

**US Army Corps
of Engineers**
Tulsa District

CANADIAN RIVER, OKLAHOMA

CANADIAN RIVER BASIN

Eufaula Lake
Arcadia Lake
Canton Lake
Fort Supply Lake

DROUGHT CONTINGENCY PLAN

Revised June 2021

Previous Edition September 1990

DROUGHT CONTINGENCY PLAN
FOR
CANADIAN RIVER BASIN

APPENDIX DCP-6
TO
WATER CONTROL MASTER MANUEL
ARKANSAS RIVER BASIN

JUNE 2021

DEPARTMENT OF THE ARMY
TULSA DISTRICT, CORPS OF ENGINEERS
OKLAHOMA

Subject: Review Comments, Canadian River Basin Drought Contingency Plan,

September 2020

SWD Water Mgmt reviewers:

(Fred Jensen and Dan Hernandez have provided comments below).

Reviewer: Fred Jensen's comments, Water Mgmt - SWD

Note: Comment Items #'s 17, 21, 22, 24, 31, 32 and 33 are related to verifying numerical values and are highlighted in **Yellow background**. These values need to be verified and/or corrected as necessary.

Note: Comments highlighted in "Red Font" represent actual suggested changes or corrections to the sentence within the body of the comment. Paragraph, Tables, and Plate Titles will be always underlined for the name of the comment section. Also, these underlines on the title are not necessarily changes to the comment unless stated.

Canadian River Oklahoma DCP (Comments are listed below).

<u>Cmt.</u> <u>No.</u>	<u>Page</u>	<u>Comment</u>
1	Cover	<u>Cover Page</u> . Suggest in providing a "Month" in 2020 for the date of DCP publication. Example "Revised September 2020". See Upper Verdigris River DCP front cover for more details. Also verify stream gage order of projects in Original DCP dated Sept 1990. I think stream gage order is Fort Supply, Canton, Arcadia, and Eufaula. See comment #13 for more details. FJ <i>Month will be changed to the month the latest version. GS</i>
2	Whole DCP	<u>Canadian River DCP – Table of Contents</u> . Verify that all Titles listed in the Table of Contents match titles in all ensuing Chapters, Tables, and Figures, etc. Also verify that all page numbers listed in the Table of Contents match page numbers in all Chapters, Tables, Figures, etc. Also add "two spaces" after each period through-out the text for Chapters 1 – 6. FJ <i>Page numbers verified. GS</i>
3	1-1	Paragraph 1-01. <u>Purpose of Document</u> . 1 st Paragraph, 1 st sentence. Add title of lake names in "Stream Gage" order. Verbiage near the end of 1 st sentence should read "The purpose of this Drought Contingency Plan (DCP)

is to provide the authorized purposes of **Fort Supply Lake, Canton Lake, Arcadia Lake, and Eufaula Lake** in the Canadian River Basin.” See the Upper Verdigris River DCP, pg. 1-1 for more details. FJ

Change applied. GS

- 4 1-1 Paragraph 1-01. Purpose of Document. 3rd Paragraph, 1st sentence. Add this verbiage to 1st sentence to say “The Drought Contingency Plan is Appendix DCP-6 to the Water Control Manual, Arkansas River Basin, **dated July 1980 (Section 7 projects were revised in 2007).**” Correct as necessary. FJ

Change applied. GS

- 5 1-1 Paragraph 1-01. Purpose of Document. 3rd Paragraph, last sentence. Consider rephrasing this last sentence. My questions is “Has Optima Lake ever reached the “top of Conservation Pool” in the lakes history? If so publish the month and year. An example could be “Optima Lake was excluded and has not reached **the top of Conservation Pool** since “**month and year**” which occurred during the construction of the dam and lake. During the time of project completion this was the only time that Optima Lake ever reached the top of Conservation Pool.” FJ

Wording changed to the following “Optima Lake was excluded from this edition because it has been determined to be a non-contributing reservoir on the system and has not reached the top of Conservation Pool since construction was completed in 1978. An initial reservoir and surveillance plan was approved in December of 1980. The top of Conservation Pool is elevation 2,763.5 feet, but the pool has not exceeded elevation 2,723 feet. “
GS

- 6 1-1 Paragraph 1-01. Purpose of Document. After 3rd Paragraph. Bottom of this page 1-1. Add a Note stating “the NGVD29 elevation conversion to NAVD88 elevations for each of the 4 Lake projects. See the “Upper Verdigris River DCP”, bottom of pg. 1-1 for more details. However only use 2 numerical places after decimal point for each NGVD 29 elevation conversion to NAVD 88. FJ

Change applied. GS

- 7 3-1 Paragraph 3-01. Basin Description. 1st paragraph, 2nd & 3rd sentences. Re-word these drainage basin sentences to read “The major reservoirs within the Tulsa District **that occur in** this basin are Eufaula, Arcadia, Canton, Fort Supply, Optima, Thunderbird, and Meredith Lakes. The Canadian River watershed extends into **the** Albuquerque District, but the New Mexico

portion is considered non-contributing as to flows entering into the Tulsa District.” Correct as necessary. FJ

Change applied. GS

- 8 3-1 Paragraph 3-01. Basin Description. 2nd paragraph, 1st, 2nd and 3rd sentences. Re-word these sentences to read “Optima Lake has never filled **its respective** conservation storage and therefore **the lake** is excluded from this edition of the DCP. Stream inflow into the **North Canadian River above Optima** has declined since the mid 1970’s because runoff that would normally flow **in the river** is now recharging the Ogallala aquifer. The groundwater levels in this aquifer are being lowered due to increased irrigation pumping and **deeper driven wells** (Effects of Regional Groundwater Level Declines August 1988).” Correct as necessary. FJ

Change applied. GS

- 9 3-1 Paragraph 3-01. Basin Description. 2nd paragraph, 5th sentence. Add the word “Also” to the front of the 5th sentence. Should read “**Also**, Thunderbird and Meredith Lakes are under the authority of the Bureau of Reclamation etc.” FJ

Change applied. GS

- 10 3-1 Paragraph 3-01. Basin Description. 3rd paragraph, 3rd sentence. Add verbiage to this sentence to read “The basin rises from an elevation of 460 feet NGVD at the mouth to 8,000 feet NGVD **at its source** in the Sangre de Cristo Mountains **in New Mexico** and slopes about 2 feet per mile in the upper reaches.” Question: Is the **2 feet** per mile correct for upper reaches? Read next comment #11 for North Canadian watershed below. I think the upper watershed is somewhat steeper. Correct as necessary. FJ

Corrected to 53.8 feet per mile from the USGS gage near Hebron, New Mexico. GS

- 11 3-1 Paragraph 3-01. Basin Description. 4th paragraph, 1st & 3rd sentences. Add “NM” to 1st sentence. Should read “The North Canadian River has its source near Des Moines, **NM**.” 3rd sentence should read “The basin rises from an elevation of 500 feet NGVD at the mouth to approximately 6,500 feet NGVD **at its source** in the Rocky Mountains and slopes about 4 feet per mile in central Oklahoma and 18 feet per mile in the upper reaches of the high plains. FJ

Change applied and stream slope was corrected to 36 feet per mile as it is near Des Moines, NM. GS

- 12 3-2 Figure 3-1. Canadian River Basin Map. Add bolder borders to delineate the watershed boundaries. Also provide a Footnote that states which color portion is “Non-Contributing drainage areas” and which are “Contributing drainage areas” into the Tulsa District Projects. Also label Ute Lake near Logan, NM as this is where one of the Non-Contributing basin areas starts downstream of the dam. Correct as necessary. FJ

The following change has been applied.

“Note:

Green shaded areas are watersheds to Eufaula Lake, Arcadia Lake, Canton Lake and Fort Supply Lake.

Brown shaded areas are watersheds to Optima Lake, Meredith Lake and Thunderbird Lake.

Red shaded areas are watersheds to Conchas Reservoir and Ute Reservoir outside the Tulsa District’s area of operation.

White shaded areas are non-contributing areas to the Lakes in the Canadian River Watershed.

Lake Meredith and Lake Thunderbird conservation pools are managed by Bureau of Reclamation and are excluded from this manual.”

GS

- 13 3-3 Table 3-1. Average Monthly Rainfall and Pan Evaporation. Normally these drought contingency plans should be documented in stream gage order, meaning starting with Fort Supply, Canton, Arcadia, and finally Eufaula. Again, check the Sept 1990 DCP and the order documented there. Also make sure and provide the Table for “Pertinent Data for Fort Supply Lake” on the same page as the text write-up. The exception will be Eufaula Lake where the text data causes the pertinent lake data Table to be carried over to next page. Therefore, list in stream gage order here in Chapter 3 and on the front cover, etc. FJ

Ordering of projects for precipitation is consistent with ordering in September 1990 version. Changes applied. GS

- 14 3-3 Table 3-1. Average Monthly Rainfall and Pan Evaporation. Footnotes. (1) Period of record for rainfall – 1923 – 1988 then there is a data break up to year 1995. Same with evaporation. Is this really coming from the 1990 DCP or the latest WCM’s? Suggest in getting a complete record from 1923 thru 1995 then 1995 thru 2017. Same with the evaporation record. Then provided footnotes as necessary. Note: There should be no gap in precipitation and evaporation records unless there is a malfunctioning gage. This all needs to be verified since before the dam was built at each project there had to be a recorded rainfall source near the Damsite that provided reliable rainfall and evaporation data through the current years. Also after the dam and lake projects were built, each respective project had its own

rainfall and evaporation stations. Also provide the year that the dam projects quit using evaporation pans and went to using the empirical formulas for calculating the evaporation. Correct as necessary

FJ

Data correction made to be consistent with the Canton 2016 WCM, unable to verify evaporation data dating back to 1923. GS

- 15 3-4 Paragraph 3-02.a. Project Description – Eufaula Lake. 1st, 2nd & 3rd sentences. For 1st sentence add word “**river** mile 27” to sentence. Add this verbiage in **red font** for both 2nd & 3rd sentences. Should read “The total drainage area above the dam of which 8,405 sq miles is considered capable of contributing runoff **into the lake**. Eufaula Lake was authorized by the River and Harbor Act approved (Public Law 525, 79th Congress, **2nd Session, H.R. 407**) for flood control, hydropower, and navigation.”
- FJ

Change applied. GS

- 16 3-4 Paragraph 3-02.a. Project Description – Eufaula Lake. End of 3rd sentence. Add a paragraph break here and move Hydropower generation 3 sentences to 3rd paragraph (See comment #17). Also start the new 2nd paragraph with these 7th & 8th & 9th sentence verbiages: “The dam embankment consists of rolled earth fill above the stream bed. The spillway is 440 feet wide ogee weir controlled by **11 – 40-foot wide** by **32-foot tall** tainter gates. The outlet works consists of one 5-foot 8-inch by 7-foot **rectangular sluice intake controlled by a single sluice gate of the same proportions.**”
- FJ

Changes applied. GS

- 17 3-4 Paragraph 3-02.a. Project Description – Eufaula Lake. End of 13th sentence. Add a paragraph break here and move the 3 sentences concerning Hydropower generation to this spot. Also start the new 3rd paragraph as such with this verbiage: “Hydropower generation **at Eufaula Dam** is conducted through an “Operating Agreement” between USACE and the Southwestern Power Administration (**SWPA**). The powerhouse contains three hydropower generator units with an **installed capacity of 30,000 kW each and a firm annual energy output of 93,400 MWh.**” Also verify if the generation capacity is correct for Yellow Highlight.
- FJ

Changes applied. Firm power based on Daily Release Energy of 358 MWh from March 2014 Eufaula WCM. GS

- 18 3-4 Paragraph 3-02.a. Project Description – Eufaula Lake. After description of Hydropower add a new 4th paragraph here. New Paragraph 4 should provide information on “Dates of bathymetric and LiDAR sedimentation

survey's and mention the 1,352,505 ac-ft of conservation storage between elevations 565.0 – 585.0 feet (NGVD 29) for Eufaula Lake". See last paragraph for the "Upper Neosho River Basin", pg 3-1 for more details.
FJ

Changes applied. GS

- 19 3-5 Paragraph 3-02.a. Project Description – Arcadia Lake. After the pertinent data Table 3-3 "Pertinent Data for Eufaula Lake" leave a blank space and start next Lake project description on next page. Too much confusion if the previous lake "Pertinent Data Table" is just above the paragraph of new lake project description. Correct every case in that format as necessary.
FJ

Change applied. GS

- 20 3-5 Paragraph 3-02.b. Project Description – Arcadia Lake. 1st & 3rd sentences. For 1st sentence add word "river mile 218" to sentence. After the 3rd sentence add a paragraph break. FJ

Change applied. GS

- 21 3-5 Paragraph 3-02.b. Project Description – Arcadia Lake. After new 2nd paragraph provide bathymetric and LiDAR verbiage to be inserted into a new Paragraph 3. New Paragraph 3 should provide information that relates to "Dates of bathymetric and LiDAR sedimentation survey's and mention the 27,226 ac-ft of conservation storage between elevations 970.0 – 1006.0 feet (NGVD 29) for Arcadia Lake". See last paragraph for the "Upper Neosho River Basin", pg 3-1 for more details. FJ

Change applied. GS

- 22 3-5 **Table 3-4. Pertinent Data for Arcadia Lake.** Verify Storages as such: Top of Flool Control Pool – 89,383 ac-ft vs 92,013 ac-ft (Tulsa Dist info); Top of Cons. Pool – 27,279.3 ac-ft vs 27380 ac-ft (needs to be rounded). Top of Inactive Pool – 100.5 ac-ft vs 114 ac-ft (SWT info); Flood Control Storage – 62,103.6 ac-ft vs 64,633 ac-ft (SWT info); Conservation Storage – 27,178.9 ac-ft vs 27,226 ac-ft (SWT info). Verify and correct as necessary. Note: All storage values should be rounded to nearest foot numbers and not decimal values. FJ

Storage volumes confirmed. GS

- 23 3-6 Paragraph 3-02.c. Project Description – Canton Lake. 1st, 3rd & 5th sentences. For 1st sentence add word "river mile 218" to sentence. For beginning of 3rd sentence add 2 spaces. After the 5th sentence add a

paragraph break. 2nd paragraph will start after 5th sentence which ends in “fish and wildlife conservation”. FJ

Change applied. GS

- 24 3-7 Paragraph 3-02.c. Project Description – Canton Lake. After new 2nd paragraph provide bathymetric and LiDAR verbiage for a new Paragraph 3 that states the “Dates of bathymetric and LiDAR sedimentation survey’s and mention the 92,519 ac-ft of conservation storage between elevations 1596.5 – 1615.4 feet (NGVD 29) for Canton Lake”. See last paragraph for the “Upper Neosho River Basin”, pg 3-1 for more details. FJ

Change applied. GS

- 25 3-7 Table 3-5. Pertinent Data for Canton Lake. Verify all Storages and all storage values should be rounded to nearest foot and no decimal numbers. Correct as necessary. FJ

Storage volumes confirmed. GS

- 26 3-7 Paragraph 3-02.d. Project Description – Fort Supply Lake. 1st & 4th & 9th sentences. For 1st sentence add word “river mile 6” to sentence. After the 4th sentence add a paragraph break. 2nd paragraph will start after 4th sentence which ends in “fish and wildlife conservation”. Start 9th sentence by adding word “Also,” to sentence. Should read “Also, a 36-inch low flow pipe with an intake invert elevation of 1980.0 etc.” FJ

Change applied. GS

- 27 3-8 Paragraph 3-02.d. Project Description – Fort Supply Lake. After new 2nd paragraph (end of 10th sentence) provide bathymetric and LiDAR verbiage for a new Paragraph 3 that states the “Dates of bathymetric and LiDAR sedimentation survey’s and mention the 12,221 ac-ft of conservation storage between elevations 1979.0 – 2004.0 feet (NGVD 29) for Fort Supply Lake”. See last paragraph for the “Upper Neosho River Basin”, pg 3-1 for more details. FJ

Change applied. GS

- 28 4-4 **Table 4-1. The 10 Lowest Annual Inflows (earliest year 1923 – 2020).** Add this **Table 4-1** to Page 4-4 after the Individual lake descriptions that describe the extreme droughts. This **Table 4-1** needs to contain the top 10 lowest inflow years for Fort Supply, Canton, Arcadia, and Eufaula Lakes in this Stream Gage order. See the Upper Neosho River Basin DCP, Table 4-2, pg 4-3 and the Upper Verdigris River Basin DCP, Table 4-1, pg 4-2 for more details. FJ

Annual inflows for POR since first fill of conservation pool. GS

- 29 4-5 **Table 4-2. Minimum Pool of Record.** Add this **Table 4-2** to Page 4-5 after Table 4-1. See **Table 4-2** in the Upper Verdigris River Basin DCP, pg 4-3 for more details. FJ

Change applied. GS

- 30 5-1 Paragraph 5-01. Current Project Water Uses and Users. 2nd & 3rd & 4th sentences. Add verbiage and make changes to match what is somewhat already presented in this document. 2nd and newly worded 3rd & 4th sentences should read as such “The Oklahoma Water Resources Board (OWRB) issues water rights to withdraw water from the lakes and the waterways upstream and downstream of the lakes **and the board should be contacted if questions arise concerning water rights. Since** water rights are continuously being granted, renewed, **and/or have expired, the water supply entities listed in this DCP may not be the most current. Therefore, contact the OWRB to obtain the most current updated list of water right holders both within the lake, upstream and downstream of the dam as necessary.**” Note: Eufaula Lake water supply storage contracts are listed in Table 5-1, pg 5-2, so the original 4th sentence does not apply here. FJ

Change applied. GS

- 31 5-3 Paragraph 5-01.b. Arcadia Lake. Verify the **29,206 ac-ft** with Table 3-4 values for Arcadia Lake. Also suggest writing this verbiage for the 1st sentence as such “Arcadia Lake has a total of **29,206 ac-ft (between elevations 970.0 to 1006.0 feet NGVD)** of conservation storage with 100%, allocated to water supply etc.” Correct as necessary. FJ

Change applied. GS

- 32 5-3 Paragraph 5-01.c. Canton Lake. Verify the **95,845 ac-ft** with Table 3-5 values for Canton Lake. Also suggest writing this verbiage for the 1st sentence as such “Canton Lake has a total of **95,845 ac-ft (between elevations 1596.5 to 1615.4 feet NGVD)** of conservation storage with 100%, allocated to water supply.” Note: Move the verbiage “(elevations 1596.5 to 1615.4)” from 2nd sentence to 1st sentence as presented above. Correct as necessary.

Change applied. GS

- 33 5-3 Paragraph 5-01.d. Fort Supply Lake. Suggest writing this verbiage for the 1st & 2nd sentences as such “Fort Supply Lake has a total of **12,221 ac-ft**

(between elevations 1979.0 to 2004.0 feet NGVD) of conservation storage with 2.46% of this storage available to be allocated for water supply. Currently, the 2.46% water supply storage in Fort Supply Lake is not under contract at this time.” Correct as necessary.

Change applied. GS

-----New updated comment as of Mon. 25 Jan 2021-----

34 2-1 Paragraph 2-01.c. ER 1110-2-8156, Preparation of Water Control Manuals. Latest date of this document should be 30 September 2018. This DCP shows 20 September 2018. Correct as necessary.

Change applied. GS

-----End of Fred Jensen’s annotated comments-----

Comments provided by David J. Williams

1. [P. 1-1] “Optima Lake was excluded from this edition because it has been determined to be a non-contributing reservoir on the system and has not reached the top of Conservation Pool since construction was completed in 1978. An initial reservoir and surveillance plan was approved in December of 1980. The top of Conservation Pool is elevation 2,763.5 feet, but the pool has not exceeded elevation 2,723 feet.”

This statement should be revised. While it is understood that Optima Lake does not provide meaningful conservation storage, it continues to provide a flood-control benefit to the system. The design of the auxiliary spillway at Canton included the flood-control benefit provided by both the Optima and Fort Supply projects.

Change applied. GS

2. [P. 3-1] “Optima Lake has never filled its respective conservation storage and therefore the lake is excluded from this edition of the DCP. Stream inflow into the North Canadian River above Optima has declined since the mid 1970s because runoff that would normally flow in the River above Optima is now recharging the Ogallala aquifer. The groundwater levels in this aquifer are being lowered due to increased irrigation pumping and deeper driven wells (Effects of Regional Ground-water Level Declines on Streamflow in the Oklahoma Panhandle, by Kenneth and Tony Wahl, American Water Resources Association, August 1988).”

This statement is incomplete. The drawdown of the Ogallala aquifer has an impact on baseflow along the Beaver River and its tributaries, but the proliferation of center-pivot irrigation systems (and subsequent capture on individual properties) have also drastically impacted the regional hydrology by limiting the amount of surface runoff available within the watershed.

Recommend consolidating the statement to simply read “Optima Lake has never filled its respective conservation storage and therefore the lake is excluded from this edition of the DCP. Stream flow in the Beaver River above Optima has declined since the mid-1970s.”

Also, in this statement, “North Canadian River” should be replaced with “Beaver River.” The North Canadian River is formed by the confluence of the Beaver River and Wolf Creek in Woodward Co., OK. The “Beaver River” is the proper name for the reach above Optima Lake.

Change applied. GS

3. [P. 4-1] “The NIDIS publishes weekly drought maps indicating current drought conditions (Figure 4-1), drought impacts, Palmer Drought Severity Index (PDSI), and other drought parameters.”

Recommend stating that “The U.S. Drought Monitor is a weekly publication is produced jointly by the National Drought Mitigation Center (NDMC) at the University of Nebraska-Lincoln, the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Department of Agriculture (USDA). See Figure 4-1 for an example from the week of November 12, 2019.”

Change applied. GS

4. [P. 4-2] In Section 4, there is no mention of the firm yields associated with these projects. It is assumed that the firm yield coincides with the critical droughts that are referenced in this section. Consider adding the firm yield either within the respective paragraphs or as a summary table.

Excluding yield is consistent with other DCPs previously approved. Change not applied. GS

-----End of David J. Williams’ annotated comments-----

DROUGHT CONTINGENCY PLAN
FOR
CANADIAN RIVER, OKLAHOMA

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I. Introduction

1-01. Purpose of Document.

The purpose of this Drought Contingency Plan (DCP) is to provide a basic reference for water management decisions and response for the Tulsa District Corps of Engineers during periods of reduced inflows when low water levels negatively affect the authorized purposes of Eufaula Lake, Arcadia Lake, Canton Lake, and Fort Supply Lake in the Canadian River Basin.

Because of the long-term nature of a drought and the uncertainties of the specific problems that may result, this document details only a limited number of specific actions that can be carried out related to water control. Its primary value is in documenting data needed in decisions and defining the coordination needed to manage the Tulsa District water resources to ensure that they are used in a matter consistent with the needs which develop.

This Drought Contingency Plan is Appendix DCP-6 to the Water Control Master Manual, Arkansas River Basin, dated July 1980 (Section 7 projects were revised in 2007). It covers Eufaula Lake, Arcadia Lake, Canton Lake, and Fort Supply Lake in the Canadian River Basin. Optima Lake was excluded from this edition because it does not provide meaningful conservation storage and has not reached the top of Conservation Pool since construction was completed in 1978. An initial reservoir and surveillance plan was approved in December of 1980. The top of Conservation Pool is elevation 2,763.5 feet, but the pool has not exceeded elevation 2,723 feet. Optima Lake continues to provide flood control benefits to the downstream reservoirs in Tulsa District.

Note:

1. Add 0.35 feet to the NVGD29 elevation to obtain the NAVD88 elevation for Eufaula.
2. Add 0.40 feet to the NVGD29 elevation to obtain the NAVD88 elevation for Arcadia.
3. Add 0.64 feet to the NVGD29 elevation to obtain the NAVD88 elevation for Canton.
4. Add 0.89 feet to the NVGD29 elevation to obtain the NAVD88 elevation for Fort Supply.

II. Authorities

2-01. Authorities for Drought Contingency Plans

- a. ER 1110-2-1941, Drought Contingency Plans, 2nd February 2018, provides policy and guidance for the preparation of drought contingency plans as a part of the Corps of Engineers' overall water management plan.
- b. Section 216, Public Law 91-611, (84 Stat 1830) Rivers and Harbors Act 1970, authorizes the Secretary of the Army to review the operation of existing Corps projects and recommend to Congress modification of their structure or operation to improve the environment.
- c. ER 1110-2-8156, Preparation of Water Control Manuals, 30 September 2018 provides a guide for preparing water control manuals for individual water resource projects which include drought contingency plans.
- d. ER 1110-2-240, Water Control Management, 30 May 2016, prescribes the policies and procedures to be followed in water management activities including special regulations to be conducted during droughts. It also sets forth the responsibility and approval authority in development of water control plans.
- e. Multiple letter, CESWD-ED-WR, 8 June 1988, subject: Drought Contingency Plans, directs the Districts within the Southwestern Division to initiate preparation of drought contingency plans for their basins and projects.
- f. PL 84-99, Emergency Supplies of Clean Drinking Water, as amended by PL 95-51, provides the authority under which the Chief of Engineers may under certain statutory conditions construct wells and transport water to farmers, ranchers, and political subdivisions within areas determined to be drought distressed.
- g. ER 500-1-1, Emergency Employment of Army and Other Resources, Natural Disaster Procedures identifies the mission, authorities, responsibilities and chain of command of the Corps in provision of disaster assistance. Specifically it establishes guidance in the application of PL 84-99 and PL 95-51 and gives reporting and assistance request procedures.
- h. EM 1110-2-3600, Management of Water Control Systems, 10 October 2017, requires that the drought management plan be incorporated into the project water

control manuals and master water control manuals. It also provides guidance in formulating strategies for project during droughts.

- i. Section 6, Flood Control Act of 1944, provides the authority for the Secretary of the Army to make contracts with states, municipalities, private concerns, or individuals at such prices and on such terms as he/she may deem reasonable for domestic and industrial uses for water that may be available at any reservoir under the control of the Department of the Army.
- j. EC 1105-2-181, Municipal and Industrial Water Supply Storage, Army General Counsel Opinion of 13 March 1986, states that Section 6 of the 1944 Flood Control Act empowers the Secretary of the Army to make reasonable reallocations between different project purposes. Thus, water stored for purposes no longer necessary, or for a better use in certain cases, can be considered surplus.
- k. Multiple memorandum, CECW-RP, 11 July 1988, subject: Request for Withdrawal of Small Amounts of Water Over Short Periods of Time. Drought and other emergencies affecting domestic, municipal, and industrial water supplies will likely generate requests for water stored in Corps reservoirs. This memo outlines an expedited process for dealing with such requests that can be included in drought contingency plans. District Commanders should take the initiative to make Section 6 assessments of the availability of storage for limited withdrawals. Up to 50 acre-feet of water may be allocated by the District Commander in accordance with EC 1105-2-181. Agreements for small amounts of water withdrawals (50 acre-feet or less) may be accomplished at the District level for a term of no more than one year and a clause may be included for an automatic renewal.
- l. ER 405-1-12 provides guidance for issuing an appropriate real estate instrument for water withdrawal users who will be installing water lines or other facilities or equipment.
- m. It should be noted that the Oklahoma Water Resources Board (OWRB) is responsible for the appropriation of Oklahoma's waters and any redistribution or use of water in Oklahoma requires OWRB approval. Nothing in these contracts or agreements constitute a change or reduction in the federal authorities or responsibility of the USACE.

III. Basin and Project Descriptions

3-01. Basin Description.

The Canadian River Basin lies in northeastern New Mexico, the Texas panhandle, and central Oklahoma. The major reservoirs within the Tulsa District that occur in this basin are Eufaula, Arcadia, Canton, Fort Supply, Optima, Thunderbird, and Meredith Lakes. The Canadian River watershed extends into the Albuquerque District, but the New Mexico portion is considered non-contributing as to flows entering the Tulsa District.

Optima Lake has never filled its respective conservation storage and therefore the lake is excluded from this edition of the DCP. Stream flow in the Beaver River above Optima has declined since the mid-1970s. Should conditions change so that inflows increase, and significant water is impounded this plan will be revised to include Optima Lake. Also, Thunderbird and Meredith Lakes are under the authority of the Bureau of Reclamation and are not included in this drought contingency plan. Figure 3-1 below shows the Canadian River watersheds within the Tulsa District, orange indicates the watershed is excluded from this DCP, green indicates the inclusion of the watershed in this DCP.

The total drainage area of the Canadian River Basin is 47,705 square miles. The basin is 560 miles long east to west with an average width of 85 miles north to south. The basin rises from an elevation of 460 feet NGVD at the mouth to 8,000 feet NGVD at its source in the Sangre de Cristo Mountains in New Mexico and slopes about 53.8 feet per mile near Hebron, NM in the upper reaches. The major tributary of the Canadian River is the North Canadian River.

The North Canadian River has its source in the region of the northeastern New Mexico near Des Moines, NM. The total drainage area is 17,712 square miles. The basin is 843 miles long east to west with an average width of 10 miles. The basin rises from an elevation of 500 feet NGVD at the mouth to 6,500 feet NGVD at the source and slopes about 4 feet per mile in central Oklahoma and 36 feet per mile at its source near Des Moines, NM in the upper reaches. The major tributary of the North Canadian River is the Deep Fork River.

The Deep Fork River lies in east-central Oklahoma. The total drainage area of the basin is 2,548 square miles. The basin is 120 miles long east to west and 25 miles wide north to south and rises from an elevation of 600 feet NGVD at the mouth to 1,200 feet NGVD

at the source. The river slopes about 1 foot per miles in the lower reaches and 30 feet per mile in the upper reaches.

Table 3-1 and Table 3-2 list the average monthly rainfall and pan evaporation for the lakes in the Canadian River Basin.

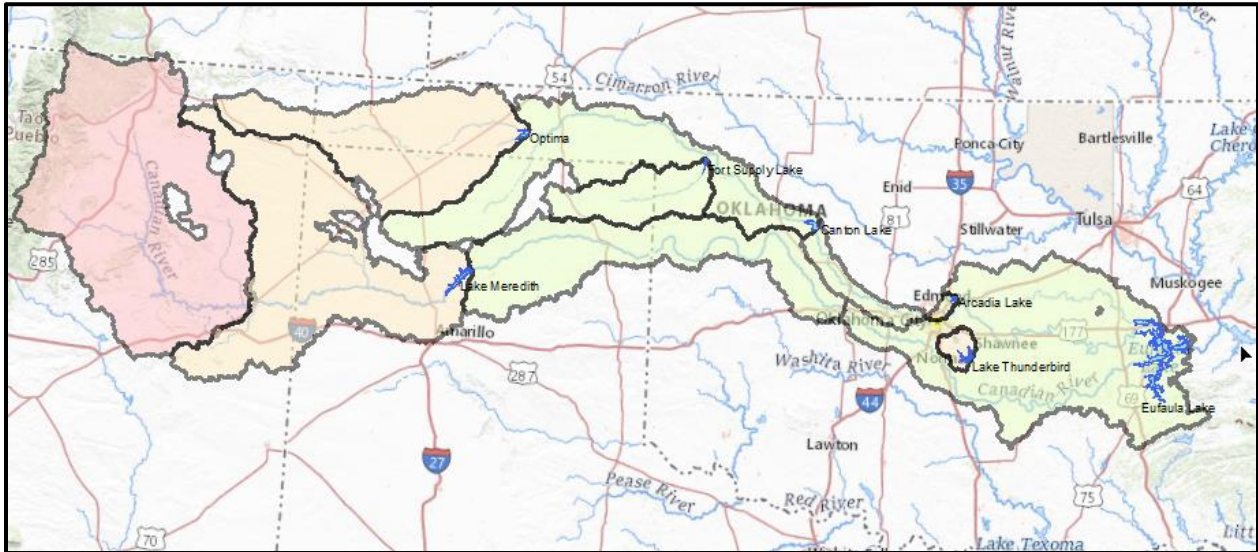


Figure 3-1: Canadian River Basin.

Note:

Green shaded areas are watersheds to Eufaula Lake, Arcadia Lake, Canton Lake and Fort Supply Lake.

Brown shaded areas are watersheds to Optima Lake, Meredith Lake and Thunderbird Lake.

Red shaded areas are watersheds to Conchas Reservoir and Ute Reservoir outside the Tulsa District's area of operation.

White shaded areas are non-contributing areas to the Lakes in the Canadian River Watershed.

Lake Meredith and Lake Thunderbird conservation pools are managed by Bureau of Reclamation and are excluded from this manual.

Table 3-1: Average Monthly Rainfall and Pan Evaporation for Eufaula and Arcadia Lakes.

Month	Eufaula		Arcadia	
	Rainfall⁽¹⁾ (inches)	Evaporation⁽²⁾ (inches)	Rainfall⁽¹⁾ (inches)	Evaporation⁽³⁾ (inches)
January	1.71	2.44	1.23	2.85
February	2.14	2.72	1.54	3.23
March	3.09	4.52	2.50	5.44
April	3.90	5.87	3.29	7.23
May	5.57	6.61	5.17	7.81
June	4.56	7.83	4.63	9.33
July	3.12	9.32	2.98	10.64
August	2.95	8.53	2.83	9.83
September	3.97	6.16	3.55	6.96
October	3.49	4.68	2.85	5.61
November	2.65	3.42	1.97	3.85
December	2.17	2.42	1.47	2.65
Total	39.31	64.52	34.01	75.44

Table 3-2: Average Monthly Rainfall and Pan Evaporation for Canton and Fort Supply Lakes.

Month	Canton		Fort Supply	
	Rainfall⁽¹⁾ (inches)	Evaporation⁽²⁾ (inches)	Rainfall⁽¹⁾ (inches)	Evaporation⁽²⁾ (inches)
January	0.49	2.12	0.51	2.29
February	0.69	2.50	0.73	2.77
March	1.25	4.48	1.28	4.63
April	1.73	6.57	1.74	6.80
May	3.16	7.88	3.30	9.38
June	2.96	9.28	3.16	11.19
July	2.54	10.87	2.37	12.49
August	2.61	9.63	2.62	10.99
September	1.92	7.16	1.84	8.35
October	1.59	5.10	1.72	6.03
November	0.89	3.31	0.89	3.68
December	0.67	2.17	0.70	2.23
Total	20.50	71.07	20.87	80.82

(1) Period of record for rainfall – October 1930 through December 2020.

(2) Period of record for evaporation – October 1979 through December 2020.

(3) Period of record for evaporation – January 1987 through December 2020.

3-02. Project Description.

- a. Eufaula Lake. Eufaula Lake is located at river mile 27 on the Canadian River in McIntosh and Pittsburg Counties, 12 miles east of Eufaula and 31 miles south of Muskogee, Oklahoma. The total drainage area above the dam is 47,522 square miles of which 8,405 square miles is considered capable of contributing runoff into the lake. Eufaula Lake was authorized by the River and Harbor Act approved 24 July 1946 (Public Law 525, 79th Congress, 2nd Session, H.R. 407) for flood control, hydropower, and navigation. The project also has project purposes of water supply, recreation, sediment control, and fish and wildlife conservation.

Hydropower generation at Eufaula Dam is conducted through an “Operating Agreement” between USCE and the Southwestern Power Administration (SWPA). When the pool elevation is between 565.0 and 585.0 feet (conservation pool), releases are made through the turbines and are governed by power generating requirements. Releases of up to about 12,000 cfs are made through the turbines, if operable, from elevation 585.0 feet and above (flood control pool). The powerhouse contains three hydropower generator units with an installed capacity of 30,000 kW each and a firm annual energy output of 130,670 MWh. There are three 22-foot diameter penstocks with an intake invert elevation of 506.0 feet NGVD29.

The dam embankment consists of rolled earth fill with a crest width of 36 feet, a length of 3,200 feet, and a maximum height of 114 feet above the stream bed. The spillway is 440 feet wide and includes a concrete gravity ogee weir controlled by 11 - 40-foot by 32-foot tainter gates. The outlet works consist of a 5-foot 8-inch by 7-foot rectangular sluice intake controlled by a single sluice gate of the same proportions. The elevation of the sluice intake is 500.0 feet NGVD29. The sluice openings discharge through the spillway weir. No water supply connections were constructed with the dam but there are privately owned water supply intake structures within the lake. See Table 5-1 for a listing of these water supply contracts.

Based on 2015 survey, Eufaula Lake has 1,352,505 ac-ft of conservation storage and 842,319 ac-ft of inactive storage between elevation 498.0 and 585.0. The conservation storage has allocated ~84% for hydroelectric power

generation, ~6% for water supply and ~10% allocated for sediment reserve storage. Pertinent data for Eufaula Lake is listed in Table 3-3.

Table 3-3: Pertinent Data for Eufaula Lake.

Feature	Elevation (Ft, NGVD29)	Storage (acre-feet)
Top of Dam	612.0	--
Top Flood Control Pool	597.0	3,545,183
Top Conservation Pool	585.0	2,194,857
Top Inactive Pool and spillway crest	565.0	842,352
Flood Control Storage	585.0 – 597.0	1,350,326
Conservation Storage	565.0 – 585.0	1,352,505
End of Boat Ramps	570.0	--

- b. Arcadia Lake. Arcadia Lake is located at river mile 218 on the Deep Fork River in Oklahoma County, twelve miles northeast of Oklahoma City, Oklahoma. The total drainage area above the dam is 105 square miles. Arcadia Lake was authorized by the Flood Control Act approved 31 December 1970 for flood control, water supply, and recreation and reauthorized by Section 192 of the Water Resources Act of 1976.

The embankment consists of rolled earth fill with a crest width of 32 feet, a length of 5,250 feet, and a maximum height of 102 feet above the streambed. The uncontrolled spillway is 350 feet wide. The outlet works consist of one 7-foot by 10-foot conduit with an invert elevation of 956.0 feet NGVD29. The conduit is controlled by two 3.5-foot by 7.5-foot sluice gates; two dual wet wells with inlets at elevations 990.0, 976.0, and 963.0 feet NGVD29 which discharge into an 18-inch water supply pipe; and two 15-inch by 21-inch low flow pipes which discharge into the flood control conduit. The 18-inch water supply line is embedded in concrete directly underneath the flood control conduit and terminates at a pump house operated by the city of Edmond.

Based on 2017 survey, Arcadia Lake has 27,179 ac-ft of conservation storage and 101 ac-ft of inactive storage between elevation 952.0 and 1,006.0. The conservation storage is allocated as water supply storage. Pertinent data for Arcadia Lake is listed in Table 3-4.

Table 3-4: Pertinent Data for Arcadia Lake.

Feature	Elevation (Ft, NGVD29)	Storage (acre-feet)
Top of Dam	1,054.0	--
Top Flood Control Pool and spillway crest	1,029.5	89,383
Top Conservation Pool	1,006.0	27,279
Top Inactive Pool	970.0	101
Flood Control Storage	1,006.0 – 1,029.5	62,104
Conservation Storage	970.0 – 1,006.0	27,179
End of Boat Ramps	995.0	--

- c. Canton Lake. Canton Lake is located at river mile 394 on the North Canadian River in Blaine and Dewey Counties, 75 miles northwest of Oklahoma City, Oklahoma. The total drainage area above the dam is 12,483 square miles, of which 7,600 square miles is considered capable of contributing runoff. Canton Lake was authorized by the Flood Control Act 24 July 1946 and 30 June 1948 for flood control, water supply, and irrigation. The Water Resources Development Act of 1990 (PL 101-640) reassigned all the irrigation storage to water supply, and fish and wildlife.

The project also provides recreation facilities and fish and wildlife conservation. The embankment consists of rolled earth fill with a crest width of 33 feet, a length of 15,140 feet, and a maximum height of 68 feet above the stream bed. The spillway is 640 feet wide and includes a concrete gravity chute controlled 16 40-foot by 25-foot tainter gates. The outlet works consist of two 7-foot by 12-foot sluices which discharge through the spillway weir at elevation 1,582.0 feet NGVD29; two 24-inch diameter low flow pipes with invert elevation of 1,583.0 feet NGVD29 which discharge into the sluices; and an irrigation structure with an intake invert elevation of 1,591.0 feet NGVD29. The auxiliary spillway is located at the right abutment. The spillway is 480 feet wide. The top of the auxiliary spillway gates (fuse gates) is at elevation 1,638.0 feet, NGVD 29. Flow through the spillway is controlled by nine hydraulically controlled 53-foot by 32-foot semi-labyrinth type concrete fuse gates. A wet well tower is located at the left abutment of the auxiliary spillway sill. The intake for the wet well is located near the left abutment of the auxiliary spillway sill, upstream of the gates. The wet well intake elevation is 1,616.5 feet, NGVD29. Inside of the wet well, there are nine inlet wells at different elevations, and each well connects to a separate fuse gate. At reservoir elevations between 1,638.0 and 1,640.5 feet, the fuse gates will act as a weir and all flow will be over the top of the gates. When the reservoir elevation reaches 1,640.5 feet, the center fuse gate will tip over, allowing more water to flow through the spillway. As the reservoir elevation continues to rise, additional fuse gates will tip at specified water surface elevations to increase the spillway opening.

Based on 2016 survey, Canton Lake has 92,519 ac-ft of conservation storage and 16,061 ac-ft of inactive storage between elevation 1,583.3 and 1,615.4. The conservation storage is allocated as water supply storage. Pertinent data for Canton Lake is listed in Table 3-5.

Table 3-5: Pertinent Data for Canton Lake.

Feature	Elevation (Ft, NGVD29)	Storage (acre-feet)
Top of Dam	1,648.0	--
Top Flood Control	1,638.0	370,107
Top Conservation Pool	1,615.4	108,580
Spillway crest	1,613.0	92,464
Bottom of Auxiliary Spillway Weir	1,606.0	53,751
Top Inactive Pool	1,596.5	16,061
Flood Control Storage	1,615.4 – 1,638.0	261,527
Conservation Storage	1,596.5 – 1,615.4	92,519
End of Boat Ramps	1,605.0	--

- d. Fort Supply Lake. Fort Supply Lake is located at river mile 6 on Wolf Creek, a tributary of the North Canadian River in Woodward County, 13 miles northwest of Woodward, Oklahoma. The total drainage area of the basin is 1,735 square miles, with 1,494 square miles above the dam. Fort Supply Lake was authorized by the Flood Control Act of 1936 for flood control. The project also provides water supply, recreation, and fish and wildlife conservation.

The embankment consists of rolled earth fill with a crest width of 25 feet, a length of 11,325 feet, and a maximum height of 85 feet above the streambed. The uncontrolled spillway is a concrete gravity chute 540 feet wide. The outlet works consists of an egg-shaped conduit with an area equal to a circular conduit 17.7 feet in diameter. The conduit has an intake invert elevation of 1,979.0 feet NGVD29 and is controlled by three 7-foot 6-inch by 16-foot sluice gates. Also, a 36-inch low flow pipe, with an intake invert elevation of 1,980.0 feet NGVD29 discharges into the conduit.

Based on 2010 survey, Fort Supply Lake has 12,221 ac-ft of conservation storage and 0 ac-ft of inactive storage between elevation 1,974.5 and 2,004.0. The conservation storage has allocated ~3% as water supply storage. Pertinent data for Fort Supply Lake is listed in Table 3-6.

Table 3-6: Pertinent Data for Fort Supply Lake.

Feature	Elevation (Ft, NGVD29)	Storage (acre-feet)
Top of Dam	2,059.5	--
Top Flood Control and spillway crest	2,028.0	97,947
Top Conservation Pool	2,004.0	12,221
Top Inactive Pool	1,979.0	0
Flood Control Storage	2,004.0 – 2,028.0	85,726
Conservation Storage	1,979.0 – 2,004.0	12,221
End of Boat Ramps	2,002.0	--

IV. Drought Identification

4-01. Climatological Drought Identification.

The National Integrated Drought Information System (NIDIS) Act was passed by Congress in 2006. The NIDIS Act established the US Drought Portal (www.drought.gov) and set an implementation plan for the development of drought research, education, and preparedness programs. The National Oceanic and Atmospheric Administration (NOAA) is the lead agency in implementing the NIDIS. Climate change has the potential to impact precipitation intensity, duration, form (snow vs. rain), ground state (frozen, saturated, unsaturated), and evapotranspiration. The climatological changes may exacerbate changes in land use and land cover, including changing agricultural practices that also impact water management activities.

The U.S. Drought Monitor is a weekly publication is produced jointly by the National Drought Mitigation Center (NDMC) at the University of Nebraska-Lincoln, the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Department of Agriculture (USDA). See Figure 4-1 for an example from the week of November 12, 2019.

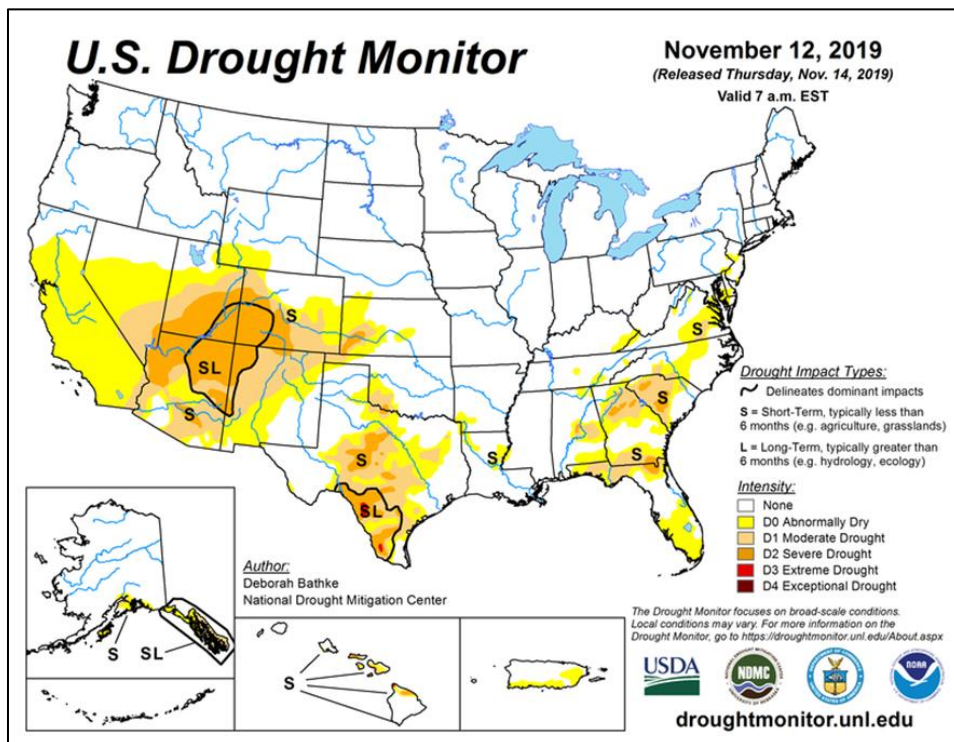


Figure 4-1: Drought Monitor Map for the Week of November 12, 2019.

4-02. Historical Droughts.

The Canadian River projects discussed within this DCP are located within Oklahoma with watersheds extending into Texas and New Mexico. The watersheds spread across several climatological divisions. The portions of the New Mexico watersheds are located outside the Tulsa district and are excluded from this DCP. The watersheds in Oklahoma include the Panhandle, West Central, Central, and East Central. The watersheds in Texas include the High Plains and Low Rolling Plains climatological divisions. Figure 4-2 shows the nine Oklahoma climatological divisions, and Figure 4-3 shows the ten Texas climatological divisions.

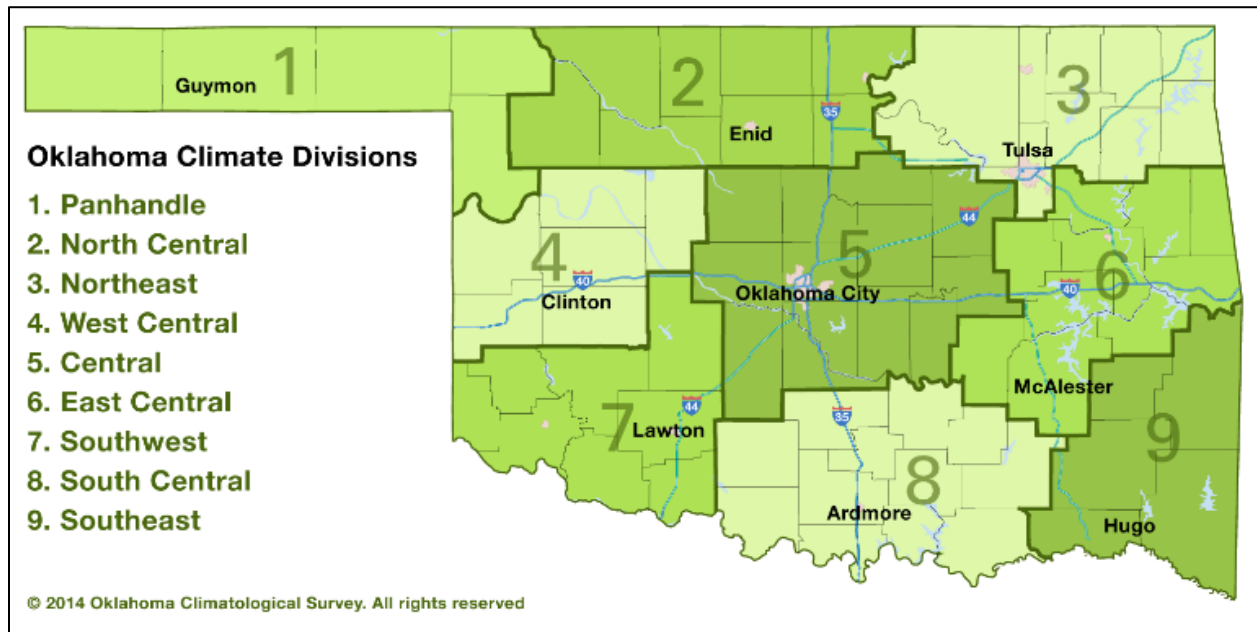


Figure 4-2: Climatological Divisions in Oklahoma

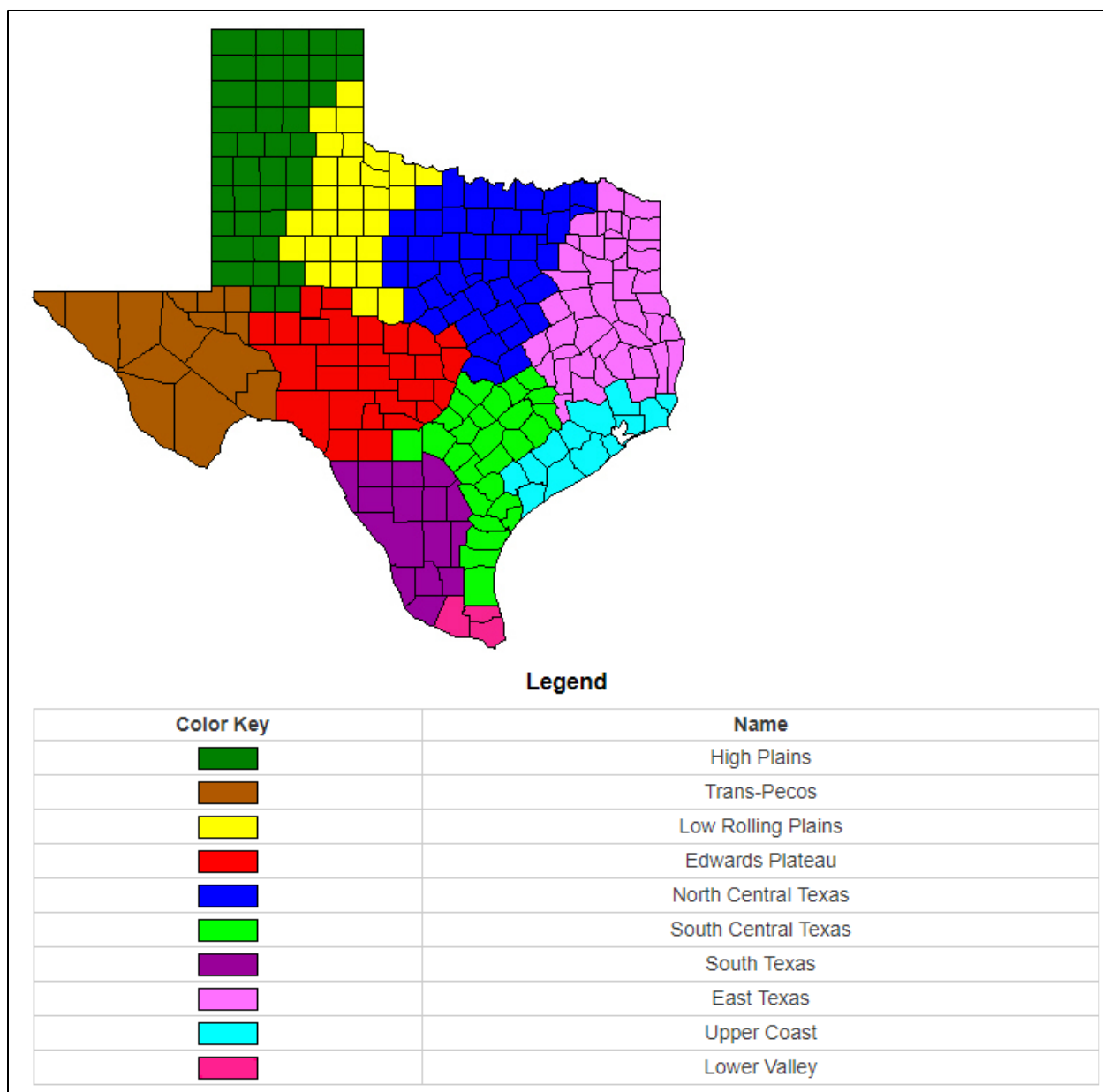


Figure 4-3: Climatological Divisions of Texas.

- a. Eufaula Lake. Eufaula Lake is in the east-central climatological division. The longest period of drought in this division was from March 1962 to March 1967 with 10 months of severe and 5 months of extreme drought. The average monthly inflow during this drought was 129,110 acre- feet compared to an average monthly inflow of 353,733 acre-feet for the period of record. Eufaula Lake was in the final stage of the filling plan when this drought occurred. Impoundment of the conservation pool was completed on 20 March 1968 when the lake reached 585.0 NGVD29. The lowest pool elevation since impoundment occurred on 19 January 1977 when the pool reached 575.1 ft NGVD29, or 9.9 feet below the normal pool at that time.

- b. Arcadia Lake. Arcadia Lake is in the central climatological division. The longest period of drought in this division was from June 1952 to February 1957 with 12 months of severe and 10 months of extreme. The average monthly inflow during this drought was 1,174 acre-feet, compared to an average monthly inflow of 2,927 acre-feet for the period of record. Arcadia Lake did not exist at the time of this drought. Impoundment of the conservation pool was completed on 28 March 1989 when the lake reached 1,006.0 ft NGVD29. The low pool elevation since impoundment occurred on 11 June 1995 and was 956.60 feet NGVD29, or 13.4 feet below normal pool.
- c. Canton Lake. Canton Lake is in the west-central climatological division. The longest period of drought in this division was from December 1951 to April 1955 with 16 months of severe and 11 months of extreme drought. The average monthly inflow during this drought was 3,840 acre-feet, compared to an average monthly inflow of 13,690 acre-feet for the period of record. Impoundment of the conservation pool was completed on July of 1948. The low pool elevation during this drought was 1,585.7 feet NGVD29, or 17.3 feet below the normal pool at that time, in May 1955, which is the lowest pool elevation for the period of record.
- d. Fort Supply Lake. Fort Supply Lake is in the north- central climatological division. The longest period of drought in this division was from June 1952 to February 1957 with 22 months of severe and 22 months of extreme. The average monthly inflow during this drought was 2,142 acre-feet, compared to an average monthly inflow of 4,676 acre-feet for the period of record. Impoundment of the conservation pool was completed in June of 1942. The low pool elevation during this drought was 1,995.7 feet NGVD29, or 6.4 feet below the normal pool at that time. The lowest pool elevation since impoundment occurred on 24 June 1947 and was 1,985.2 feet NGVD29, or 14.9 feet below the normal pool at that time.

Table 4-1 contains the top 10 lowest inflow years for Marion Reservoir, Council Grove Lake, and John Redmond Reservoir. The lowest pools of record was February 1990 for Marion Reservoir, March 1967 for Council Grove Lake, and September 1984 for John Redmond.

Table 4-1: The 10 Lowest Annual Inflows⁽¹⁾

Eufaula Lake		Arcadia Lake		Canton Lake		Fort Supply Lake	
Year	Inflow (acre-feet)	Year	Inflow (acre-feet)	Year	Inflow (acre-feet)	Year	Inflow (acre-feet)
1963	800,061	2003	17,097	1956	16,793	1943	7,558
2006	1,271,229	2006	18,177	1964	31,770	1979	9,856
2003	1,351,350	1999	18,855	1981	35,436	2011	10,164
1966	1,424,367	2011	20,230	2011	37,037	2016	10,529
2014	1,482,030	2016	20,372	2013	37,780	1994	11,812
1980	1,515,415	1996	20,989	2014	38,883	2014	11,832
1965	1,525,443	2005	24,513	1994	40,651	2017	12,165
2012	1,690,267	1998	26,453	2012	41,294	1956	12,757
1964	1,706,957	2014	27,847	1966	46,190	2015	12,768
2011	1,823,352	2012	30,394	1954	46,325	1995	13,447

(1) The period considered is the period of record since each conservation pool has been filled.

Table 4-2 contains the top five minimum pool elevations of record for Marion Reservoir, Council Grove Lake, and John Redmond Reservoir.

Table 4-2: Minimum Pool Elevations of Record

Eufaula Lake		Arcadia Lake		Canton Lake		Fort Supply Lake	
Date	Elev. (ft)	Date	Elev. (ft)	Date	Elev. (ft)	Date	Elev. (ft)
01-19-1977	575.06	01-01-1988	1,000.23	05-05-1955	1,585.66	06-24-1947	1,985.15
10-12-1972	575.87	12-18-1996	1,002.96	07-20-1953	1,588.40	11-15-1943	1,992.43
02-28-1970	576.08	10-08-2011	1,003.08	03-20-1957	1,596.40	01-18-1955	1,995.65
09-17-1970	578.19	10-14-2000	1,003.63	02-21-2013	1,599.61	12-02-1952	1,998.00
12-19-2005	578.55	08-18-2012	1,004.26	10-24-1964	1,600.47	10-24-1964	1,99.70

V. Water Uses and Users

5-01. Current Project Water Uses and Users.

The Corps of Engineers issues contracts for storage in those reservoirs which have water supply storage. The Oklahoma Water Resources Board (OWRB) issues water rights to withdraw water from the lakes and the waterways upstream and downstream of the lakes and the board should be contacted if questions arise concerning water rights. Since water rights are continuously being granted, renewed, and/or have expired, the water supply entities listed in this DCP may not be the most current. Therefore, contact the OWRB to obtain the most current updated list of water right holders both within the lake, upstream and downstream of the dam as necessary.

- a. Eufaula Lake. Currently, Eufaula Lake has a total of 1,352,505⁽¹⁾ acre-feet (between elevation 565.0 to 585.0 feet NGVD) of conservation storage, with 6.59% acre-feet allocated to water supply, and 93.4% allocated to hydropower. Table 5-1 shows current contracts for storage. The Southwestern Power Administration has negotiated peaking power sales contracts utilizing the power produced at Eufaula Lake. The storage reserved for hydroelectric power generation at this lake is essential in fulfilling these contracts and should be considered as being under contract as well.

⁽¹⁾ Based on 2015 bathymetric survey.

Table 5-1: Contracts for Storage in Eufaula Lake

Organization	Agreement #	Water Supply Storage (%)
Juniper Water Company	DACW56-01-WS-0001	21.5
RWD # 3 Muskogee County	DACW56-09-WS-0003	0.3
City of Checotah	DACW56-09-WS-0004	2.9
Rural Water District #3, Muskogee County	DACW56-09-WS-0005	0.1
OTR Dept. Arrowhead Golf Course	DACW56-10-WS-0002	0.1
OTR Dept. Fountainhead Golf Course	DACW56-10-WS-0003	0.2
City of Eufaula Public Works Authority	DACW56-10-WS-0006	0.9
City of Eufaula Public Works Authority	DACW56-12-WS-0001	1.3
Haskell County Water Company	DACW56-68-C-0202	0.7
Pittsburg County Water Authority	DACW56-68-C-0228	1.5
Longtown Rural Water and Sewer Dist #1	DACW56-69-C-0009	0.1
RWD #1 Haskell Co.	DACW56-69-C-0070	0.1
RWD #3 Muskogee Co	DACW56-70-C-0006	0.2
Porum Public Works	DACW56-70-C-0009	0.2
City of Eufaula Public Works Authority	DACW56-72-C-0016	0.1
Lakeside Water Co	DACW56-72-C-0041	0.0
RWD #3 Haskell Co	DACW56-74-C-0019	0.0
Krebbs Utility Authority	DACW56-80-C-0008	1.0
RWD #8 McIntosh Co.	DACW56-81-C-0027	2.7
RWD #1 Haskell Co.	DACW56-81-C-0050	0.7
Pittsburg Co Public Works	DACW56-81-C-0159	0.8
Longtown Rural Water and Sewer Dist #1	DACW56-85-C-0014	1.8
PSO - Tulsa	DACW56-86-C-0002	0.2
McAlester Public Works	DACW56-87-C-0066	11.2
Warner Utilities Authority	DACW56-89-C-0064	0.4
Twin Rivers Estates Inc.	DACW56-90-C-0033	0.0
Bridgeport Dunes	DACW56-90-C-0107	0.0
Rural Water District #14	DACW56-91-C-0035	0.6
Warner Utilities Authority	DACW56-96-WS-0006	0.8
Rural Water Sewer and Solid	DACW56-98-WS-0001	1.8
City of Eufaula	CIVENG-62-2467	0.8
Not Under Agreement		47.0
	Total:	100%

- b. Arcadia Lake. Arcadia Lake has a total of 27,179 acre-feet (between elevations 970.0 to 1,006.0 feet NGCD) of conservation storage with 100%, allocated to water supply for the city of Edmond by contract No. DACW56-70-C-0072. The lowest inlet elevation is 963.0 feet NGVD29. The OWRB has issued permit No. 740175 to the city of Edmond for 12,500 acre-feet per year withdrawal from Arcadia Lake.
- c. Canton Lake. Canton Lake has a total of 92,519 acre-feet (between elevations 1,979.0 to 2,004.0 feet NGVD) of conservation storage with 100% allocated to water supply. The Oklahoma City Municipal Improvement Authority has contracted with the government for the use of the entire conservation storage (elevation 1596.5 to 1615.4) for municipal and industrial water supply.
- d. Fort Supply Lake. Fort Supply Lake has 12,221 acre-feet (between elevations 1,979.0 to 2,004.0 feet NGVD) of conservation storage with 2.46% of this storage available for water supply. Currently, the water supply storage in Fort Supply Lake is not under contract at the time of this edition.

VI. Drought Management Plan

6-01. General.

a. General concept of plan.

The Drought Management Plan will be used to conserve stored water and to identify the agencies and stakeholders who are most affected by the drought. Actions in the drought plan are triggered based on percentage of conservation storage occupied as shown in Table 6-1. Communication and operational activities corresponding to each trigger are listed in Table 6-2.

b. General description of levels.

Table 6-1 shows the lake storage levels which will initiate the drought response level. Storage percentages will be the primary indicator for the levels with consideration given to inflow, predicted rainfall, and U.S. Drought Monitor. Elevations for response level will vary depending on the available storage and sedimentation rates within each reservoir. A general description of each level follows.

Table 6-1: Drought Response Level Designations

Drought Response Level	Response Level Starting Elevation (feet)				Percent Storage
	Eufaula	Arcadia	Canton	Ft. Supply	
I	585.00	1,006.00	1,615.4	2,004.00	100%
II	581.18	1,001.24	1,611.81	2,002.11	75%
III	576.79	995.43	1,607.65	1,999.98	50%
IV	571.57	987.79	1,602.88	1,997.17	25%
	565.00	970.00	1,596.5	1,990.00	0%

Note: All response level starting elevations are based on survey data at time of publishing. The percent storage is the true trigger of drought response levels.

(1) Level I.

Level I operations extend from 100% to 75% conservation storage. This level is designed as an alert phase in which the water managers monitor the onset of an apparent drought situation. The plan requires normal operational procedures and coordination for monitoring of storage, users, releases, seasonal pool plans,

deviations, etc. as needed to perform normal low flow activities and disseminate status reports within the Corps, other agencies, and users.

(2) Level II.

Level II operations extend from 75% to 50% conservation storage. In addition to the ongoing actions of Level I, a Corps Drought Management Committee (CDMC) will be activated by the District Commander. The CDMC will act to ensure that the various elements of the District are responding to the drought with a concerted effort and coordinate requests and actions with the appropriate state and Federal agencies. Water Management Personnel will forward requests for action to the CDMC and will carry out the CDMC plans and deviations. The District Commander may call an ad-hoc meeting of the Interagency Drought Management Committee (IDMC) within 60 days of activating the CDMC and brief the members on the current and projected reservoir conditions.

(3) Level III.

Level III operations extend from 50% to 25% conservation storage. In addition to the ongoing actions of Levels I and II, at Level III, the District Commander will activate the IDMC. The IDMC will act as an interface between the CDMC and water users within the basin. The IDMC will consolidate state and federal positions on drought actions and provide the CDMC with justifications, priorities, and suggested actions which will serve the most critical needs with the remaining project storage.

(4) Level IV.

Level IV operations extend from 25% to 0% conservation storage. Level IV continues the ongoing actions of Level III with increased focus on slowing the depletion of conservation storage.

6-02. Drought Management Committees

The most important aspect of the drought management plan is the development of a procedure to communicate with other Corps elements, state and Federal agencies, and the public concerning drought conditions and required or proposed actions. This communication process should include all appropriate agencies at a time when decisions need to be made and viable options are still available. Two

committees will be formed as part of the drought management plan. These committees have an important role in establishing priorities, justifications, actions, and responses.

a. Corps Drought Management Committee (CDMC)

The CDMC will be chaired by the District Commander or his designated representative and will be composed of representatives from Programs and Project Management, Engineering and Construction, Operations, Regional Planning and Environmental Center, Real Estate, and Emergency Management divisions along with the Offices of Counsel and Public Affairs. The purpose of the CDMC is to coordinate all water management activities of the District during a drought and evaluate the District's position, priorities, and justifications for water management actions which go beyond routine procedures for authorized purposes. The CDMC will coordinate requests and actions with appropriate state and Federal agencies. Water Management Personnel will forward requests for action to the CDMC and will carry out the CDMC plans and deviations.

b. Interagency Drought Management Committee (IDMC)

The IDMC will be chaired by the District Commander and will include representatives from Southwestern Power Administration, US Fish and Wildlife Service, Oklahoma Department of Environmental Quality, Oklahoma Water Resources Board, Oklahoma Department of Wildlife Conservation, Oklahoma Tourism and Recreation Department, and Secretary of Agriculture. The IDMC will also include other representatives from Federal, State, and Tribal Governments. Local Lake Associations may be invited to observe the meetings. The purpose of the IDMC will be to act as an interface between the CDMC and water users within the basin. The IDMC will consolidate state and Federal positions on drought actions and provide the CDMC with justifications, priorities, and suggested actions which will serve the most critical needs with remaining project storage. A flowchart showing the lines of communication between these agencies is shown in Figure 6-1.

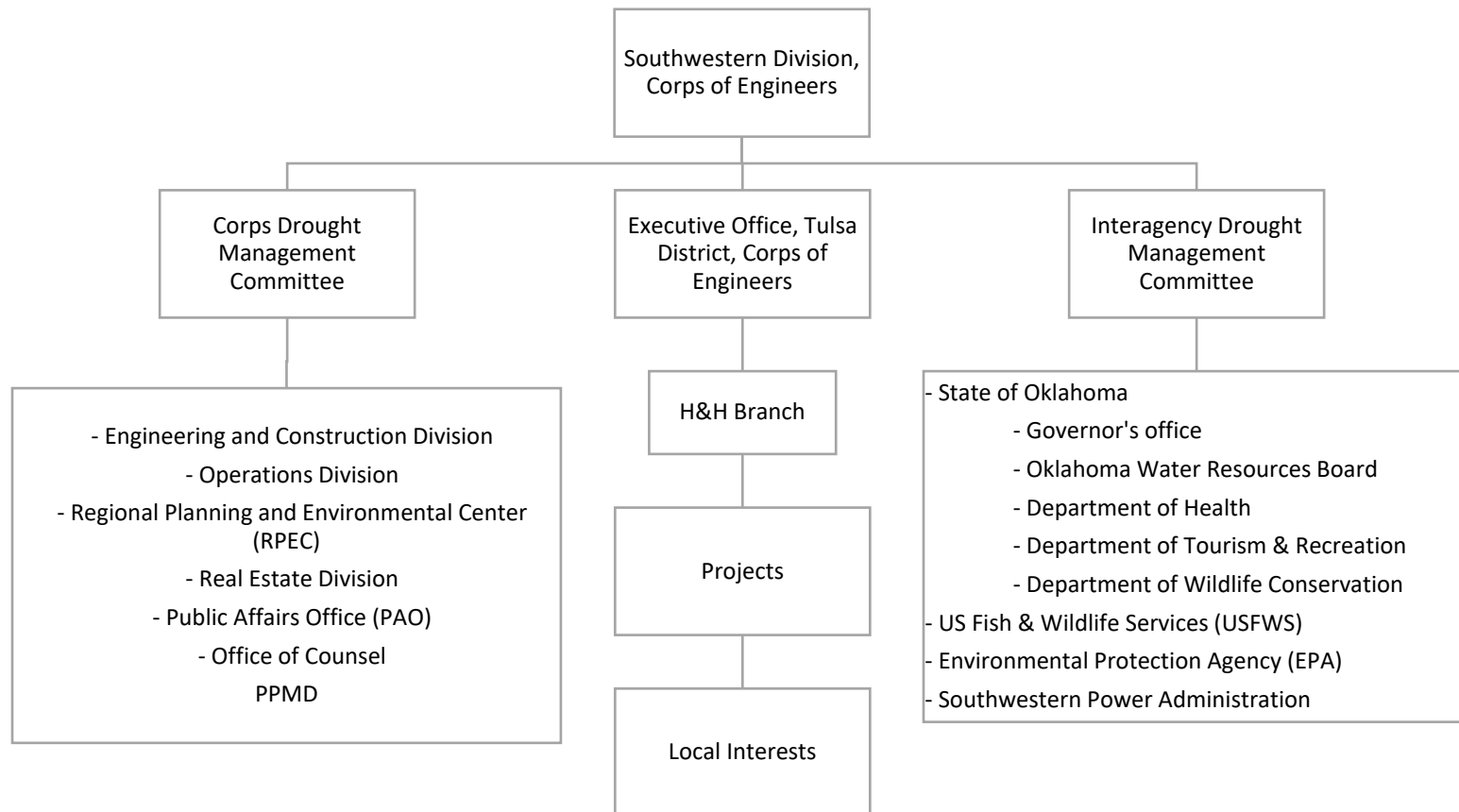


Figure 6-1: Interagency Communication Flowchart

6-03. Suggested Actions for Each Drought Response Level.

As each drought response level is reached, the USACE and the drought committees will have associated actions to take. A suggested list of these actions is contained in Table 6-2.

Table 6-2: Drought Management Procedures.

Drought Response Level	Suggested Action
I	Monitor storage, withdrawals, and low flow releases and disseminate status reports as needed within the USACE and other parties
	Evaluate seasonal pool plans, deviations, etc and meet with shareholders to discuss drought-related impacts
II	Activate the CDMC
	Notify the CDMC, Southwestern Division, and storage users of current and projected reservoir conditions
	Begin monthly storage accounting procedures when 75% of conservation storage remains
	Notify conservation storage users of their remaining storage
	Prepare data as needed for Public Affairs Office (PAO) news releases
	May call ad-hoc meeting of IDMC within 60 days of activating CDMC if drought response level does not improve
	Ensure weekly and monthly hydropower drawdown limits are being followed (if applicable)
	Assist PAO in making news releases alerting the public of boat ramp closures and boating hazards. Lake manager should post warnings on lake property.
III	Activate the IDMC
	Consider weekly storage accounting procedures
	Notify conservation storage users weekly as needed of their remaining storage
	Provide CDMC and IDMC pool projections as requested
	Assist PAO in alerting the public of the drought conditions and effects to the lake
IV	Continue weekly storage accounting procedures as needed
	Continue assisting PAO in drought-related news releases
	Continue to notify conservation storage users weekly if needed of their remaining storage
	Activate the Emergency Operations Center as needed to deal with requests for emergency water supplies