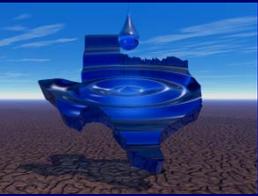




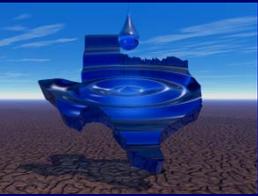
**City of Wichita Falls Texas
Water Resources
for a New Drought of Record**

March 24, 2015



Water System Summary

- Current Population Served ~ 150,000
- Supply Reservoirs
 - Lake Arrowhead, Lake Kickapoo (Fresh water)
 - Lake Kemp (Brackish water)
 - Water Rights ~95,000 acft
 - Current Storage Capacity ~ 21%
- Water Treatment Plants
 - 66 MGD Conventional Treatment Capacity
 - 10 MGD Membrane Treatment Capacity
- Supply 15 Wholesale Customers
 - Cities, WSC, River Authority



Record Temperatures

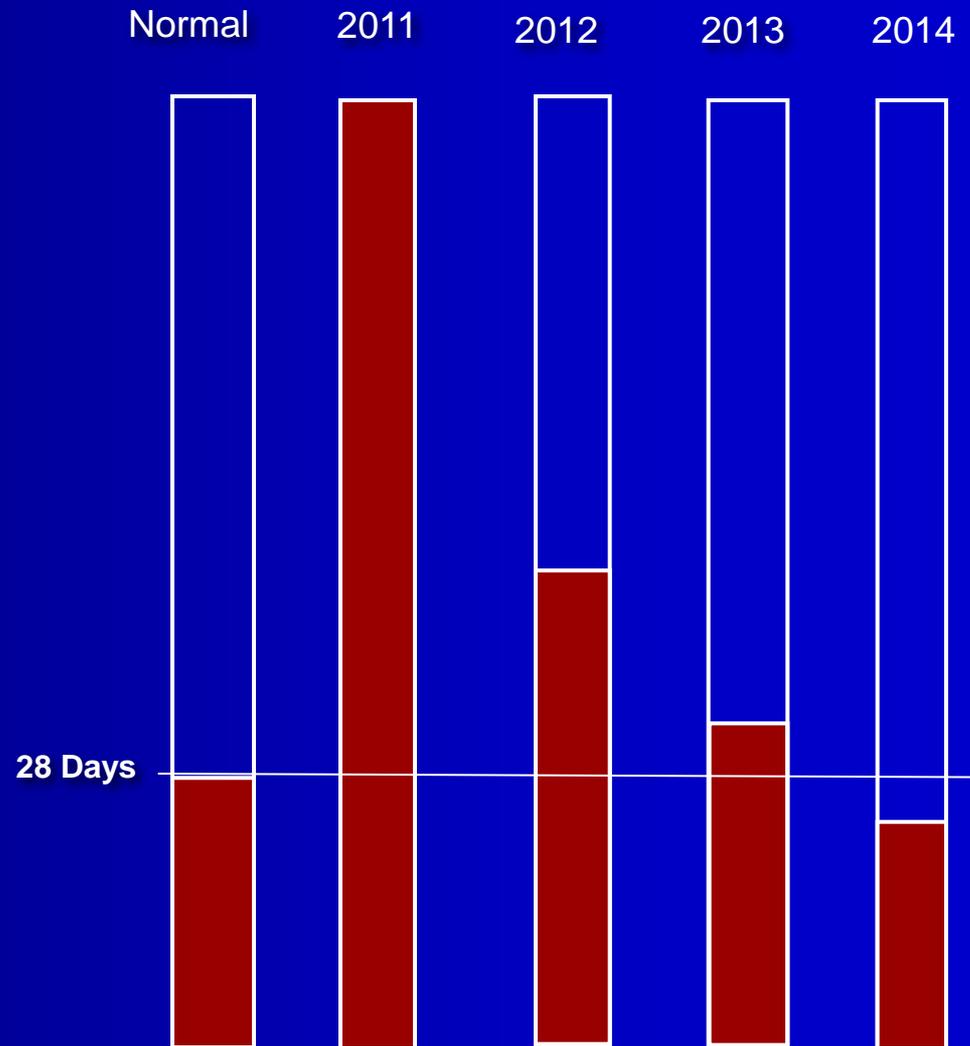
Wichita Falls typically averages 28 days over 100°

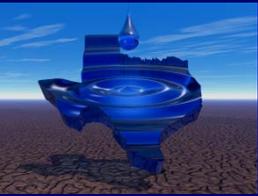
In 2011 we had 100 days over 100°

In 2012 we had 50 days over 100°

In 2013 we had 32 days over 100°

In 2014 we had 21 days over 100°





Loss of Rainfall

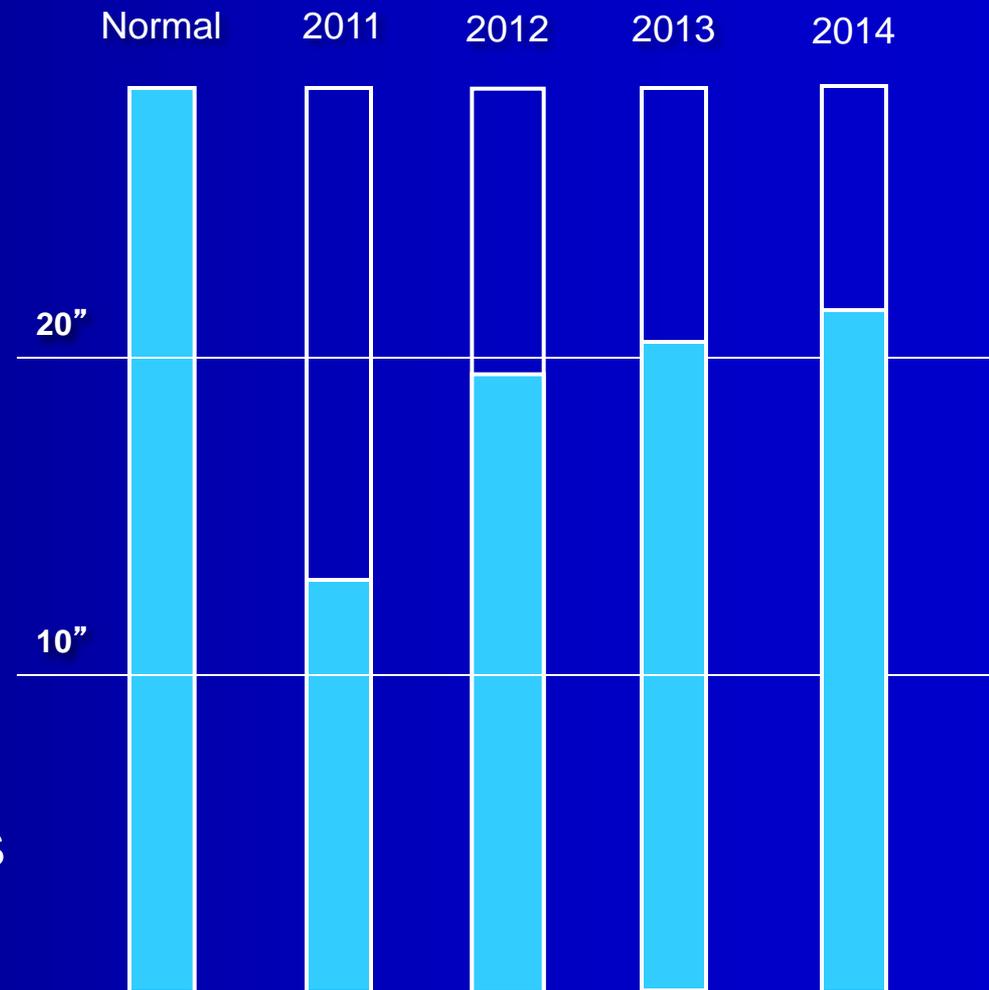
Annual average rainfall for the Wichita Falls area is 28.5 inches.

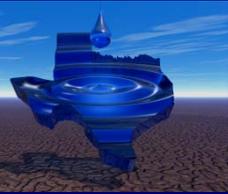
In 2011 we were 15.5 inches below normal.

In 2012 we were 8.75 inches below normal.

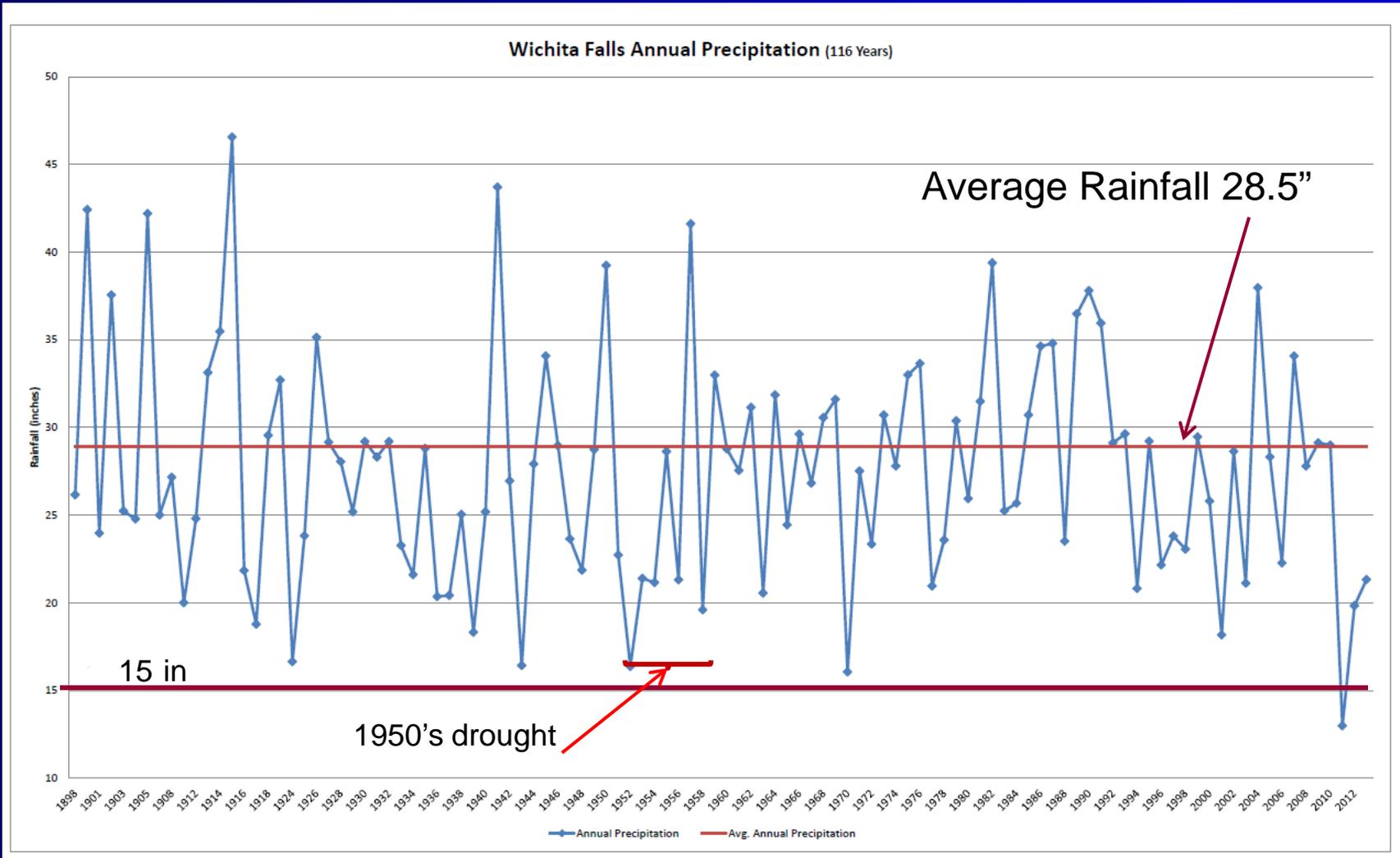
In 2013 we were 7.24 inches below normal.

In 2014 we were 6.31 inches below normal

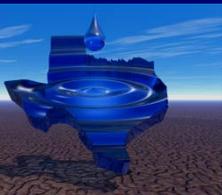




WF Precipitation Data (116yrs)



Drought Conditions 2011



Drought Conditions (Percent Area)

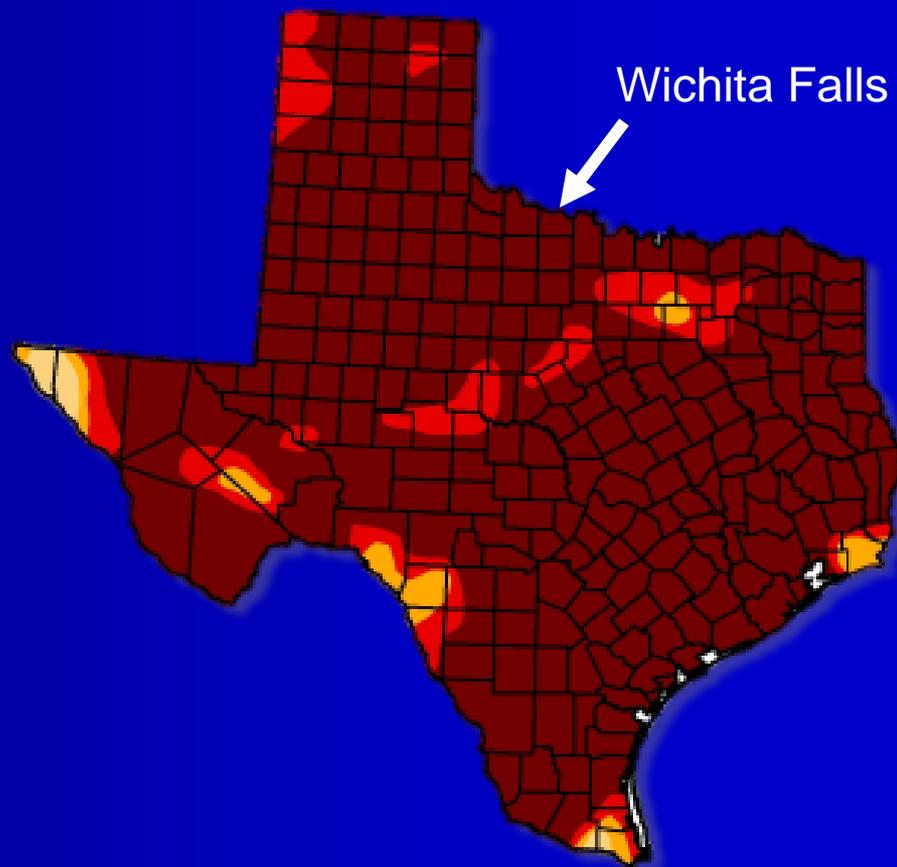
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	100.00	99.17	96.75	87.83
Last Week (09/06/2011 map)	0.00	100.00	99.93	99.01	95.68	81.06
3 Months Ago (06/14/2011 map)	1.97	98.03	96.53	94.77	88.57	64.78
Start of Calendar Year (12/28/2010 map)	7.89	92.11	69.43	37.46	9.59	0.00
Start of Water Year (09/28/2010 map)	75.57	24.43	2.43	0.99	0.00	0.00
One Year Ago (09/07/2010 map)	69.60	30.40	5.25	1.51	0.00	0.00

Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

<http://drought.unl.edu/dm>



October 2011

Drought Conditions 2015

January 6, 2015

(Released Thursday, Jan. 8, 2015)

Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	38.95	61.05	41.81	24.07	10.72	2.47
Last Week <i>12/30/2014</i>	34.37	65.63	44.68	25.73	11.70	3.17
3 Months Ago <i>10/7/2014</i>	29.64	70.36	49.29	29.49	11.78	2.88
Start of Calendar Year <i>12/30/2014</i>	34.37	65.63	44.68	25.73	11.70	3.17
Start of Water Year <i>9/30/2014</i>	28.92	71.08	48.95	29.54	11.26	2.69
One Year Ago <i>1/7/2014</i>	28.13	71.87	43.89	20.84	5.82	0.79

Intensity:



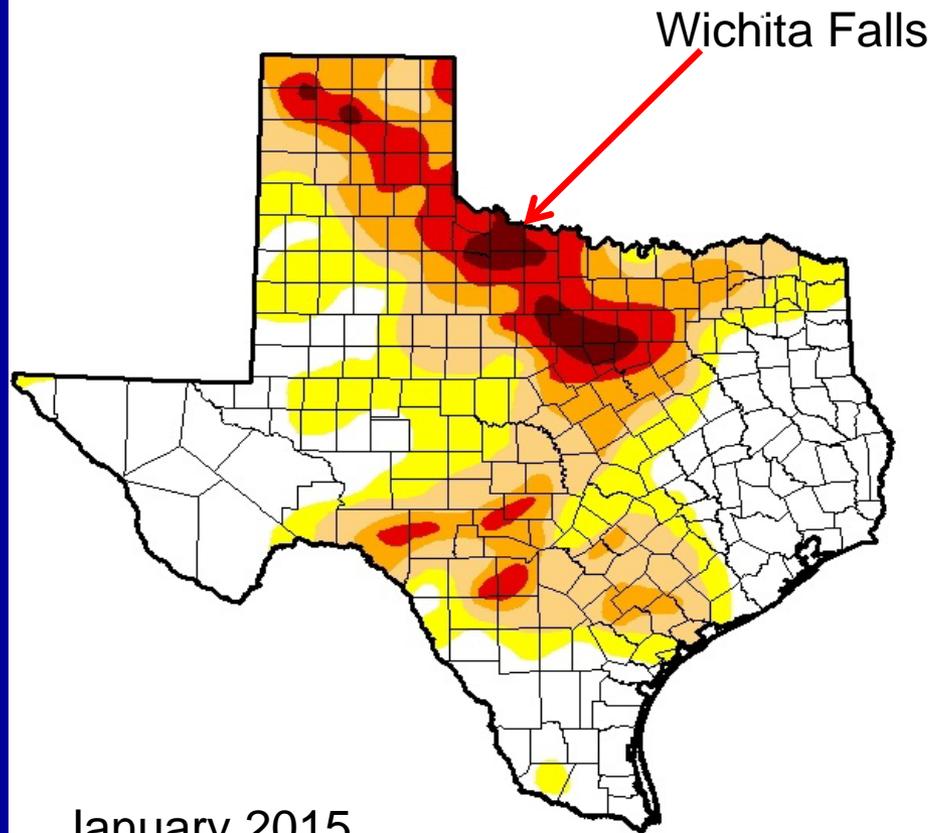
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:

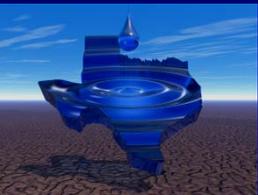
*Brad Rippey
U.S. Department of Agriculture*



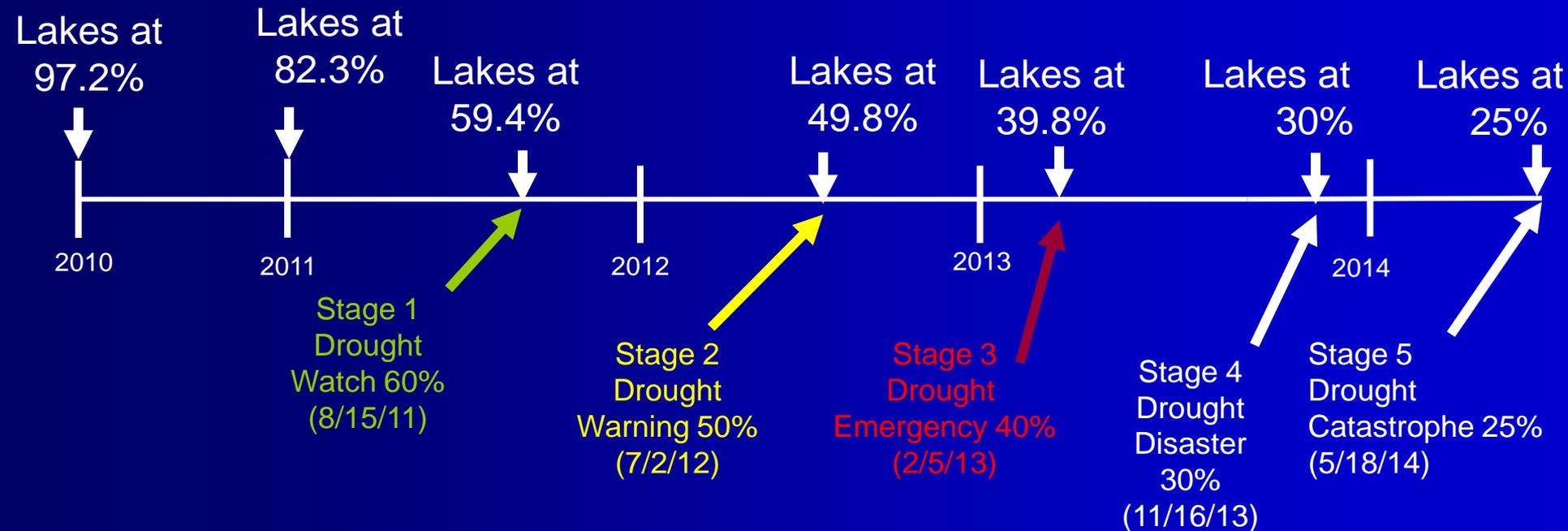
U.S. Drought Monitor Texas



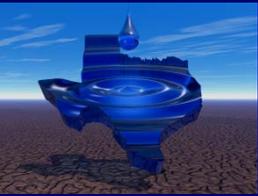
January 2015



Conservation Measures

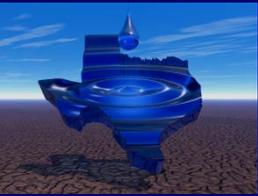


- 1275 days of water restrictions (3yrs and 180 days)
- City has been much more aggressive with restrictions during this drought.
- Conservation reduced consumption from 35 MGD to 11 MGD



Actions Taken

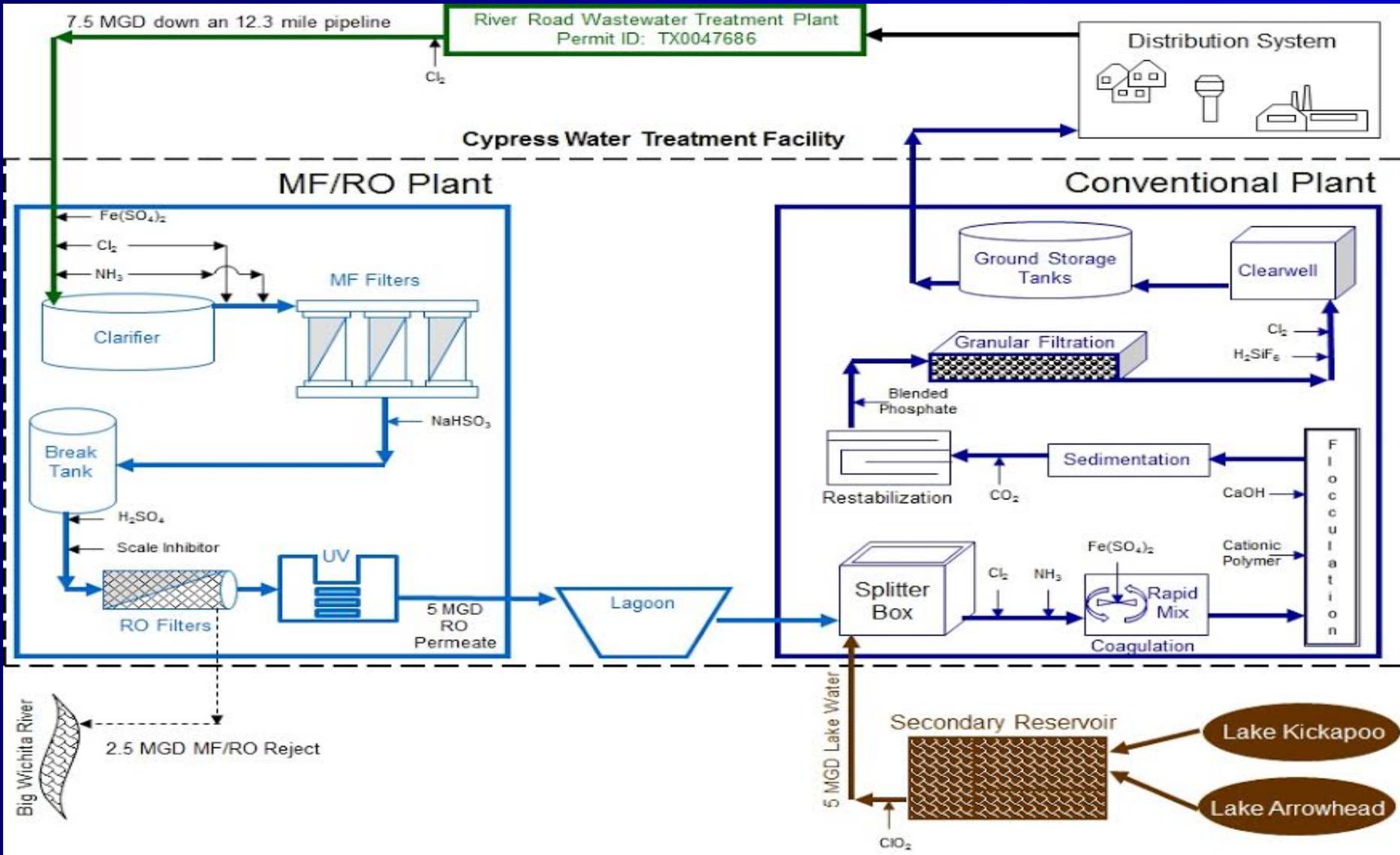
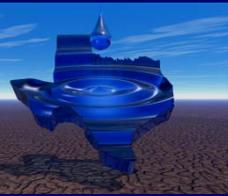
- April 2012 staff began to revive 1999/2000 Reuse Project.
- Staff met with Texas Commission on Environmental Quality (TCEQ).
- New “Definitions” were established for reuse.
 - Direct Potable Reuse (DPR)
 - Indirect Potable Reuse (IPR)
- “Guidelines” identified the level of treatment.
- Consultants were hired to evaluate long-term reuse options.
- Staff developed an Emergency Reuse Project.

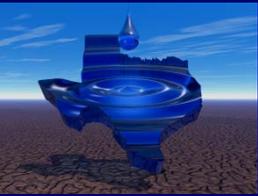


Emergency DPR Project

- Preliminary Engineering Report submitted
 - Build temporary pump station and pipeline to convey 7.5 MGD of treated effluent from RRWWTP to Cypress Microfiltration/Reverse Osmosis Plant
 - Treat effluent through both membrane systems
 - Blend water with raw lake water 50/50 ratio
 - Treat blended water through conventional treatment plant
 - Summarized level of treatment through each process, monitoring, SOP's, alarms, shutdowns, testing frequency, etc.

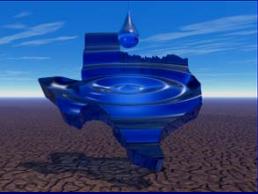
Emergency DPR Project



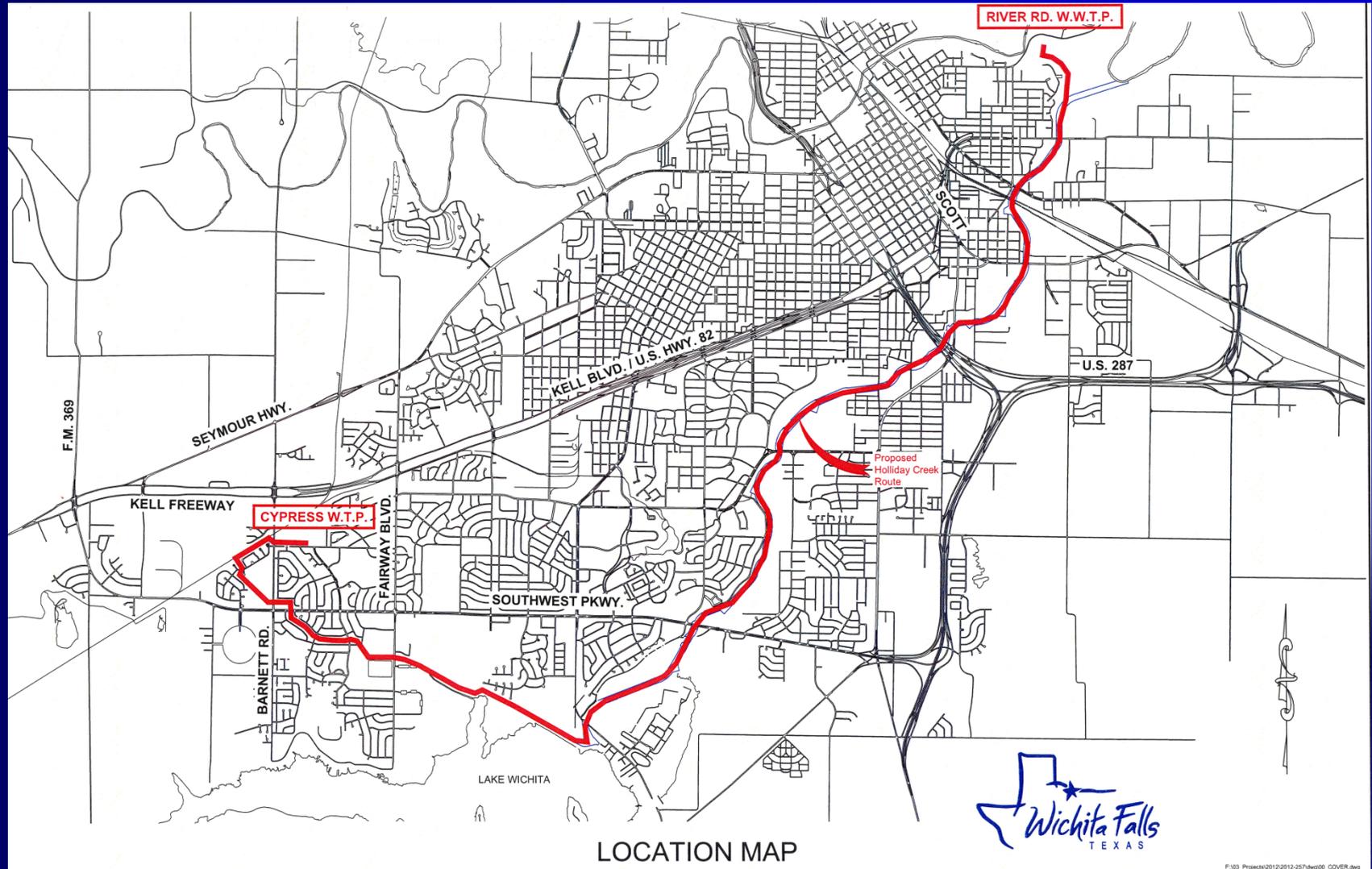


Emergency DPR Project

- Began construction on August 23, 2013
- Received TCEQ approval for construction on Sept 27, 2013
- Began 75 days of Full Scale Verification testing on January 27, 2014
- Received TCEQ approval for utilization on June 27, 2014
- Pumped water in distribution system on July 9, 2014
- Project added 5 MGD of supply (1/2 of daily demand)

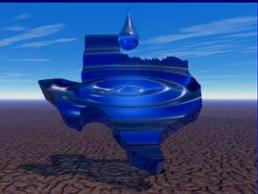


Emergency DPR Project



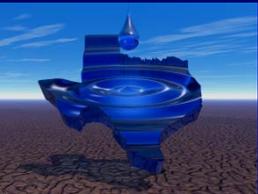
Emergency DPR Project





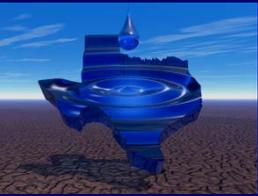
Emergency DPR Project





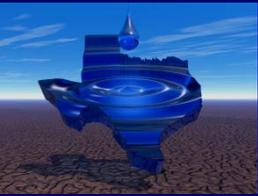
Emergency DPR Project





Emergency DPR Project





Emergency DPR Project

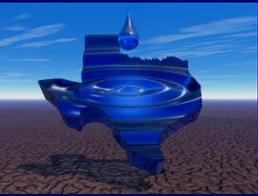


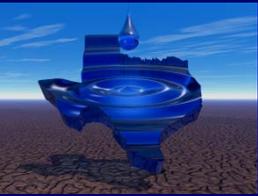


Emergency DPR Project



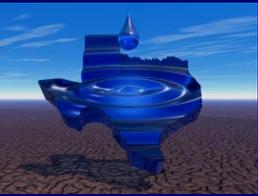
Emergency DPR Project





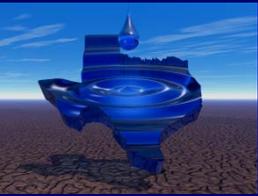
Emergency DPR Project





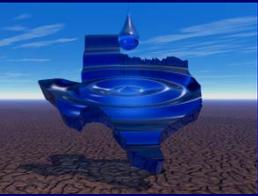
Emergency DPR Project





Emergency DPR Project (Summary)

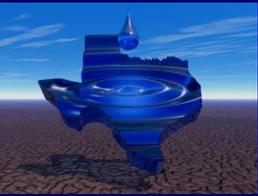
- Project has operated exceptionally well (240 days and counting)
- Project has saved over 1 billion gallons of water
- No public protests or complaints
- General acceptance of the water
 - Engaged all media outlets
 - Engaged the medical and educational profession
 - County Health Board
 - Healthcare Coalition
 - Infectious Disease Specialist
 - Professor of Physical Chemistry
 - Professor of Geosciences



Permanent IPR Project

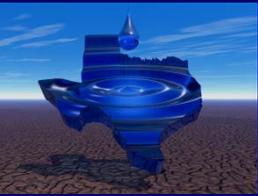
- Alternatives evaluated
 - Discharge to Lake Arrowhead ~\$29,000,000
 - Discharge to Lake Wichita ~\$158,300,000
 - Construct new MF/RO Plant ~\$91,000,000

- Discharge to Lake Arrowhead identified as most economical and feasible



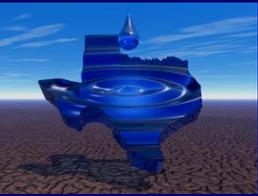
Permanent Reuse Project

- Project requires:
 - Discharge permit from TCEQ
 - Approved September 2014
 - Improvements to River Road WWTP
 - Design underway
 - 17 miles of ROW acquisition
 - Acquisition is underway
 - Construction of pipeline and pump station
 - Begin in July 2015
- Project Completion ~ May 2017
- Additional Supply 8 – 10 MGD



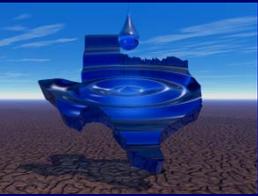
Non-Traditional Water Supply

- Cloud Seeding:
 - Operated March – June, September 2014
 - 13 County operational area
 - Increased precipitation by 400,000 acft.
 - Conservative analysis increased reservoir storage by 6,840 acft
 - Cost \$293,000 ~ to \$0.13/1000 gals
- City will continue operations in 2015



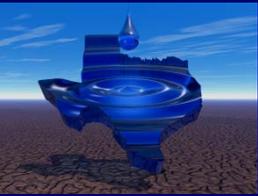
Non-Traditional Water Supply

- Evaporation Suppression:
 - Project performed Aug-Sept 2014 on Lake Arrowhead
 - Product creates bio-film
 - Has proven to reduce evaporation on smaller reservoirs by 30%
 - TWDB performed analysis
 - Concluded product appeared to be effective, however more data is needed.
 - Project was very labor intensive, city currently has no plans to continue.



Conclusions

- Immediate supply
 - Direct Potable Reuse (Emergency Reuse)
 - 5 MGD
- Intermediate supply
 - Indirect Potable Reuse (Permanent Reuse)
 - 8 to 16 MGD
- Development of additional supplies based on Water Master Plan
 - New surface water reservoir



Questions / Discussion

Contact Info

russell.schreiber@wichitafallstx.gov

940-761-7477