State of Oklahoma

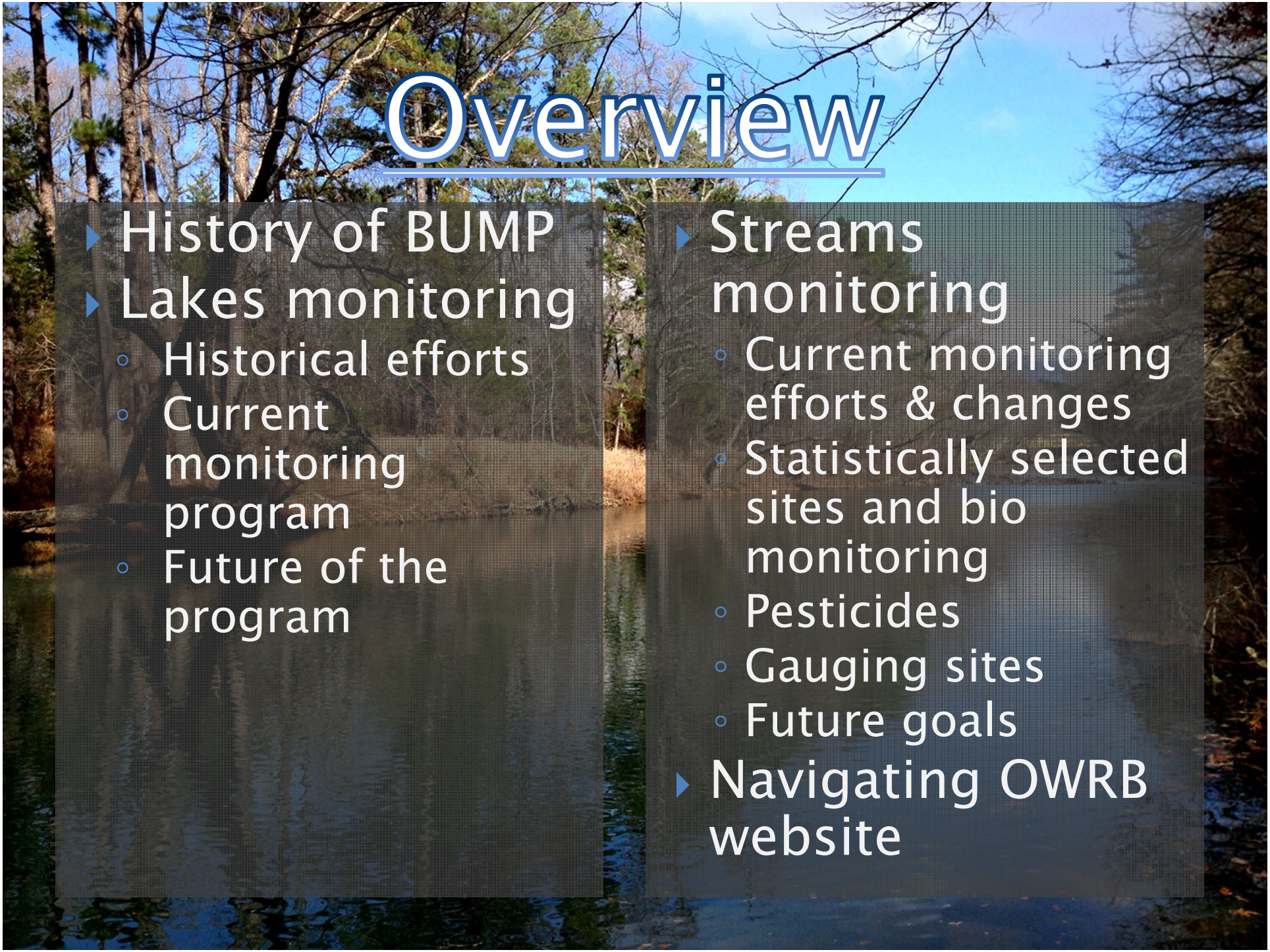
OWRB

WATER RESOURCES BOARD

the water agency

Beneficial Use Monitoring Program (B.U.M.P)

Sara D. Blocker and Brent A. Wilson
Water Quality Division, Streams & Lakes


Overview
History of BUMP
Lakes monitoring
Historical efforts
Current monitoring program
Future of the program
Streams monitoring
Current monitoring efforts & changes
Statistically selected sites and bio monitoring
Pesticides
Gauging sites
Future goals
Navigating OWRB website

Beneficial Use Monitoring Program

- a.k.a BUMP
- Initiated in 1998
- Physical, chemical, and biological data collected in OK streams & lakes
- Implement Oklahoma's Use Support Assessment Protocols (USAP) to document/quantify impairments in the beneficial uses assigned in the OK Water Quality Standards (OWQS)

- Objectives:
  - Detect & quantify long-term water quality trends
  - Document impairments to beneficial uses
  - OK Integrative Water
  - Provide data to assist in management decisions and planning

Foundation of B.U.M.P

- Standard Operating Procedures
  - Standardized methods based on industry standards
- Quality Assurance/Quality Control sampling
  - Comprehensive blank collections to assess & control cross-contamination
  - Duplicates and/or replicates to assure consistent data collection
- Training
  - mentoring of new employees and retraining of veterans
- Publication of data
  - Historical and current (2012) B.U.M.P. Reports
  - http://www.owrb.ok.gov/

Water Quality Monitoring Data Users & Uses

- **State partners**
- **Federal partners**
- **Municipalities**
- **Public**
- **Industry**
- **Consultants**
- **Academia**
- **Rural Water Districts**
- **Sub-state Planning Districts**
- **Conservancy Districts**
- **Interstate Commissions & Compacts**

- *Total Maximum Daily Loads (TMDLs)*
- *303d impaired list*
- *305b water quality status report*
- *Water quality standards*
- *Water quality assessment*
- *Water planning*
- *Non-point source management*
- *Public health decisions*
- *Waste discharge permitting*
- *Business decisions*
- *Work/funding prioritization*
- *Research*
- *Model development*
- *Resource and supply management*
- *Prioritize state and federal resources on problem areas*

Parametric Coverage

- General water quality variables:
  - Hardness, alkalinity, and turbidity
  - in situ: water temperature, dissolved oxygen (concentration and saturation), pH, specific conductance, and salinity
  - Sulfate, chloride, total dissolved solids
- Nutrients
  - Total phosphorus, TKN, and nitrate/nitrite (ODEQ lab)
  - Ammonia and ortho phosphorus field tests
- Metals
  - Site specific- based on what metals have OWQS violations or are near OWQS violations
  - Includes dissolved sample fractions
  - Toxics coverage is regionalized (e.g., selenium will not be collected for in much of the Eastern part of state)
- Bacteria
  - *E. coli, Enterococcus*
  - Collected during summer to correspond with recreational season (May-Sep)
- Biological indicators & habitat assessments

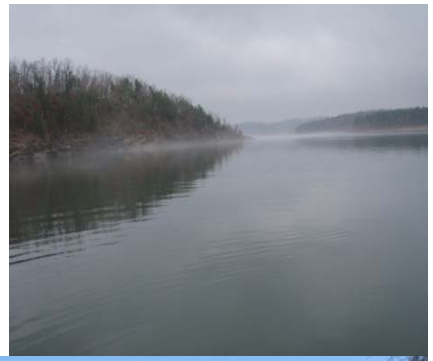

Lake Sampling

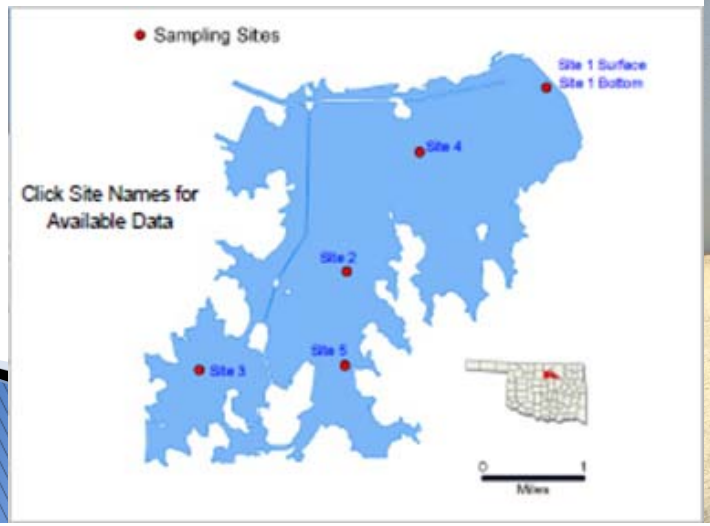
Historical Efforts

- Lake studies conducted since 1990
- Efforts were funded with federal dollars as part of the Clean Lakes Program
- Sampled during summer months only
- Goal was to prioritize waterbodies using Carlson's Trophic State Index (TSI)

Historical Efforts

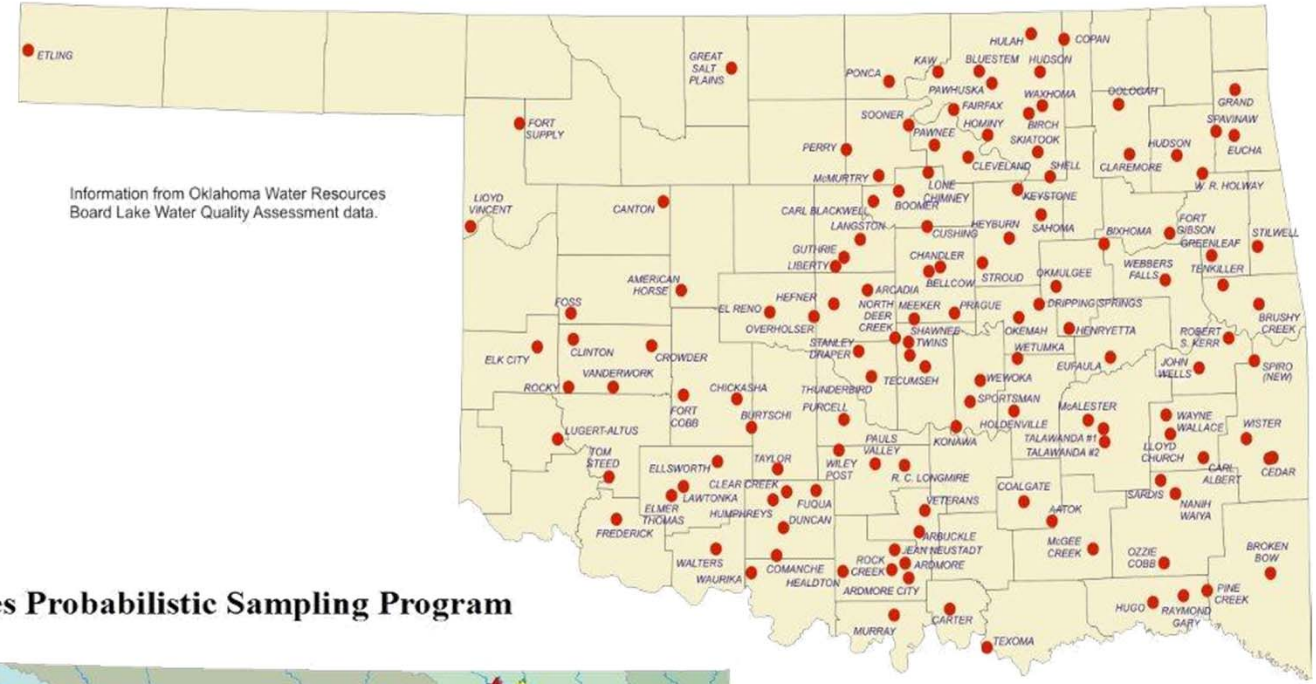
- Early program based on a fixed station design
  - 130 lakes sampled every 3-4 years
  - Broad-based water quality parameters
  - Biological indicators → chlorophyll only
- Long-term datasets
  - Use assessments
  - WQ trends



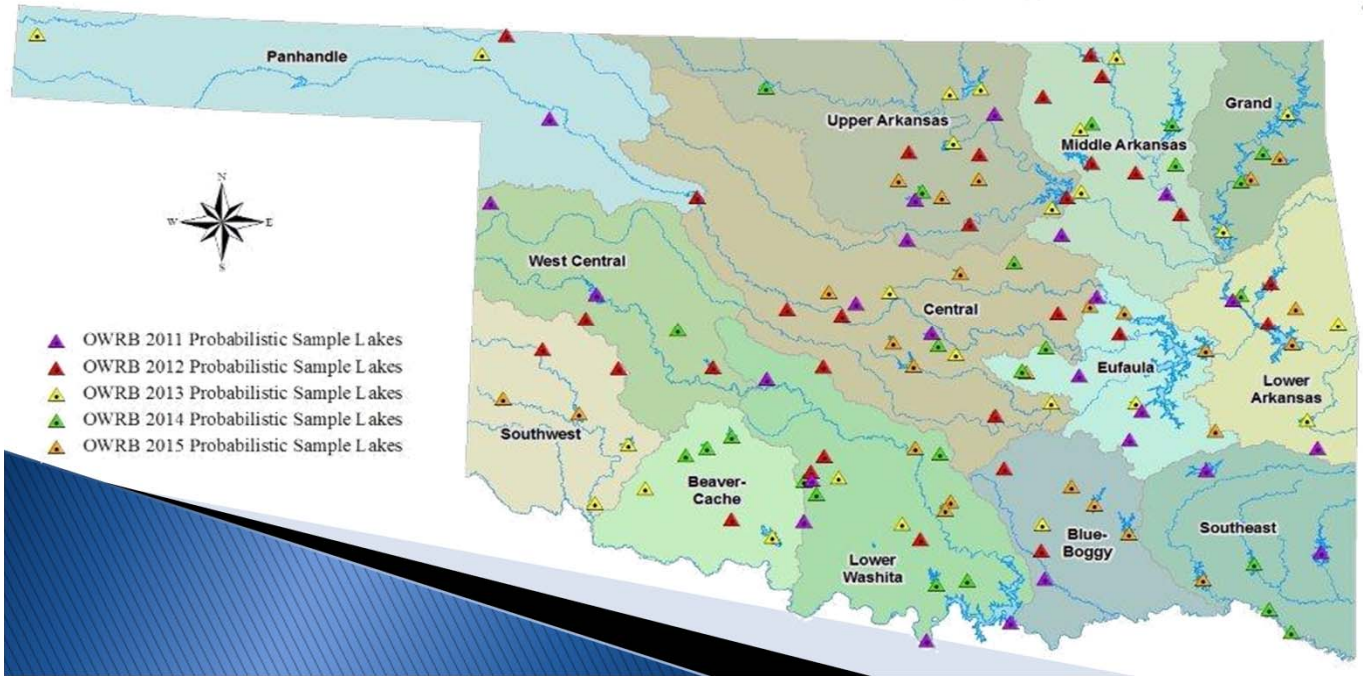


Lakes Monitored by the Beneficial Use Monitoring Program (BUMP)

Information from Oklahoma Water Resources Board Lake Water Quality Assessment data.



Oklahoma's Lakes Probabilistic Sampling Program

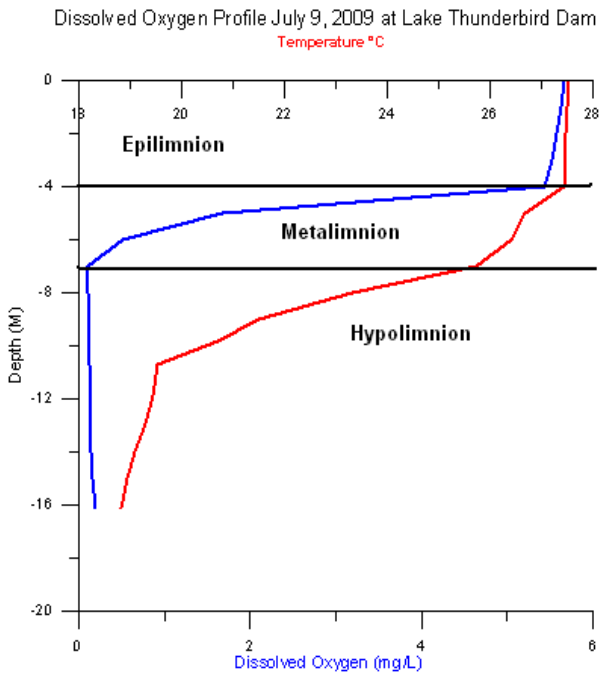


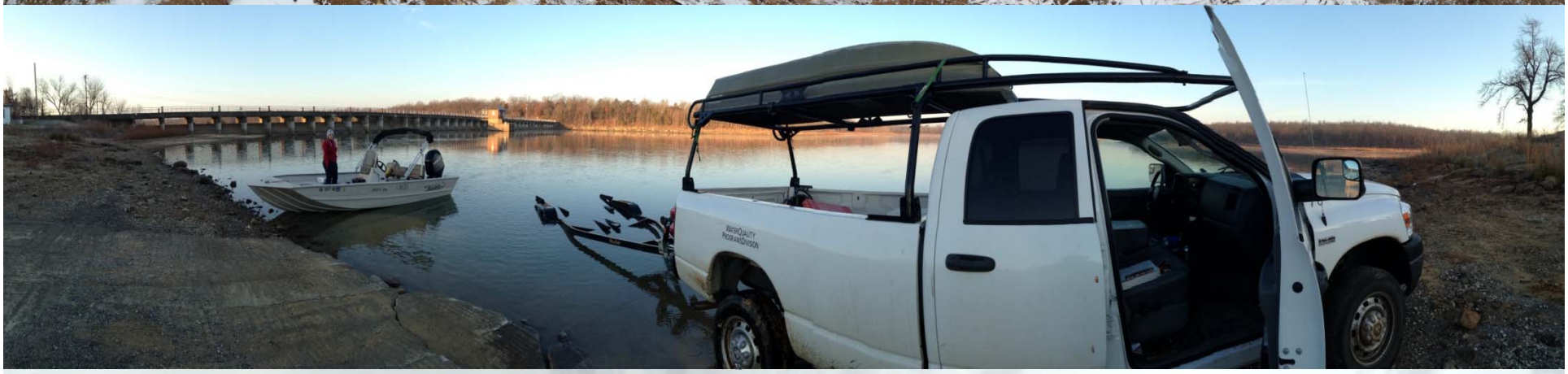
Current Lakes Program

- 5-year study plan (~37 lakes/year)
- Statistical monitoring
- Lakes classified into two groups
  1. Greater than 500 surface acres
     - 68 large multipurpose lakes
     - Sampled twice every 5 years
     - Random draw and fixed station
  2. Lakes from 50-500 surface acres
     - n = 10 annually
     - Random temporal and spatial draw
     - Only drop lakes when…
       - Trends and conditions

Current Lakes Program

- Quarterly sampling
- Multiple sites per lake
  - Vertical profiles
  - Broad based parametric coverage
    - General chemistry
    - Bio-indicators expanded to include phytoplankton and zooplankton
    - Metals, bacteria, and physical habitat assessment during the summer months
- Trend analysis & use and condition assessment on Oklahoma lakes





New Opportunities & Future Goals

- Private lakes
  - Gaining access to private water bodies
- Drought conditions
  - Modify equipment and techniques to help cope with lower lake levels
  - New data
- Nutrient limited Watershed (NLW) pilot study

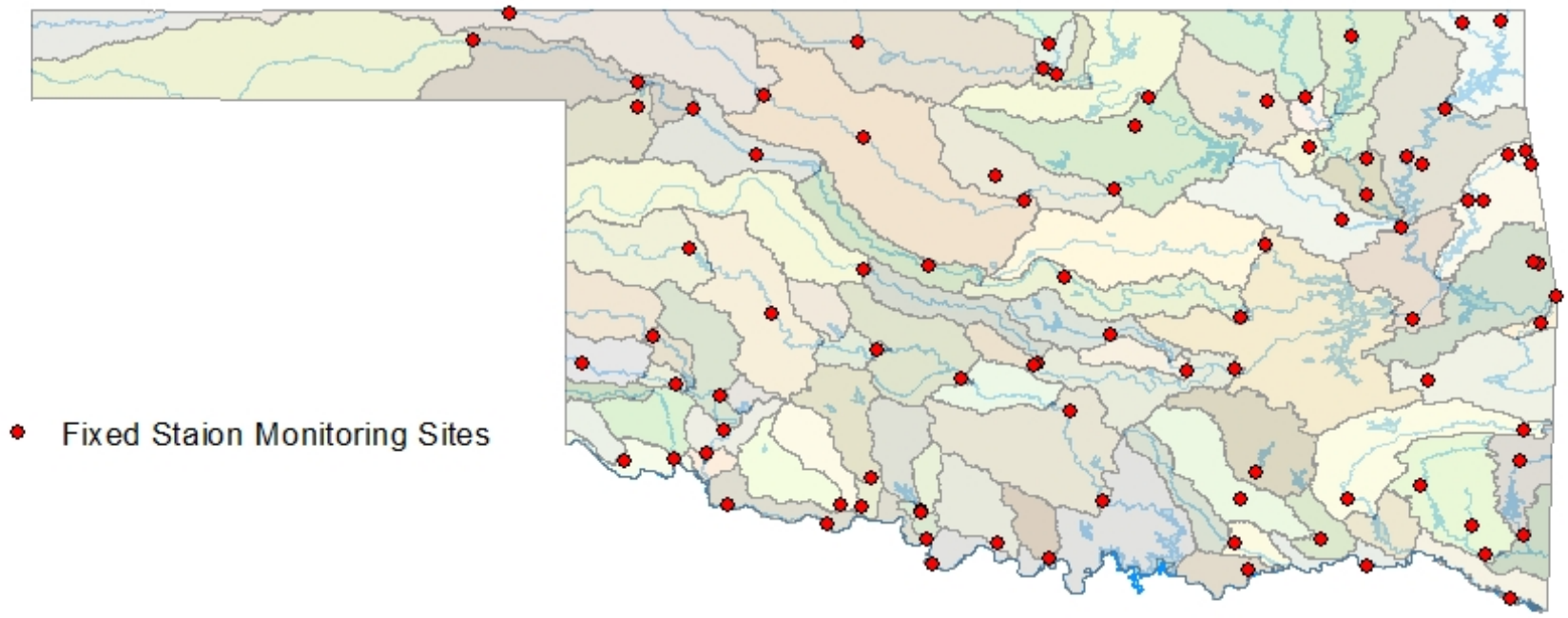
- Establish elevation data for lakes & reservoirs
  - GPS measurements for volumetric dissolved oxygen
- Investigate the potential to expand bio monitoring


Streams

Historic & Current Monitoring

- Permanent ambient trend, rotating, statistically selected sites
- The number of sites & sampling rates fluctuated over the years with program reviews & changing budgets
- Flow monitoring at all sites w/ gauging at most
- Compliments the OCC rotating basins monitoring
- Adjusted spatial coverage in 2013 to align with the OCWP planning basins
  - Goal is to have a station near the terminal end of 82 planning basins
  - Maintain a set of reference sites across the state
- In 2013, increased sampling to 8 times annually at 92 sites
- Additional gauging sites

OWRB Benificial Use Monitoring Program



Ambient Trend (AT) Sites

Pesticide monitoring

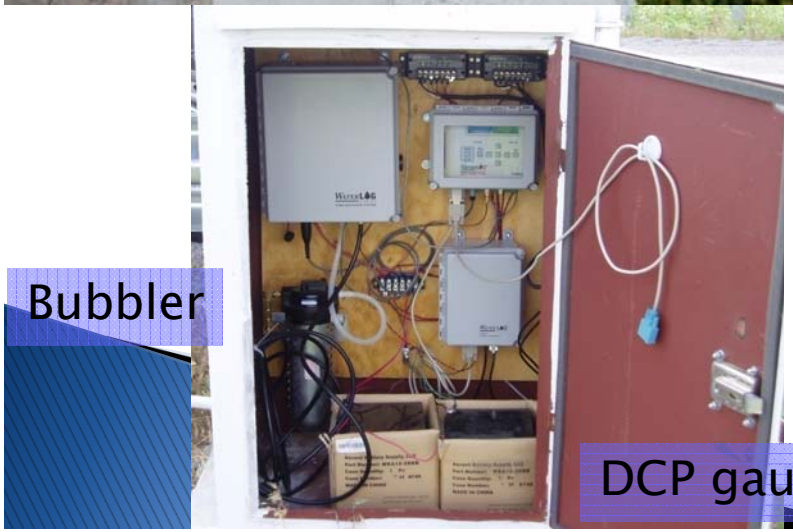
- Cooperative effort with ODAFF
- Target sampling at sites listed on Pesticide 303(d) list
- Each site sampled minimum 5 times annually
- Water quality, discharge, and fish tissue toxicology from both bottom feeders & predators
- Additional pesticide screening at BUMP sites located in high agricultural use areas

Gauging and Discharge Efforts

- OWRB is state partner for USGS Cooperative Program
- Develop rating curves at fixed station monitoring non-USGS COOP sites (currently 22 sites) → fully defensible ratings necessary for loadings and trends
- Established survey datums at all of these non-USGS COOP stations
- 13 sites currently have real-time gauges operated by the OWRB → install 7 more
- Collect one time instantaneous measurement of flow at statistically selected sites
- Use of newer technologies (ex: ADCP)

Radar

Wire weight

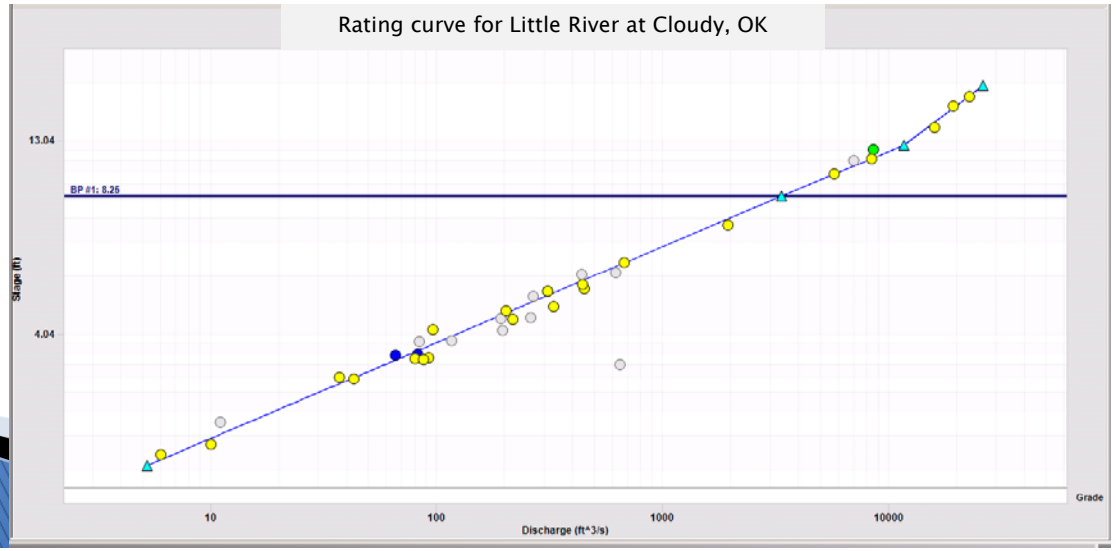


Bubbler

DCP gauge house instrumentation

SonTek Flowtracker use at Elk Creek near Roosevelt, OK

River Ray ADCP
Muddy Boggy Creek, Atoka. 5/22/2013

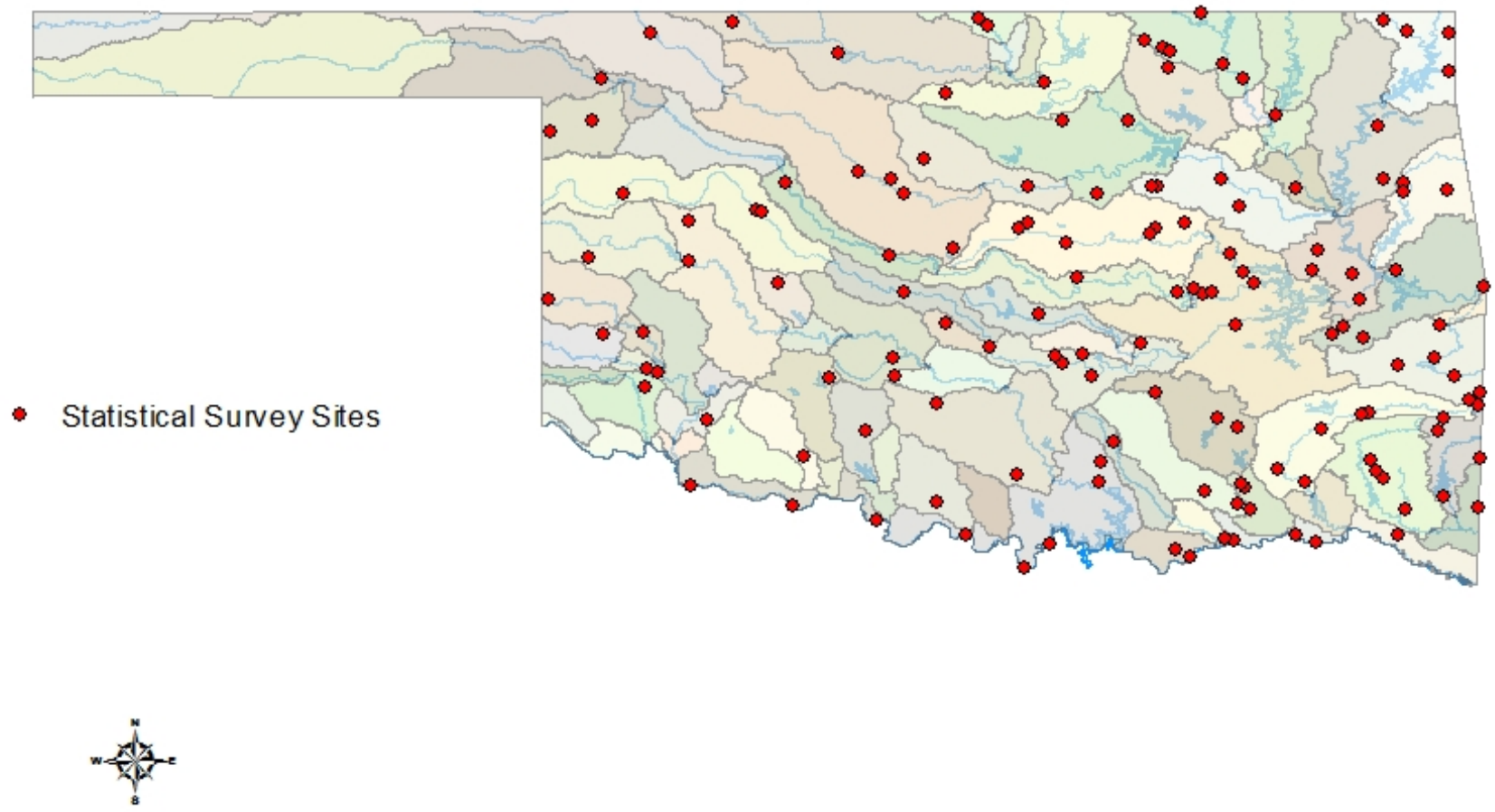



Biological
Monitoring

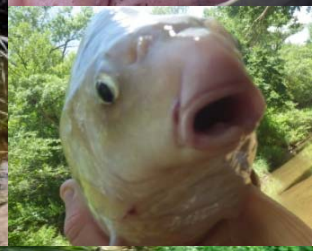
Biological Monitoring

- Ambient Trend (AT), statistically selected monitoring sites, National Rivers & Streams Assessment (NRSA) study
- Instream and riparian habitat characteristics
  - combination of rapid bio-assessment and a quantitative assessment
- Electroshocking & seine net to record fish assemblage
- Benthic macro invertebrates collected during winter and summer index periods
- Algae
  - Phytoplankton: chlorophyll-a
  - Stat. surv. stations include ash free dry mass and taxonomic analysis on phytoplankton and periphyton
- Limited fish tissue for toxicology

OWRB Benificial Use Monitoring Program



NRSA and OK Statistically Selected Sites

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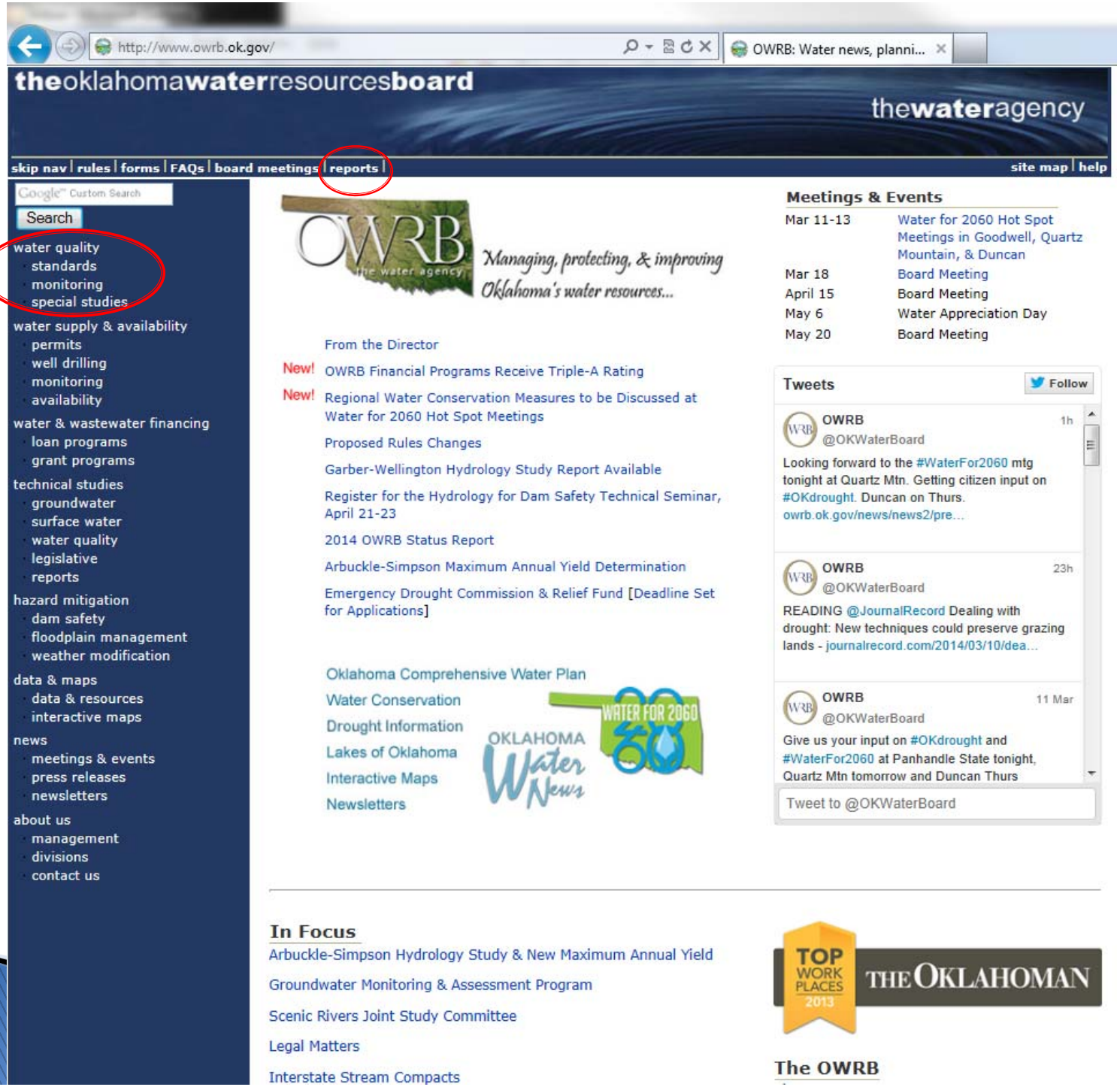
1/8 in
30 31 32 33 34 35 36
metric

Future Goals for Streams

- Develop new monitoring database to improve data management & accessibility
  - includes storing biological monitoring results
  - have summary sheets available online for all data types
- Gauging data from our sites available on OWRB website
  - Currently data is available on U.S. Army Corps of Engineers website
  - Install more gauges

How can you access all this data?

OWRB Website overview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Lakes of Oklahoma
Interactive Maps
Newsletters
OKLAHOMA Water News
WATER FOR 2060
Meetings & Events
Mar 11-13 Water for 2060 Hot Spot Meetings in Goodwell, Quartz Mountain, & Duncan
Mar 18 Board Meeting
April 15 Board Meeting
May 6 Water Appreciation Day
May 20 Board Meeting
Tweets
Follow
OWRB @OKWaterBoard 1h
Looking forward to the #WaterFor2060 mtg tonight at Quartz Mtn. Getting citizen input on #OKdrought. Duncan on Thurs. owrb.ok.gov/news/news2/pre...
OWRB @OKWaterBoard 23h
READING @JournalRecord Dealing with drought: New techniques could preserve grazing lands - journalrecord.com/2014/03/10/dea...
OWRB @OKWaterBoard 11 Mar
Give us your input on #OKdrought and #WaterFor2060 at Panhandle State tonight, Quartz Mtn tomorrow and Duncan Thurs
Tweet to @OKWaterBoard
In Focus
Arbuckle-Simpson Hydrology Study & New Maximum Annual Yield
Groundwater Monitoring & Assessment Program
Scenic Rivers Joint Study Committee
Legal Matters
Interstate Stream Compacts
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Oklahoma Comprehensive Water Plan
OCWP

Water Quality Monitoring

The OWRB's Water Quality Monitoring staff sample lakes, streams and groundwater wells throughout the year and across the state to provide data that can be used to describe both current conditions and historcal trends. Five types of sampling occur within the program: lakes, streams, biological streams, groundwater, and ambient trend. The OWRB also has probabilistic sample sites throughout the state's streams that are selected at random by computer.

Numerous and varied efforts over the past few decades have generated multiple datasets and reports.

- **Beneficial Use Monitoring Program** (BUMP) Report
- **Stream Reports**
- **Lake Reports**

OWRB monitoring activities provide necessary data for the following purposes:

- Developing, refining, or modifying numerical criteria listed in Oklahoma's Water Quality Standards;
- Studies of Total Maximum Daily Loading (TMDL), including both stream gauge and water quality data, much of which is related to confirming 303(d) listings and determining allocations;
- Stream gauging for numerous grants and contracts and providing discharge measurements on BUMP stations not currently gauged by the United States Geological Survey;
- Tracking movement of pollutants from Confined Animal Feeding Operations (CAFO) in approximately 850 wells to support regulation by the Oklahoma Department of Agriculture, Food and Forestry;
- Monitoring stream water for the Federal Energy Regulatory Commission (FERC) permitting process for hydroelectric power generation activities;
- Collection of water and biological samples for the Oklahoma Department of Agriculture to find a continued presence or document the absence of pesticides in streams which have previously been listed on the state's 303 (d) list as being impaired for pesticides.

QUICK LINKS

- FAQs
- Fact Sheet
- Groundwater Monitoring & Assessment Program
- SOPs for Lakes & Streams Sampling
- BUMP Report
- 2012 Water Quality Monitoring Strategy
- National Lake Assessment
- Lake Impairments
- Stream Impairments
- Groundwater Studies
- Groundwater Sites
- Lakes & Special Studies
- All Reports

Groundwater Monitoring & Assessment Program (GMAP)

Representing Oklahoma's first holistic groundwater network monitoring effort, GMAP staff are collecting baseline groundwater level and quality data from wells in Oklahoma's twenty-one major aquifers.

GMAP Brochure

Groundwater Information Resources

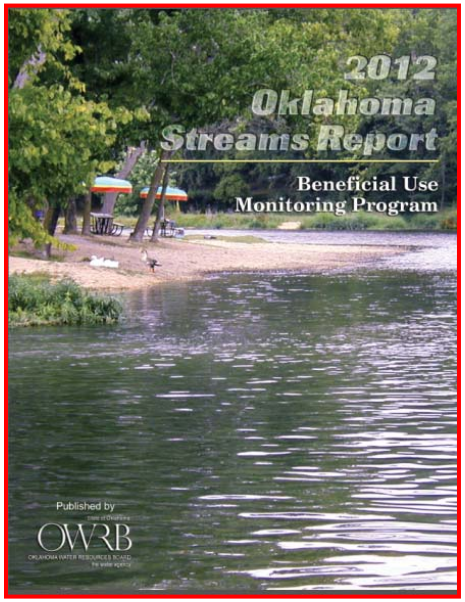
Groundwater FAQs

Lake SOPs

- Collection of Water Quality Samples
- Measurement of Hardness and Alkalinity
- Measurement of Turbidity
- Recording Physical/Chemical Parameters With Multi-Parameter Instruments
- Chlorophyll-a Collection
- Collection Of Zooplankton and Phytoplankton Samples

Stream SOPs

- Parameter Definitions for BUMP
- Collecting Water Quality Samples
- Measuring Hardness and Alkalinity
- Measuring Turbidity
- Recording Phyiscal/Chemical Parameters using a Multiparameter Instrument
- Measurement of Stream Discharge
- Using Floats to Determine Stream Discharge
- Installing Nonrecording Gages and Measurement



Beneficial Use Monitoring Program 2012 Report

OWRB

theoklahomawaterresourcesboard

Lakes Report | Why BUMP Is So Important | Streams Report

OWRB Staff

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OCWP

BUMP: Sound Science for YOUR Comprehensive Water Plan

OCWP

Learn about Oklahoma's Comprehensive Water Plan

Archived BUMP Reports

Oklahoma Water Resources Board 3800 Classen Blvd, Oklahoma City, OK 73118 405.530.8800 www.owrb.ok.gov

Streams Site Data

Back to Streams Report

Sorted Alphabetically

Arkansas River (Bixby)
Arkansas River (Haskell)
Arkansas River (Moffett)
Arkansas River (Muskogee, US 62)
Arkansas River (Ralston)
Arkansas River (Sand Springs)

Barren Fork (Eldon)
Beaver River (Beaver)
Beaver River (Fort Supply)
Beaver River (Gate)
Beaver River (Guymon)
Beaver River (Turpin)
Big Cabin Creek (Big Cabin)
Bird Creek (Catoosa)
Black Bear Creek (Pawnee)
Blue River (Durant)
Brushy Creek (Haileyville)

Canadian River (Bridgeport)
Canadian River (Calvin)
Canadian River (Konawa)
Canadian River (Purcell)
Canadian River (Taloga)
Canadian River (Whitefield)
Caney Creek (Barber)
Caney River (Ramona)
Chickaskia River (Blackwell)
Cimarron River (Ames)
Cimarron River (Buffalo)
Cimarron River (Guthrie)

Deep Fork River at Beggs

Sample Record	Times Visited	Station ID
November 1998 - Current	147	520700020010-001AT

Stream Data

County	Okmulgee	View Site Data
Location	South of the Town of Beggs off of State Highway 16	
Latitude/Longitude	35.67424336, -96.06876654	
Planning Watershed	Eufaula (8-digit HUC -11100303)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	111	17.9	18.0	1.5/33.0	10.4/25.0	
	Turbidity (NTU)	112	179	93	9/1000	51/225	59.1% of values >OWQS of 50
	pH (units)	111	7.82	7.84	6.82/8.89	7.61/8.02	
	Dissolved Oxygen (mg/L)	111	8.15	7.85	3.73/13.52	6.12/10.07	
	Hardness (mg/L)	109	226.4	204.0	27.0/1500.0	148.0/278.5	
Minerals	Total Dissolved Solids (mg/L)	116	395.0	358.5	50.0/836.2	263.7/522.0	
	Specific Conductivity (uS/cm)	111	658.6	590.0	90.0/1469.0	420.8/899.3	
	Chloride (mg/L)	112	97.6	91.2	<10.0/273.0	46.8/135.0	
	Sulfate (mg/L)	112	45.7	41.0	<10.0/129.0	31.0/58.4	
Nutrients	Total Phosphorus (mg/L)	111	0.180	0.156	0.014/0.790	0.098/0.221	
	Total Nitrogen (mg/L)	112	1.071	0.910	0.230/3.260	0.664/1.274	
	Nitrate/Nitrite (mg/L)	114	0.271	0.205	<0.050/2.660	<0.050/0.343	
	Chlorophyll A (mg/m^3)	6	10.4	10.0	8.3/13.3	8.5/12.9	
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	27	4568.8	100.0	<10.0/113000	20/400	Mean> OWQS of 33
	E. Coli (cfu/100ml)(*-Geo. Mn.)	27	654.9	41.0	<10.0/14136	<10.0/171	

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved solids	Bacteria	Bio. Fish	Bio. BMI	Sediment
Fish & Wildlife Propagation	NS	S	S	S						S	S	S
Aesthetics												NS
Agriculture					S		S	S				
Primary Body Contact Recreation									NS			
Public & Private Water Supply				S		S			S			
Fish Consumption				NS								

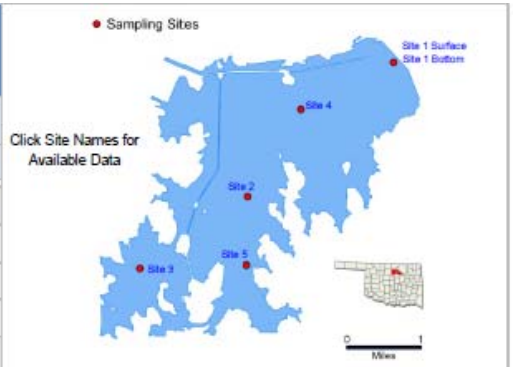
S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes: *Fish consumption not supporting for Lead*

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Sooner

Sample Period	Times Visited	Sampling Sites
November 2006 - August 2007	4	5



General

Location	Pawnee County	Click map for site data
Impoundment	1972	
Area	5,400 acres	
Capacity	149,000 acre-feet	
Purposes	Cooling Water	

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
	Average Turbidity	6 NTU	100% of values < OWQS of 25 NTU
	Average True Color	20 units	100% of values < OWQS of 70
	Average Secchi Disk Depth	115 cm	
	Water Clarity Rating	excellent	
	Trophic State Index	46	
	Trophic Class	mesotrophic	
Profile	Salinity	0.54 – 1.10 ppt	
Profile	Specific Conductivity	1039 – 2066 µS/cm	
Profile	pH	7.21 – 8.46 pH units	Neutral to slightly alkaline
Profile	Oxidation-Reduction Potential	269 - 485 mV	
Profile	Dissolved Oxygen	Up to 52% of water column < 2 mg/L in August	Occurred at sites 1 and 4
Nutrients	Surface Total Nitrogen	0.46 mg/L to 0.69 mg/L	
Nutrients	Surface Total Phosphorus	0.007 mg/L to 0.027 mg/L	
Nutrients	Nitrogen to Phosphorus Ratio	38:1	Phosphorus limited

Beneficial Uses

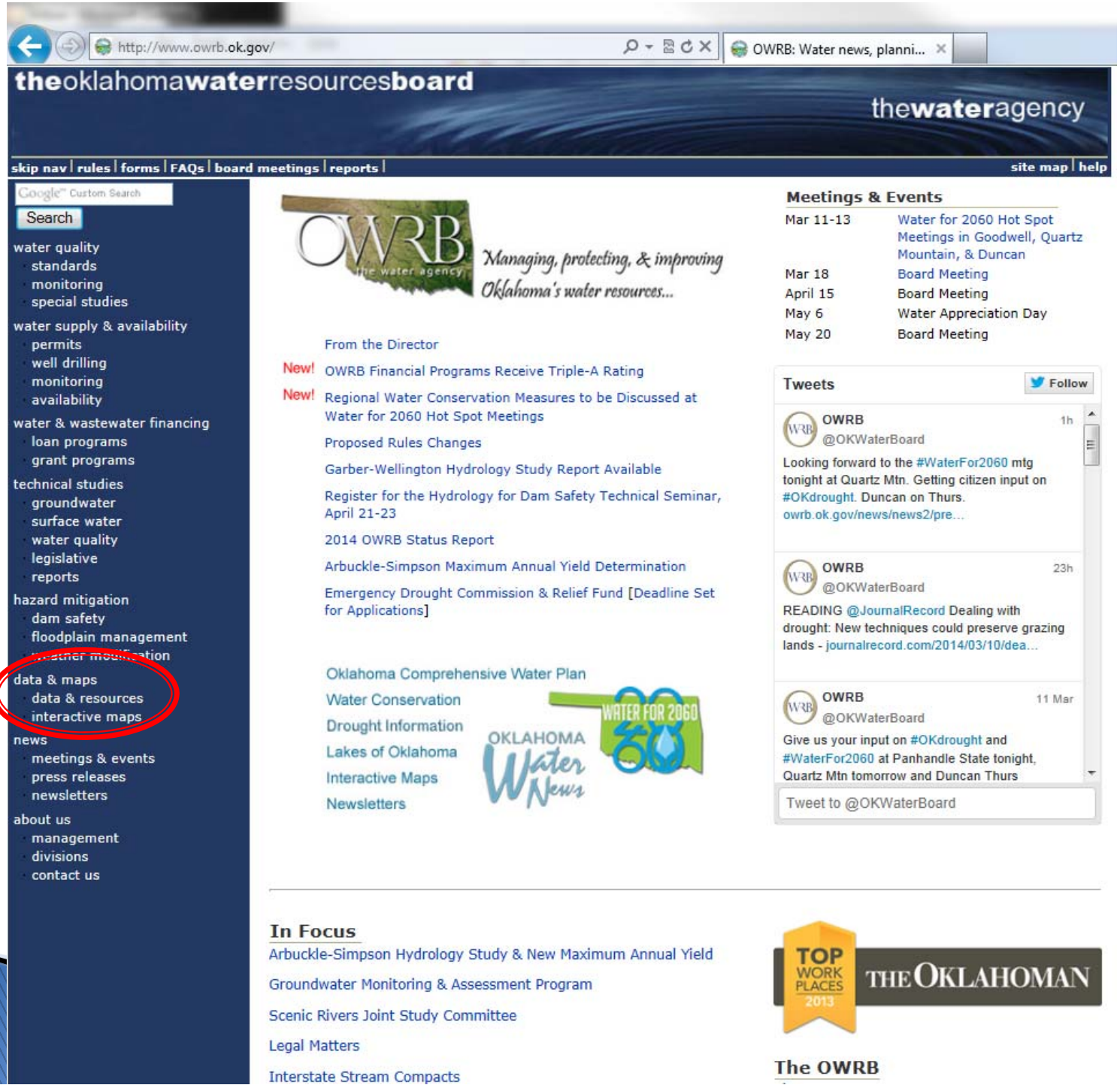
Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
Fish & Wildlife Propagation	S	S	NS	S							
Aesthetics					S	S					
Agriculture							NS*	S	S		
Primary Body Contact Recreation										NEI**	
Public & Private Water Supply											

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

* Approximately 70% of the Sulfate values were above the standard, the AG use is therefore considered not supported. ** Due to minimum data requirements not being met , an assessment of the PBCR beneficial use cannot be made for sample year 2006-2007.

NTU = nephelometric turbidity units
µS/cm = microsiemens per centimeter
E. coli = Escherichia coli
OWQS = Oklahoma Water Quality Standards
mV = millivolts
Chlor-a = Chlorophyll-a
mg/L = milligrams per liter
µS/cm = microsiemens/cm
ppt = parts per thousand
En = Enterococci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Water Conservation
Drought Information
Lakes of Oklahoma
Interactive Maps
Newsletters
OKLAHOMA Water News
WATER FOR 2060
Meetings & Events
Mar 11-13 Water for 2060 Hot Spot Meetings in Goodwell, Quartz Mountain, & Duncan
Mar 18 Board Meeting
April 15 Board Meeting
May 6 Water Appreciation Day
May 20 Board Meeting
Tweets
Follow
OWRB @OKWaterBoard 1h
Looking forward to the #WaterFor2060 mtg tonight at Quartz Mtn. Getting citizen input on #OKdrought. Duncan on Thurs. owrb.ok.gov/news/news2/pre...
OWRB @OKWaterBoard 23h
READING @JournalRecord Dealing with drought: New techniques could preserve grazing lands - journalrecord.com/2014/03/10/dea...
OWRB @OKWaterBoard 11 Mar
Give us your input on #OKdrought and #WaterFor2060 at Panhandle State tonight, Quartz Mtn tomorrow and Duncan Thurs
Tweet to @OKWaterBoard
In Focus
Arbuckle-Simpson Hydrology Study & New Maximum Annual Yield
Groundwater Monitoring & Assessment Program
Scenic Rivers Joint Study Committee
Legal Matters
Interstate Stream Compacts
TOP WORK PLACES 2013
THE OKLAHOMAN
The OWRB

Data & Maps

The links below provide access to data and information regarding Oklahoma's water resources.

Groundwater

(Aquifers, Wells, Water Levels, Standards and Protection)

Surface Water

(Lakes, Streams, Dams, Floodplain, Monitoring, Standards, Watersheds)

Water Rights

(Groundwater and Surface Water Rights, 90-Day Provisional-Temporary Permits)

Water Supply

(Water and Wastewater Financing, Public Water Supply)

Special Studies

Interactive Maps

Interactive Map Gallery

Old Map Server (WIMS)

Viewing Geographic Information System (GIS) Data

Other Maps

Frequently Requested Maps

Lake Maps

Rural Water Systems

National Wetlands Inventory (NWI) Mapping Project

Flood-Prone Area Maps

Bathymetric (Contour) Lake Maps

OWRB Home

Additional Resources

GIS Data

Groundwater Levels

Lakes of Oklahoma

Lake Level and Streamflow Conditions

Locating Available Water

Frequently Requested Maps

Frequently Asked Questions

Oklahoma Water Facts

Useful Websites

Interactive maps you can customize

Surface Water

The intent of this page is to provide online access to data and maps published by the OWRB and other water related agencies. Please note that many of these datasets are copies of production datasets and may not reflect current conditions. Each dataset has metadata documentation listing the publication date and describing the intended use and purpose of the dataset.

Information about viewing GIS Data

Icon Legend

- Map Image [PDF]
- Map Viewer
- Shapefile Download [ZIP]
- Geodatabase Download [ZIP]
- Data Table Download [ZIP]
- Metadata Documentation [HTM]

NOTE: If you have trouble viewing the [PDF] images please use Adobe Reader .

Lakes and Streams

	Map	Data
OWRB Lakes (100K)	✓	✓
OWRB Streams (100K)	✓	✓
Bathymetric Lake Contours		
National Hydrography Dataset (NHD)		

Hazard

	Map	Data
Dam Inventory	✓	✓
Jurisdictional Dams by Hazard Classification	✓	
Jurisdictional Dams by Agency and Hazard Classification	✓	
Jurisdictional Dams by Ownership	✓	
Special Flood Hazard Areas (DFIRM)	✓	
DFIRM Status Map	✓	

Water Quality Monitoring

	Map	Data
Beneficial Use Monitoring (BUMP) Sites	✓	✓
BUMP Lake Data	✓	✓
BUMP Stream Data	✓	✓
All OWRB Surface Water Monitoring Sites	✓	✓
USGS Real-Time Surface Water Quality Data for Oklahoma		

Water Quality Standards

	Map	Data
Appendix A - OWRB Lakes (100K)	✓	✓
Appendix A - OWRB Streams (100K)	✓	✓
Appendix B - Tables 1 & 2	✓	✓
Special Provision (Lakes, Streams, Watersheds)	✓	✓

OWRB Home

Additional Resources

- GIS Data
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Questions?