other appropriate data for review and approval. It will be one and one-half spaced, unbound, with all pages consecutively numbered. The report will identify all data sources and references.

b. FINAL DOCUMENT. Upon the Sponsor's approval and return of the edited draft to the Corps, the Corps will type the document in one and one-half spaced format, with corrections made as noted on the first draft. The Corps will furnish the final original document to the Sponsor, unbound, with pages numbered.

c. MEETINGS AND CONFERENCES. The Corps and the Sponsor will hold monthly meetings, either face-to-face or through telephone conference calls. The Corps or the Sponsor will request other meetings as needed for discussion of questions and problems relating to work.

d. SCHEDULE. The Corps will submit the above items according to the following schedule.

Item	Schedule
Draft Document	315 calendar days after the date of the signed agreement and receipt of Federal funds.
Sponsor Review	42 calendar days after submittal of the draft document.
Final Document	28 calendar days after receipt of Sponsor's comments on the draft document.

4. STUDY MANAGER. The Government manager for this contract will be Mr. Phillip A. Cline, Project Manager, Programs and Project Management Division, Tulsa District, Corps of Engineers. Questions or problems that may arise during the performance of the work specified in this Agreement should be discussed with Mr. Cline. The Sponsor should coordinate entry clearance with Mr. Cline before planning site or office visits. The Sponsor should appoint a project coordinator to serve as a single point of contact or liaison with the Corps of Engineers. The name of the individual so designated will be furnished in writing to the Corps. The project coordinator will be responsible for complete coordination of the work.

APPENDIX B

AMENDED TIME AND COST ESTIMATE
PLANNING ASSISTANCE TO STATES

ADAIR COUNTY RWD 5 WATER SUPPLY ALTERNATIVES STUDY
ADAIR COUNTY, OKLAHOMA

Study Item	Duration (Workdays)	Cost ($)
1. Gather Information	20	10,500
2. Evaluate Existing Facilities	20	5,000
3. Project Future Water Needs	20	6,500
4. Hydrologic & Hydraulic Analyses	80	21,000
5. Preliminary Designs	90	33,000
6. Environmental Studies		
a. Endangered Species Coordination	45	4,000
b. NEPA and Other Requirements	45	2,000
7. Real Estate Studies	45	15,000
8. Cost Estimates	10	5,000
9. Data Processing and Report Preparation	70	12,000
10. Project/Study Management	275	15,000
Total Study Cost		129,000

PLANNING ASSISTANCE TO STATES
SUPPLEMENTAL AGREEMENT NO. 1

Adair County RWD 5 Water Supply Alternatives Study
Adair County, Oklahoma

THIS SUPPLEMENTAL AGREEMENT, for convenience of reference dated as of this 1ST day of July 2002, by and between the United States of America (hereinafter called the "GOVERNMENT"), represented by the Contracting Officer executing this Agreement, and the Oklahoma Water Resources Board (hereinafter called the "Sponsor").

WITNESSETH:

WHEREAS, on the 17th day of July, 2001, the Government and the Sponsor entered into PLANNING ASSISTANCE TO STATES LETTER AGREEMENT (hereinafter referred to as LETTER AGREEMENT), for the Adair County RWD 5 Water Supply Alternatives Study, Adair County, Oklahoma; and

WHEREAS, the LETTER AGREEMENT contemplated that the time period to complete the study could be extended beyond the June 30, 2002, termination date; and

WHEREAS, the Government and the Sponsor desire to renew and extend the term of the LETTER AGREEMENT.

NOW THEREFORE, the LETTER AGREEMENT is hereby renewed and extended to be effective from July 1, 2002, through June 30, 2003, and all other provisions of the LETTER AGREEMENT are likewise renewed and incorporated by reference herein.

IN WITNESS WHEREOF, the parties hereto have executed this Supplemental Agreement No. 1 on the dates specified below.

Oklahoma Water Resources Board

By: _____
Grady Grandstaff,
Chairman

Date: June 11, 2002

Attest:

_____
Ervin Mitchell, Secretary

(Seal)

Tulsa District, U.S. Army
Corps of Engineers

By: _____
Robert L. Sutbard, Jr.
Colonel, U.S. Army
District Commander

Date: 28 June 2002

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LETTER AGREEMENT
PLANNING ASSISTANCE TO STATES

ADAIR COUNTY RWD 5 WATER SUPPLY ALTERNATIVES STUDY
ADAIR COUNTY, OKLAHOMA

THIS AGREEMENT, entered into this 17 day of July, 2001, by and between the United States of America (hereinafter called the "Government") represented by the District Engineer for the Tulsa District, U.S. Army Corps of Engineers, and the Oklahoma Water Resources Board (hereinafter called the "Sponsor").

WITNESSETH, THAT

WHEREAS, Section 22 of the Water Resources Development Act of 1974 (Public Law 93-251), as amended, authorizes the Secretary of the Army, acting through the Chief of Engineers, to assist the states in the preparation of comprehensive plans for the development, utilization and conservation of water and related land resources; and

WHEREAS, Section 319 of the Water Resources Development Act of 1990 (Public Law 101-640) authorizes the Secretary of the Army to collect from non-Federal entities fees for the purpose of recovering 50 percent of the cost of the program established by Section 22; and

WHEREAS, the Sponsor has reviewed the State's comprehensive water plans and identified the need for planning assistance as described in the Scope of Studies incorporated into this Agreement; and

WHEREAS, the Sponsor has the authority and capability to furnish the cooperation hereinafter set forth and is willing to participate in the study cost-sharing and financing in accordance with the terms of this Agreement;

NOW THEREFORE, the parties do mutually agree as follows:

1. The Government, using funds contributed by the Sponsor and appropriated by the Congress, shall expeditiously prosecute and complete the Adair County RWD 5 Water Supply Alternatives Study, Adair County, Oklahoma, currently estimated to be completed within a twelve (12) month study period (not to exceed 12 months), substantially in compliance with the Scope of Study attached as Appendix A and in conformity with applicable Federal laws and regulations and mutually acceptable standards of engineering practice.

2. The Government shall contribute in cash **50 percent** of the total study cost, and the Sponsor shall contribute in cash **50 percent** of the total study cost, which total study cost is **$117,000 (One Hundred Seventeen Thousand Dollars);** provided, that the Government shall not obligate any cash contribution toward Study costs, until such cash contribution has actually been made available to it by the Sponsor. The Sponsor agrees to provide funds in the amount of **$ 58,500 (Fifty-eight Thousand Five Hundred Dollars)**, which shall be made payable to the Finance and Accounting Officer, Tulsa District, 1645 South 101 East Avenue, Tulsa, Oklahoma 74128-4609.

3. No Federal funds may be used to meet the local Sponsor's share of study costs under this Agreement unless the expenditure of such funds is expressly authorized by statute as verified by the granting agency.

4. Before any Party to this Agreement may bring suit in any court concerning any issues relating to this Agreement, such party must first seek in good faith to resolve the issue through negotiation or other form of nonbinding alternative dispute resolution mutually acceptable to the Parties.

5. This Agreement shall terminate at the end of the Sponsor's fiscal year on June 30, 2002, or upon the completion of the Study, whichever occurs earlier; provided, that prior to such time and upon thirty (30) days written notice, either party may terminate or suspend this Agreement without penalty. It is further understood and agreed that if the Study is not completed by June 30, 2002, or cannot be completed within the total study cost of **$117,000 (One Hundred Seventeen Thousand Dollars)**, this Agreement may be renewed or amended by the mutual written agreement of the parties.

6. Within ninety days after termination of this Agreement, the Government shall prepare a final accounting of the study costs, which shall display (1) cash contributions by the Federal Government, (2) cash contributions by the Sponsor, and (3) disbursements by the Government of all funds. Subject to the availability of funds, within thirty days after the final accounting, the Government shall reimburse the Sponsor for non-Federal cash contributions that exceed the Sponsor's required share of the total study costs. Within thirty days after the final accounting, the Sponsor shall provide the Government any cash contributions required to meet the Sponsor's required share of the total study costs.

7. In the event that any (one or more) of the provisions of this Agreement is found to be invalid, illegal, or unenforceable by a court of competent jurisdiction, the validity of the remaining provisions shall not in any way be affected or impaired and shall continue in effect until the Agreement is completed.

8. This Agreement shall become effective upon the signature of both Parties.

FOR THE SPONSOR:

By: Grady Grandstaff
Grady Grandstaff, Chairman
Oklahoma Water Resources Board

Date: July 10, 2001

FOR THE GOVERNMENT:

By: _____
Colonel, U.S. Army
District Commander

Date: 17 Jul 01

Attest:

Ervin Mitchell
Ervin Mitchell, Secretary

(Seal)

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APPENDIX A

SCOPE OF STUDY
PLANNING ASSISTANCE TO STATES

ADAIR COUNTY RWD 5 WATER SUPPLY ALTERNATIVES STUDY
ADAIR COUNTY, OKLAHOMA

1. GENERAL. The Corps will conduct the Adair County RWD 5 Water Supply Alternatives Study under authority given in Section 22 of the 1974 Water Resources Development Act, Planning Assistance to States program. The Sponsor will use the information to examine alternatives for water supply for Adair County RWD 5.

2. WORK TO BE PERFORMED.

a. DEVELOP ALTERNATIVES. Three alternatives will be developed with the input of the Sponsor that address the present and future water supply needs of Adair County RWD 5. Alternatives may include off-stream storage, supplemental supply, or new reservoir. Tasks necessary to develop the alternatives include:

(1) Gather information. Information pertaining to Adair County RWD 5 and other water providers in the vicinity will be gathered.

- Name and service area
- Location, capacity, and description of treatment facilities, raw water intakes, and storage facilities
- Cost of water, price to consumers
- Quantity of water used

(2) Evaluate existing facilities. An evaluation of existing facilities serving consumers will be made that describes service deficiencies, physical condition and state-of-repair, quality of water delivered, and regulatory compliance.

(3) Project future water needs. Based on existing conditions and in coordination with the Sponsor, projections will be made of future water demand. Categories for users may be residential, municipal, industrial, and other but other categories may be developed as required during the conduct of the study.

b. EVALUATE ALTERNATIVES.

(1) Hydrologic & hydraulic analyses. Hydrologic & Hydraulic (H&H) analyses will be performed on an as-needed basis depending on the alternatives chosen for study in conjunction with the Sponsor. Analyses may include:

(a) Low flow analysis. A low flow analysis of the Barren Fork Creek will be performed to determine amount of storage or additional water supply needed by Adair County RWD 5;

(b) Reservoir yield analysis. Yields will be determined for any reservoir considered as an alternative in the study.

(2) Preliminary designs. The Corps will use available topographic mapping to provide preliminary designs for up to three alternatives. The Corps and the Sponsor will work together to select the alternatives. The designs will include site selection, location and sizing of all necessary facilities, storage sites, reservoirs, and equipment.

(3) Environmental studies.

(a) Endangered species coordination. The Corps will coordinate the study with the United States Fish and Wildlife Service and the Oklahoma Department of Wildlife Conservation to determine the impacts, if any, on any listed endangered species. If endangered species are found in the project area, the Corps will recommend that the Sponsor conduct a biological assessment and possibly formal consultation.

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(a) Real estate activities necessary for the project consist of all tasks related to determining real estate requirements and identifying and providing real estate cost estimates.

(b) The Corps will conduct a gross appraisal of each alternative to estimate real estate costs and real estate

purchase requirements such as fee simple or easement. The Corps will obtain maps of the study area that contain sufficient detail, to identify the types of land and improvements that the proposed project would affect. The Corps will research the local real estate market to gather data concerning recent sales of improved and unimproved properties comparable to the right-of-way required. The research will involve searching deed records and contacting local appraisers, brokers, attorneys, central appraisal district, and others knowledgeable of the local real estate market. The Corps will use the market information as a basis for the values of the various types of properties within the proposed project. Cost information will be incorporated into the MCACES cost estimate.

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APPENDIX B

TIME AND COST ESTIMATE
PLANNING ASSISTANCE TO STATES

ADAIR COUNTY RWD 5 WATER SUPPLY ALTERNATIVES STUDY
ADAIR COUNTY, OKLAHOMA

Study Item	Duration (Workdays)	Cost ($)
1. Gather Information	20	10,500
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3. Project Future Water Needs	20	6,500
4. Hydrologic & Hydraulic Analyses	80	16,000
5. Preliminary Designs	90	25,000
6. Environmental Studies		
a. Endangered Species Coordination	45	4,000
b. NEPA and Other Requirements	45	2,000
7. Real Estate Studies	45	15,000
8. Cost Estimates	10	5,000
9. Data Processing and Report Preparation	70	12,000
10. Project/Study Management	275	16,000
Total Study Cost		117,000

APPENDIX 2

CONCEPT DESIGN

TABLE OF CONTENTS

LIST OF DRAWINGS

ADAIR COUNTY RURAL WATER DISTRICT NO. 5
ALTERNATIVE SOURCES FUTURE DEMAND

GENERAL

Currently, Adair County Rural Water District No. 5 (RWD5) collects, treats, and distributes raw water, a maximum of 200 gallons per minute (gpm), from the Baron Fork River. This study was conducted to find additional sources to meet the projected demand of 400 gpm by the year 2050.

DESIGN CRITERIA

The Oklahoma Water Resources Board, Adair County Rural Water District No. 5, and the U.S. Army Corps of Engineers, Tulsa District established design criteria for the study as follows.

a. The existing plant can pump all the water it needs from the Baron Fork when flows exceed 35 cubic feet per second (cfs), and flows will not be reduced below 35 cfs by pumping.

b. There will be no other restrictions on Baron Fork flows.

c. No dams will be allowed on any tributary of the Baron Fork.

d. The Illinois River is not classified as a scenic river downstream of the confluence of the Baron Fork and the Illinois Rivers.

ALTERNATIVES

The group agreed on the following alternatives to be studied. A general description is shown below. More detailed design information and drawings for each alternative are provided further in this study.

a. Alternative 1. This alternative includes connecting the existing facility, by pipeline, to the Tenkiller Utilities Authority proposed water system at a location south of the city of Tahlequah. This line would be designed to supply 400 gpm of potable water. The existing system could remain in use to reduce the amount being furnished by the Tenkiller Utilities Authority proposed Water System. During times when collection is not possible, the full amount would be provided by the Tenkiller Utilities Authority; however, the existing collection and treatment facilities would not need expansion.

b. Alternative 2. This alternative will connect, by pipeline, the existing facility with the Illinois River at a location downstream of the mouth of the Baron Fork. This alternative will provide raw water to the existing facility at a maximum rate of 400 gpm. The existing treatment facility will need upgrading to process an additional 200 gpm.

c. Alternative 3. This alternative will collect water from the Baron Fork and store it in a detention site. The water will be used from the detention site to supply raw water to the existing site when collection on the Baron Fork is prohibited. This will require the existing treatment to be upgraded from 200 mgd to 400 mgd.

GENERAL CONVEYANCE DETAILS

The majority of the underground piping for this project will be PVC pipe conforming to AWWA C900 with a working pressure not less than 150 psi. Some areas will require PVC pipe conforming to AWWA C900 with a working pressure not less than 200 psi. Some areas will require ductile iron pipe conforming to AWWA C151 with a working pressure not less than 350 psi. Ductile iron pipe will be cement-mortar lined in accordance with AWWA C104 and encased with polyethylene in accordance with AWWA C105. A sacrificial anode cathodic protection system will be included for the ductile iron pipe.

PVC pipe was selected due to its lower cost. High pressures, up to 235 psi, will be necessary in some parts of the pipeline for Alternatives 1 and 2. Where pressures exceed 200 psi, ductile iron pipe will be used. The high pressure requirements are due to the length of the

pipelines. Maximum pressure in the pipelines could be reduced, but doing so would require more booster pumps. See computer outputs for pressures required at each node in the pipeline.

Piping has been sized by hydraulic analysis using the computer program KYPIPE developed by the University of Kentucky. Maps showing pipe numbers and node numbers are included at the end of this report. Computer printouts of the hydraulic analysis are also included. The piping is sized based on 24-hour operation of the treatment plant at a constant flow rate.

Other conveyance system components will include air/vacuum valves at pipeline high points and sectional control valves to assist in repairs and limit outages.

DESCRIPTION OF ALTERNATIVES

Following are descriptions of the alternatives. Plan drawings for each of the alternatives are included at the end of this appendix.

a. Alternative 1. This alternative includes a potable water pipeline extending from a point of connection to the Tenkiller Utilities Authority proposed water system to a point of connection to an existing 8-inch diameter water main owned by RWD5. The pressure in the Tenkiller Utilities Authority proposed water system at the point of connection is assumed to be 85 psi. This value was obtained from the January 2001 Tenkiller Wholesale Water Treatment and Conveyance System Study prepared by the U.S. Army Corps of Engineers. The pipeline is sized for a peak water usage rate of 574,000 gallons per day in the year 2050. This equates to 400 gpm.

The pipeline routing was chosen to take maximum advantage of existing easements located along county and state roadways. The pipeline is shown on attached drawings. Total pipeline length is approximately 20.5 miles. The pipeline design requires 5,300 feet of 8-inch ductile iron; 40,300 feet of 8-inch PVC rated for 200 psi; and 62,900 feet of 8-inch PVC rated for 150 psi.

The pipeline will require a booster pump station located where indicated on the drawings. The booster pump station will include two pumps. One pump is a backup. Both pumps will be rated for 400 gpm at 175 psi. The booster pumps will be capable of filling the existing water storage tank with an overflow elevation of 1,040 feet.

b. Alternative 2. This alternative includes a raw water pipeline extending from a water collection point located on the Illinois River, downstream of the mouth of the Baron Fork, to the existing treatment plant owned by RWD5. The pipeline is sized for a peak water usage rate of 574,000 gallons per day in the year 2050. This equates to 400 gpm.

The pipeline routing was chosen to take maximum advantage of existing easements located along county and state roadways. The pipeline is shown on attached drawings. Total pipeline length is approximately 19.4 miles. The pipeline design requires 7,800 feet of 8-inch ductile iron and 94,700 feet of 8-inch PVC rated for 150 psi.

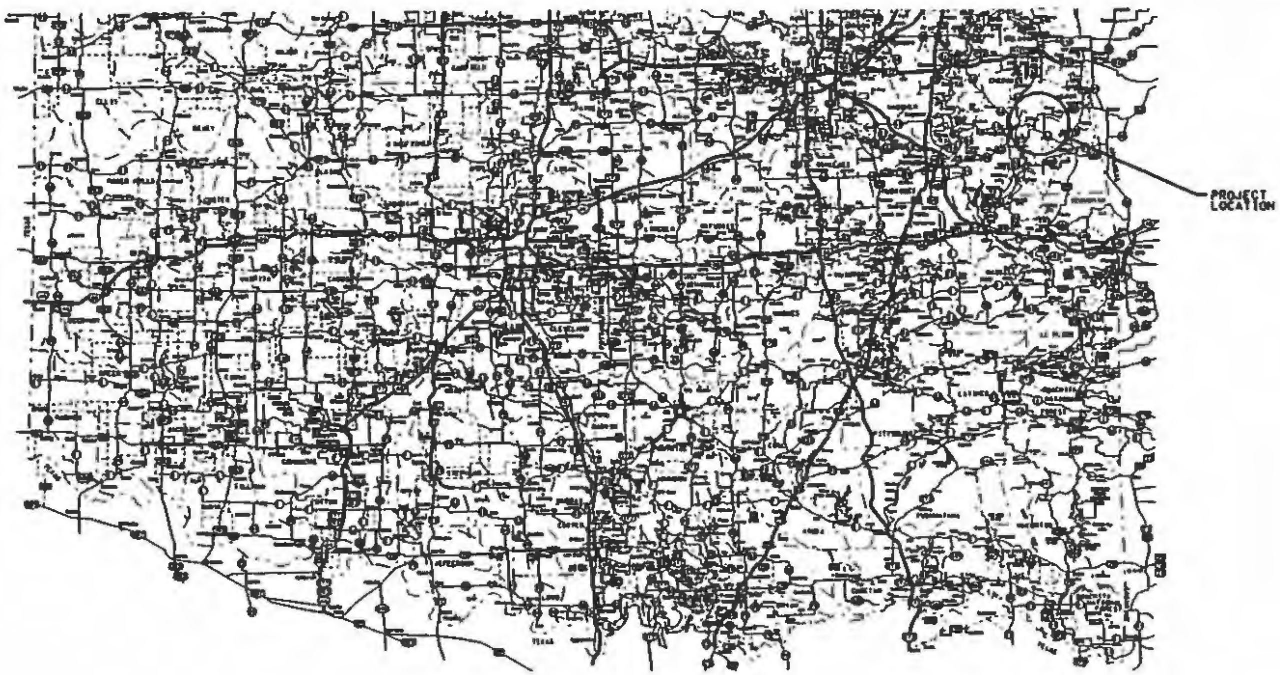
The pipeline will require a water intake pump station located where indicated on the drawings. The pump station will include two pumps. One pump is a backup. Both pumps will be rated for 400 gpm at 235 psi. The pressure at the treatment plant will be 40 psi.

c. Alternative 3. This alternative includes a retention pond located near the existing RWD5 treatment plant. The retention pond is sized to provide all the water supply for the district for 204 days during a period from July to January. The 204-day interval was chosen from historical data, which indicated that 204 days is the longest period of consecutive days in which the flows in the Baron Fork did not exceed 40 cfs since 1949. The average daily water consumption for the district in the year 2050 is projected to be 492,000 gallons per day during the July to January period. This equates to a total of 308 acre-feet for 204 days. Adding 20 acre-feet for evaporation comes to a total of 328 acre-feet for the pond capacity. The pond area shown on the drawing is based on an average pond depth of 10 feet. The pond has been located outside the 100-year floodplain.

The pond will be filled by a new water intake station located upstream of the current water intake station. At the request of the Lyle Collins, RWD5 manager, the intake will be located in an area of the Baron Fork with a deep pool. The intake pumps were sized based on a 90-day period to fill the pond. Historical data indicate that there would be at least 90 days to fill the pond in the driest year. With 90 days to fill the pond, the pumping capacity required is 825 gpm. This assumes that the pumps will run 24 hours per day. The intake pump station will include three pumps rated for 400 gpm. One of the pumps is a backup. The pipeline from the intake to the pond will be 1,550 feet of 8-inch PVC pipe rated for 150 psi. A gravity pipeline will connect the pond to the current intake pump station.

HYDRAULIC COMPUTER ANALYSIS

The hydraulic analysis for sizing the piping was performed with the KYPIPE computer program developed by the University of Kentucky. The figures on the following pages show the pipe and node numbers, node elevations, and pipe lengths. Computer input and output for alternatives 1 and 2 follow the figures. Piping was sized based on the 24-hour average flow required to meet the projected peak daily demand in the year 2050.



DRAWING NO.	SHEET TITLE
G1	ALTERNATIVE 1 LOCATION PLAN, POTABLE WATER LINE
H1	ALTERNATIVE 1 POTABLE WATER LINE
H2	ALTERNATIVE 1 POTABLE WATER LINE
H3	ALTERNATIVE 1 POTABLE WATER LINE
G2	ALTERNATIVE 2 LOCATION PLAN, RAW WATER LINE
[illegible]	ALTERNATIVE 2 RAW WATER LINE
[illegible]	ALTERNATIVE 2 RAW WATER LINE
[illegible]	ALTERNATIVE 2 RAW WATER LINE
G3	ALTERNATIVE 3 RETENTION POND

SYMBOL	DESCRIPTION	DATE	APPR.

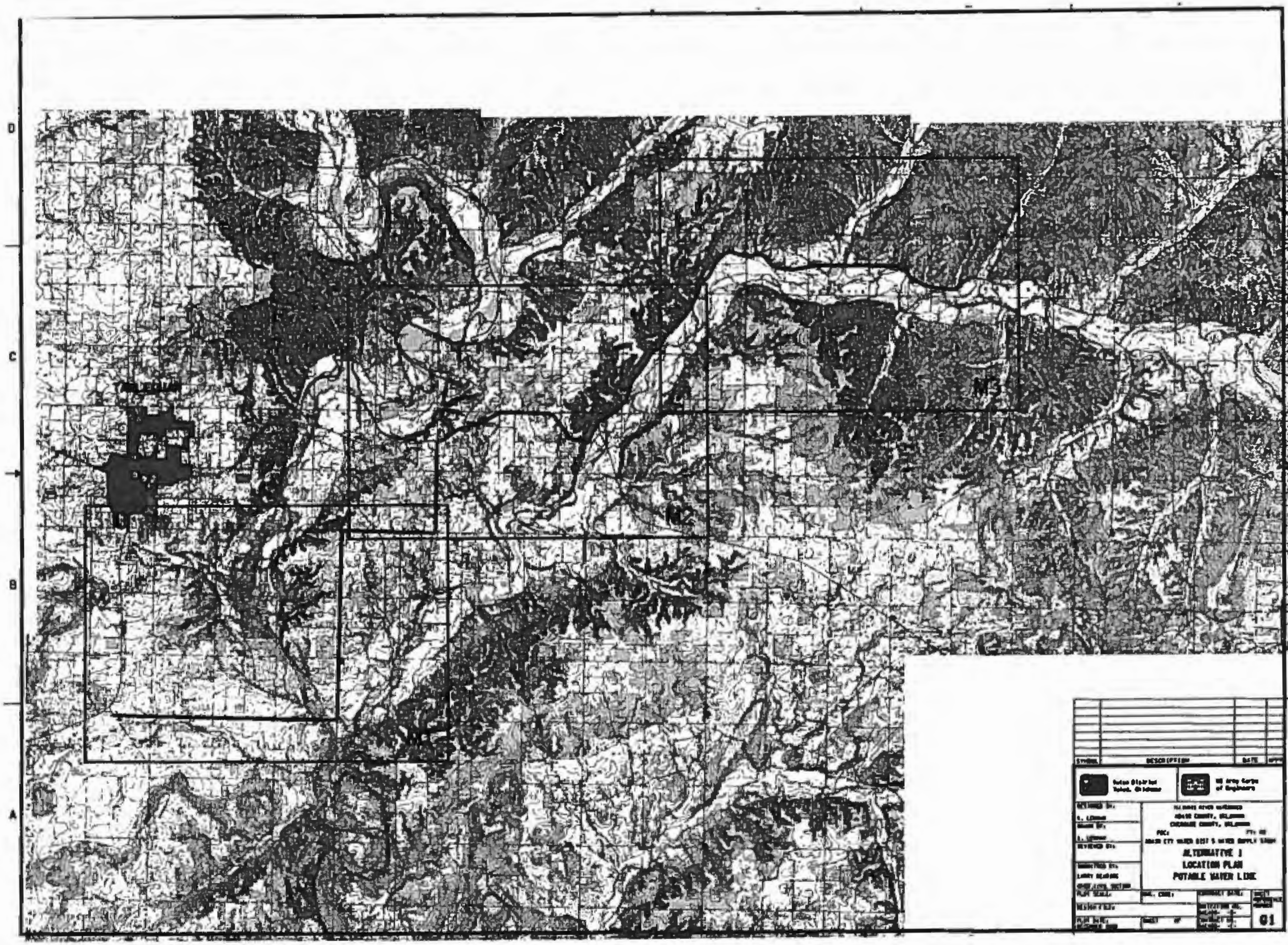
Tulsa District, Tulsa, Oklahoma

US Army Corps of Engineers

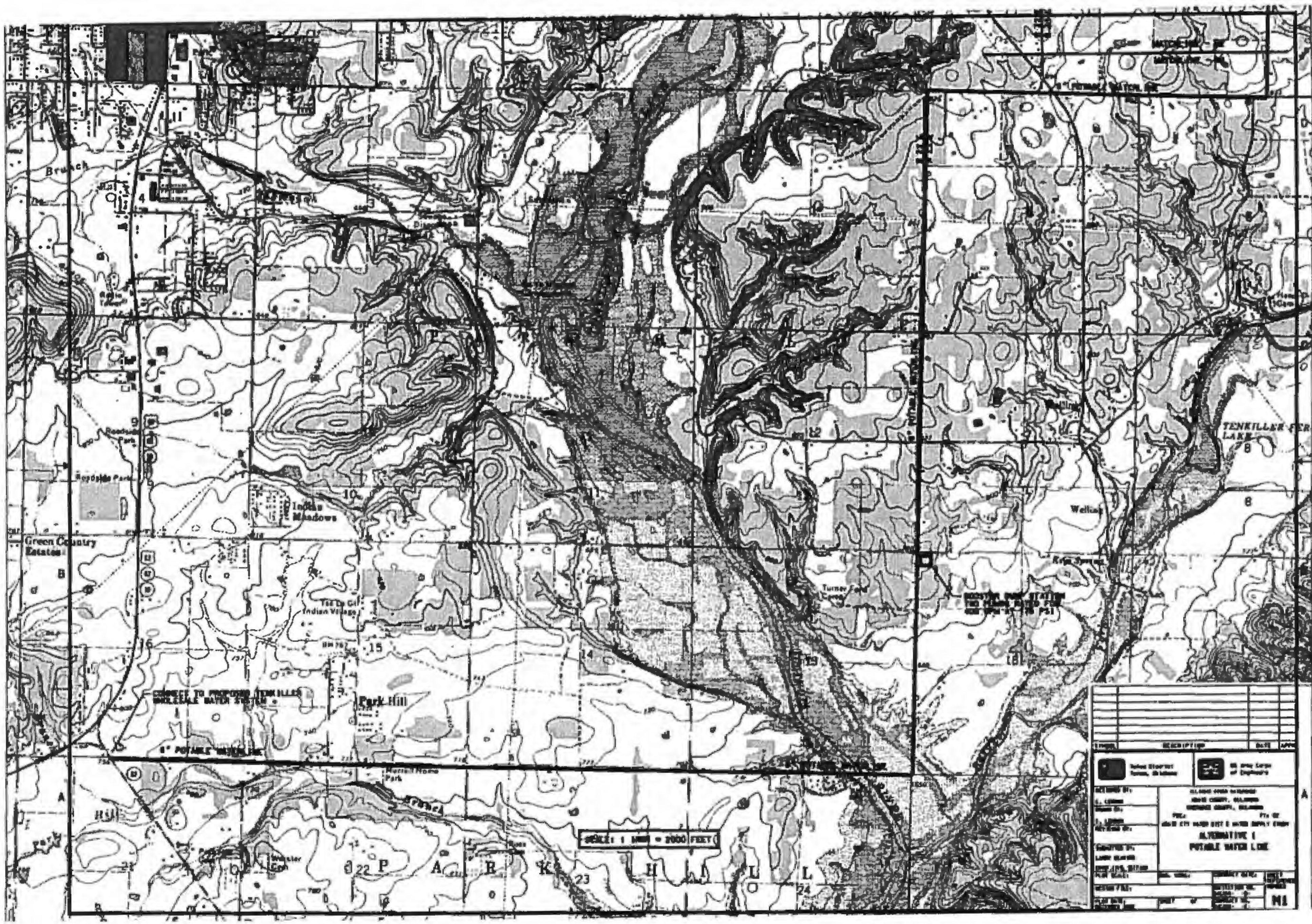
ADAIR COUNTY, OKLAHOMA
CHEROKEE COUNTY, OKLAHOMA

SITE LOCATION AND INDEX

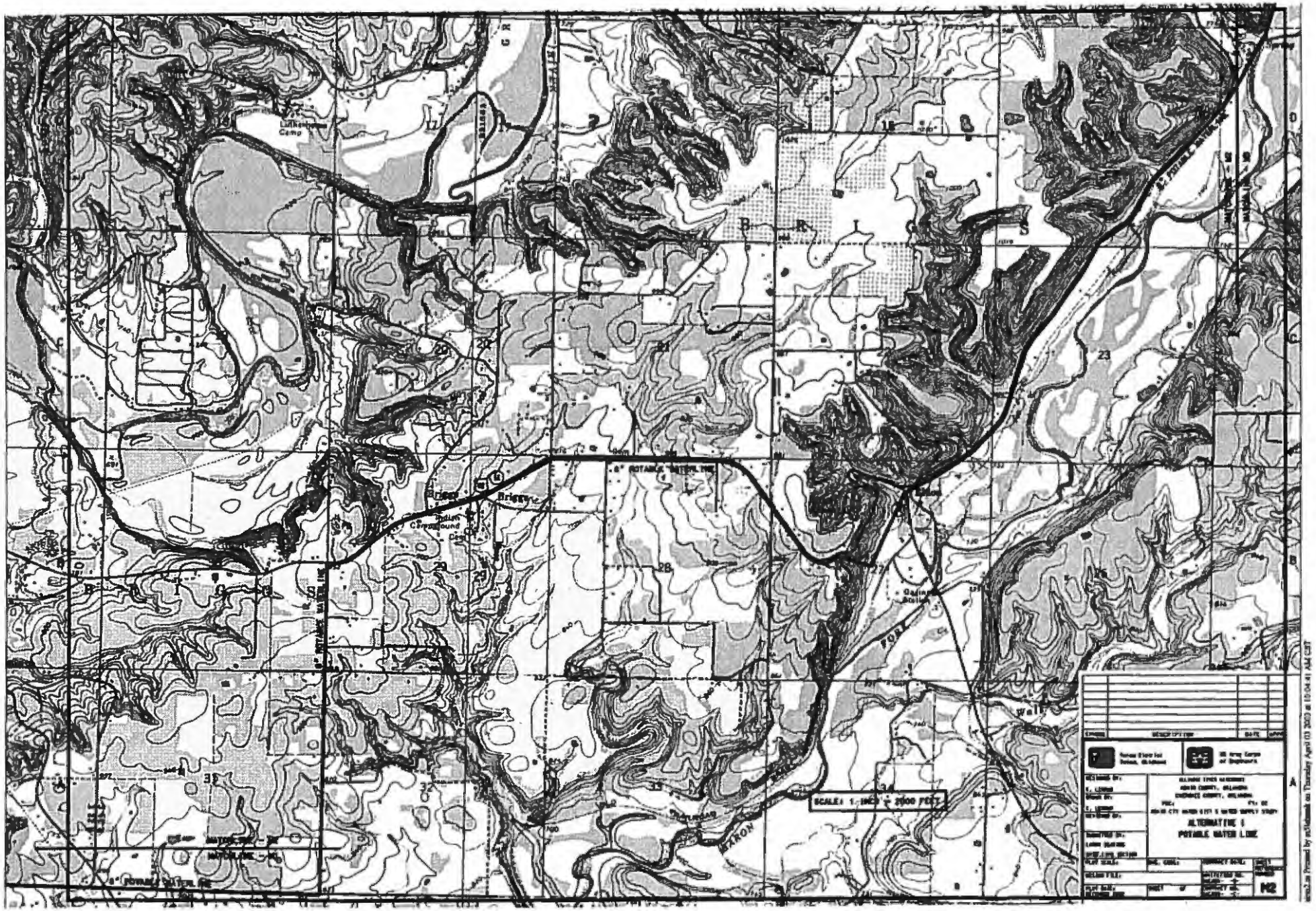
GO



A
B
C
D
M2
M3
DESCRIPTION
DATE
ALTERNATIVE 1
LOCATION PLAN
POTABLE WATER LINE
01



TENKILLER FERRY LAKE
Welling
Green Country Estates
Indian Meadows
Park Hill
Tsa La Gi Indian Village
Turner Ford
BOOSTER PUMP STATION
CONNECT TO PROPOSED TENKILLER WHOLESALE WATER SYSTEM
6" POTABLE WATER LINE
SCALE: 1 MM = 2000 FEET
P A R K H I L L
ALTERNATIVE 1
POTABLE WATER LINE
M1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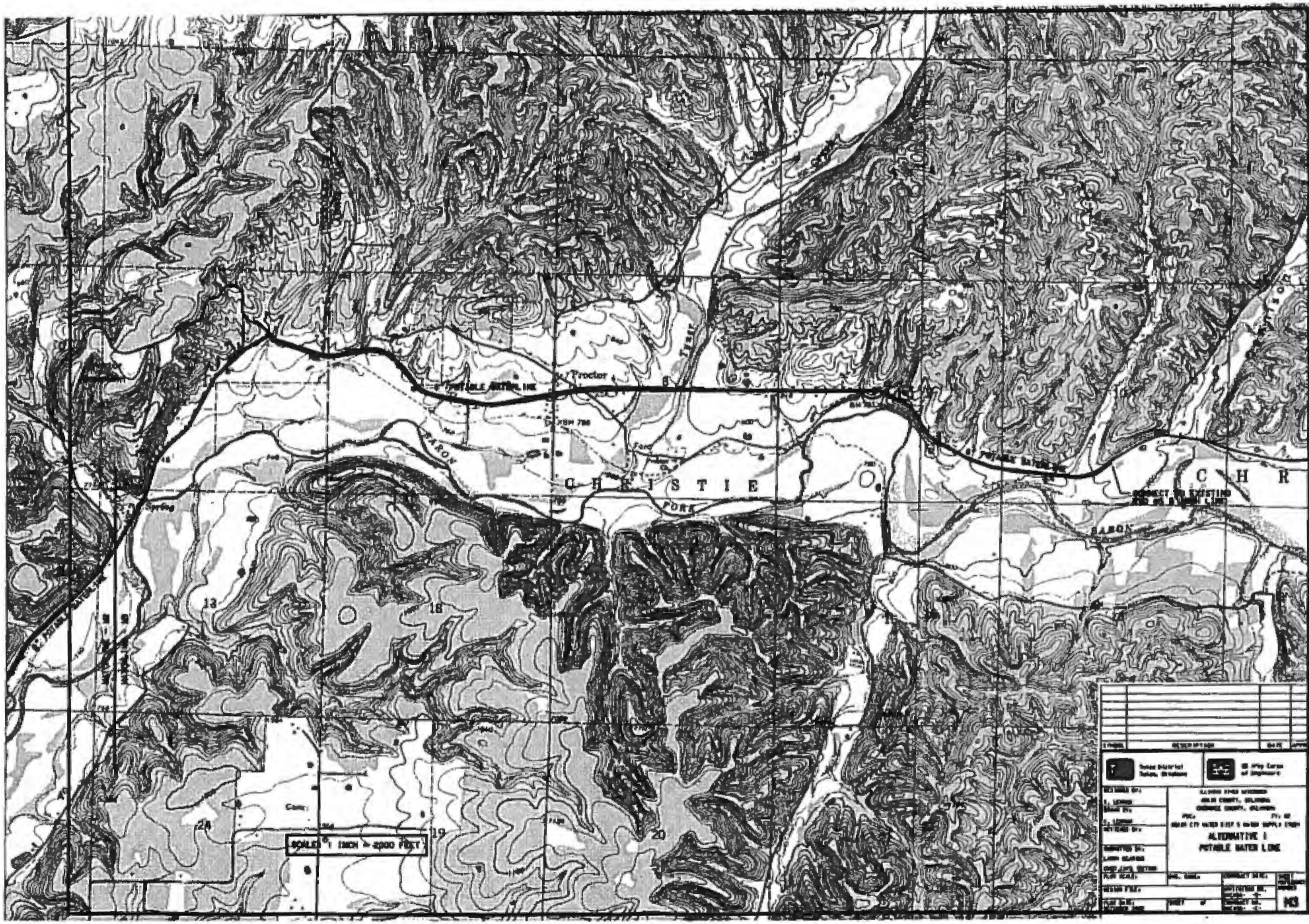
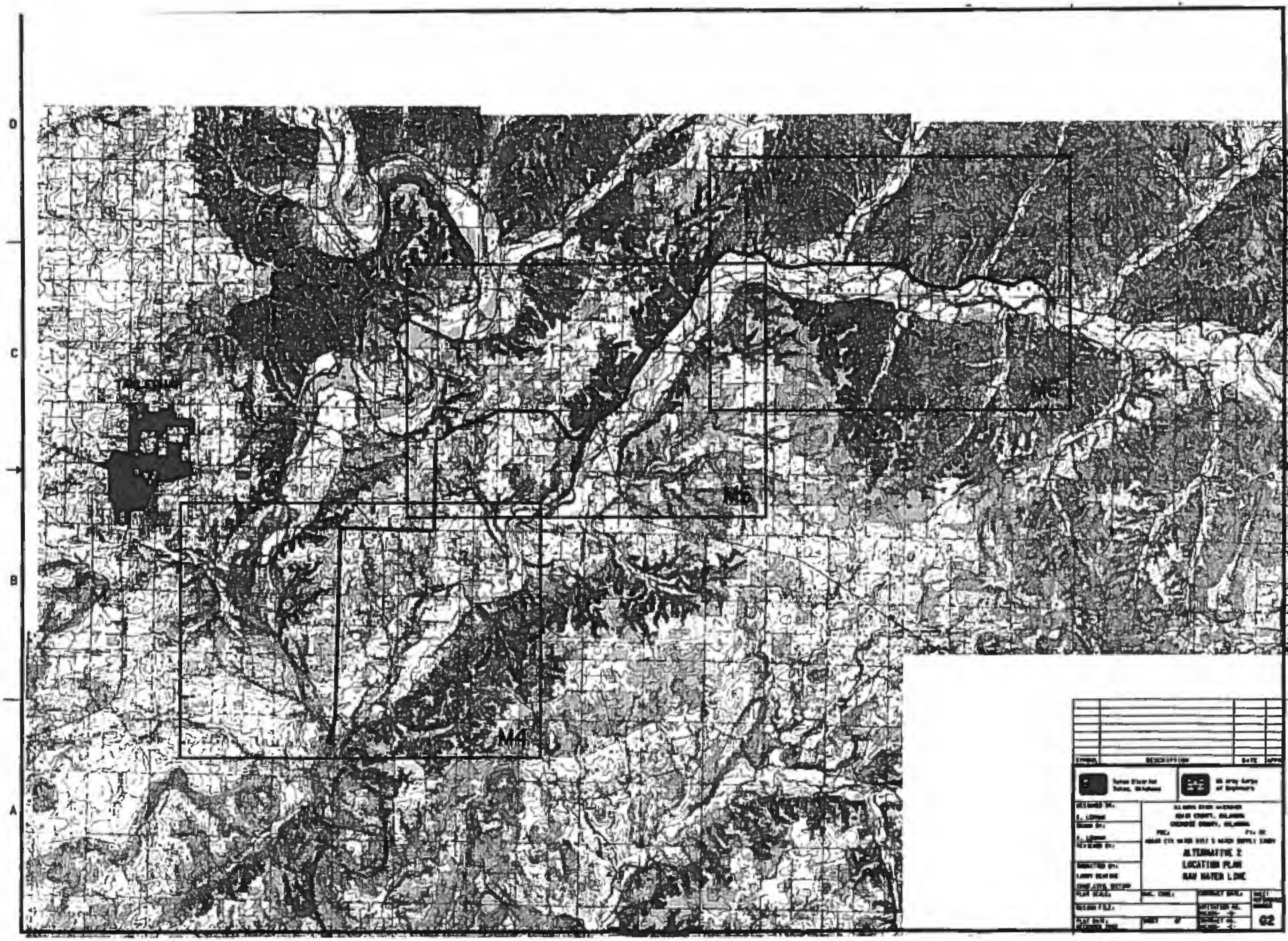
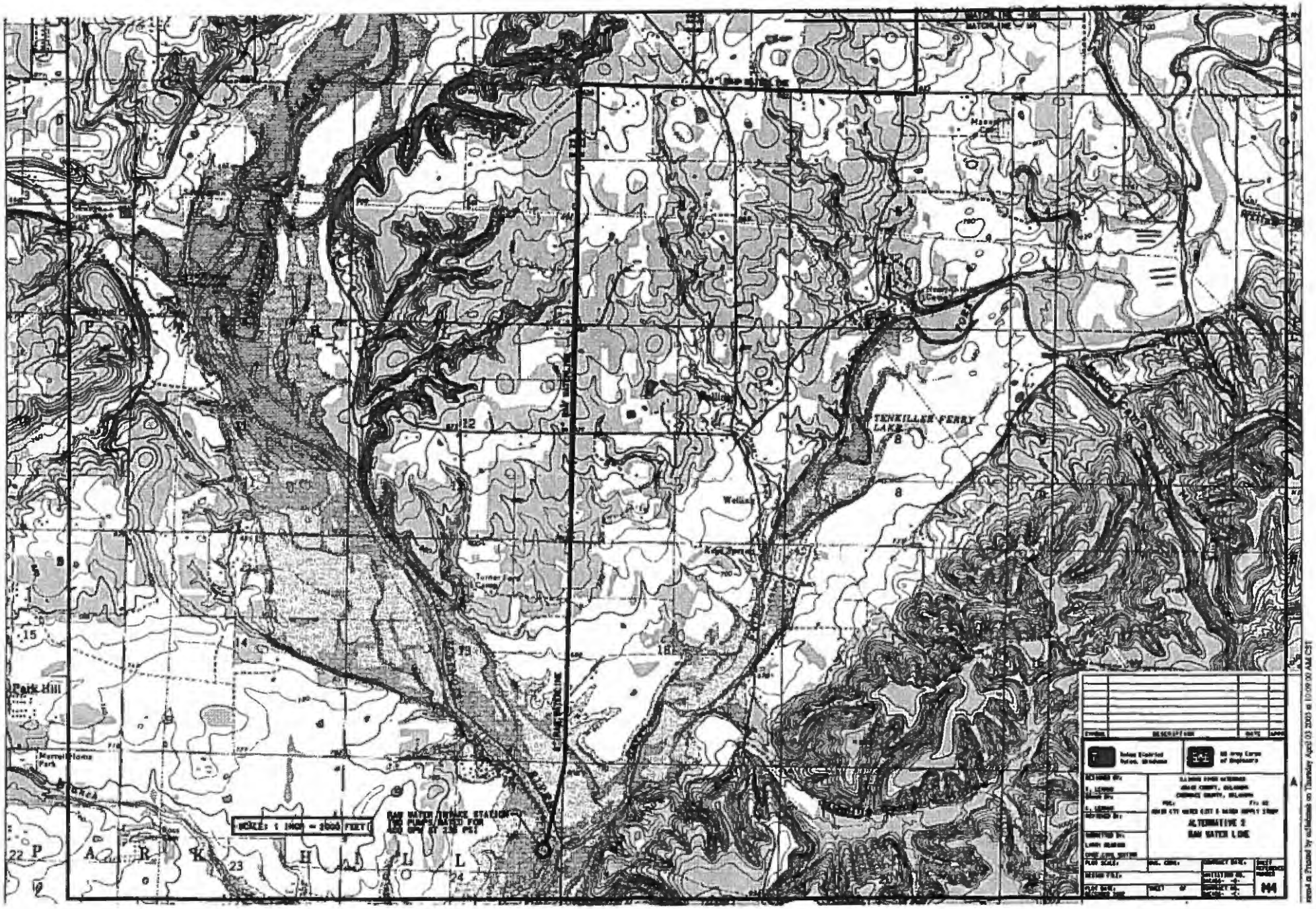
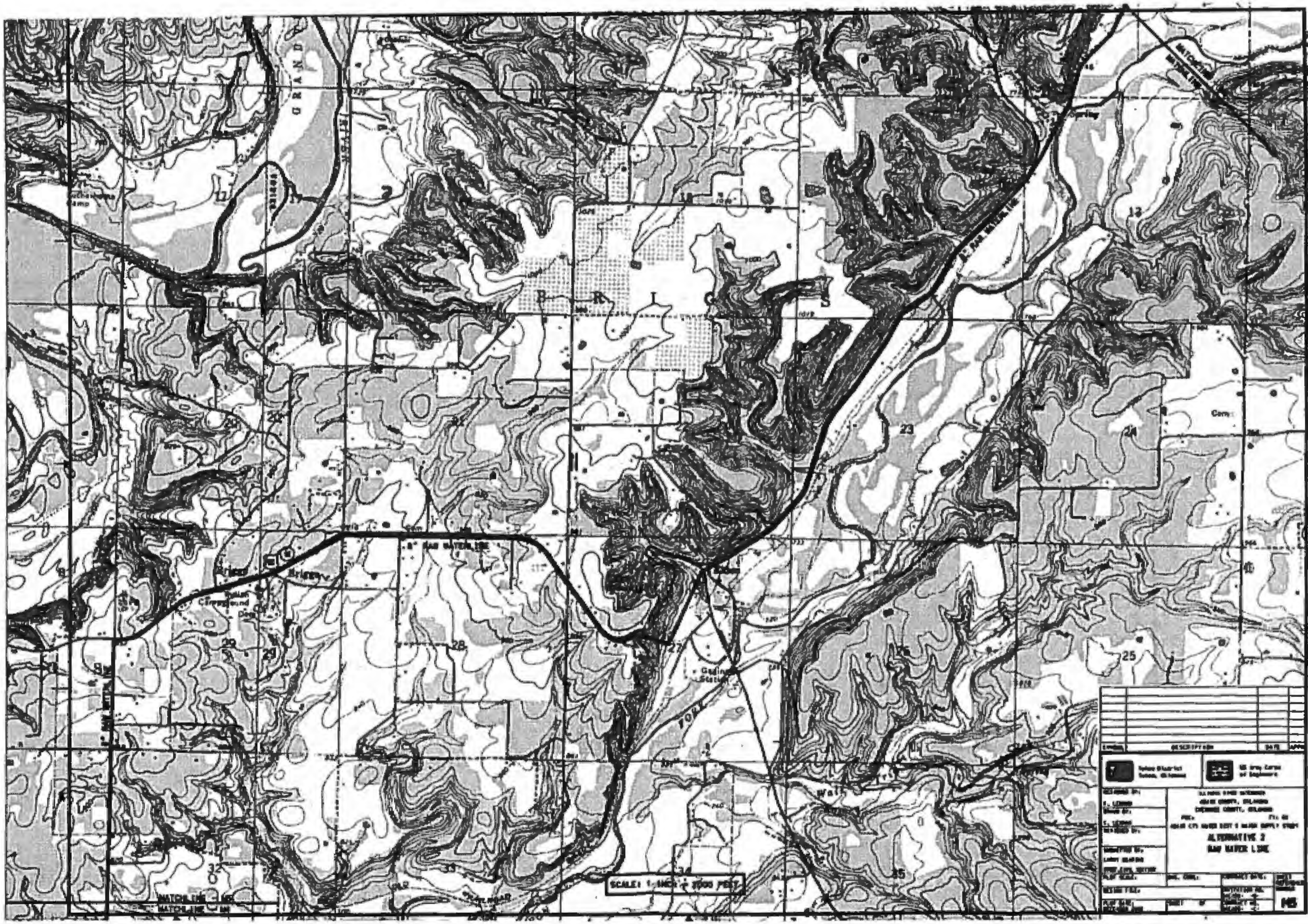
ALTERNATIVE 1
POTABLE WATER LINE
M2



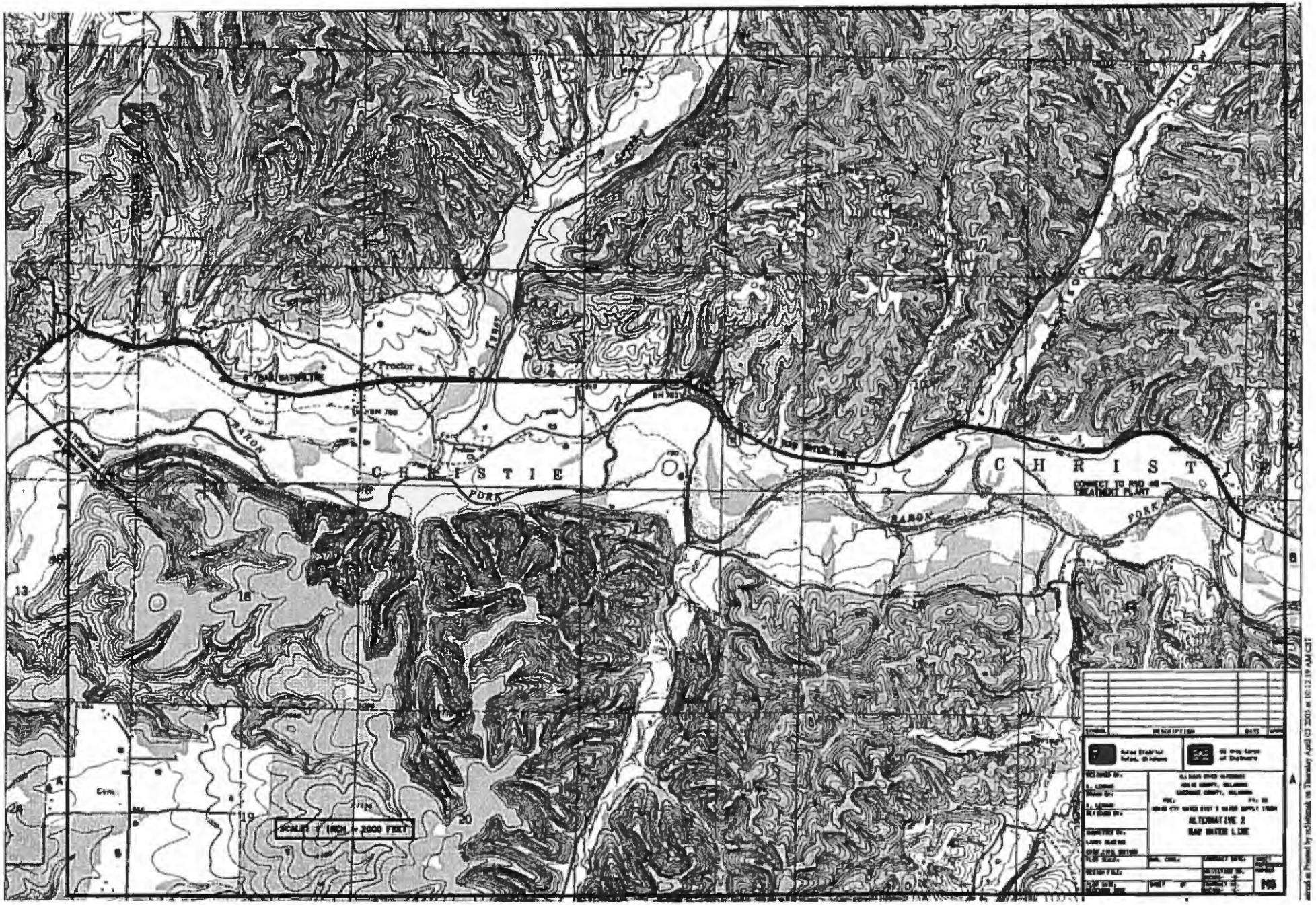
ALTERNATIVE I
POTABLE WATER LINE
SCALE 1 INCH = 2000 FEET
Proctor
CHRISTIE
BARON
FORK
CONNECT TO EXISTING
Spring
13
18
19
20
24

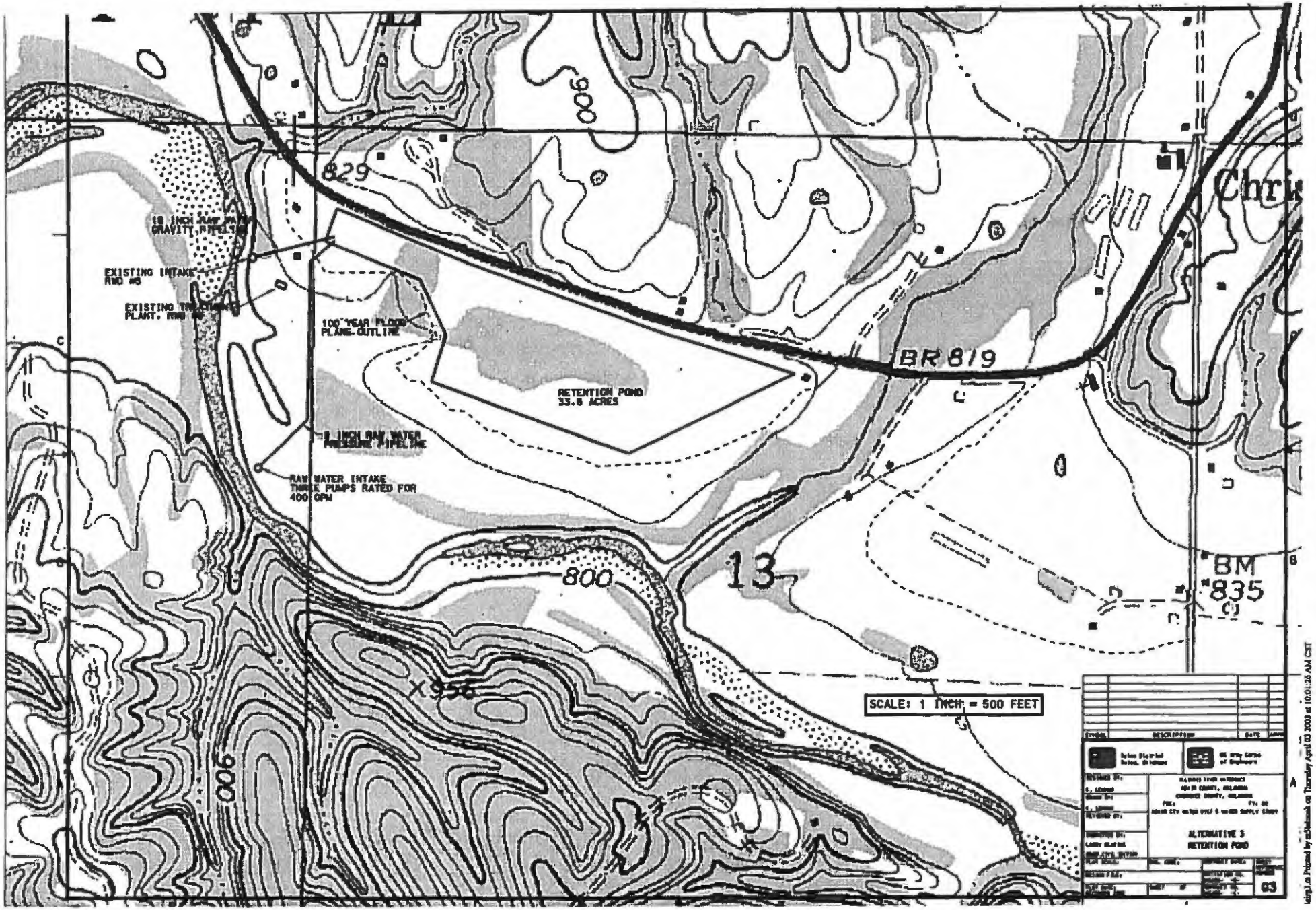

D
C
B
A
M4
M5
M6
ALTERNATIVE 2
LOCATION PLAN
RAW WATER LINE
G2


TENKILLER FERRY LAKE
Park Hill
Marrel Plains Park
SCALE: 1 INCH = 2000 FEET
RAW WATER INTAKE STATION
ALTERNATIVE 2
RAW WATER LINE
A R K H L L
22 23 24
15 14 13 18 12 8



GRAND
RIVER
SCALE: 1 INCH = 2000 FEET
ALTERNATIVE 2
RAW WATER LINE
M5


CHRISTIE
CHRISTIE
Proctor
BARON FORK
BARON FORK
FORK
SCALE: 1 INCH = 2000 FEET
ALTERNATIVE 3
RAW WATER LINE


900
829
EXISTING INTAKE
RND #8
100 YEAR FLOOD
PLAIN OUTLINE
BR 819
RETENTION POND
33.8 ACRES
RAW WATER INTAKE
THREE PUMPS RATED FOR
400 GPM
800
13
BM
835
906
X956
SCALE: 1 Inch = 500 FEET
ALTERNATIVE 3
RETENTION POND
03

APPENDIX 3
COST ESTIMATES

APPENDIX 3

COST ESTIMATE

GENERAL

Following is a summary of the cost estimates prepared for each alternative, which shows the main items of work. The estimates contain a 20% contingency and are at December 2002 price levels. Included in Alternatives 2 and 3 is a treatment plant. The cost of the treatment plant was supplied by RWD5 personnel based on the cost of the plant they constructed in 1996. That cost was escalated to 2002 price levels. No treatment plant was required in Alternative 1 since the future water supply for this alternative is potable water. Some future annual cost for the treated water for Alternative 1 should be considered when comparing this annual cost to the annual cost for the treatment costs for Alternatives 2 and 3. In addition, 15% for engineering and design is included in the estimate. The MCASES cost estimate is attached.

Cost Estimate	Alternative 1	Alternative 2	Alternative 3
Lands and Rights of Way	153,400	117,900	111,500
8-inch Pipeline and Booster Pump	2,182,000	2,084,000	90,000
Pumps and Sump	N/A	54,000	47,000
Treatment Plant	N/A	1,083,000	1,083,000
Potable Water Cost	Unknown	N/A	N/A
Detention Site	N/A	N/A	1,630,000
Engineering & Construction Mgmt. (15%)	350,310	500,835	444,225
Total	2,685,710	3,839,735	3,405,725

Future Demand
Adair County Rural Water
District NO. 5
Adair City
Oklahoma

Designed By:
Estimated By: L Gage

Prepared By: L Gage

Preparation Date: 12/10/02
Effective Date of Pricing: 12/10/02

Sales Tax: 7.50%

CONTINGENCEY
A total of 20.0% applied to this estimate.

LABOR ID: CIVL02 EQUIP ID: NAT99A Currency in DOLLARS CREW ID: NAT01B UPB ID: UP01EA

Tue 18 Mar 2003 U.S. Army Corps of Engineers TIME 10:08:46
Eff. Date 12/10/02 PROJECT ADRWD5: Future Demand - Adair County Rural Water Paramitric Eastimate SETTINGS PAGE 1

** CONTRACTOR SETTINGS **

		AMOUNT	PCT	PCT S	RISK	DIFF	SIZE	PERIOD	INVEST	ASSIST	SUBCON
AA PRIME CONTRACTOR											
10% OVERHEAD	P	10.00									
7.5% HOME OFFICE EXPENSE	P	2.00									
7.5% PROFIT	P	7.50									
2.0% BOND	P	2.00									
SC Sub-Contractor											
10% OVERHEAD	P	15.00									
7.5% HOME OFFICE EXPENSE	P	0.00									
7.5% PROFIT	P	10.00									
2.0% BOND	P	0.00									

Pipeline & Booster Pump	QUANTY	UOM	MANHOUR	LABOR	EQUIP	MATERIAL	SUBCTR	TOTAL COST
Alternative # 1								
Pipeline & Booster Pump								
8" PVC Water Line (200 PSI)								
Excavate trench, hvy soil, 4'-6'			0.02	0.63	0.40	0.00	0.00	1.03
	4000.00	CY	80	3,188	2,024	0	0	5,212
3" Sand Bedding			0.04	1.25	1.39	17.74	0.00	20.38
	560.00	CY	22	885	985	12,565	0	14,435
Piping, water dist, 8", PVC,			0.13	4.17	0.00	9.70	0.00	13.87
	40300	LF	5,239	212,585	0	494,323	0	706,907
Backfill, strl, 6" lifts,			0.03	0.90	0.63	0.00	0.00	1.53
	5600.00	CY	168	6,376	4,463	0	0	10,839
Compaction, struct/trench, 6"			0.05	1.40	0.12	0.00	0.00	1.52
	5600.00	CY	280	9,918	850	0	0	10,768
Excavate trench, blast rock,			0.04	1.16	0.75	0.00	0.00	1.91
	2000.00	CY	80	2,935	1,898	0	0	4,832
TOTAL 8" PVC Water Line (200 PSI)			5,869	235,886	10,219	506,888	0	752,993
8" PVC Water Line (150 PSI)								
Excavate trench, hvy soil, 4'-6'			0.02	0.63	0.40	0.00	0.00	1.03
	5900.00	CY	118	4,702	2,985	0	0	7,687
3" Sand Bedding			0.04	1.25	1.39	17.74	0.00	20.38
	880.00	CY	35	1,392	1,547	19,745	0	22,684
Piping, water dist, PVC, class			0.16	5.05	0.00	6.40	0.00	11.45
	62900	LF	10,064	401,821	0	508,940	0	910,761
Backfill, strl, 6" lifts,			0.03	0.90	0.63	0.00	0.00	1.53
	8750.00	CY	263	9,962	6,973	0	0	16,935
Compaction, struct/trench, 6"			0.05	1.40	0.12	0.00	0.00	1.52
	8750.00	CY	438	15,496	1,328	0	0	16,825
Excavate trench, blast rock,			0.04	1.16	0.75	0.00	0.00	1.91
	3000.00	CY	120	4,402	2,846	0	0	7,248
TOTAL 8" PVC Water Line (150 PSI)			11,037	437,775	15,681	528,685	0	982,141

Pipeline & Booster Pump	QUANTY	UOM	MANHOUR	LABOR	EQUIP	MATERIAL	SUBCTR	TOTAL COST
Booster Pumps								
Concrete Pad & Shead			24.00	600.00	25.00	483.75	0.00	1108.75
	2.00	LS	48	1,518	63	1,224	0	2,805
Pump, cntfgl,3"D, horiz mtd.			35.09	1233.80	0.00	12631.25	0.00	13865.05
	2.00	EA	70	3,122	0	31,957	0	35,079
TOTAL Booster Pumps			118	4,640	63	33,181	0	37,884
TOTAL Pipeline & Booster Pump			17,025	678,300	25,963	1,068,754	0	1,773,017
TOTAL Alternative # 1			17,025	678,300	25,963	1,068,754	0	1,773,017

Pipeline	QUANTY	UOM	MANHOUR	LABOR	EQUIP	MATERIAL	SUBCTR	TOTAL COST
Alternative # 2								
Pipeline								
8" Ductile Iron								
Excavate trench, hvy soil, 4'-6'	740.00	CY	0.02 15	0.63 590	0.40 374	0.00 0	0.00 0	1.03 964
3" Sand Bedding	108.39	CY	0.04 4	1.25 171	1.39 191	17.74 2,432	0.00 0	20.38 2,794
Piping, water dist, 8" dia, DI,	7800.00	LF	0.27 2,106	8.62 85,054	1.52 14,998	10.92 107,767	0.00 0	21.06 207,819
Backfill, strl, 6" lifts,	1083.88	CY	0.03 33	0.90 1,234	0.63 864	0.00 0	0.00 0	1.53 2,098
Compaction, struct/trench, 6"	1083.88	CY	0.05 54	1.40 1,920	0.12 165	0.00 0	0.00 0	1.52 2,084
Excavate trench, blast rock,	360.00	CY	0.04 14	1.16 528	0.75 342	0.00 0	0.00 0	1.91 870
TOTAL 8" Ductile Iron			2,226	89,496	16,933	110,199	0	216,629
8" PVC Water Line (150 PSI)								
Excavate trench, hvy soil, 4'-6'	8850.00	CY	0.02 177	0.63 7,053	0.40 4,478	0.00 0	0.00 0	1.03 11,531
3" Sand Bedding	1324.90	CY	0.04 53	1.25 2,095	1.39 2,330	17.74 29,728	0.00 0	20.38 34,153
Piping, water dist, PVC, class	94700	LF	0.16 15,152	5.05 604,967	0.00 0	6.40 766,242	0.00 0	11.45 1,371,209
Backfill, strl, 6" lifts,	13174	CY	0.03 395	0.90 14,998	0.63 10,499	0.00 0	0.00 0	1.53 25,497
Compaction, struct/trench, 6"	13174	CY	0.05 659	1.40 23,331	0.12 2,000	0.00 0	0.00 0	1.52 25,330
Excavate trench, blast rock,	4250.00	CY	0.04 170	1.16 6,236	0.75 4,032	0.00 0	0.00 0	1.91 10,269
TOTAL 8" PVC Water Line (150 PSI)			16,606	658,680	23,338	795,970	0	1,477,989
TOTAL Pipeline			18,832	748,177	40,271	906,169	0	1,694,617

2-Vertical Turbine Pump w/Sump	QUANTY	UOM	MANHOUR	LABOR	EQUIP	MATERIAL	SUBCTR	TOTAL COST
2-Vertical Turbine Pump w/Sump								
Excavation & Backfill								
Excavate trench, hvy soil, 4'-6'			0.02	0.63	0.40	0.00	0.00	1.03
	230.00	CY	5	183	116	0	0	300
Backfill, strl, 6" lifts,			0.03	0.90	0.63	0.00	0.00	1.53
	230.00	CY	7	262	183	0	0	445
Compaction, struct/trench, 6"			0.05	1.40	0.12	0.00	0.00	1.52
	230.00	CY	12	407	35	0	0	442
TOTAL Excavation & Backfill			23	852	335	0	0	1,187
Concrete Sump								
8'deep manhole, conc, precast,			20.27	633.45	107.93	491.46	0.00	1232.83
	2.00	EA	41	1,603	273	1,243	0	3,119
manholes, conc, precast, for			2.53	79.18	13.49	84.43	0.00	177.10
	34.00	VLF	86	3,406	580	3,631	0	7,617
manholes, conc, 8" thick slab			4.00	113.41	17.28	168.08	0.00	298.76
	2.00	EA	8	287	44	425	0	756
manholes, steps,galv. 10"			0.27	9.33	0.00	14.33	0.00	23.66
	28.00	EA	8	330	0	508	0	838
TOTAL Concrete Sump			142	5,626	897	5,808	0	12,330
Vertical Turbine Pump								
Vertical Turbine pump, 75 HP,			42.67	1603.65	0.00	10158.75	0.00	11762.40
	2.00	EA	85	4,057	0	25,702	0	29,759
TOTAL Vertical Turbine Pump			85	4,057	0	25,702	0	29,759
TOTAL 2-Vertical Turbine Pump w/Sump			251	10,535	1,232	31,509	0	43,276

Treatment Plant	QUANTY	UOM	MANHOUR	LABOR	EQUIP	MATERIAL	SUBCTR	TOTAL COST
Treatment Plant								
Water Treatment Plant, 200 GPM			5026.77	180000.00	0.00	516000.00	0.00	696000.00
	1.00	EA	5,027	227,700	0	652,740	0	880,440
TOTAL Treatment Plant			5,027	227,700	0	652,740	0	880,440
TOTAL Alternative # 2			24,109	986,412	41,503	1,590,418	0	2,618,333

Pipeline	QUANTY	UOM	MANHOUR	LABOR	EQUIP	MATERIAL	SUBCTR	TOTAL COST
Alternative # 3								
Pipeline								
8" PVC Water Line (150 PSI)								
Excavate trench, hvy soil, 4'-6'	56.07	CY	0.02 1	0.63 45	0.40 28	0.00 0	0.00 0	1.03 73
Excavate trench, blast rock,	26.93	CY	0.04 1	1.16 40	0.75 26	0.00 0	0.00 0	1.91 65
3" Sand Bedding	8.39	CY	0.04 0	1.25 13	1.39 15	17.74 188	0.00 0	20.38 216
Piping, water dist, PVC, class	600.00	LF	0.16 96	5.05 3,833	0.00 0	6.40 4,855	0.00 0	11.45 8,688
Backfill, strl, 6" lifts,	83.47	CY	0.03 3	0.90 95	0.63 67	0.00 0	0.00 0	1.53 162
Compaction, struct/trench, 6"	83.47	CY	0.05 4	1.40 148	0.12 13	0.00 0	0.00 0	1.52 160
TOTAL 8" PVC Water Line (150 PSI)			105	4,173	148	5,043	0	9,364
18" RCP Water Line (150 PSI)								
Excavate trench, hvy soil, 4'-6'	140.00	CY	0.02 3	0.63 112	0.40 71	0.00 0	0.00 0	1.03 182
Excavate trench, blast rock,	60.00	CY	0.04 2	1.16 88	0.75 57	0.00 0	0.00 0	1.91 145
3" Sand Bedding	22.00	CY	0.04 1	1.25 35	1.39 39	17.74 494	0.00 0	20.38 567
Piping, water dist, 18" dia, 150	600.00	LF	0.57 342	16.20 12,296	6.67 5,063	58.82 44,647	0.00 0	81.69 62,006
Backfill, strl, 6" lifts,	200.00	CY	0.03 6	0.90 228	0.63 159	0.00 0	0.00 0	1.53 387
Compaction, struct/trench, 6"	200.00	CY	0.05 10	1.40 354	0.12 30	0.00 0	0.00 0	1.52 385
TOTAL 18" RCP Water Line (150 PSI)			364	13,112	5,419	45,141	0	63,672
TOTAL Pipeline			469	17,285	5,567	50,184	0	73,036

Pumps & Sumps	QUANTY	UOM	MANHOUR	LABOR	EQUIP	MATERIAL	SUBCTR	TOTAL COST
Pumps & Sumps								
Excavation & Backfill								
Excavate trench, hvy soil, 4'-6'			0.02	0.63	0.40	0.00	0.00	1.03
	290.00	CY	6	231	147	0	0	378
Backfill, strl, 6" lifts,			0.03	0.90	0.63	0.00	0.00	1.53
	290.00	CY	9	330	231	0	0	561
Compaction, struct/trench, 6"			0.05	1.40	0.12	0.00	0.00	1.52
	290.00	CY	15	514	44	0	0	558
TOTAL Excavation & Backfill			29	1,075	422	0	0	1,497
Concrete Sump								
8'deep manhole, conc, precast,			20.27	633.45	107.93	491.46	0.00	1232.83
	2.00	EA	41	1,603	273	1,243	0	3,119
manholes, conc, precast, for			2.53	79.18	13.49	84.43	0.00	177.10
	34.00	VLF	86	3,406	580	3,631	0	7,617
manholes, conc, 8" thick slab			4.00	113.41	17.28	168.08	0.00	298.76
	2.00	EA	8	287	44	425	0	756
manholes, steps,galv. 10"			0.27	9.33	0.00	14.33	0.00	23.66
	28.00	EA	8	330	0	508	0	838
TOTAL Concrete Sump			142	5,626	897	5,808	0	12,330
3 Submersible Pumps								
Submersible well pump, 15hp			33.33	1193.77	0.00	5106.25	0.00	6300.02
	3.00	EA	100	4,530	0	19,378	0	23,909
TOTAL 3 Submersible Pumps			100	4,530	0	19,378	0	23,909
TOTAL Pumps & Sumps			271	11,231	1,319	25,186	0	37,735

Treatment Plant	QUANTY	UOM	MANHOUR	LABOR	EQUIP	MATERIAL	SUBCTR	TOTAL COST
Treatment Plant								
Water Treatment Plant, 200 GPM			5026.77	180000.00	0.00	516000.00	0.00	696000.00
	1.00	EA	5,027	227,700	0	652,740	0	880,440
TOTAL Treatment Plant			5,027	227,700	0	652,740	0	880,440

Detention Site	QUANTY	UOM	MANHOUR	LABOR	EQUIP	MATERIAL	SUBCTR	TOTAL COST
Detention Site								
topsoil, 6" deep, remove/pile			0.02	0.58	0.69	0.00	0.00	1.27
	26700	CY	534	19,590	23,305	0	0	42,895
Excavate & fill berm w/dozer			0.08	2.53	1.28	0.00	0.00	3.81
	66700	CY	5,336	213,470	108,001	0	0	321,471
Compaction of backfill,			0.02	0.54	0.46	0.00	0.00	1.00
	62600	CY	1,252	42,762	36,427	0	0	79,189
Membrane lining, HDPE, 100,000			0.04	1.26	0.09	3.10	0.00	4.45
	145000	SY	5,800	231,116	16,508	567,884	0	815,508
Sodding, 1" deep,			0.02	0.60	0.03	1.51	0.00	2.14
	24500	SY	490	18,596	930	46,644	0	66,169
Membrane lining, HDPE, 30 mil			0.00	0.00	0.00	0.00	0.00	0.00
	145000	SY	0	0	0	0	0	0
TOTAL Detention Site			13,412	525,533	185,171	614,528	0	1,325,231
TOTAL Alternative # 3			19,179	781,749	192,056	1,342,637	0	2,316,443
TOTAL Future Demand			60,314	2,446,461	259,522	4,001,810	0	6,707,793

LABOR ID: CIVL02 EQUIP ID: NAT99A Currency in DOLLARS CREW ID: NAT01B UPB ID: UP01EA

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Paramitric Eastimate SUMMARY PAGE 1
** PROJECT OWNER SUMMARY - LEVEL 2 **

	QUANTITY UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT COST
01 Alternative # 1					
01.02 Pipeline & Booster Pump		2,181,295	0	2,181,295	
TOTAL Alternative # 1		2,181,295	0	2,181,295	
02 Alternative # 2					
02.01 Pipeline		2,084,842	0	2,084,842	
02.02 2-Vertical Turbine Pump w/Sump		53,241	0	53,241	
02.03 Treatment Plant		1,083,182	0	1,083,182	
TOTAL Alternative # 2		3,221,265	0	3,221,265	
03 Alternative # 3					
03.02 Pipeline		89,854	0	89,854	
03.03 Pumps & Sumps		46,425	0	46,425	
03.04 Treatment Plant		1,083,182	0	1,083,182	
03.05 Detention Site		1,630,396	0	1,630,396	
TOTAL Alternative # 3		2,849,857	0	2,849,857	

LABOR ID: CIVL02 EQUIP ID: NAT99A Currency in DOLLARS CREW ID: NAT01B UPB ID: UP01EA

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ERROR REPORT Paramitric Eastimate ERROR PAGE 1

No errors detected...

* * * END OF ERROR REPORT * * *

LABOR ID: CIVL02 EQUIP ID: NAT99A Currency in DOLLARS CREW ID: NAT01B UPB ID: UP01EA

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No Backup Reports...

* * * END TABLE OF CONTENTS * * *

APPENDIX 4
HYDROLOGIC AND HYDRAULIC ANALYSIS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

HYDROLOGIC AND HYDRAULIC ANALYSES OF THE BARON FORK RIVER

BASIN AND PROJECT DESCRIPTION

The Baron Fork River is a left bank tributary to the Illinois River. The Baron Fork watershed is located in northeast Oklahoma and northwest Arkansas. The total drainage area of the basin above the Eldon gage is about 312 square miles. The basin is about 26 miles long and 10 miles wide. The river originates in the southeast part of Washington County in northwest Arkansas and flows generally west through Adair County, Oklahoma, toward the Illinois River. The upper portions of the basin are comprised mainly of deciduous forest and cropland. The lower portion of basin is generally undeveloped mixed forest. The average streambed slope of the Baron Fork River is about 26 feet per mile. Basin topography is very hilly with forest cover and river valley floodplains. The area has an average yearly precipitation of about 37 inches. The project consists of analyzing existing flow data along the Baron Fork River to support water supply for Adair County RWD5. This will include adjusting flow in the river for the diversion location and incorporating current restrictions for diverting flow from the river. The Oklahoma Cooperative Fish and Wildlife Research Unit conducted a previous study[1]. The study incorporated a flow assessment of the Baron Fork and how is affects the fish and wildlife aspects of the Baron Fork River.

MAPPING AND STREAM GAGING

Aerial photogrammetric mapping was obtained from the U.S. Geological Survey (USGS) in the form of Digital Ortho Quarter Quadrangles (DOQQ). These photos were taken in 1995. Elevation data were also obtained from USGS Digital Elevation Model (DEM) data. This is the same data used to develop contours for the 24000:1 scale quadrangle maps. Two USGS stream gages are located on the Baron Fork River. The Eldon gage is located southeast of Eldon, Oklahoma, in Cherokee County. The gage is mounted on the State Highway 51 Bridge at river

[1] "Instream Flow Assessment of Baron Fork Creek, Oklahoma, Final Report", Oklahoma Cooperative Fish and Wildlife Research Unit, Oklahoma State University, Stillwater, Oklahoma, William L. Fisher and W. Jason Remshardt.

mile 8.8. The Dutch Mills gage is located in Washington County in Arkansas 2.9 miles upstream from the Arkansas-Oklahoma State line. The period of record for the Eldon and Dutch Mills gages are 1949 to present and 1958 to present, respectively.

BASIN DELINEATION

The watershed basin up stream of the existing intake site was delineated using the following USGS 7.5-minute quadrangle maps.

FLOW DEVELOPMENT

River flow for the RWD5 intake location was developed by applying a drainage area ratio to the period of record discharges obtained at the Eldon gage. The drainage area at the diversion point is about 236 square miles resulting in a drainage area ratio of 0.755 with the 312 square miles at the Eldon gage. A curve was computed from the mean daily flows obtained from the Eldon Gage. The curve is shown in Figure 4-1.

WATER SUPPLY

Water supply availability at the existing intake structure was assessed based on the anticipated directive to prohibit extraction when the river flow is below a certain threshold value. This study considered threshold flow values of 20, 35, 50, and 80 cfs. The period of record discharges were evaluated to determine how often RWD5 would not be able to extract water. The results of this analysis are shown in Table 4-1.

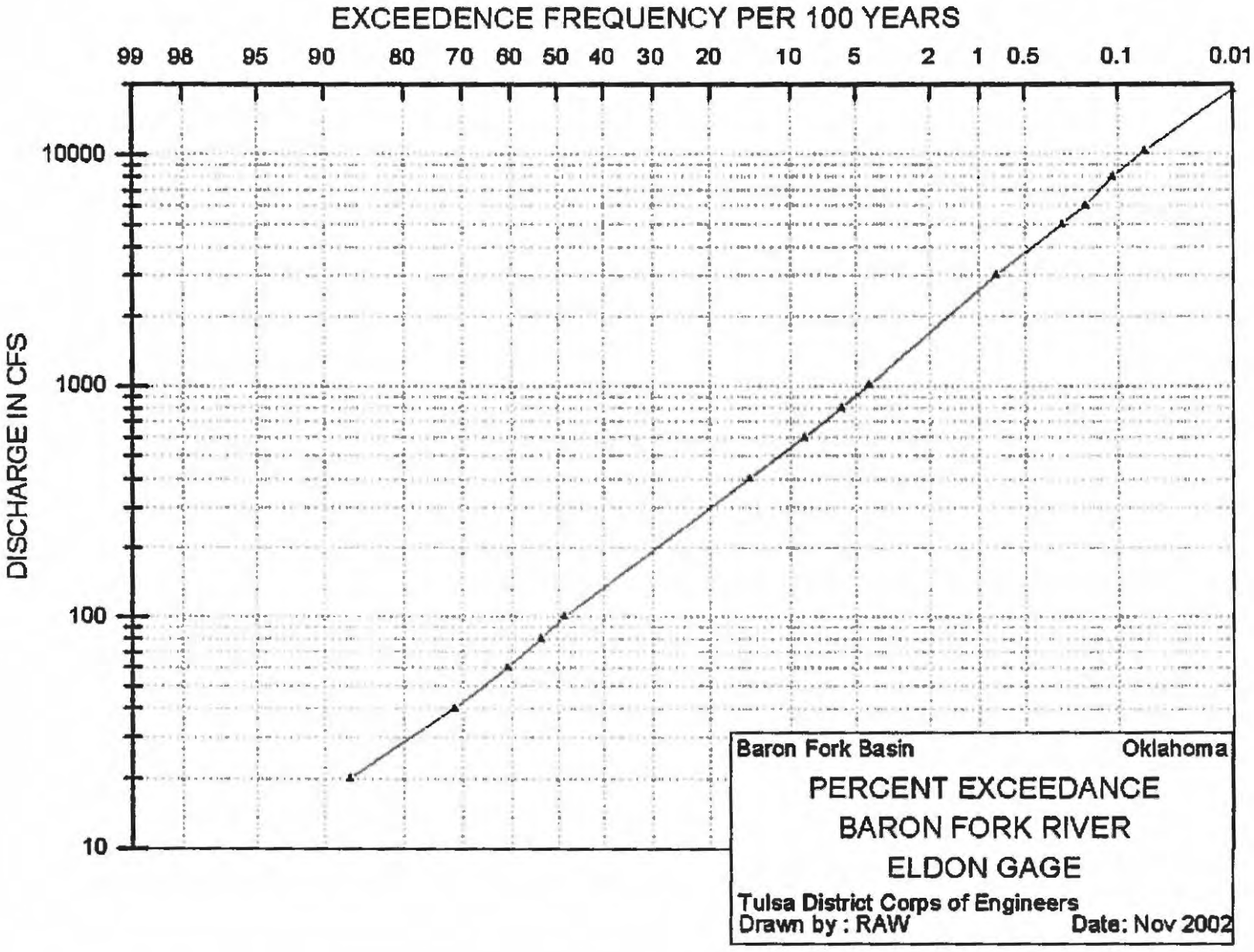

Figure 4-1. Percent Exceedance Curve.

Table 4-1

Occurrences Below Threshold Flow

Threshold Flood (mean daily in cfs)	* Number of Occurrences	Longest Occurrence (consecutive days below threshold flow in days)
20	54	167
35	100	204
50	117	220
80	149	294

* Discharge values that were less than or equal to the Mean Daily Flow occurring consecutively equal to or greater than 10 times.

The 50 years of data were queried to determine how many times the flow in the river was less than or equal to the threshold flow for 10 or more consecutive days. Then the longest period was used to determine how much water storage would be needed to supply current and projected water usage rates without extraction from the river. The needed water storage based on the daily requirement averaged over the year is shown in Table 4-2.

Table 4-2

Required Water Supply Storage

Threshold Flow (cfs)	Consecutive Days	Average Daily Water Supply Use (ac-ft)	Consecutive Storage (ac-ft)	Evaporation Loss (ac-ft)	Required Storage (ac-ft)	Peak Daily Water Supply Use (ac-ft)	Consecutive Storage (ac-ft)	Evaporation Loss (ac-ft)	Required Storage (ac-ft)
Existing Usage									
20	167	0.5	84.1	20.3	104.4	0.6	107.6	20.3	128.0
40	204	0.5	102.7	20.3	123.0	0.6	131.5	20.3	151.8
50	220	0.5	110.8	20.3	131.1	0.6	141.7	20.3	162.0
80	294	0.5	148.0	20.3	168.3	0.6	189.5	20.3	209.8
Projected 2050 Usage									
20	167	1.37	229.6	20.3	249.9	1.8	294.2	20.3	314.5
40	204	1.37	280.5	20.3	300.8	1.8	359.4	20.3	379.7
50	220	1.37	302.5	20.3	322.8	1.8	387.6	20.3	407.9
80	294	1.37	404.2	20.3	424.5	1.8	517.9	20.3	538.2

APPENDIX 5
ENVIRONMENTAL ANALYSIS

APPENDIX 5
ENVIRONMENTAL ANALYSIS

SCOPE

Existing environmental conditions were determined from investigations to identify potential environmental concerns or issues, such as endangered species, cultural resources, wetlands, and water quality. The scope of this investigation does not include documentation consistent with the National Environmental Policy Act of 1969, but does identify potentially significant environmental issues that would need to be addressed prior to any construction.

INTRODUCTION

The proposed project is located along the Baron Fork River near the northeastern end of Tenkiller Ferry Lake in Cherokee County, Oklahoma. The Baron Fork River is a left bank tributary to the Illinois River. The Baron Fork watershed is located in northeast Oklahoma and northwest Arkansas. The total drainage area of the basin above the Eldon gage is about 312 miles. The basin is approximately 26 miles long and 10 miles wide. The river originates in the southeast part of Washington County, Arkansas, and flows generally west through Adair County, Oklahoma, toward the Illinois River. Tenkiller Ferry Lake and Dam was constructed by the U.S. Army Corps of Engineers on the Illinois River and impounds 12,900 surface acres at normal pool.

ENVIRONMENTAL SETTING

The proposed project area lies within the Ozark Highlands of the Eastern Broadleaf Forest Province (Bailey 1980). Most of the area is rolling, but some of the area is nearly flat. The majority of this dissected limestone plateau is forested; oak-hickory is the predominant type, but stands of oak and pine are also common. Less than one-fourth of this region has been

cleared for pasture and cropland. Average annual precipitation is about 37 inches per year and falls mainly during the growing season (April-October). The average annual temperature is 40° to 65° Fahrenheit.

The province is dominated by broadleaf deciduous forest, but the smaller amount of precipitation found here favor the drought-resistant oak-hickory association. The oak-hickory forest is medium to tall, becoming savanna-like in the northern reaches from eastern Oklahoma to Minnesota. The upland forest type is characterized by post oak, blackjack oak, southern red oak, black oak, white oak, black hickory, shellbark hickory, and shagbark hickory. The understory is well developed consisting of flowering dogwood, sassafras, green brier, poison ivy, and coral berry. Native grasses consist of big bluestem, little bluestem, switchgrass, and Indian grass. Bottomland forests are characterized by water oak, willow oak, pin oak, bur oak, sycamore, cottonwood, hackberry, black walnut, pecan, and slippery elm. The understory consists of hawthorn, redbud, honey locust, green ash, and buttonbush. Native grasses common to the bottomland are Indian grass, switchgrass, and big bluestem.

Game animals in the area include white-tailed deer, gray and fox squirrels, cottontail rabbits, raccoons, bobwhite quail, mourning doves, wild turkeys, mallard ducks, and wood ducks. Furbearers include raccoon, beaver, coyotes, red foxes, and bobcats. Sport fish include smallmouth and largemouth bass; channel, blue, and flathead catfish; and several sunfish species.

Land use is varied consisting of developed, recreational, residential, agricultural, and pasturelands, all of which are heavily influenced by recreational activities associated with the scenic Illinois and Baron Fork rivers and Tenkiller Ferry Lake.

ENDANGERED SPECIES

A number of Federally-listed threatened and/or endangered species are present in the project area. There is no designated critical habitat for listed species in Cherokee County. Federally-listed threatened bald eagles (*Haliaeetus leucocephalus*) winter and may be spring

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residents at Tenkiller Ferry Lake and along the Illinois and Baron Fork rivers. They utilize the riverbanks and lakeshore for perching and secluded areas for roosting. Federally-listed endangered American burying beetles (*Nicrophorus americanus) (ABB)* are found in oak-hickory forests and grasslands. An ABB survey should be conducted prior to commencement of work. The endangered piping plover (*Charadrius melodus)* may be seen migrating through in the spring and fall. Piping plovers use the bare areas of islands or sandbars along rivers. Caves that exist within the project area may be inhabited by the endangered Ozark big-eared bat (*Plecotus townsendii ingens).* The Ozark big-eared bat is generally associated with caves, cliffs, and rock ledges in well drained, oak-hickory Ozark forests. The endangered Gray bat (*Myotis grisescens),* Indiana bat (*Myotis sodalis*), Ozark crayfish *(Cambarus aculabrum),* and the threatened Ozark cavefish (*Amblyopsis rosae*) also use caves in the area and frequently the same caves. To avoid potential adverse impacts, all rights-of-way should be surveyed for the presence of caves. If caves are found and utilized by one of the Federally-listed species or ABB are found within the proposed project area, additional coordination and/or consultation with the U.S. Fish and Wildlife Service (USFWS) may be required. Correspondence from the USFWS is included at the end of this appendix. Several other species of concern are found within the area and include the Eastern small-footed bat (*Myotis leibii*), Southeastern bat (*Myotic austroriparius),* Southeastern big-eared bat *(Plecotus rafinesquii),* Ozark cave crayfish (*Cambarus tartarus*), Bowman's cave amphipod (*Stygobronus bowmani*), Ozark cave amphipod (*Stygobromus oxarkensis*), Bat cave isopod (*Caecidotea macropoda*), and Ozark chinquapin (*Castanea pumila var.ozarkensis*). They are not afforded protection under the Endangered Species Act at this time, but should be considered in any planning activities. Reference Table 5-1 for listed species in the area and their status.

Table 5-1

Endangered, Threatened, and Species of Concern

Species	Status
Ozark big-eared bat *((Corynorhinus townsendii ingens)*	Endangered
Gray bat *(Myotis grisescens)*	Endangered
Indiana bat *(Myotis sodalis)*	Endangered
Ozark crayfish *(Cambarus aculabrum)*	Endangered
Ozark cavefish *(Amblyopsis rosae)*	Threatened
Neosho madtom *(Noturus placidus)*	Threatened
Bald eagle *(Haliaeetus leucocephalus)*	Threatened
Eastern small-footed bat *(Myotis leibii)*	Species of Concern
Southeastern bat *(Myotis austroriparius)*	Species of Concern
Southeastern big-eared bat *(Plecotus rafinesquii)*	Species of Concern
Longnose darter *(Percina nasuta)*	Species of Concern
Ozark cave crayfish *(Cambarus tartarus)*	Species of Concern
Bowman's cave amphipod *(Stygobromus ozarkernsis)*	Species of Concern
Ozark cave amphipod *(Stygobromus ozarkensis)*	Species of Concern
Bat cave isopod *(Caecidotea macropoda)*	Species of Concern
Ozark chinquapin (*Castanea pumila var ozarkensis)*	Species of Concern

CULTURAL RESOURCES

Overview

Archaeological sites representative of the Early Archaic Period through the Middle and Late Archaic, Woodland, Caddoan, and Historic Periods are known in the larger vicinity of the Baron Fork and Illinois Rivers, and in Adair County. This culture-historical sequence falls generally within the overall sequence that has been established for eastern Oklahoma. Many sites in this area have undisturbed, deeply buried deposits; many are comprised of multi-component prehistoric and/or historic occupations. A number of cultural resources investigations, including survey and excavation, were conducted incident to the construction of Tenkiller and Fort Gibson Lakes. There are hundreds of archaeological sites and historic standing structures in the larger Adair-Cherokee County project area vicinity that are on record with the Oklahoma State Historic Preservation Office and the Oklahoma Archeological Survey (OAS).

Impacts

Any of the three proposed Adair County Rural Water District No. 5 alternatives has the potential to impact cultural resources. Sections 106 and 110 of the National Historic Preservation Act (NHPA) of 1966 (as amended) require agencies to evaluate the impacts of federal undertakings on historic properties, which include prehistoric and historic archaeological sites, and historic standing structures. Section 106 requires the identification of all historic properties, which emphasizes an evaluation of eligibility for listing on the National Register of Historic Places (NRHP). Agencies must then determine which historic properties (those eligible for listing on the NRHP) will be adversely impacted. Sections 106 and 110 require that agencies resolve adverse effects to these properties. Plans for resolving adverse effects will be determined through consultation with the Oklahoma State Historic Preservation Office (SHPO), Oklahoma Archeological Survey (OAS), potentially the Advisory Council on Historic Preservation (ACHP), and appropriate and interested Native American tribes and other interested parties.

Prior to construction, archaeological reconnaissance investigations, to include archival research, will be necessary to identify archaeological sites and standing structures that exist within the proposed project area. Each site and structure will require National Register evaluation; some will require sub-surface evaluation, detailed archival research or architectural documentation. NRHP-eligible sites and structures that will be adversely impacted by the undertaking will require mitigation, which will be determined through formal consultation with the SHPO and OAS, and potentially the ACHP.

WATER QUALITY

The Baron Fork River is an Ozark-type stream and a tributary to the Illinois River and ultimately to Tenkiller Lake, Oklahoma. Historically, water quality has been characterized by low water temperature, exceptional water clarity, and relatively low concentrations of nutrients, pesticides, and other contaminants. Exceptional historical water quality and aesthetic value have resulted in classification of a 35-mile section of the Baron Fork upstream of its confluence with

the Illinois River as an Oklahoma Scenic River and outstanding resource water in Oklahoma's Water Quality Standards (http://www.okcc.state.ok.us/Water Quality Web/WP113.pdf).

Water quality degradation has been noted in the Baron Fork River in recent years. Water quality impairment owing to pesticides, nutrients, siltation, and organic matter/dissolved oxygen problems have been reported. Potential sources for these problems may include non-irrigated agriculture, animal management/holding facilities, construction activities, range and pasture, silviculture, riparian zone removal, and stream bank erosion. As a result of these problems, the Baron Fork River is listed on the current (2003) State of Oklahoma integrated list of waters. Input from the Baron Fork have also been identified as contributing to unacceptably high nutrient loading to the Illinois River and Tenkiller Lake, Oklahoma.

WETLANDS

Wetlands and deepwater habitats are essential for many species of fish and wildlife. In addition to providing habitat for fish and wildlife, they also perform important roles and function in controlling floods and pollution abatement. The USFWS developed and adopted a classification system to be used for classifying wetlands and conducted a national inventory of wetland habitats (National Wetland Inventory Maps [NWI]). The three alternatives were evaluated for the presence of wetlands based on the NWI maps. Numerous wetland types were found to be present in the delineated project area and are summarized as follows:

Sheet Reference M1 & M4 (Refer to drawings at the end of Appendix 2). A majority of wetlands within this project component are farm ponds characterized as Palustrine Open Water Permanently Flooded Diked/Impounded (POWHh). Other wetlands identified are classified as Palustrine Emergent Persistent Seasonally Flooded (PEM1C), Palustrine Emergent Persistent Semi-permanently Flooded (PEM1F), Riverine Intermittent Streambed Seasonally Flooded (R4SBC), and Riverine Lower Perennial Openwater Permanently Flooded (R2OWH).

Sheet Reference M2 & M5 (Refer to drawings at the end of Appendix 2). All the wetlands within this project component are farm ponds characterized as Palustrine Open Water Permanently Flooded Diked/Impounded (POWHh).

Sheet Reference M3 & M6 (Refer to drawings at the end of Appendix 2). A majority of wetlands identified in this project component are farm ponds characterized as Palustrine Open Water Permanently Flooded Diked/Impounded (POWHh), as well. A few other wetlands identified are Palustrine Forested Broad Leaved Deciduous Seasonally Flooded (PF01C), Palustrine Forested Broad Leaved Deciduous Temporarily Flooded (PFO1A), Riverine Intermittent Streambed Seasonally Flooded (R4SBC), Riverine Lower Perennial Openwater Permanently Flooded (R2OWH), and Riverine Lower Perennial Unconsolidated Shore Seasonally Flooded (R2USC).

Sheet Reference G3 (Refer to drawings at the end of Appendix 2). The only wetland in this area identified as Riverine Lower Perennial Unconsolidated Shore Seasonally Flooded (R2USC) is associated with the proposed raw water intake.

The majority of wetlands appear to be small farm ponds or impoundments. All proposed water facilities and the retention pond should be carefully evaluated to avoid wetland habitats and adverse impacts associated with construction in wetlands.

SECTION 404, CLEAN WATER ACT

The construction and placement of water pipelines and related water facilities would be subject to Section 404 of the Clean Water Act permitting activities. The construction of an intake structure should fall within the scope of a Nationwide permit or a General permit, and the placement of water pipelines should fall within the scope of Nationwide Permit No. 12, Utility Line Discharges. Prior to construction, a Section 404 (Clean Water Act) determination should be requested from the U.S. Army Corps of Engineers, Tulsa District (Regulatory Branch) to assure compliance with Federal law.

NATIONAL FORESTS AND OTHER PUBLIC USE AREAS

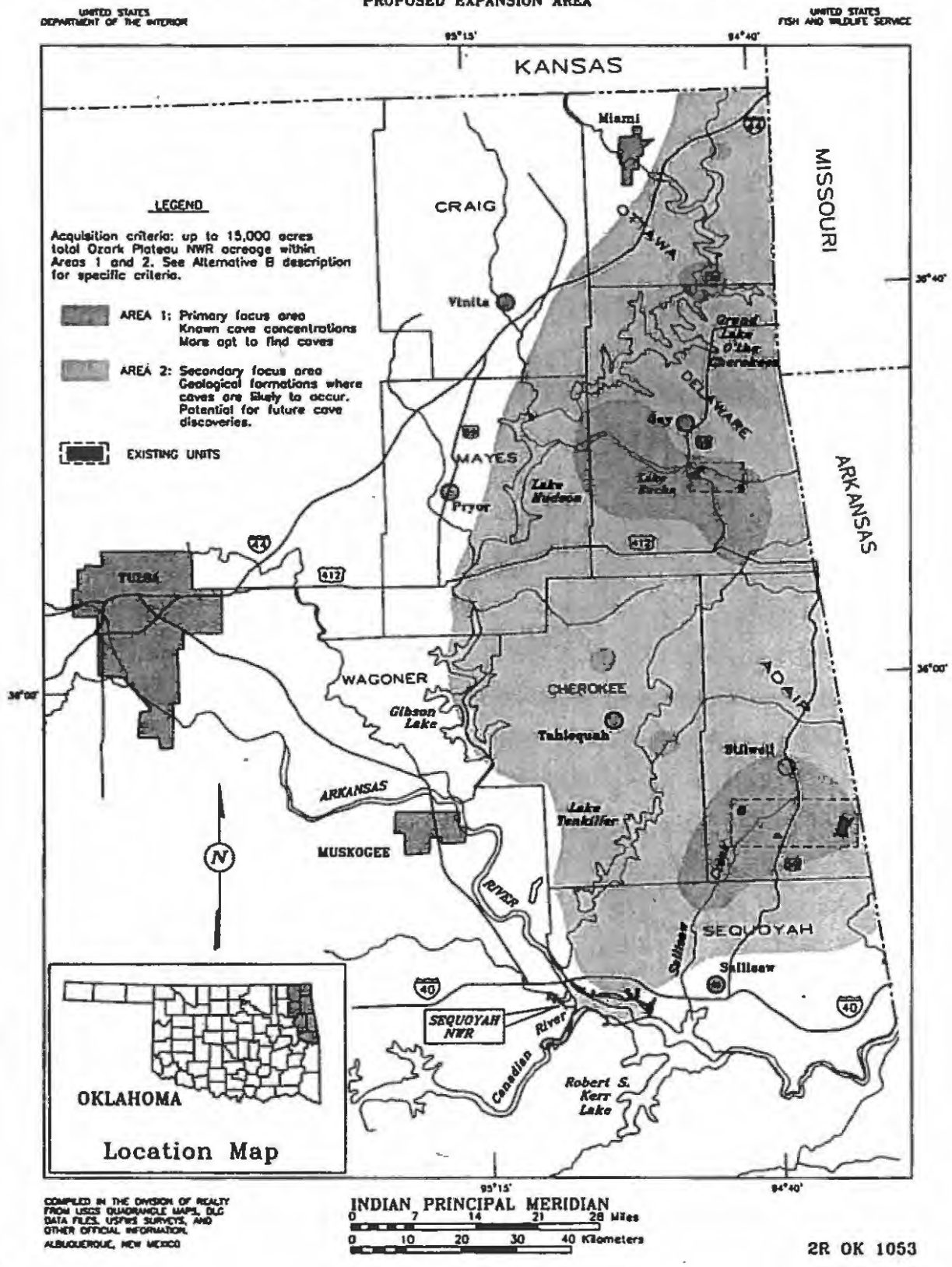
The proposed project area is not located within any national forests, national parks or monuments. However, a public review and comment period just closed on an environmental assessment, land protection plan, and conceptual management plan prepared by the U.S. Fish and Wildlife Service (USFWS) for a proposed expansion of the Ozark Plateau National Wildlife Refuge. The USFWS proposes to expand the refuge to include units in Cherokee, Craig, Mayes, and Sequoyah counties. The proposed waterline project appears to fall within a primary focus area on the Baron Fork River where there are known cave concentrations or where caves are more apt to be found. The proposed project is definitely located within the proposed refuge expansion secondary focus area where geological formations indicate caves are likely to occur, and there is potential for future cave discoveries. For more information concerning the Ozark Plateau National Wildlife Refuge proposed expansion, contact Ms. Jeannie Wagner-Greven at 505-248-6633 with the USFWS. A copy of the proposed refuge expansion area is included as Figure 5-1.

The proposed waterline will cross property owned by the U.S. Army Corps of Engineers and managed by the Tenkiller Ferry Lake Office; however, there are no public recreation areas within the proposed project area. The Illinois River, from the Oklahoma State line downstream to the headwaters of the Tenkiller Reservoir, and the Barren (Baron) Fork Creek from the present alignment of Highway 59 west to the Illinois River are classified as scenic rivers and outstanding resource water by the Oklahoma Legislature. Both rivers qualify and meet eligibility requirements for the National Wild and Scenic River System, but have not been added to the system at this time.

The public participates in hunting, fishing, hiking, camping, nature observation, and caving (cave exploration) on wild lands in the area. Deer, turkey, squirrel, raccoon, bobwhite quail, and rabbit are the most commonly hunted animals. Some waterfowl hunting occurs in the lake and wetland areas. Fishing and boating are popular in the Illinois and Baron Fork rivers and Tenkiller Ferry Lake.

Figure: 1 OZARK PLATEAU NATIONAL WILDLIFE REFUGE

PROPOSED EXPANSION AREA



NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

Should Federal funds be expended for construction of any part of the proposed alternatives and/or should the proposed facilities be constructed on Federal property, appropriate NEPA documentation would be required. Documentation required by NEPA would consist of either an Environmental Assessment and signed Finding of No Significant Impact or an Environmental Impact Statement and signed Record of Decision.

Public involvement is an important component to the NEPA process. It requires full disclosure of project purpose(s), design, alternatives, and environmental impacts. The public should be given an opportunity to comment on the proposed action early in the planning process through a "Scoping Process", which includes public meetings or workshops. If warranted, an additional public meeting(s) could be required at the time the NEPA documentation is released for public review and comments. The public should be given at least 2 weeks' notice prior to all public meetings or workshops, which should be held at a time of convenience to the public (Monday-Friday). Notification should be made by purchasing an advertisement in local newspapers and through the use of public service announcements on local radio and television stations. Since the project is regional in scope, several community newspapers should be used for notification purposes.

CONCLUSIONS

Construction of the project could have potential adverse impacts on Federally-listed threatened and endangered species and wetlands. However, with proper planning and coordination with the U.S. Fish and Wildlife Service and Tulsa District Regulatory Branch, these impacts can be avoided and/or mitigated.

REFERENCES

Bailey, Robert G. 1980. Description of Ecoregions of the United States. United States Department of Agriculture Forest Service Miscellaneous Publication No. 1391, 77 pp.

USFWS. 2002. Ozark Plateau National Wildlife Refuge Proposed Refuge Expansion Environmental Assessment.

APPENDIX 6

REAL ESTATE

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REAL ESTATE

PURPOSE OF RECONNAISSANCE VALUATION STUDY

The purpose of this reconnaissance level valuation study is to estimate the market value and acquisition costs of the real estate interest that would be required to implement the Adair County RWD No. 5 Regional Water System. The Corps of Engineers is preparing this study for the Oklahoma Water Resources Board, the study sponsor, under the authority of Section 22 of the Water Resource Development Act of 1974, the Planning Assistance to the States Program. The sponsor will use the information to decide the best method to supply the future needs for Adair County Rural Water District #5.

DATE OF VALUATION STUDY

The fieldwork for the land values was completed December 18, 2002.

REAL ESTATE COST ESTIMATE SUMMARY

	Alternative 1	Alternative 2	Alternative 3
Lands & Damages	$9,400	$9,900	$63,500
Relocation Assistance	$0	$0	$0
Minerals	$0	$0	$0
Contingencies	$24,000	$18,000	$8,000
Administrative	$120,000	$90,000	$40,000
Total:	$153,400	$117,900	$111,500

ESTIMATE OF VALUE

The estimated values of the real estate for the three alternatives are $153,400, $117,900, and $11,500, respectively. Contingencies represent the risks of condemnation and negotiation.

The estimated value for the real estate interests and damages is based upon an assumption that county road rights-of-way will provide adequate spacing, and will always be available and used. In addition, it is assumed that all private lands would be acquired by negotiation or condemnation at some fair market related value. The normal practice for many rural water districts is to receive donated land in consideration of the net benefit of system access to the landowner.

The study information on the design of the regional water system only addressed the primary distribution system and pump stations. No secondary system elements were evaluated.

PROPERTY ESTATES FOR THE PROJECT

The estate for the pipeline would be a standard perpetual right-of-way easement. A fee estate with mineral subordination would be recommended for the lake (Alternative 3). A fee estate would be appropriate for the pump stations.

ESTIMATED NUMBER OF OWNERSHIPS

Alternative 1: For this alternative, there are 10 private ownerships, 2 county ownerships, and 1 Federal ownership that would need to be acquired..

Alternative 2: For this alternative, there are 8 private, 1 county, and 1 Federal ownerships.

Alternative 3: There are 4 private ownerships involved in this alternative.

No navigation servitude is located in the subject study area.