ORDER INCLUDING THE MISSISSIPI RIVER VALLEY ALLUVIAL AQUIFER WITHIN PHILLIPS COUNTY WEST OF CROWLEY'S RIDGE WITHIN THE CACHE CRITICAL GROUND WATER AREA

The Commission hereby adopts the "Proposed Staff Recommendation for the Designation of a Critical Ground Water Area" executed by Water Resources Management Chief Edward Swaim on May 18, 2015.

Adopted this 20th day of May, 2015.

Arkansas Natural
Resources Commission

David Feilke, Chair

ATTEST:

J. Randy Young, P.E.
Executive Director

BEFORE THE ARKANSAS NATURAL RESOURCES COMMISSION

In the Matter of: The Designation of the Mississippi River Valley alluvial aquifer within the portion of Phillips County west of Crowley's Ridge as a Critical Ground Water Area.

CGWA 2015-1.

PROPOSED STAFF RECOMMENDATION FOR THE DESIGNATION OF A CRITICAL GROUND WATER AREA

INTRODUCTION

As a function of the Arkansas Natural Resources Commission's comprehensive ground water protection program required by Arkansas Code Ann. § 15-22-906, Commission staff acting upon a petition from the City of Marvell, completed a scientific investigation of reported ground water problems in Phillips County. In 2009, the Commission designated the Cache Critical Ground Water Area, which includes portions of Clay, Craighead, Cross, Greene, Poinsett, St. Francis, and Lee Counties lying west of Crowley's Ridge. Based upon investigation and comments obtained from citizens within Phillips County, Commission staff members recommend that the Arkansas Natural Resources Commission ('ANRC') enter Findings of Fact and Conclusions of Law, and Order including the portion of Phillips County west of Crowley's Ridge within the Cache Critical Ground Water Area.

PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW

I. Statutory and regulatory requirements.

When making a determination that an area within Arkansas should be designated as a Critical Ground Water Area pursuant to § 15-22-908, ANRC staff undertakes an analysis pursuant to Section 403.1. Through this analysis, ANRC staff determines areas that have developed, or may develop, significant ground water depletion or degradation. Designating an

area indicates that limitation of withdrawals through the use of water rights may be necessary to maximize the present and continued beneficial use of the area's remaining ground water resources. Section 403.1(A) reads as follows:

> A. Indicators to be used in an analysis leading to a recommendation of a critical ground water area will consist of, but not be restricted to, the following parameters:
>
> 1. Water Quantity:
>
> (a) For water table conditions (unconfined aquifer): Average declines of one foot or more have occurred annually for a minimum of five years and/or water levels have been reduced such that 50% or less of the formation is saturated.
>
> (b) For artesian conditions (confined aquifer): Average declines of one foot or more have occurred annually for a minimum of five years and/or the potentiometric surface is at or below the top of the formation.
>
> 2. Water Quality: Ground water quality has been degraded or trends indicate probable future degradation that would render the water unusable for the beneficial uses of the aquifer.
>
> 3. Projections/Hydrologic Boundaries: Consideration will be given to a safe yield of ground water pumping strategy for the aquifer including the utilization of a ground-water flow model, the natural hydrologic boundaries of the aquifer, and projected water-level declines.

The criteria listed in part A of the rule are non-exclusive criteria provided as guidelines for addressing ground water quantity and quality. Though analysis using the criteria is required, the criteria are not litmus tests for designation. It is not necessary to show, for example, a one-foot per year decline over five years in a given area to include it in the designation.

Once ANRC staff conducted an analysis of Phillips County, ANRC staff prepared and published a recommendation based on the indicators in Section 403.1(A) as well as on specific geologic and hydrologic characteristics of the area judged by Commission staff to warrant inclusion. ANRC staff next conducted a public hearing within Phillips County on May 19, 2015, in accordance with the Administrative Procedure Act. After consideration of all evidence, public

comments, and recommendations of ANRC staff, the Commission may issue an order designating the proposed area as a critical ground water area.

II. Boundaries of the Cache Critical Ground Water Area.

The Cache Critical Ground Water Area ("Cache CGWA") includes portions of Clay, Craighead, Cross, Greene, Poinsett, St. Francis, and Lee Counties lying west of Crowley's Ridge as defined and illustrated in the Geologic Map of Arkansas (Haley, B.R.; assisted by Glick, E.E., Bush, W.V., Clardy, B.F., Stone, C.G., Woodward, M.B., and Zachry, D.L., 1993, Geologic Map of Arkansas: U.S. Geol. Survey, Special Geologic Map, scale 1:500,000.).

Crowley's Ridge does not extend all the way across Lee County. Therefore, the portion of Lee County subject to the critical ground water area designation is that portion of Lee County lying west of Crowley's Ridge and that portion of Lee County lying west of Range 3 East beginning at the Southeast Corner of Section 24, Township 2 North, Range 3 East and extending North to the Northeast corner of Section 12, Township 3 North, Range 3 East.

Crowley's Ridge does not extend all the way across Phillips County either. Therefore, the boundaries for the portion of Phillips County proposed for designation are the county lines on the North, West, and South, with the Mississippi River as the Eastern boundary less the portion of Phillips County lying east of Crowley's Ridge. The excluded portion is east of Townships 1 South, 4 East, 2 South and 4 East.

The current Cache CGWA has been designated as critical for both the alluvial and Memphis Sand aquifers. However, Commission staff only recommend designation for the alluvial aquifer underlying Phillips County west of Crowley's Ridge; this recommendation does not cover designation of the Memphis Sand aquifer underlying Phillips County west of Crowley's Ridge.

A map of the Cache CGWA with the part of Phillips County proposed for designation is attached as Exhibit 1.

III. Description of the Aquifers.

The natural hydrogeologic boundary for the Mississippi River Valley alluvial aquifer in this area is the White River and the Black River to the west and Crowley's Ridge to the east. The alluvial aquifer is an unconfined aquifer, generally consisting of 60 to 140 feet of sand and gravel that underlies all of the Cache CGWA. The Mississippi River Confining Unit, composed of up to 80 feet of fine-grained sand, silt, and clay, overlies it. The alluvial aquifer is connected hydraulically to several rivers (including the White, Black, and Cache), streams, and other bodies of water. Rainfall infiltration and inflow of surface water recharge the aquifer, while water is removed from the aquifer by pumping and outflow to surface water bodies.

The Memphis Sand aquifer is composed mainly of sand with considerable amounts of silt, clay, and some lignite. The aquifer in eastern Arkansas is part of a thick sand section in the middle and lower portions of the Claiborne Group. This aquifer is underlain by a layer of clay that is part of the Wilcox Group. Lithologically, it varies considerably both vertically and laterally. The Memphis Sand aquifer includes the Sparta Sand, the predominantly sandy facies of the Cane River formation, and the Carrizo Sand. It is a confined aquifer with very low storage compared to the overlying alluvial aquifer.

A very general comparison of the alluvial and the Memphis Sand aquifers can be made by considering the volume of water stored in each formation. One square mile of confined Memphis Sand aquifer with a thickness of one foot (with a specific yield of 0.0001) can provide 0.06 acre-feet (19,554 gallons) of water. By contrast, a similar volume, one mile square by one foot thick, of the alluvial aquifer yields approximately 192 acre-feet of water (with a specific

yield of 0.3). Therefore, the alluvial aquifer can supply 3,000 times the amount of water as the same volume of confined Memphis Sand aquifer. Transmissivity of the alluvial aquifer ranges from 30,000 to 45,000 feet squared per day as compared with the Memphis Sand aquifer that has a transmissivity of 4,000 to 17,000 feet squared per day. Water is transmitted through the alluvial aquifer at a rate ranging from 1.76 to 11.25 times faster than through the Memphis Sand.

The alluvial and Memphis Sand aquifers have been pumped in ever-increasing amounts for agricultural irrigation since the early 1900s. From 1985 to 2005, use from the alluvial aquifer in the Cache CGWA increased from 1278.8 million gallons per day (mgd) to 2864.5 mgd. (Holland 1985, 2005). This represents a 124.0% increase in water use.

IV. Rule 403.1 Analysis of Phillips County.

The alluvial aquifer underlying Phillips County west of Crowley's Ridge meets the requirements of Commission Rule 403.1 and should be declared a Critical Ground Water Area. However, the Memphis Sand aquifer underlying Phillips County does not meet the criteria for designation.

1. Water Level Declines.

As water levels decline, the potentiometric surface, or hydraulic pressure head, of the formation is lowered. Where removal of water lowers the potentiometric surface to below the top of the formation, the aquifer may compact under the weight of overlying formations. This compaction can permanently reduce the aquifer's storage capacity, reducing the yield of wells drilled into the formation. Not only is the aquifer's capacity to store water affected, but its transmissivity, the ability of the aquifer to allow water to move through the aquifer, will be reduced, thereby lowering the volume of water available to wells.

Phillips County alluvial well measurements taken from eight wells between 2004 - 2014 illustrate that the average depth to water within that time period was about 5.47 feet lower in 2014 than in 2004. Measurements from five Phillips County alluvial wells from 2009-2014 indicate that the decline was about 1.77 feet between 2009 -2014. Phillips County measurements taken from five wells in the Sparta between 2004 - 2014 illustrate that the average depth to water within that time period was about 3.06 feet higher in 2014 than in 2004 with only two of the five wells showing declines. Between 2009-2014, the average depth to water was 9.44 feet higher with only 1 well showing a decline. Because Phillips County has not experienced average declines of one foot or more occurring annually for a minimum of five years, this criterion alone does not indicate that Phillips County should be designated as a critical ground water area.

However, an existing cone of depression in the potentiometric surface of the alluvial aquifer has spread to the northwestern portion of Phillips County. A cone of depression indicates that the aquifer is being pumped at an unsustainable rate. Withdrawals from the alluvial aquifer are above the estimated sustainable yield for Phillips County. Currently, Phillips County can only sustain 37.8% of its water usage.

As water levels continue to decline, the aquifer will not be able to sustain either the quantity or the quality of ground water supplied in the past. This decline will result in increased pumping costs, decreased well yields, and increased well interference as well as the threat of degradation in the form of salt water intrusion, land subsidence, and reduced recharge to streams and wetlands. Many wells will need to be deepened at great cost to water users. Because rivers and streams that are hydraulically connected to the alluvial aquifer and their base flows depend on ground water levels, excessive withdrawals near the rivers, streams, and wetlands can

adversely affect surface water levels. Both wildlife and navigation will be affected by lower surface water levels.

Water-level decline data supporting this proposed designation are found in the "Arkansas Ground Water Protection and Management Reports" for 2013 and 2014 published by the Commission, the "Technical Presentation for the Phillips County Critical Ground Water Area", and the United States Geological Survey (USGS) Scientific Investigations Report Numbers 2007-5029, 2008-5092, 2003-4230, 2003-4231, 2008-5138, 2009-5040, 2007-5241, and 2006-5052.

2. Decreased Saturated Thickness.

Saturated thickness is another indicator used to determine whether an aquifer should be designated critical. The "saturated thickness" of an unconfined aquifer is the portion of the aquifer that is filled with water. The immediate effect of a loss of saturated thickness is an inability to acquire water from the aquifer. Stored water also helps support the structure of the aquifer. As pumping removes water, the aquifer can be damaged by collapse of that structure, causing loss of storage capacity and possibly land subsidence. Having a saturated thickness of 50% or less of the formation is indicative that an aquifer should be designated as a critical ground water area. The aquifers within Phillips County are healthy in this respect, with all measured wells having saturated thicknesses of 82.2 – 89.4% of the formation.

3. Degradation of Water Quality.

ANRC staff also examined water quality produced by the aquifers within Phillips County to make this recommendation. Excessive pumping of the alluvial can cause salt-water intrusion and render water unsuitable for drinking and agricultural purposes. There is no immediate indication of groundwater quality degradation within Phillips County.

4. Geologic and Hydrologic Characteristics Warranting Inclusion of Phillips County in the Cache CGWA.

Phillips County meets critical ground water criteria for the Mississippi River Valley alluvial aquifer because a cone of depression has now extended into the northwestern portion of the county and pumping rates are above the sustainable yield of the alluvial aquifer.

Increasing declines in the alluvial aquifer have forced some water users in the Cache Critical Ground Water Area to drill into the deeper Memphis Sand to obtain sufficient water. Municipal water systems have historically been the primary users of Memphis Sand aquifer water, since the high quality water requires minimal treatment. At the same time, agricultural ground water users have depended on water from the alluvial aquifer, which can provide a much greater volume of water at a much lower cost. Historic patterns are changing as the alluvial aquifer is depleted. Though water users continue to turn to the Memphis Sand aquifer, it does not have the storage capacity or ability to transmit water and cannot be relied upon as a replacement for the alluvial aquifer.

5. Summarized Comments from Phillips County Hearing.

At the Phillips County Hearing, attendees expressed concern about future water supplies and two attendees noted that they had been forced to deepen some of their wells. Attendees also noted that they would like to receive assistance to build reservoirs. A few attendees expressed fear of government regulations in general.

PROPOSED ORDER

Based on the Proposed Findings of Fact and Conclusions of Law, the staff recommends adoption of the following Order:

1. Having met the requirements of Commission Rule 403.1(A), the alluvial aquifer underlying Phillips County west of Crowley's Ride, as defined and illustrated in the Geologic Map of Arkansas, is designated a Critical Ground Water Area pursuant to the Arkansas Ground Water Protection and Management Act and will be included within the Cache Critical Ground Water Area.

2. This designation **does not** include institution of regulatory authority. While the General Assembly provided for regulation in the Arkansas Ground Water Protection and Management Act, it is not the intent of the Commission to take this step at this time. The recommended designation is a non-regulatory means of focusing educational and conservation efforts on a serious resource threat. The designation will focus resources of the Phillips County Conservation District, the University of Arkansas Division of Agriculture Cooperative Extension Service, and the Commission, on resolving ground water depletion within Phillips County.

3. The Commission and staff will take the following actions:

(a) Water Plan Compliance review of projects under Arkansas Code Ann. §15-22-503(e) and Title VI of the Commission's rules that make additional use of the alluvial aquifer underlying Phillips County west of Crowley's Ridge should be approved only when there is no other economically or technically feasible alternative, or when human health requires.

(b) The Commission's financial assistance programs will give priority to projects within Phillips County west of Crowley's Ridge that use surface water, avoid use of the Memphis Sand aquifer, and implement ground water conservation.

(c) The Commission's conservation, education, and information program will focus its efforts within Phillips County on technology transfer, training, technical

assistance, research, and demonstration projects. The Commission will use a portion of the water use fees collected pursuant to Arkansas Code Ann. § 15-22-913 and 914 to encourage conjunctive water use including, when appropriate, the substitution of surface water, avoidance of the Memphis Sand aquifer, and water conservation within the designated portion of Phillips County.

(d) ANRC staff will encourage the use of state income tax credits available under the Water Resources Conservation and Development Incentives Act (Arkansas Code Ann. § 26-51-1001 - 1014). Persons who convert from ground to surface water use within the area can receive tax credits amounting to 50% percent of project costs. Landowners converting to surface water use outside critical areas are limited to a 10% credit.

(e) As required by Commission Rule 403.2(A), ANRC staff is directed to continue monitoring the situation within the designated portion of Phillips County and to report back to the Commission periodically.

(f) The Commission shall maintain jurisdiction over this matter and shall enter additional orders as it deems necessary.

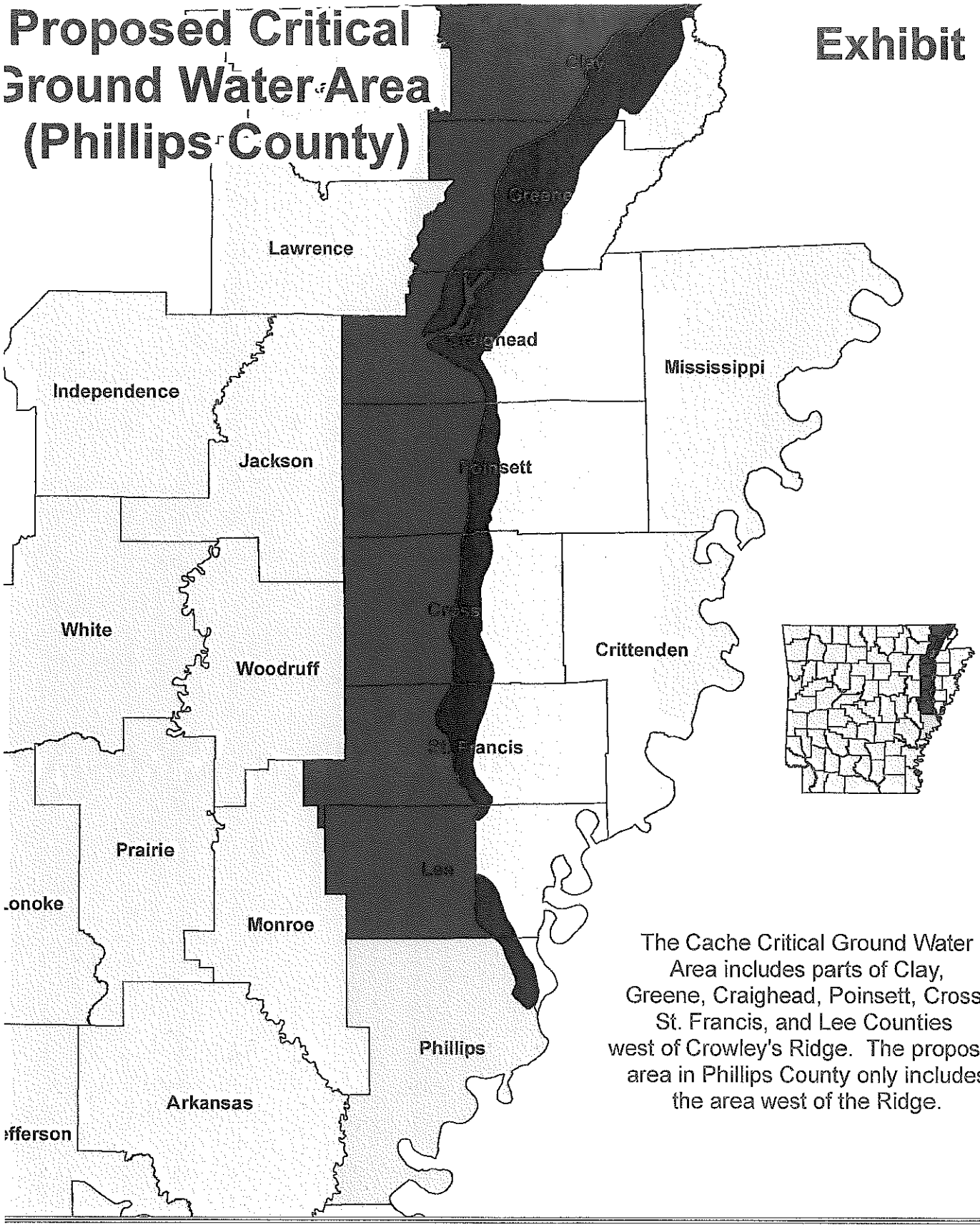
Respectfully submitted this 18 **day of** MAY **, 2015.**

Edward C. Swaim

Edward Swaim
Water Resources Management Chief
Arkansas Natural Resources Commission

Proposed Critical Ground Water Area (Phillips County)

Exhibit 1



The Cache Critical Ground Water Area includes parts of Clay, Greene, Craighead, Poinsett, Cross, St. Francis, and Lee Counties west of Crowley's Ridge. The proposed area in Phillips County only includes the area west of the Ridge.

Legend

- Proposed Area
- Cache Critical Ground Water Area
- Crowley's Ridge
- County Boundaries

N W E S

0 5 10 20 30 40 Miles

ORDER INCLUDING THE MISSISSIPI RIVER VALLEY ALLUVIAL AQUIFER WITHIN PHILLIPS COUNTY WEST OF CROWLEY'S RIDGE WITHIN THE CACHE CRITICAL GROUND WATER AREA

The Commission hereby adopts the "Proposed Staff Recommendation for the Designation of a Critical Ground Water Area" executed by Water Resources Management Chief Edward Swaim on May 18, 2015.

Adopted this 20th day of May, 2015.

Arkansas Natural
Resources Commission

David Feilke, Chair

ATTEST:

J. Randy Young, P.E.
Executive Director