

Kentucky Drought Mitigation and Response Plan



Prepared by the Energy and Environment Cabinet in partnership
with the Kentucky Drought Mitigation
and Response Advisory Council

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Executive Summary

Kentucky is perceived as a “water-rich” state with an average annual rainfall of 45 to 50 inches and abundant groundwater and surface water resources. However, Kentucky can experience extended periods of dry weather ranging from relatively short-duration single-season events to multi-year events.

Drought is a natural and recurring climatic feature but unlike other natural disasters it is not a distinct event that has a clearly defined beginning and end. Rather it is often the result of the interactions between various complex physical and social factors that are difficult to quantify or predict. Ultimately drought is manifest as an amount or distribution of moisture that is not sufficient to meet the needs of society or the environment and can result from both natural events that decrease supply and from human activities that increase the demand for water.

The impacts to the environment, economy and human health and safety caused by droughts underscore a need to move toward a proactive approach to drought planning and management. The risk of these potential impacts depends on the types of water demands, how these demands are met and the availability of water supplies necessary to meet these demands. This plan serves as a foundation to a proactive drought planning process intended to reduce drought risk in Kentucky. The plan describes a simple collaborative approach to accelerate the decision-making processes of state and federal agencies that are necessary to assist local government efforts in drought *response*. It establishes a mechanism for these agencies to work together during nondrought years with various agencies and individuals outside of state government to identify *mitigation* actions that can be taken to reduce the impacts of future droughts.

This plan was developed in consultation with the Drought Mitigation and Response Advisory Council (see Appendix III). This council provided invaluable insight and advice, and the cabinet is greatly appreciative of the members of this council for their participation and efforts.

1. Purpose

Kentucky has experienced three significant drought periods in the past 20 years: 1988, 1999-2000 and 2007-2008. Government responses have generally been slow and fragmented with little focus on preparedness and mitigation. Coordination and synergy between state agencies has not been absent, but generally implemented on an *ad hoc* basis in later stages of drought with a “crisis management” motive. Much of this can be attributed to the lack of timely transfer of information between agencies early on in the development of a drought and the absence of a consistent set of criteria to define the onset and severity of drought.

This plan provides statewide guidance to assess and minimize the impacts of a drought in Kentucky. To accomplish these objectives, the Kentucky Drought Mitigation and Response Plan will

- a. Create a state-level organizational structure that facilitates coordination of state and federal agencies in drought monitoring, response and mitigation activities.
- b. Establish a consistent basis for evaluating the severity of drought situations.

- c. Promote a long-term strategy of evaluating the state's drought vulnerabilities and identifying actions that will reduce the impacts from future droughts.

2. Defining Drought, Drought Response and Drought Mitigation

There is not a single definition of drought to succinctly describe the progressive nature of drought development. Most often drought is defined by a combination of several definitions for increasing drought severity that are based on meteorological, agricultural, hydrological and socioeconomic effects.

2.1 Meteorological Drought

Meteorological measurements are generally the first indicators of drought development. This category of drought is often defined by a period of precipitation deficit that is outside of a "normal" range over a defined period of time. The concept of normal is often derived from a 30-year record of daily precipitation measurements at a specific location. Thus, a definition of meteorological drought is regionally-specific and presumably based on a thorough understanding of regional climatology.

2.2 Agricultural Drought

Agricultural drought occurs when there is not enough soil moisture to meet the needs of a particular crop at a particular time. Agricultural drought develops at some point after meteorological drought and is identified by linking the characteristics of a meteorological drought to agricultural impacts. This category of drought can develop quite suddenly and is usually the first economic sector to be affected by drought.

2.3 Hydrological Drought

Hydrological drought refers to the deficiencies in surface and subsurface water supplies. It is measured as streamflow and as lake, reservoir and groundwater levels. There is a time lag between lack of rain and diminished quantities of water in streams, rivers, reservoirs and aquifers. Therefore, hydrological measurements are not the earliest indicators of drought. Drought will not be reflected in declining subsurface and surface water levels until precipitation is deficient over an extended period of time. Although it is a natural phenomenon, the impacts of hydrological drought are often intensified by human activities and land use.

2.4 Socioeconomic Drought

Socioeconomic drought occurs when physical water shortage begins to affect people, individually or collectively. This category of drought is manifested by adverse impacts to the health, well-being and quality of life of the people, or when drought begins to affect the supply and demand of an economic product.

2.5 Drought Response

Drought response is the process of taking actions during a drought event to reduce its immediate impacts to the environment or society. The purpose of drought response is to reduce the impacts of drought by making temporary adjustments to normal practices until the threat of drought is relieved by a resumption of normal climatic conditions.

2.6 Drought Mitigation

Mitigating drought is the process of taking actions in advance of drought to reduce its long-term risk. The purpose of mitigation and preparedness actions is to reduce the impacts of drought by identifying principal activities, groups or regions most at risk and developing mitigation actions and programs that alter these vulnerabilities.

3. The Kentucky Drought Mitigation Team

In order for the state to effectively manage a developing drought situation, this plan recommends the establishment of the Kentucky Drought Mitigation Team (KDMT) that will be chaired by the secretary of the Energy and Environment Cabinet or a designee. The purpose of the KDMT is to (1) engage multiple agencies in a coordinated approach for responding to drought situations (drought response), and (2) use lessons learned and information gained from drought experiences, to develop recommendations for reducing long-term drought risk (drought mitigation). The KDMT will consist of officials from state and federal agencies and representatives of local agencies and professional organizations that have responsibility for areas likely to be affected by drought conditions or who have an interest in supporting the actions of the KDMT.

The KDMT is intended to function as a group of coordinating agencies, each having its respective statutory obligations and responsibilities in responding to a drought situation. It is not intended to infringe upon these obligations; rather it will serve as a forum for agencies to collaborate about the impacts of drought, discuss possible interagency responses and identify opportunities for technical assistance or information transfer between coordinating agencies. The KDMT exercises no operational authority over any of the coordinating member agencies.

3.1 KDMT Membership

The KDMT will monitor drought development and facilitate coordination between various state, federal and local agency responses to drought situations. The following state agencies will be designated members of the KDMT:

- The Energy and Environment Cabinet (Chair)
 - Division of Water
 - Division of Environmental Program Support
 - Division of Forestry
 - Division of Conservation
 - Department of Energy
 - Public Service Commission
- Department of Fish and Wildlife Resources
- Department for Public Health
- Division of Emergency Management
- Kentucky National Guard

- Kentucky Department of Agriculture
- Governor's Office of Agricultural Policy
- Kentucky Infrastructure Authority
- Kentucky Cooperative Extension Service
- Kentucky State Climatologist Office
- Kentucky River Authority
- Department of Homeland Security

The following agencies and organizations will be invited to participate and support the KDMT:

- Kentucky Council of Area Development Districts
- Kentucky Geological Survey
- National Weather Service
- U.S. Geological Survey
- U.S. Army Corps of Engineers
- Kentucky Rural Water Association
- Kentucky/Tennessee Section of the American Water Works Association
- Kentucky Farm Bureau
- Kentucky Association of Counties
- Kentucky League of Cities
- Kentucky Pollution Prevention Center
- University of Louisville Center for Hazards Research and Policy Development
- University of Kentucky College of Agriculture
- Kentucky Municipal Utilities Association
- Representative(s) of electrical power generators
- Representative(s) of municipal and rural water utilities
- Representative(s) of industrial water users
- Representative(s) of environmental interests
- Representative(s) of recreational interests

3.2 KDMT Activities

The chairperson will be responsible for activating the KDMT and ensuring that the coordinating agencies are informed of the proceedings and findings of drought assessment teams (section 3.3) during a drought event. During mild to moderate levels of drought, most of the actions of the KDMT will be carried out by the chairperson or a designee without formal activation of the KDMT. These actions may include producing and distributing reports to the coordinating

agencies of the KDMT and drafting press releases or other public notifications related to general drought conditions in the state or a region of the state.

- a. Upon activation, the primary **drought response** activities of the KDMT will be to:
 - Meet as necessary to collect, review and distribute information on the drought situation throughout the state. The types and sources of drought information gathered by the KDMT are summarized in Table 3.1.
 - Facilitate interagency communications and the sharing of technical or other resources among coordinating agencies.
 - Coordinate and maintain a record of the state's drought response activities.
 - Develop and implement a process to systematically gather and analyze the extent of impacts to various drought impact sectors in each drought event.
 - Routinely distribute a *Drought Situation Report* to the heads of coordinating agencies containing information on the severity of drought and its impacts to the state's water resources, public water supplies and other impacted sectors.
 - Coordinate communication through media outlets, the Internet and other avenues to keep the general public informed about the location, severity and potential impacts of a developing drought.

Table 3.1. The primary types and sources of information used for drought monitoring and impact assessment.

DROUGHT ASSESSMENT INFORMATION	SOURCE AGENCIES
Groundwater levels, spring discharges, streamflow conditions and lake levels	Division of Water U.S. Geological Survey
Climatic outlooks and short-term forecasts Summary of historical comparisons	National Weather Service
Summary of precipitation data	Division of Water National Weather Service State Climatologist's Office
Current drought status and historical comparisons of drought indices and regional or global climate patterns	State Climatologist's Office
Status of water supplies List of systems activating water shortage response measures Priority list of vulnerable water suppliers	Division of Water Division of Environmental Program Support
Drinking water quality, infrastructure (e.g., pressure or treatment problems) Public health concerns with drinking water supplies	Division of Water Department for Public Health
Status of U.S. Army Corps of Engineers projects	U.S. Army Corps of Engineers
Summary of drought indicators	Division of Water
Summary of potential emerging drought-related	Department for Public Health

health issues	
DROUGHT ASSESSMENT INFORMATION (cont.)	SOURCE AGENCIES
Updates of crop, soil moisture, water sources and agricultural conditions Summary of agricultural weather reports	Kentucky Department of Agriculture University of Kentucky Agriculture Weather Center
Updates of forest fire conditions	Division of Forestry
Summary of impacts to fish and wildlife resources	Kentucky Department of Fish and Wildlife Resources
Other data or information as needed	Specific to type of information required

b. The primary **drought mitigation** actions of the KDMT will be to:

- Meet on a regular basis during nondrought years to review and, if necessary, revise the drought mitigation (section 7) and response plan. The frequency and scheduling of meetings will be determined by consensus of the members of the KDMT.
- Identify vulnerabilities associated with drought and recommend actions to mitigate those vulnerabilities.
- Develop long-range strategies for mitigating the impacts of future droughts.
- Work to integrate drought planning with other planning processes, particularly local and regional water resources planning and hazard mitigation planning.

3.3 KDMT Drought Assessment Teams

Drought Assessment Teams (DAT) will be established to support and carry out the work of the KDMT (Appendix Figure II.E). Membership in a DAT will consist mainly of individuals who will be actively engaged in the assessment or analysis of drought impacts for their respective agencies. Additional DATs may be convened at any time if it is determined that drought assessments should be broadened to include other impacted sectors. The chair of the KDMT will be responsible for inviting participants, naming chairpersons and defining the objectives of *ad hoc* workgroups.

The purpose of a DAT is to provide a mechanism that brings agencies sharing common interests together much earlier in the development of a drought than has typically occurred in the past. As with the KDMT, a DAT will exercise no operational authority over any of the coordinating member agencies.

The core membership of the DATs listed below will remain flexible and does not preclude participation in any workgroup by any other interested members of the KDMT.

3.3.1 Climate and Water Resources Data Team (CWRD)

The role of the CWRD is to compile surface water, groundwater, climatic, meteorological and other data necessary to assess drought conditions. Membership of the CWRD will include technical and professional representation from state and federal agencies with expertise in climatology, meteorology, hydrology and water resources management. This team will assume

the functions of the Water Availability Advisory Group, an advisory body that has assisted state drought response efforts since 1984. The following agencies will be designated core members of the CWRD:

- Kentucky State Climatologist Office (co-Chair)
- Division of Water (co-Chair)
- Division of Conservation
- Division of Forestry
- Kentucky Department of Fish and Wildlife Resources
- National Weather Service
- U.S. Geological Survey
- Kentucky Geological Survey
- University of Kentucky Agricultural Weather Center
- U.S. Army Corps of Engineers
- Kentucky River Authority

The CWRD team will meet annually between the dates of March 15 and April 15 to make a preliminary assessment of the potential for drought conditions for the current year. At all other times the CWRD will meet as needed to monitor drought conditions or related activities according to a schedule established by the chairpersons until a Level I drought declaration is issued (Section 5.1.3). The chairperson or a designee will

- Convene the CWRD when climatic conditions or other assessments indicate potential for drought development;
- Activate the CWRD upon a Level I Drought Declaration
- Notify the KDMT of scheduled meeting dates;
- Preparing briefings of findings after each meeting for distribution to the KDMT, chairpersons of other DATs and other agencies as requested;

When activated the CWRD will begin to collect, monitor, and evaluate selected climatic, agricultural weather, water-supply and other water-related data as necessary to identify at an early stage the onset of a drought or potential for drought. As drought conditions progress, the CWRD will monitor the geographic extent of the affected areas and routinely report its findings to the KDMT. Functions that may be performed by the CWR include, but are not limited to:

- Deciding the most effective available data for monitoring drought development across the state and providing recommendations for appropriate drought level classifications for each of fifteen drought management regions in Kentucky.
- Using all available historical data, models and other expertise to alert water-sensitive sectors as early as possible to the potential for drought development in the current year.
- Evaluating the effectiveness of the state drought severity classification system and making modifications as needed.
- Identifying gaps to be filled in climatic, water resources or other data necessary for drought monitoring and long-term drought mitigation and water resources planning.
- Coordinating with the Division of Water to develop and produce a monthly water resources summary for Kentucky and published to the Drought Information Center Website.

- Contributing to KDMT Drought Situation Reports.

3.3.2 Agriculture and Natural Resources Team (AGNR)

The role of the AGNR is to identify potential impacts of drought conditions to agriculture and track their occurrence and intensity. Findings and recommendations of this team are assimilated into the overall Drought Situation Report and are intended to assure effective response capabilities, as well as provide documentation for any emergency declaration. The following agencies will be designated core members of the AGNR:

- Kentucky Department of Agriculture (Chair)
- Kentucky Cooperative Extension Service
- Division of Conservation
- Division of Forestry
- Governor's Office of Agricultural Policy
- University of Kentucky Agricultural Weather Center
- Division of Water

The AGNR will be convened at the discretion of the chairperson and will be activated only during periods of drought or anticipated drought. Given that agricultural impacts are typically the first to develop in a drought, it is expected that the AGNR will begin monitoring early drought development during the Drought Advisory phase (section 5.1.2) in coordination with the CWRD.

The chairperson or a designee will

- Activate the AGNR when climatic conditions indicate potential for drought development.
- Notify the KDMT of scheduled meeting dates.
- Prepare briefings of findings after each meeting for distribution to the KDMT, chairpersons of other DATs and other agencies as requested.
- Invite participation from agencies or individuals as necessary to enhance the effectiveness of the AGNR.

When activated the AGNR will begin to collect, monitor, and evaluate agricultural weather and production data as they are impacted by drought. As drought conditions progress, the AGNR will monitor the geographic extent of the affected areas and routinely report its findings to the KDMT. Functions that may be performed by the AGNR include, but are not limited to:

- Assess current and potential agricultural drought severity.
- Work to develop a systematic process that can effectively and rapidly gather agricultural impact assessment data from multiple sources during a drought event.
- Determine the types and sources of drought impact data that will be gathered by the AGNR.
- Assist in identifying and resolving conflicts that may arise when water availability is diminished by drought.
- Contribute to KDMT Drought Situation Reports.
- Identify sources of water that may be used by livestock producers for emergency livestock watering during declared agricultural drought emergencies.

3.3.3 Drinking Water and Public Health Team (DWPH)

The role of the DWPH is to identify potential impacts of drought conditions to drinking water supplies and public health and track their occurrence and intensity. Findings and recommendations of this team are assimilated into the overall Drought Situation Report and are intended to assure effective response capabilities, as well as provide documentation for any emergency declaration. The following agencies will be designated core members of the DWPH:

- Kentucky Department for Public Health (co-Chair)
- Kentucky Division of Water (co-Chair)
- Kentucky Infrastructure Authority
- Public Service Commission
- Kentucky River Authority

The following agencies/organizations will be invited to participate in the DWPH:

- Kentucky Rural Water Association
- Kentucky Association of Counties
- Kentucky League of Cities
- Kentucky Council of Area Development Districts
- Kentucky/Tennessee Section of the American Water Works Association

The DWPH will be convened at the discretion of the chairpersons or when the KDMT makes a declaration of Level I drought status (Section 5.1.3). The DWPH will be activated only during periods of drought or anticipated drought.

The chairpersons or a designee will

- Activate the DWPH when climatic conditions indicate potential for drought development.
- Notify the KDMT of scheduled meeting dates.
- Prepare briefings of findings after each meeting for distribution to the KDMT, chairpersons of other DATs and other agencies as requested.
- Invite participation from agencies or individuals as necessary to enhance the effectiveness of the DWPH

When activated the DWPH will begin to collect, monitor, and evaluate data on water supplies, water utility operations and related public health impacts of drought. As drought conditions progress, the DWPH will monitor the geographic extent of the affected areas and routinely report its findings to the KDMT. Functions that may be performed by the DWPH include, but are not limited to:

- Work to develop a systematic process that can effectively and rapidly gather water supply impact data from multiple sources during a drought event.
- Determine the types and sources of drought impact data that will be gathered by the DWPH.
- Assist in the identification and resolution of conflicts that may arise when water availability is diminished by drought.

- Contribute to KDMT Drought Situation Reports.
- Prepare and maintaining lists of resources such as water haulers and certified well drillers.
- Evaluate alternative or emergency sources and emergency interconnections in cases of water shortage emergencies.
- Coordinate technical assistance to water systems or local agencies dealing with drought impacts to water sources, treatment or distribution.
- Determine the need for water shortage watches and warnings and coordinate with public information officers in developing media releases and notifying affected local governments and water suppliers.

3.3.4 Drought and Water Emergency Team (DWE)

The role of the DWE is to identify locations, municipalities or water supplies that have an elevated risk of experiencing emergency shortages of available water that threaten human health, safety and sanitation. Findings and recommendations of this team are assimilated into the overall Drought Situation Report and are intended to assure effective response capabilities, as well as provide documentation for any emergency declaration. The following agencies will be designated core members of the DWE:

- Kentucky Division of Emergency Management (co-Chair)
- Kentucky Department for Environmental Protection/Division of Environmental Program Support (co-Chair)
- Kentucky Division of Water
- Kentucky Department for Public Health
- Kentucky Infrastructure Authority
- Public Service Commission
- Kentucky National Guard
- Kentucky Department of Homeland Security

Depending on the nature of drought development and types of regional impacts, the DWE may also need to include the following:

- Kentucky Division of Conservation
- Kentucky Department of Agriculture
- Kentucky Division of Forestry

The DWE will be convened at the discretion of the chairpersons or when the KDMT makes a declaration of Level II drought status (Section 5.1.4). The chairs may elect to activate the DWE prior to a Level II declaration upon the recommendation by the KDMT or drought assessment teams. The DWE will be activated only during periods of drought.

The chairpersons or a designee will

- Activate the DWE.

- Notify the KDMT of scheduled meeting dates.
- Prepare briefings of findings after each meeting for distribution to the KDMT chairpersons of other DATs and other agencies as requested.
- Invite participation from agencies or individuals as necessary to enhance the effectiveness of the DWE

When activated, the DWE will coordinate with the CWRD, AGNR and DWPB drought assessment teams to develop an *Emerging Situations* report for distribution to the KDMT and heads of coordinating member agencies. As drought conditions progress, the DWE will maintain communication with the drought assessment teams and update the report as information becomes available. Functions that may be performed by the DWPB include, but are not limited to:

- Contribute to KDMT Drought Situation Reports.
- Prepare Governor's Declaration of a Drought Emergency and supporting documentation in regards to a drought or water shortage emergency.
- Serve as a coordinating body for communications between the lead state agencies in charge of emergency response, KYEM and local emergency managers.

4. Drought Monitoring

The monitoring system and drought actions levels outlined in this plan were developed after a review of several other drought response plans from states in the eastern United States. It provides general guidelines for interpreting a number of different indicators that will be used to detect emerging drought conditions define levels of drought severity and initiate drought response actions.

4.1 Drought Management Regions

For purposes of drought planning and drought response, the 15 Area Development Districts (ADDs) in Kentucky will be designated as drought management regions. These regional boundaries correspond with local and regional planning boundaries which:

- simplify the implementation of this plan, and
- facilitate the integration of drought mitigation measures into the local hazard mitigation planning process through the Kentucky Division of Emergency Management.

In order to prevent overly broad responses to drought conditions, the state drought response measures will be considered within individual drought management regions, or even within individual counties or municipalities, if applicable. The drought management regions and associated counties are established as follows:

Barren River Region: Allen, Barren, Butler, Edmonson, Hart, Logan, Metcalfe, Monroe, Simpson, Warren

Big Sandy Region: Floyd, Johnson, Magoffin, Martin, Pike

Bluegrass Region: Anderson, Bourbon, Boyle, Clark, Estill, Fayette, Franklin, Garrard, Harrison, Jessamine, Lincoln, Madison, Mercer, Nicholas, Powell, Scott, Woodford

Buffalo Trace Region: Bracken, Fleming, Lewis, Mason, Robertson

Cumberland Valley Region: Bell, Clay, Harlan, Jackson, Knox, Laurel, Rockcastle, Whitley

FIVCO Region: Boyd, Carter, Elliot, Greenup, Lawrence

Gateway Region: Bath, Menifee, Montgomery, Morgan, Rowan

Green River Region: Daviess, Hancock, Henderson, McLean, Ohio, Union, Webster

Kentucky River Region: Breathitt, Knott, Lee, Leslie, Letcher, Owsley, Perry, Wolfe

KIPDA Region: Bullitt, Henry, Jefferson, Oldham, Shelby, Spencer, Trimble

Lake Cumberland Region: Adair, Casey, Clinton, Cumberland, Green, McCreary, Pulaski, Russell, Taylor, Wayne

Lincoln Trail Region: Breckinridge, Grayson, Hardin, Larue, Marion, Meade, Nelson, Washington

Northern Kentucky Region: Boone, Campbell, Carroll, Gallatin, Grant, Kenton, Owen, Pendleton

Pennyrile Region: Caldwell, Christian, Crittenden, Hopkins, Livingston, Lyon, Muhlenberg, Todd, Trigg

Purchase Region: Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, McCracken, Marshall

4.2 Drought Indicators

To be most effective, the drought monitoring system employed must be capable of identifying when an increased potential for drought development exists. To meet this objective, a set of primary drought indicators will be monitored on at least a monthly basis to maintain a continuous assessment of the climatic and hydrologic status in the state. Where possible, indicators will be evaluated by comparing current conditions to a range of normal conditions observed for a long-term period of record. In this way it can be determined if a current anomaly is within a commonly recurring range or whether it is unusually large.

Historically, significant droughts have exhibited unique patterns in how they have developed, intensified and persisted. For that reason, threshold values of the primary indicators used for drought classification are not absolute requirements for drought designation, but a mechanism to be used by the KDMT to reach consensus on the appropriate drought recommendations. When a threshold “trigger” is observed, the CWRD will evaluate all other drought indicators to determine the appropriate level of drought response.

Under normal, nondrought conditions, the Division of Water will, in consultation with the CWRD, maintain the monthly monitoring schedule and produce a monthly summary of the water resources of Kentucky that includes the status of primary drought indicators. The primary drought indicators selected for this purpose include:

- Precipitation deficits
- Streamflows
- The Drought Monitor (a comprehensive drought index)
- Soil moisture
- Reservoir storage

An inventory of selected drought indicators is provided in Appendix Table I.A. A more complete inventory of useful drought resources will be kept current on the Drought Information Center Website that is maintained by the Energy and Environment Cabinet's Division of Water.

4.2.1 Precipitation Deficits

Precipitation deficits are the first indication of abnormally dry conditions that might signal early stages of drought development. Precipitation data for drought monitoring will be collected from selected stations across Kentucky, and displayed in Appendix Figure II.A. These stations are comprised of a combination of agricultural weather stations and first-order National Weather Service stations. This network provides at least one precipitation monitoring location for each of the 15 drought management regions and will be designated as primary precipitation stations.

A second and more complete source of climate data will be provided in the future by the Kentucky Mesonet. The Kentucky Mesonet is a network of automated weather and climate monitoring stations being developed by the Kentucky Climate Center at Western Kentucky University to serve diverse needs in communities across the commonwealth of Kentucky. This network will offer comprehensive coverage of the commonwealth that will substantially improve the effectiveness of climate monitoring that is the fundamental driver for making drought-related decisions by state, local and federal partners.

Precipitation will also be monitored using the NWS Precipitation Estimator tool that is available on the Internet at <http://water.weather.gov/>. This tool provides a near real-time NEXRAD radar estimate of precipitation and also offers cumulative assessments for a range of time periods up to 12 months. Radar estimates of precipitation deficits will be used to verify observed data at the primary precipitation stations, assess regional differences in precipitation between or within individual drought management regions and identify small-scale areas of precipitation deficits that may be overlooked by regional precipitation assessments.

Precipitation deficits will be monitored for each drought management region by comparing current precipitation amounts with historical precipitation values as a percent of normal long-term average values for the time period being evaluated. Normal long-term average precipitation is defined as the mean precipitation for a 30-year period of record for the area and time period being evaluated.

A long-term precipitation indicator will evaluate cumulative precipitation deficits (a running total of the accumulated precipitation deficit) for a six-month and a 12-month cumulative evaluation period. A serious long-term precipitation deficit can have prolonged impacts on stream base flows and groundwater storage even after normal precipitation patterns return and the immediate impacts of drought begin to subside.

A short-term precipitation indicator will be used to identify early stages of drought development that will generally not be detected when evaluating cumulative deficits over a period of several months. This indicator will evaluate 30-, 60-, 90- and 120-day cumulative precipitation deficits.

Table 4.1 Cumulative precipitation triggers for drought level determinations

Cumulative Evaluation Period (days)	Drought Level			
	Advisory	Level I	Level II	Level III
	Percent of Normal Precipitation			
60	< 70%	< 60%		
90	< 74%	< 65%		
120	< 77%	< 70%		
180	---	< 75%		

Precipitation deficits will continue to be evaluated for the duration of a drought event to help assess drought severity. Short-term deficits will be used as the primary precipitation indicator for assessing the rate and intensity of drought development. Long-term deficits will be used primarily to help determine a return to normal conditions or the end of a drought.

4.2.2 Streamflows

Drought impacts to streamflows in each drought management region will be monitored at selected streamflow gages displayed in Appendix Figure II.B and listed in Appendix I.B. These gages will be used to make inferences about the regional impacts of drought on surface water resources and of the potential for shortages of available water for such uses as irrigation, drinking water supplies, energy production and industrial or mining enterprises.

Stream gages were selected on the basis of the availability of real-time data, period of record and relative location within a drought management region. In drought management regions where no appropriate stream gages exist, this indicator will be estimated using data from adjacent regions.

Streamflows are usually sustained at a “normal” level by regular inputs from precipitation and runoff and can deviate substantially from a normal condition after only a few weeks of precipitation deficits depending on the soil types and underlying geology. However, the implications of abnormally low flows are very different depending on the time of year. In a majority of streams that have permitted withdrawals, abnormally low flows in the winter months may still be well above what is required to provide water for water supplies and other uses. In addition, many of the gages used for the network are influenced by a range of factors including land uses, withdrawals, discharges, hydro-electric generation and regulation by releases from large reservoirs. All of these factors are taken into consideration when evaluating the severity and implications of drought impacts to observed streamflows.

For purposes of evaluating streamflows, the 28-day average flow (index flow) will be compared with historic flow statistics for the period of record for each gage. Averaging over a 28-day period reduces the significance of short-term fluctuations in flow that might result after scattered precipitation events during an otherwise abnormally dry period. A drought level determination will be based on the magnitude of the departure of the current index flow from the historical range of normal flows for the same evaluation period.

4.2.3 The Drought Monitor

The Drought Monitor is a comprehensive drought index produced through a partnership consisting of the U.S. Department of Agriculture, the National Weather Service's Climate Prediction Center, National Climatic Data Center, and the National Drought Mitigation Center at the University of Nebraska Lincoln. This index has proven to be reasonably accurate in its depictions of the severity and geographic extent of drought in Kentucky and is particularly useful for alerting to the early stages of drought development. In addition, the Drought Monitor is useful for monitoring drought conditions in adjacent states and tracking drought expansion into Kentucky.

This index identifies general drought areas, labeling drought areas by intensity, with D1 being the least intense and D4 being the most intense. D0, drought watch areas, are either drying out and possibly heading for drought, or are recovering from drought but not yet back to normal, suffering long-term impacts such as low reservoir levels.

The Drought Monitor will be considered in combination with more localized data such as rainfall, streamflows, groundwater levels and climatic outlooks to form an accurate assessment of drought severity in a given location.

4.2.4 Reservoir Storage

Storage in water supply reservoirs will be used to make determinations of regional and local impacts of drought to the hydrologic status of all or a portion of a drought management region.

Small and medium-sized water supply reservoirs are generally too small to infer regional drought impacts but can be useful for assessing drought conditions related to local water supplies. Reservoirs will be evaluated by comparing to past records of lake levels during normal conditions and drought conditions based on information provided by local water managers. For some lakes where DOW has developed safe yield models, evaluations will also compare observed deficits to modeled conditions under nondrought scenarios. Water supply reservoirs will be evaluated based on the estimated days of available useable storage relative to the time of the year.

Large reservoirs in Kentucky support a wide variety of uses that include water supply storage, recreation, electric power generation and flow augmentation to support and protect water quality. Many of these reservoirs are projects managed by the U.S. Army Corps of Engineers and impound relatively large drainage basins, making them suitable to infer regional impacts to a hydrologic system. U.S. Army Corps of Engineer reservoirs will be evaluated by considering the timing and amount of reservoir releases and the timing and magnitude of deviation from normal operating levels established by operating guide curves. (Quantitative threshold descriptions are not yet available but will be developed by the Division of Water in 2009.)

Lakes and reservoirs that will be monitored in each drought management region are displayed in Appendix Figure II.C and listed in Appendix Table I.C. In regions where a suitable lake or reservoir is not available, this indicator will not be used.

4.2.5 Soil Moisture Status

The soil moisture status of a drought management region is an important indicator of the developing stages of drought. Soil moisture shortages or departures from a normal seasonal condition can signal the early stages of drought development and can adversely impact the growth and development of important agricultural crops or pastures. In later stages of drought, severe deficits in soil moisture can be reflected in the loss of flow in many shallow wells and springs that supply water for agricultural and domestic uses.

There is no means of assessing soil moisture status on a statewide basis that can be used to develop a reliable quantitative regional indicator similar to that developed for precipitation and streamflows. However, there are available regional estimates of soil moisture status based on soil moisture models. In addition, the weekly crop and soil conditions reported through the Cooperative Extension Service provide a qualitative description of agricultural drought impacts at the county level. The following sources of information will be used to assess drought soil moisture deficit:

- The USDA Crop and Weather Report for Kentucky
 - o Produced in a joint effort by the University of Kentucky Agriculture Weather Center, Cooperative Extension Service County Agents, individual farmers, the Kentucky Department of Agriculture and the USDA National Agricultural Statistics Service.
- The Midwest Regional Climate Center
 - o Soil moisture deficits and departures from normal levels for 12 inches and 72 inches are calculated using a multi-level soil model responding to daily temperature and precipitation in the climate divisions of the region.
- The National Weather Service Climate Prediction Center
 - o Modeled soil moisture, soil moisture anomaly and soil moisture percentiles for the most recent day, month and 12-month periods.
 - o The Crop Moisture Index calculated weekly for each of four climate divisions in Kentucky (Appendix Figure II.D). The CMI reflects short-term soil moisture conditions as used for agriculture

The Crop Moisture Index provides a numerical index value and will therefore serve as the primary soil moisture indicator for purposes of determining drought response levels.

4.2.6 Other Drought Indicators

The KDMT and drought assessment teams will evaluate all other available drought information during the deliberations of drought level declarations. Other drought indicators that will be considered include the Standardized Precipitation Index, Palmer Drought Severity Index, the Climate Prediction Center Seasonal Drought Outlook and National Oceanic and Atmospheric Administration monthly and seasonal precipitation and temperature outlooks.

The types and regional occurrence of drought impacts compiled by the drought assessment teams will also be used to support drought level determinations in a drought management region. The KDMT will consider the following impacts and any others that may be relevant in a drought management region:

- Number of wildfire starts and number of acres of forest burned as supplied by the Division of Forestry.
- Impacts of drought on agricultural interests in a region.
- Number of water suppliers implementing voluntary or mandatory water use restrictions.
- Reported impacts to fisheries supplied by the Kentucky Department of Fish and Wildlife Resources.
- Impacts of drought to springs monitored by the Division of Water.

5. State Drought Response

The principal drought response actions developed in this plan pertain to the coordination of interactions between state agencies in all phases of a drought experience. State responses remain largely a function of many separate agencies with oversight of various constituencies that may be impacted by drought. Most of the specific action items associated with the drought action levels described in the plan serve to coordinate the actions of the KDMT and supporting drought assessment teams. Each coordinating agency of the KDMT retains its individual responsibilities for responding to drought and communicating with their constituents. However, the opportunity for state agencies to coordinate throughout all stages of drought development will ensure a more timely response and a more effective use of state resources responding to drought.

The actions at each general drought action level in the following sections are supplemented by additional actions for lead state and local agencies presented in Appendix Table I.D. It is important to note that lead agencies may find it necessary to initiate drought response actions independent of the drought levels outlined in this plan. This plan presents only general guidelines for a “typical” progressive drought scenario. It is expected that the KDMT will tailor the state drought response plan to best serve its intended purpose based on the particular traits of each future drought experience.

5.1 General Drought Action Levels

The levels of drought response outlined in this plan will be driven by determinations of the level of impacts that are caused by drought. These impacts are defined using both physical measures of climatic, hydrologic or agronomic factors (precipitation, streamflow, soil moisture) and the severity and geographic extent of observed impacts to human health and safety and the environment (low water supplies, fire danger, poor water quality). The plan is organized to define progressively more involvement by state agencies as drought severity is determined to increase according to four general action levels:

- Drought Advisory
- Level I Drought
- Level II Drought
- Level III Drought

The plan does not designate a level for Drought Emergency. The term “emergency” is reserved for those situations in which a local or state agency has determined that conditions are critical enough to declare a state of emergency or petition the governor to declare a state of emergency. Most emergency situations are localized (agricultural emergencies are the exception) and emergency declarations are most credible when restricted to only those areas that are experiencing the crisis.

Drought-related emergencies will typically be managed by lead state agencies either independently or in cooperation with the Kentucky Division of Emergency Management. For example, in a water supply emergency situation, the EEC is the responsible lead agency who will recommend a Governor's Declaration of Emergency and coordinate the emergency response with the Division of Emergency Management. Similarly, emergency situations affecting agriculture will be managed by the Department of Agriculture, and emergencies related to wildfires will be managed by the Division of Forestry. The plan puts in place a mechanism for identifying potential emergencies before they happen and provides a process through which lead state agencies can support one another in managing emergency situations.

5.1.1 Accelerated Monitoring

The Division of Water and coordinating agencies within the CWRD continuously monitor climate and water resources conditions as part of their respective agency missions. Whenever routine monthly monitoring indicates the potential for drought development, the Division of Water will begin accelerated weekly monitoring of 30-, 60- and 90-day precipitation deficits. Accelerated monitoring will be initiated whenever the Drought Monitor indicates abnormally dry conditions (D0) or a 30-day precipitation deficit is less than 60 percent of normal for a drought management region.

Accelerated monitoring will continue for the affected region(s) until the 30-day precipitation indicator returns to normal or until the short-term indicators reach the threshold for a drought advisory.

5.1.2 Drought Advisory

A drought advisory will serve as an early notification to the coordinating members of the KDMT that drought conditions may be developing in one or more drought management regions. An advisory is an internal notification to the coordinating agencies of the KDMT and will not generate a general public drought declaration. The indicators and trigger thresholds for a drought advisory will include precipitation deficits, the Drought Monitor (DM) and the Crop Moisture Index (CMI):

- Precipitation: Two of three thresholds met for the time periods in Table 4.1
- DM: Drought severity level D0 to D1
- CMI: -0.5 to -0.9 (topsoil moisture short)

When two or more trigger thresholds are met, the Division of Water will make a recommendation to convene the CWRD and review current conditions, short-term and long-term climate outlooks, long-term precipitation deficits or surpluses, and drought conditions in neighboring states. The CWRD may also query the chairs or individual members of the AGNR and DWPH to look for evidence of emerging impacts to water-sensitive sectors. If after review of all available data the CWRD determines that there is a reasonable potential for further drought development, a recommendation will be made to the chair of the KDMT to issue a drought advisory and notify the coordinating member agencies.

A drought advisory is not intended to be a prediction of drought development. Droughts remain a relatively uncommon occurrence and conditions may never progress beyond the advisory stage. Based on an analysis of precipitation data for a 30-year period of record, the

precipitation threshold for an advisory is expected to be met on average about once every four to five years.

5.1.3 Drought Level I

- Precipitation: One or more thresholds for the time period in Table 4.1
- Streamflows: Index flow ranges from 25 to 11 percent duration
- DM: Range from D1 to D2
- CMI: Range from -1.0 to -1.9
- Small reservoirs: Abnormally low levels for the time of year

A Drought Level I declaration will be considered when at least three of the five indicators meet the trigger threshold. At this stage of drought it is expected that some level of drought impact will be observed in one or more drought management regions. The Division of Water will make a recommendation to convene the CWRD and review current conditions and the drought indicators. The CWRD will also consider short-term and long-term climate outlooks, long-term precipitation deficits or surpluses, and drought conditions in neighboring states and also query the chairs or individual members of the AGNR and DWPH to verify drought impacts to one or more sectors. If after review of all available data the CWRD determines that a Level I drought condition exists, a recommendation will be made to the chair of the KDMT to issue a Level I Drought Declaration and notify the coordinating member agencies. A Level I Drought Declaration signifies that the state has officially designated a prolonged dry period as a drought.

A Level I Drought Declaration will trigger certain coordinating and other drought responses by the KDMT and drought assessment teams. In order to act in a timely manner, many of these actions may be implemented by the EEC with proper follow-up notification to all KDMT members. The following actions will commence immediately upon release of a Level I declaration:

1. The KDMT will issue a press release stating the reasons for the declaration, the potential impacts that might develop if drought continues and recommended actions to be considered by those individuals or enterprises that may be affected.
2. The Chair of the CWRD will activate the team and begin routine monitoring according to procedures outlined section 3.3.1.
3. The Chair of the DWPH will activate the team and begin routine monitoring according to procedures outlined section 3.3.3.
4. The Division of Water and DWPH will prepare or update an inventory of water utilities with a history of drought problems in the affected drought management regions.
5. The KDMT will provide notification to all local governments in the affected drought management regions of the change in the drought status.
6. The KDMT will provide notification to all water utilities in the affected drought management regions of the change in the drought status.
7. The KDMT Chair or designee will prepare a Drought Situation Report from information supplied by the drought assessment teams for distribution to all coordinating agencies of the KDMT and posting on the Drought Information Center Website.
8. The Division of Water will commence updating the EEC and Division of Water Drought Information Center Website on a bi-weekly basis.

9. The Division of Water and CWRD will continue weekly assessments of short-term drought indicators (Section 5.1.2).
10. Coordinating agencies with drought response functions will designate spokespersons for drought-related media inquiries.
11. The Division of Water and DWPH will commence assessments of local water utilities and delineate potential water shortage watch or warning areas in each drought management region.

5.1.4 Drought Level II

- Precipitation: One or more thresholds for the time period in Table 4.3.1
- Streamflows: Index flow ranges from 10 to 6 percent duration
- DM: Range from D2 to D3
- CMI: Range from -2.0 to -2.9
- Small reservoirs: 90-120 days available supply

A Drought Level II declaration will be considered when at least three of the five indicators meet the trigger threshold. At this stage of drought it is expected that drought impacts, some severe, will be observed in all of the affected drought management regions including:

- Moderate to severe impacts to water-sensitive enterprises
- Unusually high demands placed on water treatment facilities
- Depletion of water supplies in shallow wells, springs and small ponds
- Reports of water conservation advisories from communities with drought-vulnerable sources of supply
- Increased incidence wildland and residential fires

The Division of Water will make a recommendation to convene the CWRD and review current conditions and the drought indicators. The CWRD will also consider short-term and long-term climate outlooks, long-term precipitation deficits or surpluses, and drought conditions in neighboring states and also query the chairs or individual members of the AGNR and DWPH to verify drought impacts and levels of severity. If after review of all available data the CWRD determines that a Level II drought condition exists, a recommendation will be made to the chair of the KDMT to issue a Level II Drought Declaration and notify the coordinating member agencies.

A Level II Drought Declaration will trigger certain coordinating and other drought responses by the KDMT and drought assessment teams. In order to act in a timely manner, some of these actions may be implemented by the EEC with proper follow-up notification to all KDMT members. The following actions will commence immediately upon release of a Level II declaration:

1. The KDMT will issue a press release stating the reasons for the declaration, the types of impacts that have developed, and recommended actions to be considered by those individuals or enterprises that may be affected.
2. The KDMT Chair or designee will activate the KDMT and coordinate a meeting as soon as practical; the KDMT will develop procedures and review drought response actions listed in section 3.2.

3. The Chair of the DWE will activate the drought assessment team.
4. Increased frequency of meeting of the DWPH, AGNR and CWRD drought assessment teams.
5. The KDMT will provide notification to all local governments in the affected drought management regions.
6. The KDMT will provide notification to all water utilities in the affected drought management regions.
7. The KDMT chair or designee will prepare a Drought Situation Report for distribution to all coordinating agencies of the KDMT and posting on the Drought Information Center Website.
8. The Division of Water will continue updating the EEC and Division of Water Drought Information Center Website on a bi-weekly basis.
9. The Division of Water and CWRD will initiate weekly assessments of all drought indicators and drought progression in all affected drought management regions.
10. The Division of Water and DWPH will update the inventory of water utilities with a history of drought problems in the affected drought management regions.
11. The AGNR will coordinate with relevant state and federal agencies with regard to locations, availability and requirements for accessing emergency sources of water for uses such as livestock watering or fire protection.
12. The Division of Water and DWPH will assess local water utilities in affected drought management regions and announce water shortage watches or warnings as appropriate.
13. The Division of Water will contact drought-vulnerable utilities weekly and create a list of "Target Systems" for inclusion in Drought Situation Reports. The list will be updated weekly for use by the DWE upon its activation.
14. The KDMT will establish bi-weekly schedule of media releases to update the public on the drought situation, coordinated between public information officers (PIOs) from KDMT agency members. The PIOs will jointly develop materials for releases to provide timely information related to specific topics that promote efficient uses of water for multiple sectors (industry, agriculture, domestic, municipal, residential, self-supplied).

5.1.5 Drought Level III

- Precipitation: One or more thresholds for the time period in Table 4.1
- Streamflows: Index flow at or below a 5 percent duration
- DM: Range from D3 to D4
- CMI: -3.0 or less
- Small reservoirs: 60-90 days available supply

A Drought Level III declaration will be considered when at least three of the five indicators meet the trigger threshold. During this stage of drought it is expected that drought impacts will be widespread and severe and develop into *emergencies* if drought conditions are not abated, including:

- Severe to extreme impacts to water-sensitive enterprises
- Loss of water supplies in shallow wells, springs and small ponds

- Multiple occurrences of water utilities requiring mandatory water-use restrictions or declaring local water shortage emergencies
- Critical low streamflows impacting water quality and aquatic habitat
- Frequent reports of water utilities having difficulties with adequate treatment for iron or manganese, or with taste and odor problems
- Critically low flows in some major rivers that provide drinking water to large population centers in the drought management regions
- Increased incidence of conflicts between users of diminishing water resources

The Division of Water will make a recommendation to convene the CWRD and review current conditions and the drought indicators. The CWRD will also consider short-term and long-term climate outlooks, long-term precipitation deficits or surpluses, and drought conditions in neighboring states and also query the chairs or individual members of the AGNR and DWPH to verify drought impacts and levels of severity. If after review of all available data the CWRD determines that a Level III drought condition exists, a recommendation will be made to the chair of the KDMT to issue a Level III Drought Declaration and notify the coordinating member agencies.

A Level III Drought Declaration will trigger certain coordinating and other drought responses by the KDMT and drought assessment teams. An increasing focus for drought assessment teams and responding agencies will be identifying potential emergencies or preparing to respond to actual emergencies. The following actions will commence immediately upon release of a Level III declaration:

1. The KDMT will issue a press release stating the reasons for the declaration, the types of impacts that have developed, and recommended actions to be considered by those individuals or enterprises that may be affected.
2. The Chair of the DWE or designee will convene the drought assessment team and coordinate the assessments of potential emergencies and forward a report to the Chair of the KDMT.
3. In the event that the resources of the commonwealth in meeting the drought response are exceeded, the DWE will coordinate with state response agencies to develop a Governor's Declaration of Emergency and coordinate response to these and agricultural declarations of emergency.
4. Coordinating agencies will communicate with their constituents to ensure that they understand the procedures for declaring local emergencies and coordinating with local and state emergency management personnel.
5. Increased frequency of meeting of the DWPH, AGNR and CWRD drought assessment teams.
6. The KDMT will provide notification to all local governments in the affected drought management regions.
7. The KDMT will provide notification to all water utilities in the affected drought management regions.
8. The KDMT chair or designee will prepare a Drought Situation Report for distribution to all coordinating agencies of the KDMT and posting on the Drought Information Center Website.

9. The Division of Water will commence updating the EEC and Division of Water Drought Information Center Website on a weekly basis or more frequently as needed.
10. The Division of Water and CWRD will continue weekly assessments of all drought indicators and drought progression in all affected drought management regions.
11. The Division of Water and DWPH will update the inventory of water utilities with a history of drought problems in the affected drought management regions.
12. The AGNR will coordinate with relevant state and federal agencies with regard to locations, availability and requirements for accessing emergency sources of water for uses such as livestock watering or fire protection.
13. The Division of Water and DWPH will assess local water utilities in affected drought management regions and announce water shortage watches or warnings as appropriate.
14. The Division of Water will maintain contacts with drought-vulnerable utilities on a weekly basis and update a list of "Target Systems" for inclusion in Drought Situation Reports and delivered to the Chair of the DWE.
15. The KDMT will establish bi-weekly schedule of media releases, or as needed, to update the public on the drought situation, coordinated between Public Information Officers (PIOs) from KDMT agency members. The PIOs will jointly produce media releases to provide timely information related to specific topics that promote efficient uses of water for multiple sectors (industry, agriculture, domestic, municipal, residential, self-supplied).

5.2 Targeted Drought Declarations

The drought declarations outlined in the plan are in place to provide general information about the status of drought development. For purposes of evaluating drought severity, the KDMT considers both physical causes or expressions of drought (rainfall deficits, streamflows, drought indices) and observed impacts of drought to the environment and society. Other declarations that are more specific to certain types of impacts may be utilized by the KDMT to focus attention on potential or imminent threats to human health and safety.

- **Water Shortage Watches and Warnings**

The EEC will announce a Water Shortage Watch for a drought management region, portion of a drought management region, county or water service area when water supply data indicates a potential for water shortages to develop. The watch is intended to encourage increased awareness by water supply managers in an area and help local governments communicate the severity of a drought situation to affected customers.

The EEC will announce a Water Shortage Warning for a drought management region, portions of a drought management region, county or water service area when water supply data indicates that a critical water shortage is imminent. A warning may also be issued for an area in which one or more systems have entered the emergency phase of a local water shortage response plan.

Water shortage watches and warnings will not necessarily dictate individual water shortage response stages in local water shortage response plans. The impacts of a drought on individual water supply sources may be as dependent on the reliability of the

source as it is on the severity of drought conditions for the area under a watch or a warning. Local governments and water utility managers are responsible for determining the need for local response. Their actions are taken independently and often ahead of the state's water shortage declarations.

5.3 Emergency Declarations

5.3.1 State Declarations

When water shortages endanger the health and safety of the citizens of the commonwealth, the governor can issue a Water Emergency Declaration giving the Energy and Environment Cabinet the ability to restrict, redirect or stop water usage in the affected areas in an effort to ensure adequate water supplies to meet health and safety needs.

In the event that drought conditions present a danger for fire conditions, the governor can issue an executive order banning all outdoor burning.

The governor may declare a State of Emergency leading to a Presidential Declaration in the event that the resources of the commonwealth have been exceeded in providing response to consequences attributed to a drought. The declaration may make the state eligible for receipt of federal assistance and reimbursement from the Federal Emergency Management Agency. Following a declaration of a State of Emergency, the governor may also request resources from other states through Emergency Management Assistance Compacts.

5.3.2 Local Declarations

In the event that the resources of a local government are exceeded in responding to consequences attributed to a drought, a county judge/executive, mayor of an urban-county government, chief executive of other local governments, or mayor of a city, or their designees as provided by ordinance, can declare in writing that a state of emergency exists. This declaration allows these individuals to thereafter execute any emergency powers granted to them under Kentucky Revised Statute 39 B to provide for adequate and appropriate response to the emergency situation. In the event that drought conditions present a danger to the water supply or enhance fire conditions, the individuals cited above have the authority to issue water emergency declarations and executive orders banning all outdoor burning within their jurisdiction.

5.3.3 Agricultural Disaster Declaration

The governor may request the U.S. Department of Agriculture to issue an Agriculture Disaster Declaration designating counties hit by drought as natural disaster areas and qualifying farmers in those counties for USDA assistance programs including low-interest emergency loans.

6. Local Drought Response

Local governments and water suppliers are responsible for managing their water system in a manner that ensures an adequate and safe supply of water. Although this plan is primarily intended to help coordinate the actions of state agencies, it is recognized that the most effective

drought response measures are those implemented at the local level by governments, water suppliers and individual citizens. Predetermined actions to reduce the impacts of local water shortage situations must be anticipated and planned for in advance. Effective public information strategies, routine monitoring of water supply levels, methods to reduce water demand and identification of alternate or emergency sources of water are key elements of a successful plan. While many drought-vulnerable water systems have these plans in place, it is critical that the public, elected officials and water utility managers are knowledgeable about the plan contents and implement them in a timely manner to help avoid serious water shortages from occurring.

Reactions to drought at the local level can range from conservation for self-supplied individuals to voluntary or mandatory conservation imposed under local ordinances for customers of public water suppliers. Under more extreme circumstances, local governments may declare a water shortage emergency based on the status of the water supply and impose severe restrictions on all water use beyond that needed for human health and sanitation purposes. Given that Kentucky's water supply sources vary considerably across the state, these local actions will often be taken independently of the state responses and action levels outlined in this plan. In fact, these local actions provide valuable information about water shortages to state agencies and will be used to help assess regional impacts of drought.

7. Drought Mitigation and Preparedness

“Mitigation” will be used in this document to define those actions or activities that reduce the overall risk to drought. The purpose of a mitigation measure is to implement processes or procedures that will reduce or eliminate the severity of drought impacts. Effective drought mitigation will be executed prior to the onset of drought as part of an overall plan that is built on the concept of preparedness. Drought mitigation activities should be ongoing and periodically assessed for their effectiveness and support of the overall goal of reducing drought risk.

Drought mitigation comprises a broad range of proactive measures. Kentucky's experience at the state and local level has been one of dealing with drought from a crisis management perspective. While this approach may be successful in alleviating the crisis at hand, it creates an unnecessary level of stress and hardship for decision-makers and citizens alike. A coordinated drought preparedness program can reduce drought risk to individuals, communities and the environment and foster a change from crisis-management to crisis prevention.

There is no substitute for good drought response planning to guide state and local officials in the management of a drought situation. Local water shortage response plans have been developed for most water suppliers that have been deemed drought-vulnerable in water supply plans developed through the 15 Area Water Management Planning Councils. These plans contain procedures that are followed to monitor raw water sources, implement water conservation measures or other demand management strategies, procure alternative sources of water supply and provide effective communication with the public for the duration of a water shortage experience. Experience has shown that even with these plans in place, there remains a substantial amount of uncertainty among many communities on how to proceed when a drought event occurs. Improving the effectiveness of local drought response is a primary mitigation action that should be undertaken as part of the state drought plan.

The mitigation actions described in this document are intended to lay the foundation for beginning a systematic approach to addressing drought risk in Kentucky. These actions have been identified by the Drought Mitigation and Response Advisory Council as important first steps toward developing a sustained mitigation approach to drought management. While this

action plan is intended to address drought risk to all sectors, its initial focus is largely aimed at reducing or eliminating critical water shortages affecting drinking water and public health. However, many of the recommended actions will have direct applications for use in addressing risk to other drought impact sectors including agriculture, the environment, and economic development.

7.1 Ensure the availability of data needed to assess water resources and support drought monitoring

Data networks that provide dependable, high-quality data are an essential component of a drought response and mitigation strategy for the commonwealth. Water resources and climate data are used to detect early trends that suggest drought development and are essential to accurate assessments of drought conditions. Drought response actions are closely tied to these assessments, as are the triggers that initiate drought response actions at the state level. These networks require long-term financial support in order to provide essential historical data for use in model development, regulatory decision-making, project planning and assessing climate variability and its impacts on water resources. Support for long-term data collection networks in Kentucky comes from state, federal, local and private stakeholders.

- Perform an assessment of the stream gaging network in Kentucky to identify gaps in existing coverage. Work with the U.S. Geological Survey to develop recommendations for optimizing the network.
- Investigate options and develop recommendations for creating a reliable groundwater-level monitoring network.
- Develop a surface water storage monitoring network to track drought impacts to lakes and reservoirs.
- Initiate and participate in efforts to create a sustainable level of financial support for the state stream gaging network.
- Create an inventory of existing sources of weather and climate data and information that can be used to aid in drought monitoring and impact assessment.
- Promote and support the development of the Kentucky Mesonet and participate in developing value-added products from the Mesonet to improve drought monitoring and impact assessment.

7.2 Develop an inventory and projection of the state's available water resources

A better understanding of Kentucky's water resources is essential to the task of developing strategies for their use that promote the general welfare of the citizens of the commonwealth. Waters of the commonwealth are to be "put to the fullest beneficial use to the fullest extent of which they are capable" and the "waste or nonbeneficial use of water" is to be prevented (KRS 151.110 (1) (a)).

- Develop an approach capable of assessing water availability and the effects that human and climatic influences may have on future availability.
- Develop methods to evaluate current and future demand for public water supplies and other water uses.

- Create an inventory of water availability for use in pre-screening and site evaluations for potential new uses including energy enterprises, industry, or regional water supplies.
- Support and participate in the development of specific research to study the impacts of climate change, natural climatic variations, and climatic extremes on the variability and volume of available water supplies.

7.3 Conduct assessments to identify and project drought vulnerabilities

A drought vulnerability assessment for each drought impact sector will build upon the water resources inventory and provide the basis for prioritizing mitigation actions that reduce drought risk. Where possible, vulnerability assessments should be created that consider the combined impacts of drought and human activities on the quantity and quality of available water supplies beginning with the following drought impact sectors:

1. Public use – an assessment process should be developed that evaluates source(s) of supply, projected demand, infrastructure constraints and competing demands for water within a source watershed or aquifer. This sector also includes such public uses as energy production, recreation and wastewater assimilation.
 2. Agricultural use – an assessment process should consider differences in geology, hydrology, soils and types of production. Particular emphasis should be placed on drought impacts that diminish the supply of water available to agriculture for purposes of irrigation of crops and watering of livestock.
 3. Environmental use – drought impacts on the aquatic environment can be exacerbated by the presence of human activities that affect the quality or quantity of instream flow. An assessment of environmental vulnerability to drought should include a consideration of human activities such as water withdrawals, wastewater discharges, reservoir operations and land-use effects on the quality and quantity of water available for aquatic needs.
- Develop a process to identify drought vulnerabilities of public water systems related to raw water supply, projected customer demand, treatment and distribution infrastructure and climatic variation.
 - Create guidance for individual public water systems or regional planning agencies to perform periodic drought vulnerability assessments as part of the area water management planning framework.
 - Create and make available for public use an inventory of existing opportunities for interconnections or other partnerships between or among systems to utilize existing excess capacity to offset regional water supply deficiencies.
 - Work with the Kentucky Infrastructure Authority, Area Development Districts, Water Management Planning Councils, conservation districts and county extension offices to develop priority projects for drought mitigation at the local level.
 - Develop a process to assess drought vulnerabilities related to raw water needs for the production of electrical power or other fuels.

- Develop a process to assess drought vulnerabilities related to agricultural irrigation and livestock watering and identify areas of potential conflict between agricultural use and public drinking water supplies.
- Review existing state regulations and policies that manage human impacts on water quality and quantity to determine their effectiveness under the compounding conditions of severe or extreme drought.
- Promote and participate in partnerships that seek to increase knowledge of environmental flow requirements in watersheds that support high demands for public water supplies, waste assimilation or other water uses.
- Review other state's use of allocation planning that involves users in drought-vulnerable watersheds or aquifers in decisions on sharing the available water supply during times of shortage.

7.4 Identify and develop opportunities to increase the available raw water supply to address vulnerabilities

Regions or localities that are determined to have significant drought risk because of a limited supply of available water may need to develop additional sources of raw water supply. For purposes of this plan, increases to the available raw water supply refers to any action that develops a new source of supply or augments existing raw water sources in order to create a permanent increase to the available raw water supply.

- Utilize a water resources inventory and drought vulnerability assessment to identify opportunities for new source development, including those that create regional raw water sources.
- Promote and participate in collaborative efforts with the U.S. Corps of Engineers to study the potential of using storage in existing Corps of Engineer projects to optimize regional raw water availability.
- Promote and participate in studies that promote the use of the Ohio River and similarly situated "border" rivers and their connected aquifers as a new source of water for interior regions of the commonwealth.

7.5 Improve the effectiveness of the state drought response plan

Effective and aggressive drought response is an essential element of an overall approach to reducing drought risk. Periodic assessment of the effectiveness of the state drought response plan is a primary mitigation strategy. The state drought plan as presented represents a step forward in implementing a process that creates a consistent state drought response and communication strategy. The plan document will be periodically updated to take advantage of new ideas or approaches intended to improve the overall effectiveness of state drought response actions. The Drought Advisory Council has identified certain action items that will improve the effectiveness of the state drought response plan.

- Develop a Kentucky drought index based on a drought assessment system that merges potential natural and socioeconomic impacts into a comprehensive measure of drought severity.

- Complete a summary of legal authorities for managing drought emergencies that are in place at the state, local and federal level.
- Initiate a review, in cooperation with the Public Service Commission, of the quality and effectiveness of local water shortage response plans.
- Develop an inventory of all state or federally owned lakes that can be used during drought emergencies as alternative sources for activities such as livestock watering or garden irrigation.

7.6 Provide direction and leadership to move the commonwealth toward becoming more efficient in the use of the state’s water resources

- Develop an ongoing public awareness program that provides the public with basic information on the source of their water, the importance of using water efficiently and how to conserve water in the home.
- Take a leadership role by implementing water conservation efforts at state facilities.
- Work with schools to promote drought and water conservation awareness and develop educational exercises or teaching units that can be incorporated into school science curricula.
- Support development and implementation of programs that result in improved efficiencies in water use in all drought impact sectors.
- Review the Energy and Environment Cabinet water resources policy (KRS 151.110 (1)(b)) pertaining to water conservation and water efficiency and develop strategies to more effectively implement those policies.

7.7 Promote and participate in public education, awareness and outreach

A key element of successful drought preparedness is public education. Educational programs such as workshops, newsletters, public service announcements, press releases, community meetings, school curricula and interactive participatory decision-making processes can increase awareness of the value of preparing and planning for droughts. A more informed public will be more likely to be active participants in developing successful strategies to prepare for and respond to droughts.

- Update and expand the Drought Monitoring Website maintained by the Division of Water to increase and improve public dissemination of drought information.
- Develop necessary contacts and processes to disseminate information from water resources inventories or drought vulnerability assessments to county emergency management agencies tasked with developing hazard mitigation plans.
- Develop a public service announcement campaign for selected drought impact sectors with materials appropriate for radio, television and print media.
- Establish a “drought awareness week” modeled after the annual “severe weather week” as a vehicle for maintaining public awareness of hardships that droughts can create and the need for drought preparedness.

- Investigate opportunities for cooperating with television meteorologists in developing drought-related weather segments that educate the public about the “science” of drought development, drought impacts and the importance of drought preparedness.

8. Plan Implementation Recommendations

The Drought Mitigation and Response Advisory Council recommend that this plan be implemented by initiating the following actions:

- Identify this plan as the official operations guideline for state actions in drought response and mitigation and make the plan available to the public.
- Evaluate deficiencies in the state stream gaging network and provide an estimate of funding necessary to correct those deficiencies.
- Initiate a review of the quality and effectiveness of local water shortage response plans.
- Evaluate public water supply drought vulnerabilities related to raw water supply, projected customer demand, treatment and distribution infrastructure and climatic variation.
- Maximize the integrity of the Water Resources Information System (WRIS) and utilize the WRIS as the primary database that supports water and wastewater planning at the local and state level.
- Develop a summary of legal authorities for managing drought emergencies that are in place at the state, local and federal levels.

APPENDIX I

Tables

Appendix I.A. Selected data and indices used for drought monitoring

DRUGHT MONITORING INDICATOR	DESCRIPTION
Kentucky Climate Data	Daily climate data (precipitation, air temperature, relative humidity and soil temperature) from the National Climatic Data Center for 24 in-state monitoring stations with records beginning in 1971.
Precipitation Analysis	Daily precipitation analysis from the National Weather Service's Advanced Hydrologic Prediction Service.
Kentucky Climate Maps	Precipitation totals and deviations maps from the University of Kentucky's Agricultural Weather Center.
Temperature and Precipitation Outlooks	Product of the National Weather Center's Climate Prediction Center for the upcoming 6 to 10 day or 8 to 14 day period.
Water Watch Stream Discharge Maps	Wide assortment of products from the U.S. Geological Survey that assess current and historical streamflows across the state.
U.S. Army Corps of Engineers Louisville District Daily Lake Reports	Daily lake conditions for projects under control of the U.S. Army Corps of Engineers Louisville District.
U.S. Army Corps of Engineers Huntington District Current Lake Conditions	Daily lake conditions for the projects under control of the U.S. Army Corps of Engineers Huntington District.
U.S. Seasonal Drought Outlook	According to the National Weather Center's Climate Prediction Center, this is a product that "depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts."
U.S. Drought Monitor	The Drought Monitor of the National Drought Mitigation Center identifies areas of drought based on a five-stage intensity classification system.
Midwest Regional Climate Center	Modeled soil moisture and departure from normal for 12 inch and 72 inches soil depths.
Crop Moisture Index	A short-term drought indicator that is designed to reflect moisture conditions affecting crop growth and development.

Appendix I.B. Listing of real-time USGS stream gages used for drought monitoring.

DROUGHT MANAGEMENT REGION	USGS STREAM GAGE NAME	USGS NUMBER	COUNTY	BASIN
Barren River ADD	Barren River at Bowling Green	3314500	Warren	Green River
	Green River near Munfordville	3308500	Hart	Green River
	West Fork Drakes Creek near Franklin	3313700	Simpson	Green River
Big Sandy ADD	Johns Creek near Meta	3210000	Pike	Big Sandy River
	Levisa Fork a Pikeville	3209500	Pike	Big Sandy River
Bluegrass ADD	Dix River near Danville	3285000	Garrard	Kentucky River
	Elkhorn Creek near Frankfort	3289500	Franklin	Kentucky River
	Kentucky River at Lock 4 at Frankfort	3287500	Franklin	Kentucky River
	Kentucky River at Lock 6 Near Salvisa	3287000	Woodford	Kentucky River
	Kentucky River at Lock 8 near Camp	3284500	Jessamine	Kentucky River
	Kentucky River at Lock 10 near Winchester	3284000	Clark	Kentucky River
	Red River at Clay City	3283500	Powell	Kentucky River
Cumberland Valley ADD	South Fork Elkhorn Creek at Fort Spring	3289000	Fayette	Kentucky River
	Cumberland River near Harlan	3401000	Harlan	Upper Cumberland River
	Cumberland River at Williamsburg	3404000	Whitley	Upper Cumberland River
	Goose Creek at Manchester	3281100	Clay	Kentucky River
FIVCO ADD	Rockcastle River at Billows	3406500	Laurel	Upper Cumberland River
	Little Sandy River at Grayson	3216500	Carter	Little Sandy River
Green River ADD	Green River at Lock 2 at Calhoun	3320000	McLean	Green River
Kentucky River ADD	Cutshin Creek at Wooten	3280700	Leslie	Kentucky River
	Kentucky River at Lock 14 at Heidelberg	3282000	Lee	Kentucky River
	Middle Fork Kentucky River at Tallega	3281000	Lee	Kentucky River
	North Fork Kentucky River at Jackson	3280000	Breathitt	Kentucky River
	North Fork Kentucky River at Whitesburg	3277300	Letcher	Kentucky River
	Red River at Hazel Green	3282500	Wolfe	Kentucky River
KIPDA ADD	South Fork Kentucky River at Booneville	3281500	Owsley	Kentucky River
	Floyds Fork at Fisherville	3298000	Jefferson	Salt River
	Kentucky River at Lock 2 at Lockport	3290500	Henry	Kentucky River
	Middle Fork Beargrass Creek at Old	3293000	Jefferson	Salt River
	Pond Creek near Louisville	3302000	Jefferson	Salt River
	Salt River at Shepherdsville	3298500	Bullitt	Salt River
Lake Cumberland ADD	South Fork Beargrass Creek at Louisville	3292500	Jefferson	Salt River
	Beaver Creek near Monticello	3413200	Wayne	Upper Cumberland River
Lincoln Trail ADD	Russell Creek near Columbia	3307000	Adair	Green River
	Beech Fork at Bardstown	3301000	Nelson	Salt River
	Beech Fork at Maud	3300400	Nelson	Salt River
	Nolin River at White Mills	3310300	Hardin	Green River
Northern Kentucky ADD	Rolling Fork near Boston	3301500	Nelson	Salt River
	Eagle Creek at Glencoe	3291500	Gallatin	Kentucky River
	Licking River at Catawba	3253500	Pendleton	Licking River
Pennyrile ADD	Licking River at McKinneyburg	3251500	Pendleton	Licking River
	Little River near Cadiz	3438000	Trigg	Lower Cumberland River
Purchase ADD	Tradewater River at Olney	3383000	Caldwell	Tradewater River
	Bayou De Chien near Clinton	7024000	Hickman	Bayou De Chien

Appendix I.C. Listing of lakes and reservoirs used for drought monitoring.

DROUGHT MANAGEMENT REGION	NAME	COUNTY	BASIN	MAP REFERENCE NUMBER
Barren River ADD	Barren River Lake	Barren	Green River	201
	Mill Creek Lake	Monroe	Green River	101
	Nolin River Lake	Edmonson	Green River	202
Big Sandy ADD	Curtis Crum Reservoir	Martin	Big Sandy River	102
	Dewey Lake	Floyd	Big Sandy River	203
	Fishtrap Lake	Pike	Big Sandy River	204
	Paintsville Lake	Johnson	Big Sandy River	205
Bluegrass ADD	Herrington Lake	Mercer/Garrard	Kentucky River	103
	Stanford Reservoir	Lincoln	Kentucky River	104
Buffalo Trace ADD	Flemingsburg Reservoir (New)	Fleming	Licking River	105
Cumberland Valley ADD	Bert T. Combs Lake	Clay	Kentucky River	106
	Beulah Lake	Jackson	Upper Cumberland River	107
	Cannon Creek Lake	Bell	Upper Cumberland River	108
	Fern Lake	Bell	Upper Cumberland River	109
	Laurel River Lake	Laurel/Whitley	Upper Cumberland River	206
	Wood Creek Lake	Laurel	Upper Cumberland River	110
FIVCO ADD	Grayson Lake	Carter	Little Sandy River	207
	Olive Hill Reservoir	Carter	Little Sandy River	111
Gateway ADD	Cave Run Lake	Bath	Licking River	208
	Greenbriar Reservoir	Montgomery	Licking River	112
Green River ADD	Providence City Lake (New)	Webster	Tradewater River	113
Kentucky River ADD	Buckhorn Lake	Perry	Kentucky River	209
	Campton Lake	Wolfe	Kentucky River	114
	Carr Creek Lake	Knott	Kentucky River	210
	Elkhorn Lake	Letcher	Big Sandy River	115
KIPDA ADD	Guist Creek Lake	Shelby	Salt River	116
	Taylorsville Lake	Spencer	Salt River	211
Lake Cumberland ADD	Campbellsville City Reservoir	Taylor	Green River	117
	Green River Lake	Taylor	Green River	212
	Liberty City Lake	Casey	Green River	118
Lincoln Trail ADD	Fagan Branch Reservoir	Marion	Salt River	119
	Freeman Lake	Hardin	Green River	120
	Salem Lake	LaRue	Green River	121
	Lake Sympson	Nelson	Salt River	122
	Rough River Lake	Breckinridge/Grayson	Green River	213
	Willisburg Lake	Washington	Salt River	123
Northern Kentucky ADD	Bullock Penn Lake	Grant	Kentucky River	124
	Williamstown Lake	Grant	Licking River	125
Pennyrile ADD	Lake Beshear	Caldwell	Green River	126
	Lake Luzerne	Muhlenberg	Green River	127
	Lake Pewee	Hopkins	Tradewater River	128

Appendix Table I.D. Summary of primary drought response actions of lead state and local agencies*

LEAD RESPONSE AGENCY		PRIMARY AGENCY DROUGHT RESPONSE ACTIONS
<p>Energy and Environment Cabinet</p> <ul style="list-style-type: none"> - Department for Environmental Protection <ul style="list-style-type: none"> - Division of Water - Division for Environmental Program Support - Department for Natural Resources <ul style="list-style-type: none"> - Division of Conservation - Division of Forestry 	<p>EEC</p> <p>DEP DOW DEPS</p> <p>DNR DOC DOF</p>	<ul style="list-style-type: none"> ▪ Lead agency for coordinating activities of the Kentucky Drought Mitigation Team including declarations of drought action levels, notifications regarding drought status to the general public and routine dissemination of Drought Situation Reports to heads of coordinating state agencies ▪ Provide a co-chair and coordinate the activities for the Climate and Water Resources DAT ▪ Provide a co-chair and coordinate the activities for the Drinking Water and Public Health DAT ▪ Member of the Agriculture and Natural Resources DAT ▪ Allocate available water resources under a Governor’s Declaration of Drought Emergency ▪ Enforce water withdrawal permit conditions during periods of declining surface water levels or groundwater levels ▪ Coordinate with other local, state or federal agencies regarding emergency sources of water for agriculture, water supply, fire protection and domestic use ▪ Declare water shortage watches and warnings ▪ Provide technical assistance to water utilities related to water supply shortages, development of alternate or emergency water supplies, implementation of demand management measures, leak detection and repair and water treatment issues caused by poor raw water quality during drought ▪ Maintain a Drought Information Center Website consisting of drought assessment information, notifications of local and regional drought status and impacts, inventories of conservation and contingency management information and links to all state and federal agencies active in drought response ▪ Monitor drought impacts to public and private water supplies and maintain a record of the number of systems activating water shortage response plans ▪ Encourage the development and implementation of water conservation and drought contingency plans for enterprises holding water withdrawal permits to limit any unnecessary consumption during droughts ▪ Identify vulnerable water-dependent industries and work to determine their impacts and assist with identifying procedures to curtail water use during droughts or identify alternative sources of water for emergency use

LEAD RESPONSE AGENCY (cont.)		PRIMARY AGENCY DROUGHT RESPONSE ACTIONS
<p>Energy and Environment Cabinet (cont.)</p> <ul style="list-style-type: none"> - Department for Environmental Protection <ul style="list-style-type: none"> - Division of Water - Division for Environmental Program Support - Department for Natural Resources <ul style="list-style-type: none"> - Division of Conservation - Division of Forestry 	<p>EEC</p> <p>DEP DOW DEPS</p> <p>DNR DOC DOF</p>	<ul style="list-style-type: none"> ▪ Review water supply systems that have a history of adequacy problems; create and maintain an up-to-date inventory of “target systems” for each drought management region ▪ Establish contact with and conduct routine monitoring of water systems with drought-vulnerable sources of supply ▪ Provide technical assistance for drought-related issues with water availability for agricultural, industrial, energy production and other public uses of water; assist with evaluating or assisting the development of drought contingency plans ▪ Assess drought-impacted sources of supply for water utilities and delineate potential water shortage watch or warning areas in each affected drought management region ▪ Establish up-to-date lists of approved water haulers and bottled water purveyors and link the list to the Drought Information Center Website ▪ Maintain year-round monthly monitoring of climate and water resources data and initiate drought assessment and preparation as early as possible during the developmental stages of drought ▪ Designate agency spokespersons or technical points of contact to coordinate with agency public information officers to expedite information referrals and ensure effective responses to media inquiries and interviews with radio, television and print media ▪ Manage state wildland fire detection, suppression and law enforcement activities ▪ Maintain continuous monitoring of weather conditions used to determine fire danger rating ▪ Maintain the Kentucky Wildland Fire Situation Report to continuously update information related to number of fires, acres impacted and listing of counties with active burning bans ▪ Recommend a Governor’s Emergency Proclamation to prohibit public access to forest lands, brush lands and fields where extraordinary fire hazard may endanger lives or property

LEAD RESPONSE AGENCY (cont.)		PRIMARY AGENCY DROUGHT RESPONSE ACTIONS
Kentucky Department of Agriculture	KDA	<ul style="list-style-type: none"> ▪ Member of the Kentucky Drought Mitigation Team ▪ Agency responsible for recommending to the governor a declaration of agricultural emergency based on actual or anticipated impacts to agricultural products ▪ Determine the types and timing of federal assistance that may be available and ensure that the state applies for such assistance as needed ▪ Provide a chairperson for the Agricultural Impacts Workgroup ▪ Make routine assessments of the impacts of drought on agricultural operations and economies ▪ Maintain an inventory of the types and requirements of federal agricultural disaster assistance and ensure that the state applies for such assistance as needed ▪ Facilitate communications and cooperation between among agricultural stakeholders and relevant state and federal agencies regarding available assistance during drought conditions
Cabinet for Health and Family Services - Department for Public Health	DPH	<ul style="list-style-type: none"> ▪ Member of Kentucky Drought Mitigation Team ▪ Provide a co-chair for the Drinking Water and Public Health Workgroup ▪ Primary point of contact in the event of a public health emergency ▪ Provide technical assistance to local health departments and to private well users through local health departments ▪ Provide guidance to local health departments regarding purification of water for emergency use ▪ Provide guidance to local health departments regarding testing and use of private water supplies ▪ Provide guidance for emergency operational procedures for retail food establishments during a water supply emergency, including boil water advisories, chemical contaminations or pressure reductions that may be associated with drought
Tourism, Arts and Heritage Cabinet - Department of Fish and Wildlife Resources	KDFW	<ul style="list-style-type: none"> ▪ Member of Kentucky Drought Mitigation Team ▪ Identify potential impacts to specific fisheries and wildlife populations and recommend actions to reduce the impacts to these resources

LEAD RESPONSE AGENCY (cont.)		PRIMARY AGENCY DROUGHT RESPONSE ACTIONS
Kentucky Division of Emergency Management	KYEM	<ul style="list-style-type: none"> ▪ Member of the Kentucky Drought Mitigation Team ▪ Activate the Emergency Operations Center ▪ Provide planning, response and recovery support to state and local agencies dealing with drought-related emergencies ▪ Through regional managers provide situational awareness of local drought conditions ▪ Coordinate resource allocation as needed and available to alleviate water shortage emergencies ▪ In the event of a governor's declaration, coordinate resources and receipts under the Emergency Management Assistance Compact program
The University of Kentucky College of Agriculture <ul style="list-style-type: none"> - Cooperative Extension Service - Agricultural Weather Center 	UKCES	<ul style="list-style-type: none"> ▪ Member of the Kentucky Drought Mitigation Team ▪ Extension Specialists and County Extension Agents at UK College of Agriculture Cooperative Extension Service respond to the needs of the citizens of Kentucky related to drought conditions in the state ▪ Maintain a Web site to provide information and decision aids for farmers, homeowners and others to deal with the impacts of the drought ▪ Provide technical assistance to agricultural producers through education and outreach programs ▪ Provide up-to-date agricultural weather data and information used for planning and performing agricultural activities
County Health Departments		<ul style="list-style-type: none"> ▪ Assess and respond to impacts of water shortages or other drought impacts on public health ▪ Provide public education related to drought, e.g., water purification, boil water advisories, sanitation, food services and other public health issues ▪ Member of county or local water shortage task force
County and Local Governments		<ul style="list-style-type: none"> ▪ Make declarations of drought-related emergencies such as water shortages or burn bans ▪ Develop emergency response plans ▪ Maintain and implement of water shortage response plans for purposes of notifying customers of impending water shortage, initiating demand-management measures and identifying alternative or emergency sources of water supply ▪ Establish local drought or water shortage emergency public information strategy ▪ Develop local ordinances creating legal authority to impose mandatory restrictions to reduce water use as drought conditions develop ▪ Convene and coordinate activities of county or local water shortage task force

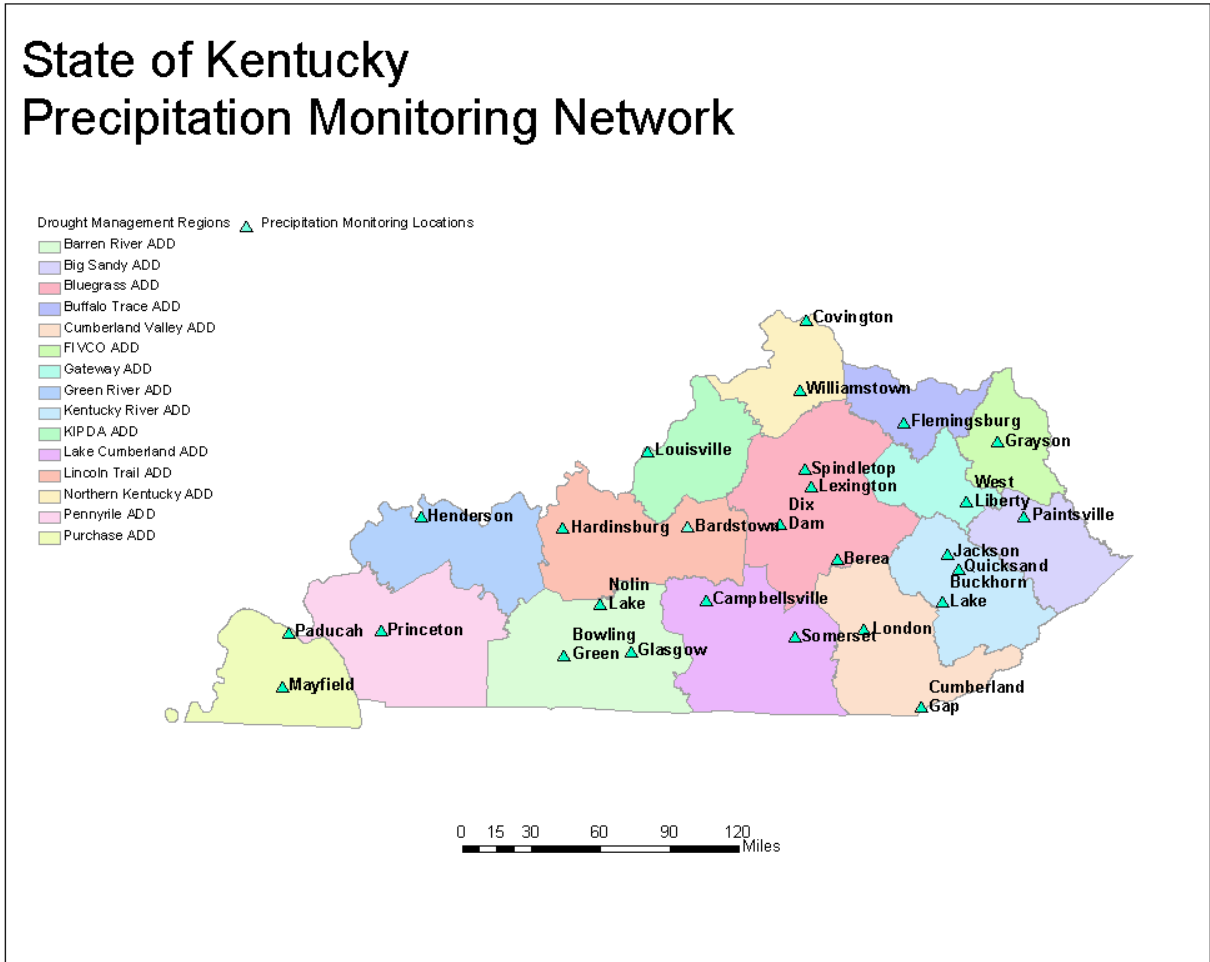
LEAD RESPONSE AGENCY (cont.)		PRIMARY AGENCY DROUGHT RESPONSE ACTIONS
Water Supply Utilities		<ul style="list-style-type: none"> ▪ Respond to customer complaints and report any drought-related problems to the Division of Water ▪ Monitor drought impacts to water supply levels to ensure timely implementation of water shortage response measures ▪ Maintain communication with county and local government officials regarding the status of water supplies ▪ Member of county or local water shortage task force

*These actions may be taken by coordinating lead agencies independently of the official drought action level due to regional differences in drought vulnerabilities of their constituents related to characteristics of water resources, soils, land uses, or types of water uses.

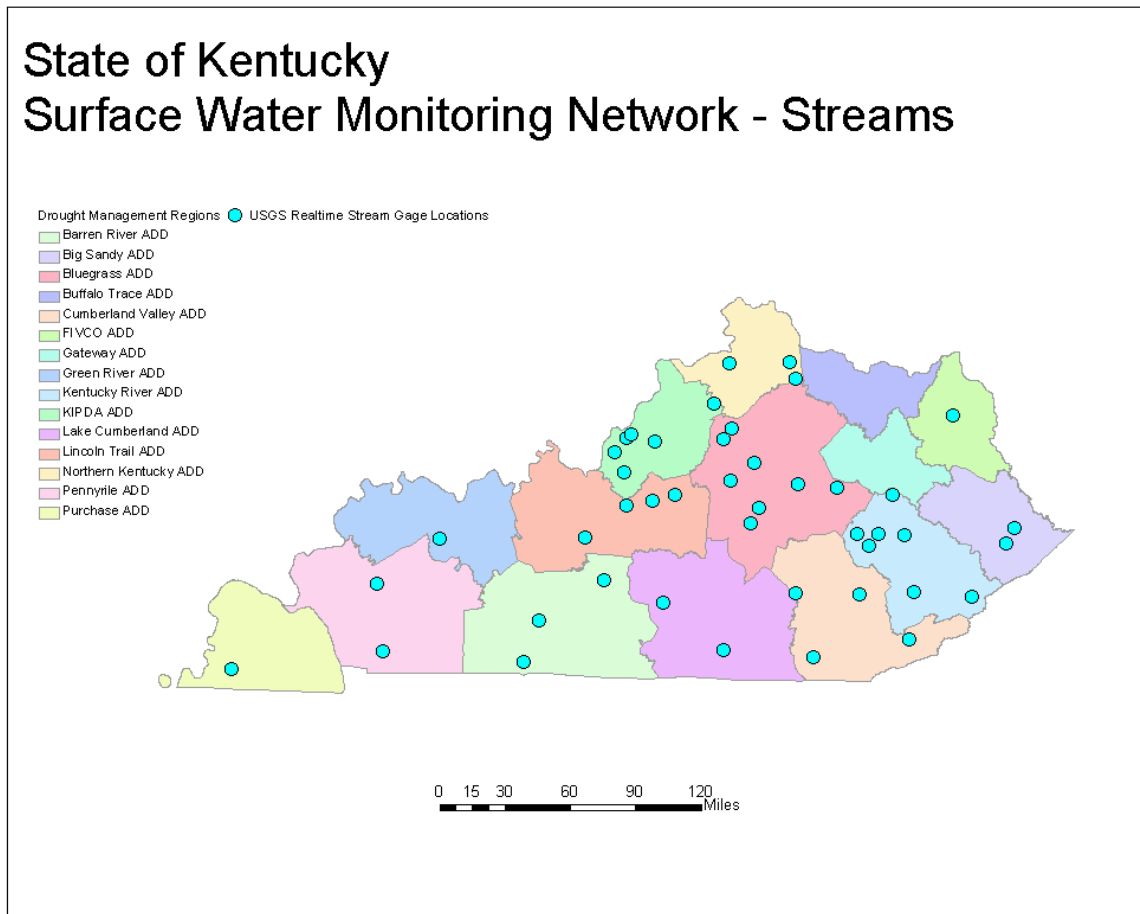
APPENDIX II

Figures

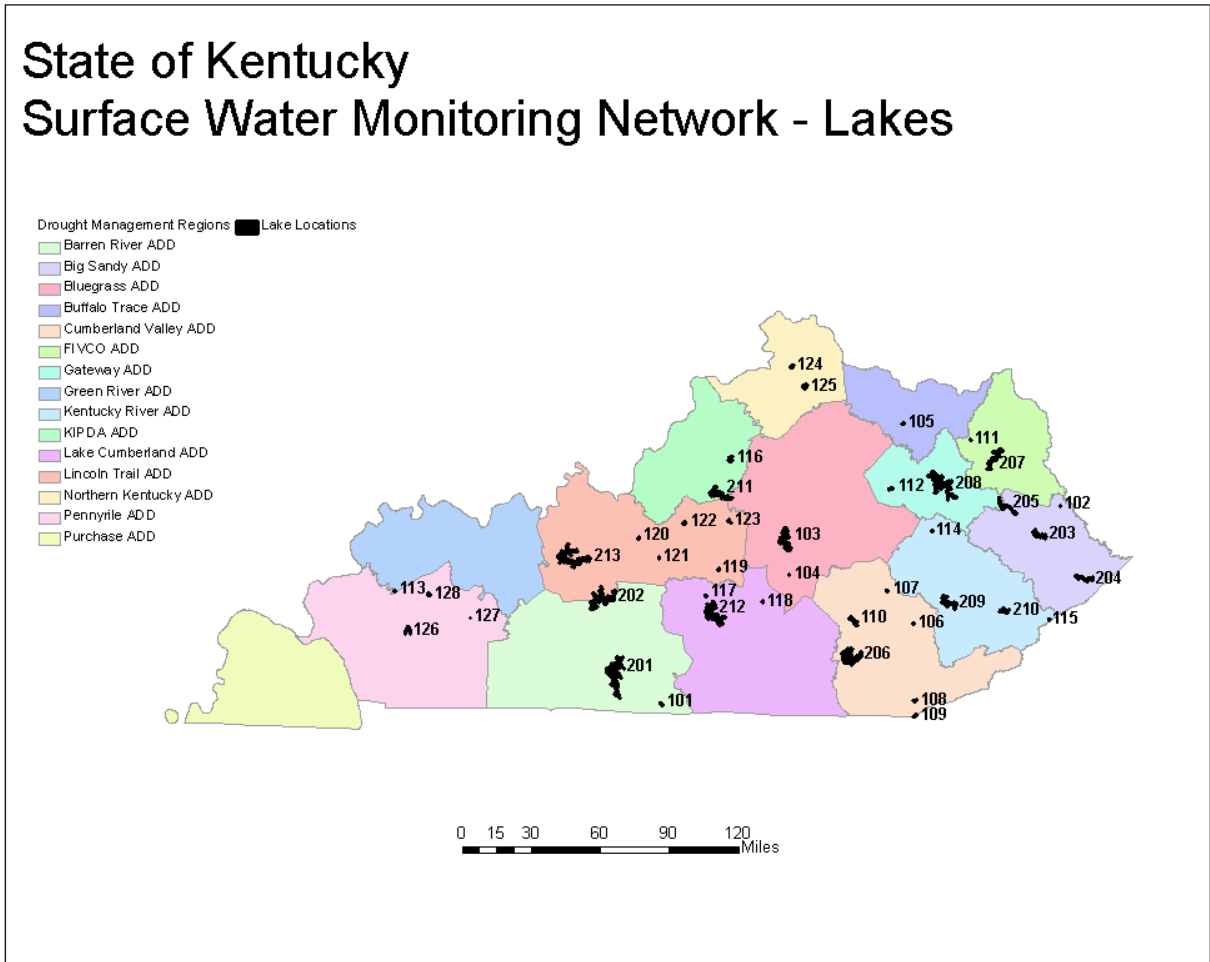
Appendix II.A. Locations of Drought Management Regions and associated precipitation monitoring stations



Appendix II.B. Location of Drought Management Regions and associated USGS stream gage monitoring locations



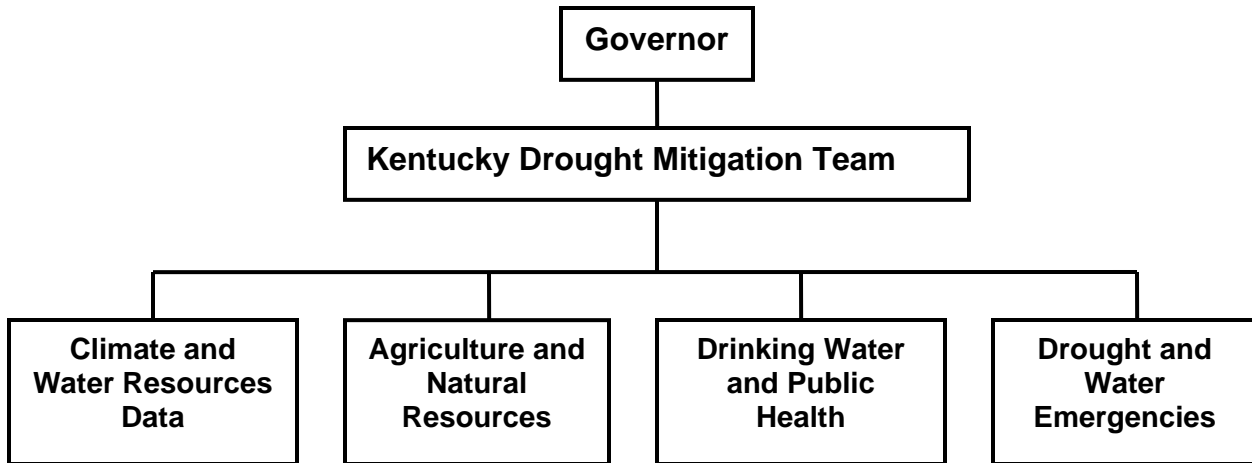
Appendix II.C. Location of Drought Management Regions and associated lakes and reservoirs used for drought monitoring



Appendix II.D. The four climatic divisions of Kentucky used by the National Weather Service and others to collect and maintain records of regional climatic data



Appendix II.E. A collaborative interagency framework to manage drought mitigation and response activities in Kentucky



APPENDIX III

Drought Mitigation and Response Advisory Council

Membership and Participants List

Appendix III. Drought Mitigation and Response Advisory Council

Henry “Hank” List
Deputy Secretary

Kentucky Energy and Environmental Cabinet

Brigadier General John W. Heltzel

Deputy Commander

Kentucky Department of Military Affairs

Director

Division of Emergency Management

Steven A. Coleman

Director

Kentucky Department for Natural Resources

Division of Conservation

Tim Curran

U.S. Army Corps of Engineers

Huntington District

Aimee Downs

Geographer

U.S. Geological Survey

Mike Callahan

Hydrologist

National Weather Service

Dr. Tom Priddy

Director

University of Kentucky College of Agriculture

Weather Center

Department of Agricultural Engineering

Josh Human

Associate Director

University of Louisville

Center for Hazards Research and Policy Development

Joe Ewalt

Director

Kentucky League of Cities

Policy Development

Sharon Dodson

Director

EON-US

Environmental Affairs

Linda Bridwell

Manager

Kentucky American Water Company

Kasey Voils

Coordinator

Lake Cumberland Area Development District

Sandy Gruzesky

Director

Kentucky Department for Environmental Protection

Division of Water

Brigadier General Joseph Culver

Deputy Adjutant General

Kentucky Department of Military Affairs

Division of Emergency Management

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Management Team Leader

U.S. Army Corps of Engineers

Louisville District

David Meadows

U.S. Army Corps of Engineers

Huntington District

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State Climatologist

Western Kentucky University

Kentucky Climate Center

Col. Steve Bullard

Division Director

Kentucky Department of Military Affairs

Jim Maczko

Meteorologist

National Weather Service

Roger Recktenwald

Director

Kentucky Association of Counties

Research, Planning and Regulatory Affairs

John Covington

Executive Director

Kentucky Infrastructure Authority

Michael Winkler

EON-US

Environmental Affairs

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Louisville Water Company

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McCreary County Water District

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Frankfort Country Club

Gary Larimore
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Kentucky Rural Water Association

Jeff Ross
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Canoe Kentucky

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