Kansas Department of Health and Environment
Division of Environment

Kansas Harmful Algal Bloom Response Program

KS Governor’s Conference - 2018

Kansas HAB Program

- Started in 2010
- Complaint – based response program
- Triggers based on cell counts and/or microcystin concentrations – Public Lakes
- 2017: 26 lakes affected
- 2018: 32 lakes affected
- Program and policies are in constant evolution; Response plan revised 2018, few for 2019
- Includes investigation of PWS impacts- raw & finished

KDHE Thresholds

Watch > 4 µg/L or 80K/mL cell counts

Warning > 20 µg/L or 250K/mL cell counts

Closure > 2000 µg/L or 10M/mL cell counts

Public Water Supply

Follow WHO & EPA Guidelines

- Microcystin & Cylindrospermopsin
- A looming issue for PWS source water
- Treatment with activated carbon has been effective
- Cyanotoxins not prevalent in river systems under most conditions

Recreation

Modeled after NWS tornado alerts

Impacts of eutrophication and blooms (what we know)

Ecological

- Reduces overall water quality
- Reduces diversity, richness and complexity of the biological community

Economic

- Loss of recreational revenues
- Increased costs for water supply
- Land value, loss of opportunity revenues

Quality of Life

- Development of and intensity of odor (e.g. experienced by the communities of Wakefield and Milford)
- Potential health impacts and costs

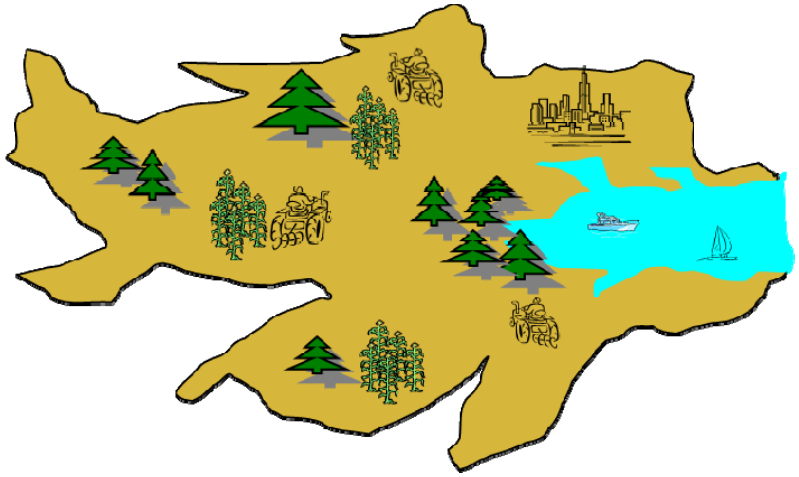
Recreational

- Boating, fishing, swimming

What causes harmful algal blooms?

- Excessive nutrients
- Sunlight
- Warm water temperatures
  - Blooms typically occur in summer and early fall
- Calm winds
- Slow-moving/ stagnant water
- Blooms thrive in warm, shallow, nutrient rich lakes
- Often found in secluded coves, shorelines, or on the downwind side of a lake

Causes: Watersheds hold the key



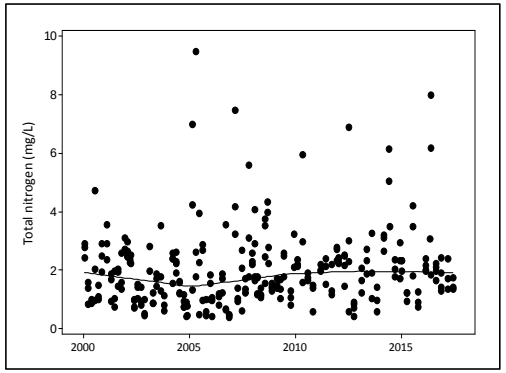
(adapted from Statewide Eutrophication Status, E. Carney, 2012)

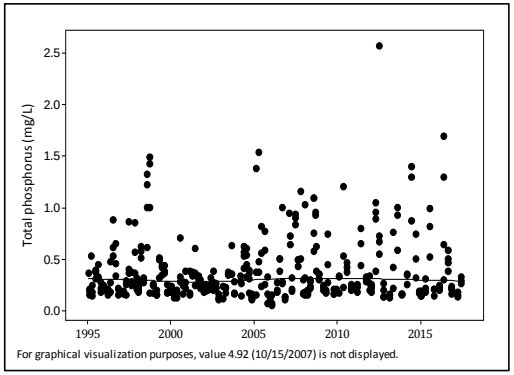
- Eutrophication – “excessive nutrients” is the root cause of excessive algal growth (i.e. amount of biomass or standing crop produced) and blooms

Background or cultural eutrophication?

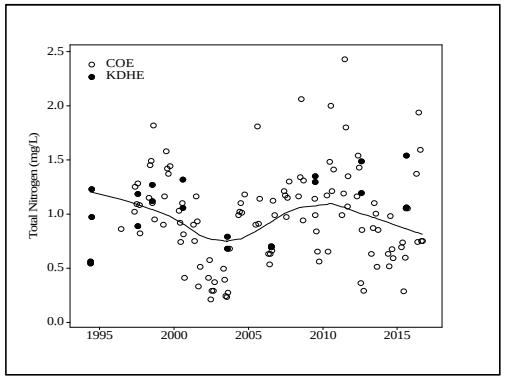
Watershed: Nitrogen & Phosphorus

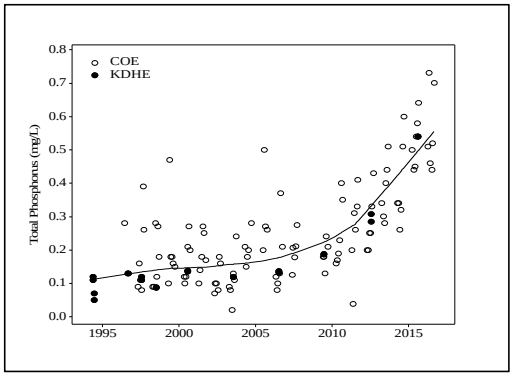
Republican River





Milford Lake





Watershed: Phosphorus (form)

Total Phosphorus

- All forms of phosphorus
  - Inorganic form attached to suspended solids
  - Organic form bound up in algae

Orthophosphate (Reactive Phosphates)

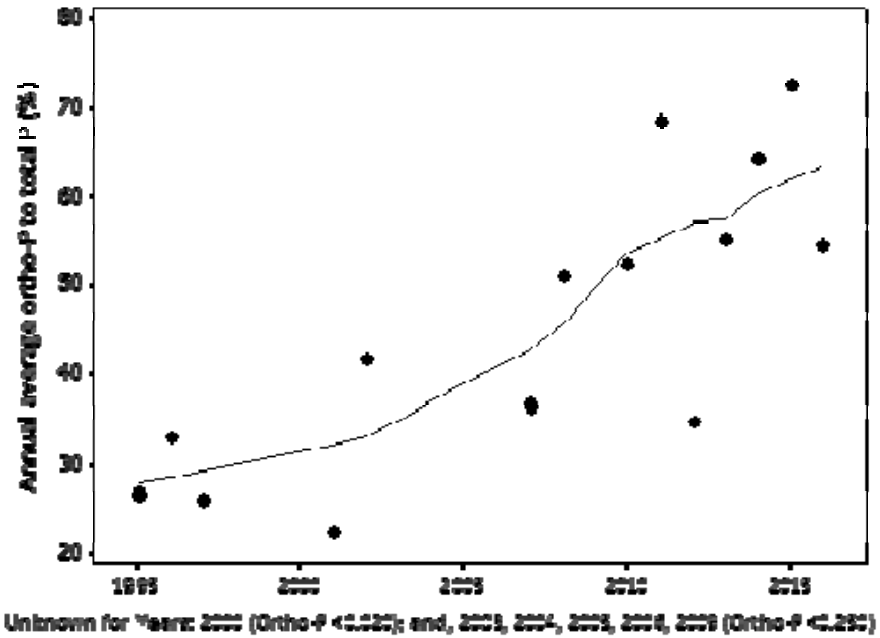
- Main constituents in agricultural and residential fertilizers
- Provides estimate of amount of P available for algae growth

Causes: Watershed: Phosphorus (form)

Soluble reactive phosphorus increasing

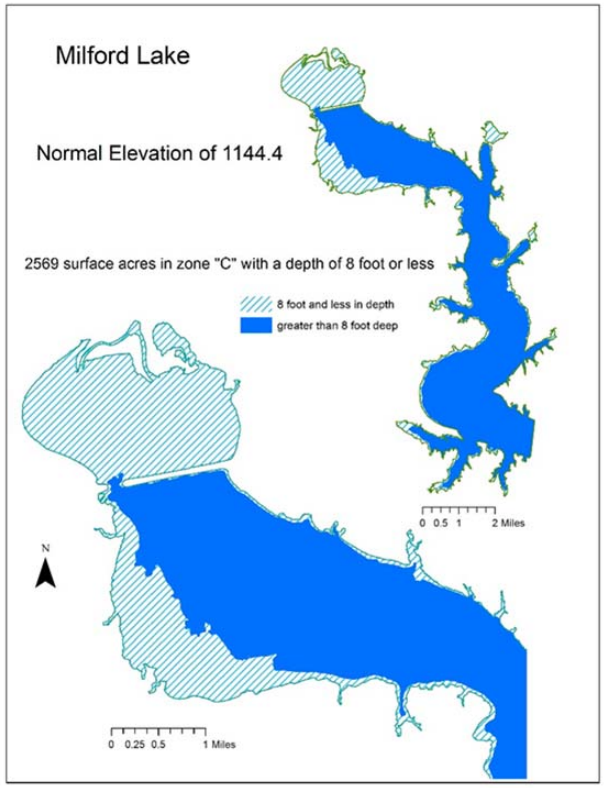
- Changes in Agricultural Practices
- Newer formulations
- Tile drains
- Fertilizer application methods

(H. Jarvie et al., 2017)



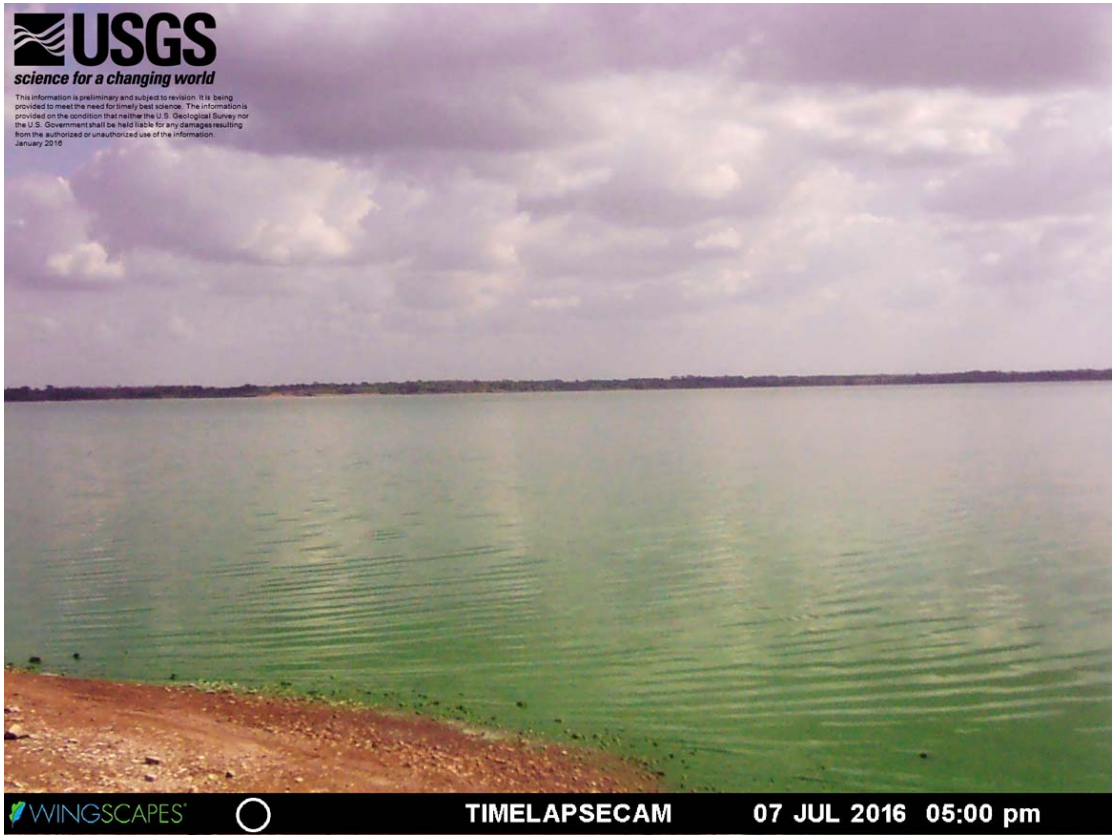
Lake Hydrology: Size, Shape, Depth

- Milford: ~ 65 % of the lake's shallow water (< 8 ft) occurs in upper end
  - Total surface area
    - 15,700 acres (USACE)
  - Shallow water surface area
    - 3,897 acres
  - Shallow water surface area in northern portion (Zone C)
    - 2,569 acres



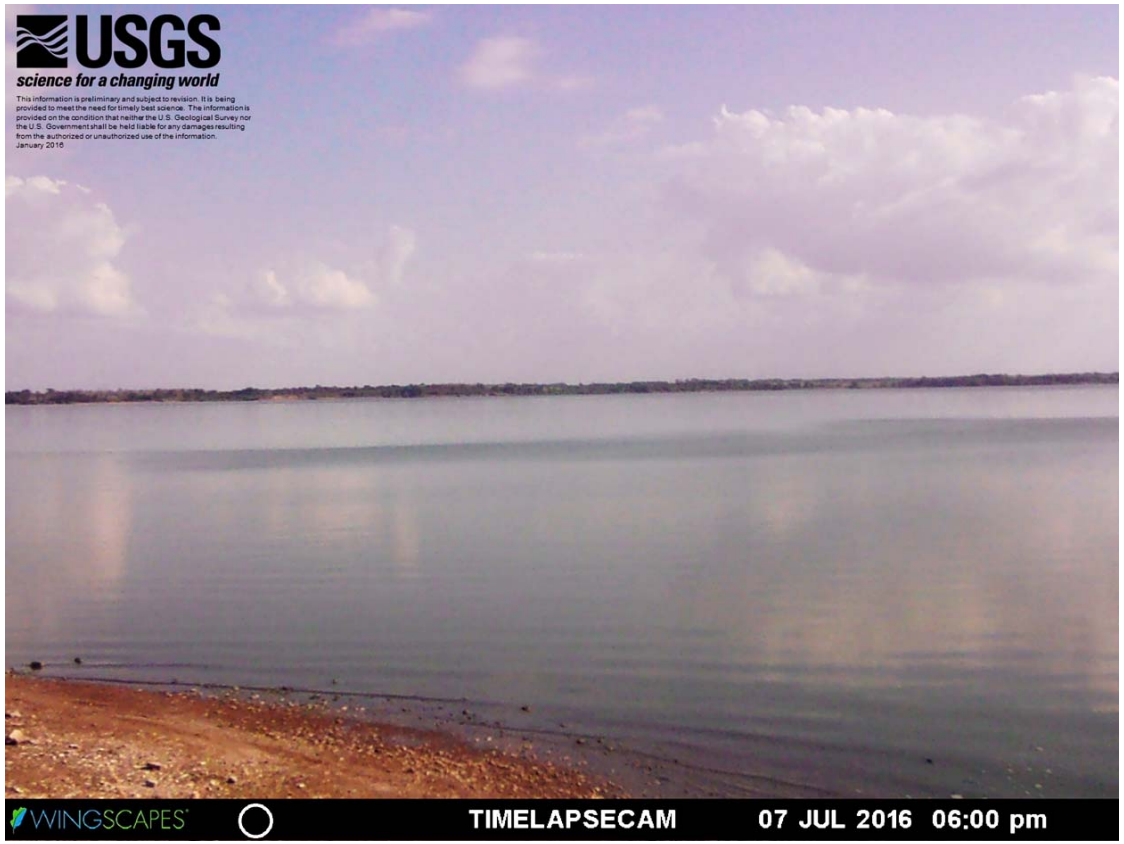
Causes:
Lake Hydrology,
Size, Shape,
Depth

Kansas Harmful Algal Bloom Response Program



Causes:
Current weather conditions

Highly variable with time



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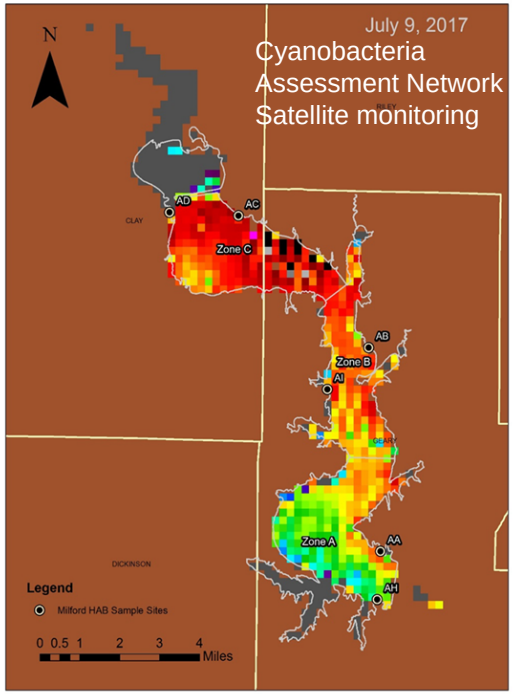

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Monitoring Efforts

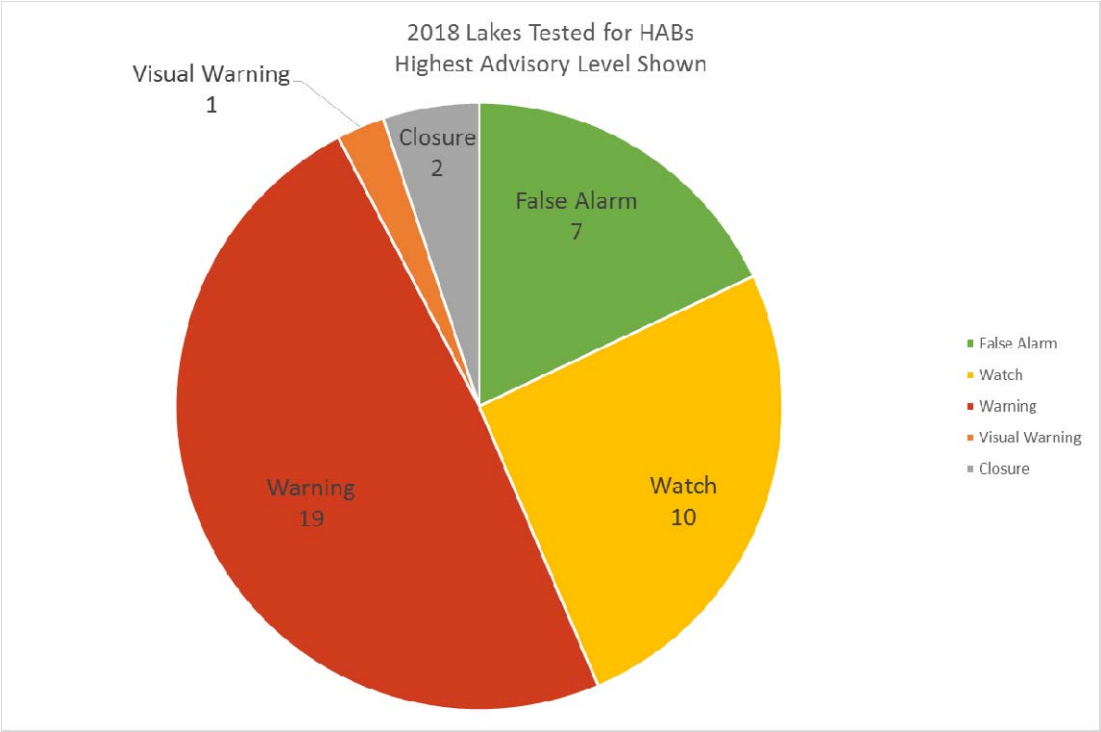
HAB results for week of July 09, 2017

SITE NAME	COL. DATE	TIME	TOTAL CELLS	PERCENT BG	BG CELLS	MICROCYSTIN	SUGGESTED STATUS
Milford Reservoir			*GEARY, DICKINSON, CLAY*			NCDO	
LMA190AA	20170710	1240	749,070	99.2	743,077	9.0	WARNING
LMA190AH	20170710	1215	1			0.7	
LMB190AB	20170710	1300	345,555	97.8	337,953	2.0	WARNING
LMB190AI	20170710	1350	99,603	82.9	82,571	0.7	WATCH
LMC190AC	20170710	1315	5,613,300	99.9	5,607,687	27.0	WARNING
LMC190AD	20170710	1325	1			0.5 <	

Monitoring 2018

Waterbody and ID	Sampler	5/7 5/10	5/14 5/17	5/21 5/24	5/29 6/1	6/4 6/7	6/11 6/14	6/18 6/21	6/25 6/28	7/2 7/5	7/9 7/12	7/16 7/19	7/23 7/26	7/30 8/2	8/6 8/9	8/13 8/16	8/20 8/23	8/27 8/30	9/4 9/6	9/10 9/13	9/17 9/20	9/24 9/27	10/1 10/4	10/8 10/12	10/15 10/19	10/22 10/25	10/29 11/1
Anthony City Lake (75%) LM0488	SC								L																		
Atchison County Park Lake (75%) LM0606	NE									W	W	W	W	W	W	W	W	W	W	W	W	W	W	L			
Atchison Co SFL (25%) LM0126	NE																				Watch	Watch	Watch	L			
Atwood Township Lake (75%) LM0712	NW																W	W	W	W	L						
Big Hill Lake (25%) LM0310	SE	L																									
Carbondale West Lake (75%) LM0608	NE								W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	L	
Central Park Lake (75%) LM0609	Central			Watch	Watch	W	L			W	W	Watch	Watch	L		Watch	Watch	W	W	W	W	W	W	L			
Clarion Woods Lake (75%) LM0759	NE								W	W	W	L															
Colwich City Lake (75%) LM0175	SC				Watch	Watch	Watch	Watch	L																		
Cottonwood River, South of Emporia	SE															Watch	Watch	Watch	Watch	L							
Council Grove City Lake (25%) (PWS) LM0430	NC																			Watch	L						
Frazier Lake LM0602	SW											W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Hodgeman County SFL (75%) LM0742	SW												W	W	W	W	Watch	Watch	Watch	W	W	W	W	W	Watch	L	
Jerry Ivey Pond (75%) LM0760	NC										W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	L
Kirwin Lake (25%) LM0110	NW							L																			
Lake Afton (25%) LM0492	SC										W	W	W	W	W	W	W	W	W	W	W	W	W	W	L		
Lake Scott State Park (75%) LM0112	SW														W	W	W	W	W	Watch	Watch	W	W	L			
Lake Wabaunsee (25%) (PWS) LM0420	NE											W	W	W	W	Watch	Watch	W	Watch	W	W	W	L				
Lakewood Park Lake (75%) LM0698	NC														C	C	W	W	W	W	W	W	W	Watch	Watch	L	
Linn Valley Lake (PWS) LM0443	SE																Watch	L									
Marais des Cygnes Wildlife Area LM0532	SE												W	W	W	W	W	W	W	W	W	W	W	W	W	L	L
Marion County Lake (25%) LM0121	NC						L																				
Mary's Lake (75%) LM0614	NE											Watch	Watch	Watch	Watch	Watch	Watch	Watch	Watch	Watch	Watch	Watch	Watch	Watch	L		
Melvern Lake (25%) (PWS) LM0270	NE																Watch	Watch	Watch	Watch	Watch	Watch	L				
Melvern Outlet Pond (25%) (PWS) LM0271	NE									W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	L	
Melvern Outlet Swim Pond (25%) LM0272	NE									W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	L		
Overbrook City Lake (75%) LM0205	NE												Watch	Watch	Watch	W	W	W	W	W	W	W	Watch	Watch	L		
Overbrook City Kids Pond LM0763	NE																						Watch	Watch	L		
Perry Lake (25%) LM0290 Zone A	NE												L	L	Watch	Watch	Watch	L									
Perry Lake (25%) LM0290 Zone B	NE												W	W	Watch	Watch	Watch	L									
Perry Lake (25%) LM0290 Zone C	NE												L	L													
Perry Lake (25%) LM0290 Zone D	NE												L	L													
Pomona Lake (25%) (PWS) LM0280	NE																Watch	Watch	Watch	Watch	Watch	Watch	Watch	Watch	L		
Rock Garden Pond LM0761	Central												Watch	Watch	Watch	Watch	Watch	Watch	W	W	W	W	W	W	W	L	
Rooks Co. State Fishing Lake (75%) LM119	NW										W	W	W	L													
Sebelius (Norton) Lake (75%) (PWS) LM0100	NW						W	W	L																		
South Lake (75%) LM0675	NE											W	W	W	W	W	W	W	W	W	W	W	W	W	W	Watch	Watch
Tomahawk Park Lakes LM0417	NE																		Watch	Watch	Watch	Watch	Watch	Watch	L		
Webster Lake (75%) LM0120	NW							Wc	Wc	W	W	W	W	W	W	C	C	W	W	W	W	W	W	Watch	Watch	L	
West Campus Pond, KU	NE																						L				

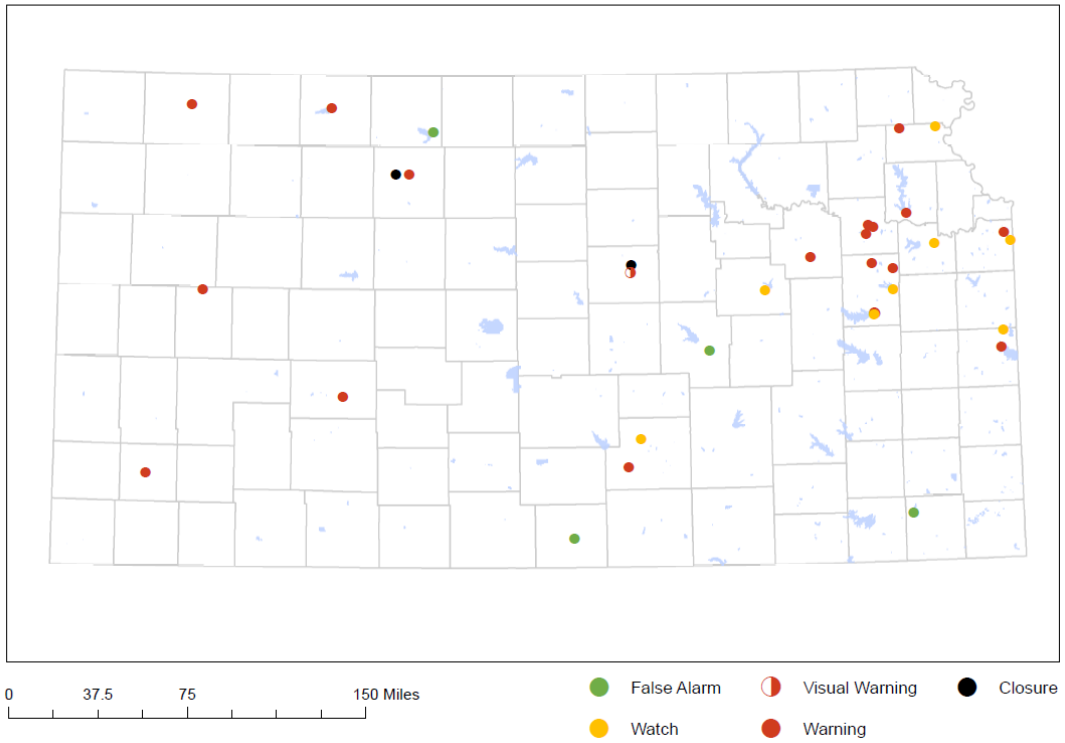
Monitoring 2018



- 39 Lakes Sampled
- 7 False Alarms
- 2 Closures
- 32 Lake Advisories
- ~295 Toxin Samples
- ~187 Cell Count Samples

Monitoring 2018

2018 Harmful Algal Blooms as of Oct 1
Highest Level of Advisory per Lake



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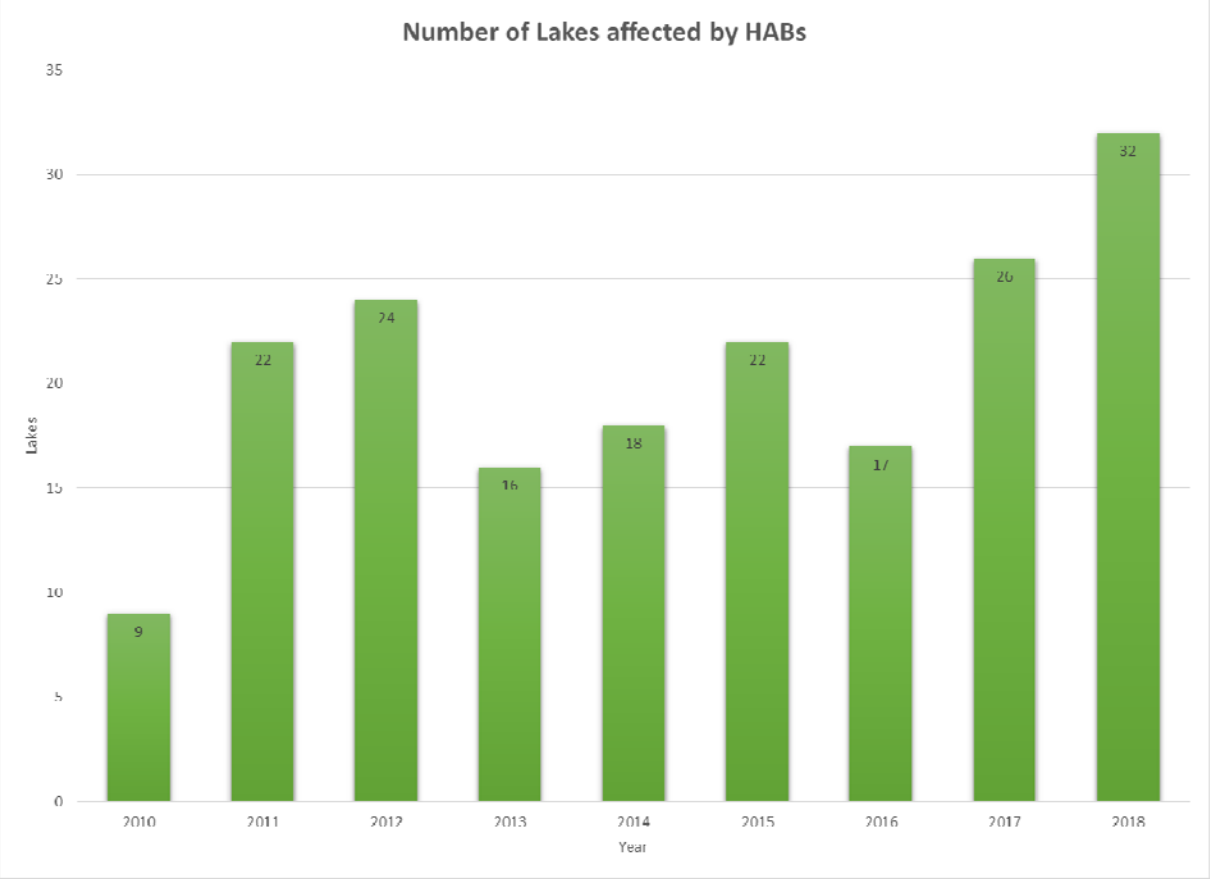


HAB Mitigation Strategies

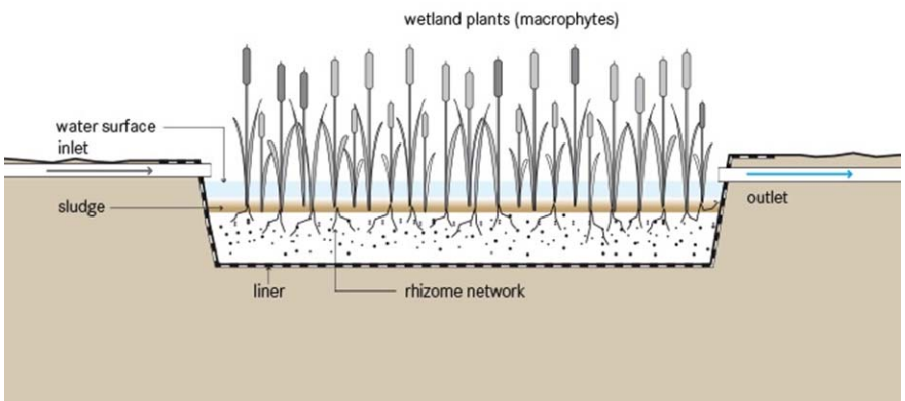
Nutrient Removal

Destruction of Cyanobacteria

Inhibit Cyanobacteria Habitat

HAB Mitigation Strategies

- Nutrient Removal External
  - Treatment Trains
  - Struvite



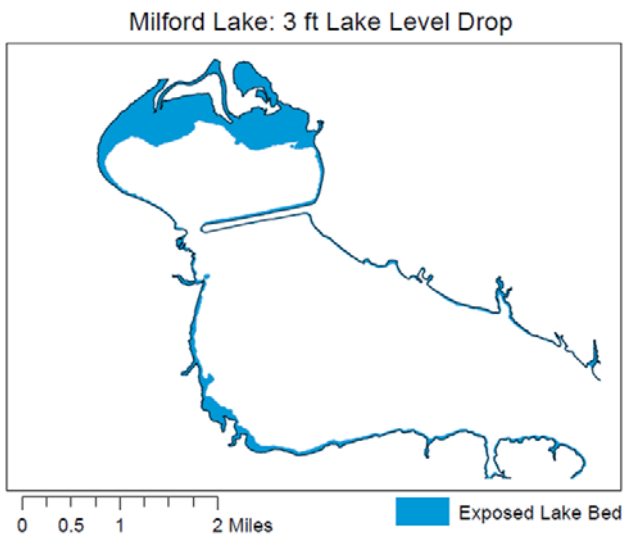
Tilley, E.; Luethi, C.; Morel, A.; Zurbruegg, C.; Schertenleib, R. (2008): Compendium of Sanitation Systems and Technologies. Duebendorf, Switzerland: Swiss Federal Institute of Aquatic Science and Technology (EAWAG) and Water Supply and Sanitation Collaborative Council (WSSCC).

- Nutrient Removal – Internal
  - Alum and Phoslock
  - Floating Wetlands / Vegetation

Source: Phoslock

HAB Mitigation Strategies

- Inhibit Cyanobacteria
  - Algae Barriers
  - Aeration and Mixing
  - Drawdown



- Destruction of Cyanobacteria
  - Algaecides
  - Superoxides
  - Ultrasound

Source: LGSonic, The display of a commercial product is not an endorsement from the KDHE

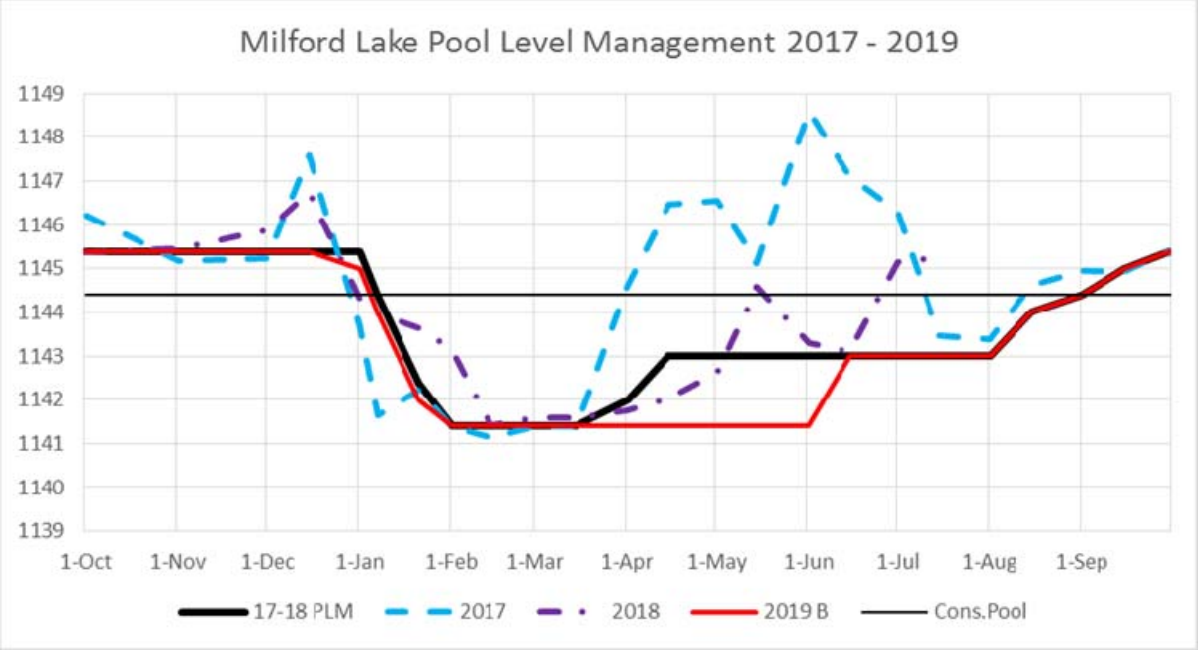
HAB Mitigation Strategies: CY2019 HAB Pilot in Kansas

Milford Lake

- Drawdown
- Vegetation
- Peroxide based algaecide
- Ultrasound
- Fish removal

Marion Lake

- Supplemental vegetation
- Peroxide based spot treatment
- Ultrasound
- Phosphorus binding feasibility study



KDHE Initiatives: Nutrients and HABs

Watershed

- WRAPS Nutrient Reduction Efforts
- BMPs
- Cover crops
- Milford RCPP Partner

TMDLs

- Prioritized toward nutrient impairments
- Allocates TP loads
- Implementation leads to nutrient reductions

Mitigation

- Drawdown
- Vegetation
- Peroxide based algaecide
- Ultrasound
- Fish Harvesting

Other

- Research: contracts with USGS & KU
- CYAN project partner
- Workgroups
- HAB response & sampling

Thank you/Questions

Contact: Trevor Flynn
Trevor.Flynn@ks.gov