TECHNICAL PAPER A-7
PROPOSED METHODOLOGY FOR IDENTIFYING A DROUGHT POTENTIALLY WORSE THAN THE DROUGHT OF RECORD
January 2026

1.0 BACKGROUND

The LCRA Water Management Plan, as approved by the Texas Commission on Environmental Quality (TCEQ), provides for special curtailment policies and procedures during drought conditions potentially worse than the drought of record.[1] The "Drought of Record[2]" is a criterion used by the State of Texas for the permitting and planning of firm surface water supplies. However, droughts worse than this may occur in the future. Recognizing this possibility, the method outlined in this technical paper is meant to establish when a drought worse than the Drought of Record may be underway. This will allow additional water supply management strategies to be implemented in a timely manner.

Droughts can be characterized in many ways. For purposes of this document a hydrologic drought (a drought that affects water supplies) is implied throughout. A drought can vary in terms of both duration and intensity. Severe droughts may be more intense but have shorter durations or have longer durations and less intensity. This technical paper presents a methodology to identify droughts potentially worse than the Drought of Record in terms of the combined impacts of duration and intensity, to allow LCRA to take prudent management actions in a timely manner.

An important element of developing a comprehensive methodology is to be able to identify a drought potentially worse than the Drought of Record while the drought is still in progress. This allows timely measures to be implemented to help mitigate potential shortages during such an event. Timely action under a drought potentially worse than the Drought of Record can lessen the need for more restrictive demand reductions and the resulting consequences of more severe water supply shortages. In general, the earlier demand reduction measures can be taken in a drought, the less likely it becomes that more restrictive measures will be needed later in the drought cycle. It can only be known for sure that a drought is worse than the Drought of Record either after the drought is over or after low inflow conditions have persisted long enough that the combined firm yield could not have been sustained. It could then be too late to take demand reduction measures to avert a severe shortage and the potential to run out of water. Similarly, declaring a drought worse than the Drought of Record too early can lead to false alarms. False alarms can be costly to customers and stakeholders while eroding the effectiveness of declarations. The method outlined below has been developed to strike a balance between early detection and minimizing false alarms.

[1] TEX. WATER COMM'N., *Order Approving Lower Colorado River Authority's Drought Management Plan*, Ordering Provision 1.f. (Dec. 23, 1991).
[2] Drought of record--The historic period of record for a watershed in which the lowest flows were known to have occurred based on naturalized streamflow. 30 TAC §297.1(19).

Precautionary actions taken earlier in a drought provide for greater water supply security than the Drought of Record criteria alone. Procedures have been developed for identifying a drought potentially worse than the Drought of Record for the water supply reservoirs in the Highland Lakes (lakes Buchanan and Travis). These procedures should be reevaluated as additional data and methods become available. This document sets forth the current approach for anticipating drought conditions potentially worse than the Drought of Record and the technical basis for declaring a drought potentially worse than Drought of Record. This approach is unchanged from the approach in the 2020 Water Management Plan.

2.0 CRITERIA FOR DECLARATION OF A DROUGHT WORSE THAN DROUGHT OF RECORD

The proposed criteria should include all of the following:

- Drought duration of more than 24 months since the start of the drought.
- Drought intensity greater than that of the Drought of Record as measured by inflows into the Highland Lakes.
- Combined storage of lakes Buchanan and Travis of 600,000 acre-feet or less.

Alternatively, if a drought in progress has exceeded 84 months in duration, and the combined storage criteria also is met, a declaration of a Drought Worse than Drought of Record should be made regardless of the status of the intensity criteria.

2.1 Duration Criterion

To meet the duration criteria, the duration of the drought must be at least 24 months since lakes Buchanan and Travis were both full. A hydrologic drought could be in progress at any time that combined conservation storage of lakes Buchanan and Travis is less than full. For the purposes of this method, full is defined as when either of the following criteria is met:

a) Combined storage in lakes Buchanan and Travis is at or above 98 percent of the combined managed conservation storage. The managed combined storage reflects the storage in Lake Travis up to elevation 681.0 feet above mean sea level (feet msl) and the storage in Lake Buchanan up to elevation 1,020 feet msl.
b) Lakes Travis and Buchanan have each been at their respective managed conservation storage maximum capacity within 30 days of each other.

2.2 Inflow Criterion

The LCRA inflow data set is compared to an inflow criterion curve. The LCRA inflow data is computed by LCRA from measurements at U.S. Geological Survey (USGS) and LCRA jointly monitored gauges above lakes Buchanan and Travis on the Colorado River, Llano River, Pedernales River and Sandy Creek and include adjustments to reflect the drainage areas between the four gauges and the Highland Lakes. Measurements may be preliminary, provisional or published and are subject to revision until published. Measurements reflect upstream diversions made by upstream water right holders.

An inflow criterion curve has been developed and tested against the period of record to verify it can adequately identify intense droughts. The curve has been increased by 5 percent over the historical values to account for inflow measurement uncertainty. The curve can be expressed by the following equation:

$$I1 = (22{,}292 * m + 787{,}402) * 1.05$$

Where:
I1 = cumulative inflow in acre-feet since Travis and Buchanan were each full using the determination of full described above and a 5 percent increase for gauge uncertainty.
m = months since lakes Travis and Buchanan were each full using the determination described above.

If the cumulative inflow since the start of a drought in progress is more than the criterion curve value for the same duration of drought, the intensity criterion is not met. Conversely, if the cumulative inflow is below the criterion curve, then the criterion is met and the drought is considered more intense than the Drought of Record. The curve is shown in Figure 1, and the values are provided in Table 1.

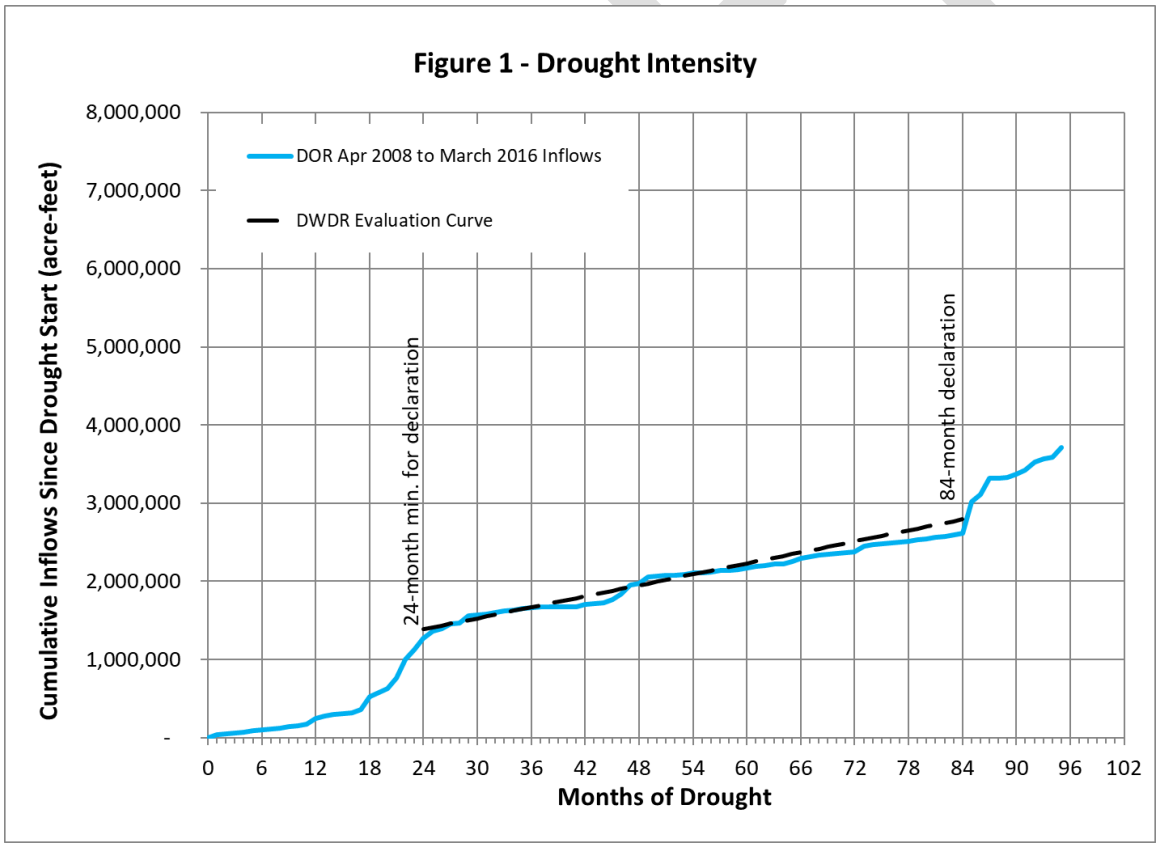

Table 1. Table of Evaluation Curve Values

Months	Cumulative Inflow (acre-feet)	Months	Cumulative Inflow (acre-feet)	Months	Cumulative Inflow (acre-feet)
1	850,179	29	1,505,564	57	2,160,948
2	873,585	30	1,528,970	58	2,184,355
3	896,992	31	1,552,377	59	2,207,762
4	920,399	32	1,575,783	60	2,231,168
5	943,805	33	1,599,190	61	2,254,575
6	967,212	34	1,622,597	62	2,277,981
7	990,618	35	1,646,003	63	2,301,388
8	1,014,025	36	1,669,410	64	2,324,795
9	1,037,432	37	1,692,816	65	2,348,201
10	1,060,838	38	1,716,223	66	2,371,608
11	1,084,245	39	1,739,630	67	2,395,014
12	1,107,651	40	1,763,036	68	2,418,421
13	1,131,058	41	1,786,443	69	2,441,828
14	1,154,465	42	1,809,849	70	2,465,234
15	1,177,871	43	1,833,256	71	2,488,641
16	1,201,278	44	1,856,663	72	2,512,047
17	1,224,684	45	1,880,069	73	2,535,454
18	1,248,091	46	1,903,476	74	2,558,861
19	1,271,498	47	1,926,882	75	2,582,267
20	1,294,904	48	1,950,289	76	2,605,674
21	1,318,311	49	1,973,696	77	2,629,080
22	1,341,717	50	1,997,102	78	2,652,487
23	1,365,124	51	2,020,509	79	2,675,894
24	1,388,531	52	2,043,915	80	2,699,300
25	1,411,937	53	2,067,322	81	2,722,707
26	1,435,344	54	2,090,729	82	2,746,113
27	1,458,750	55	2,114,135	83	2,769,520
28	1,482,157	56	2,137,542	84	2,792,927

2.3 Combined Storage Criterion

The combined storage criterion for a drought potentially worse than the Drought of Record is that the combined storage of lakes Buchanan and Travis is less than 600,000 acre-feet. This level of combined storage has never been previously observed[3] and provides a practical restriction to reduce false alarms.

[3] The lowest recorded combined storage of 621,221 acre-feet was observed on Sept. 9, 1952.

3.0 DECLARATION AND CANCELLATION

For a declaration of drought potentially worse than the Drought of Record, all three of the intensity, duration and combined storage criteria should be simultaneously satisfied. Alternatively, if a drought in progress has exceeded seven years in duration, and combined storage is below the 600,000 acre-feet criterion, a declaration of a drought potentially worse than the Drought of Record also should be made regardless of the status of the intensity criterion.

Criterion for the cancellation of a declaration of drought potentially worse than Drought of Record may be based upon an increase in combined storage to a level of 1.4 million acre-feet.

4.0 ANALYSIS OF HISTORICAL DROUGHTS

Inflows for the longest droughts after OH Ivie Reservoir began impounding in 1990 were analyzed according to this procedure. Cumulative inflows of the selected historical droughts are shown in Figure 2. This figure shows that, for some of these droughts, cumulative inflows early in the drought cycle satisfied the intensity criterion. However, some of the droughts had not lasted 24 months and none had storage that fell below the combined storage criterion necessary for declaration of a drought potentially worse than Drought of Record. Also, all of the selected droughts are shorter than the 84-month criteria.

In summary, none of these other historical droughts would have triggered a declaration of a drought potentially worse than Drought of Record based on this procedure and current criteria. A summary of the droughts and respective criteria are shown in Table 2.

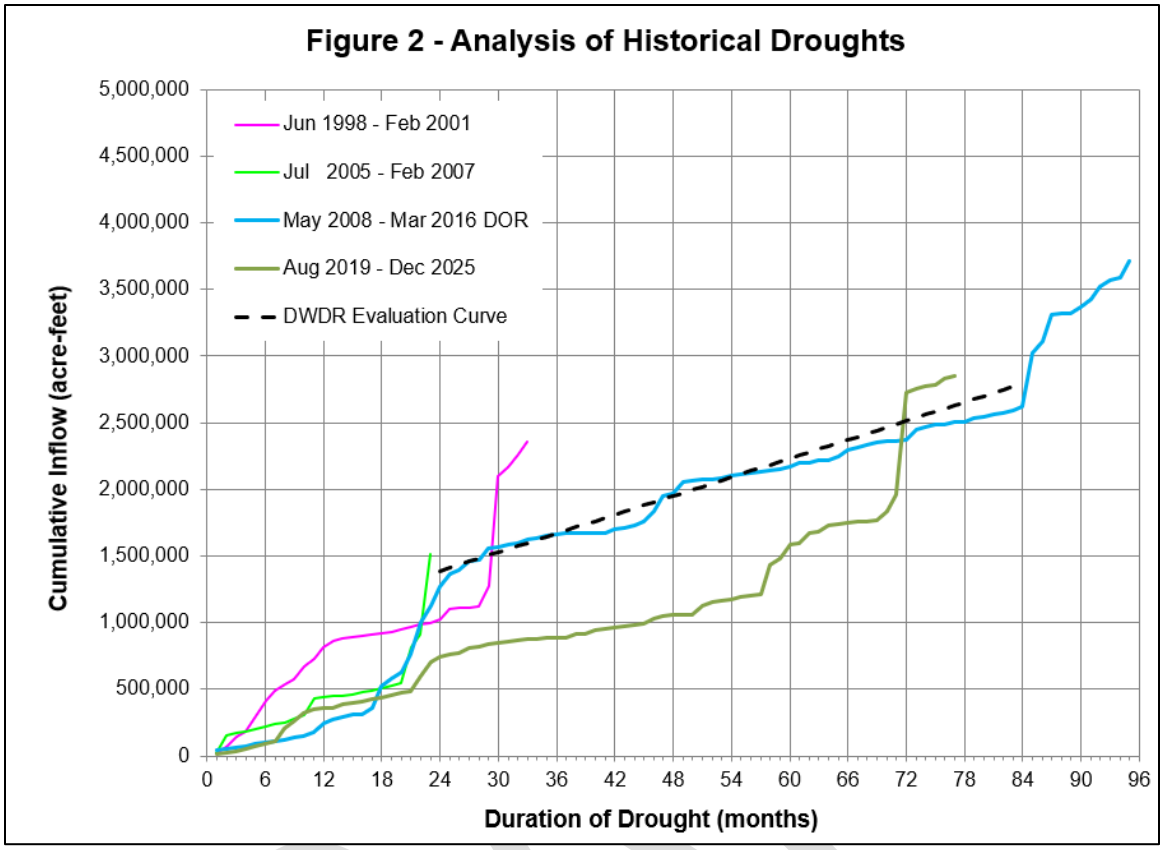

Table 2. Summary of Selected Historical Droughts Compared to Drought Potentially Worse Than Drought of Record Declaration Criteria

	Simultaneous Criteria				
Years of Drought	Inflows < DOR	Duration ≥ 24 months	Duration ≥ 84 months	Storage < 600,000 ac-ft	Eligible for Declaration
Jun 1998 - Jul 2001	At times	Yes	No	No	No
Jul 2005 - Feb 2007	N/A	No	No	No	No
May 2008 - Mar 2016	At times	Yes	Yes	No	No
Aug 2019 - Dec 2025	At times	Yes	No	No	No