

An aerial photograph showing a large dam with multiple spillways across a river. The river flows from the bottom left towards the dam. The surrounding area is a mix of dense green forest and some cleared land with buildings and roads. The sky is a pale blue.

# The Grand River Dam Authority & “the Great Grand Lake Algae Bloom of 2011”

***23<sup>rd</sup> Annual Oklahoma Clean Lakes and  
Watersheds Conference  
April 2, 2014***

# *Topics of Discussion...*

- What is GRDA...GRDA at a glance
- GRDA's Impact on Local Communities
- Watershed Challenges & Algae Bloom of 2011





# GRDA at a glance ...

- Nation's 20<sup>th</sup> largest public power utility\*
- Built and manages Grand Lake,  
Oklahoma's premier recreation destination.



## **Pensacola Dam (120MW)**

Constructed 1938-40 for \$28 million.

*Updated construction cost:  
\$300+ million.*



## **Robert S. Kerr Dam (114MW)**

Constructed 1962-64 for \$40 million.

*Updated construction cost:  
\$280+ million*



## **Salina Pumped Storage (260MW)**

Constructed 1968-72 for \$30 million.

*Updated construction cost:  
\$350+ million.*

\*by generation, American Public Power Association 2005-06 statistical report

# *Grand Lake ...*

*Oklahoma's Premiere Recreational Destination...*



...And At Times, Oklahoma's 3rd Largest City!!!





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*Oklahoma's Premiere Recreational Destination...*

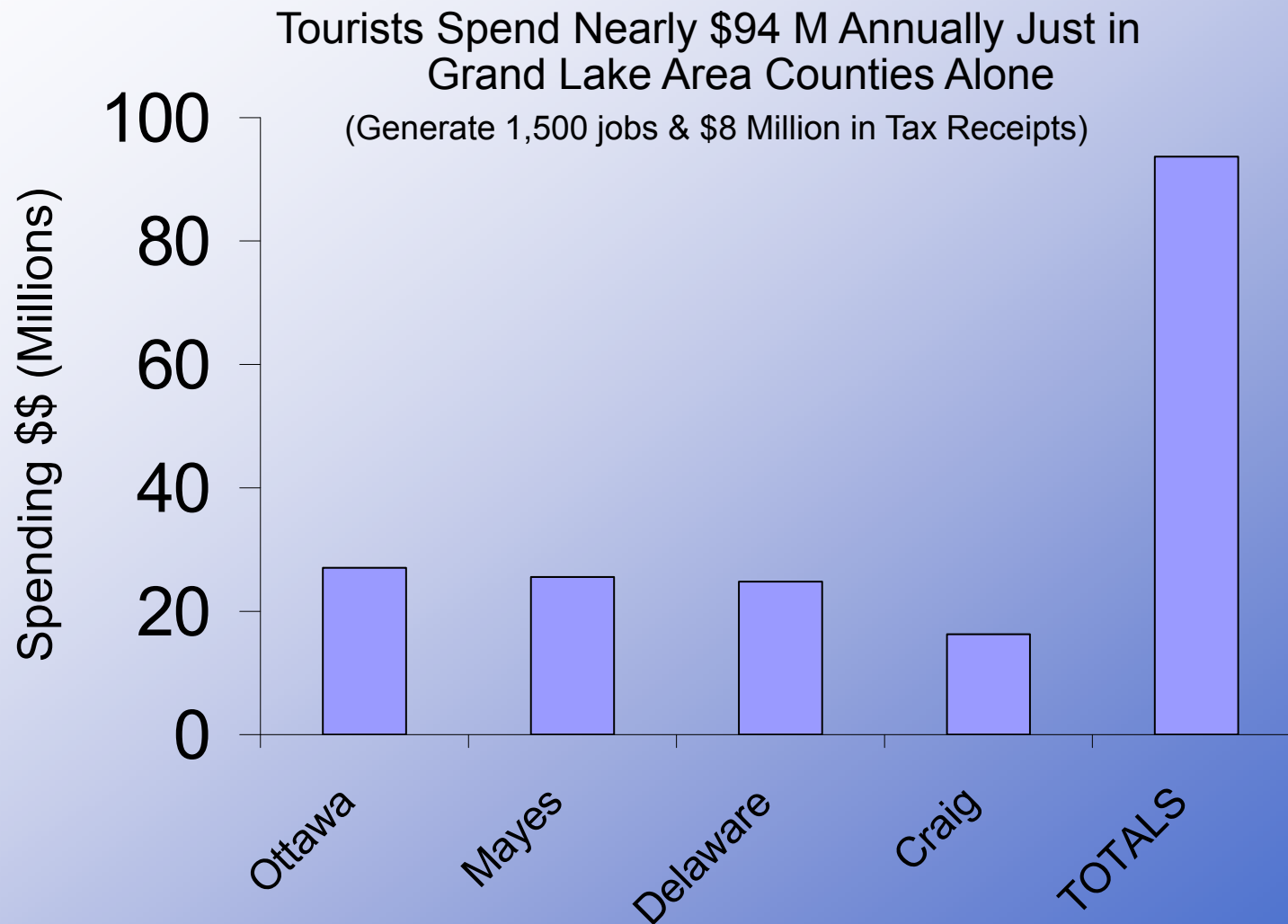
- Basic Stats...
  - 18,000 Waterfront Homes
  - >10,000 boat slips
  - 150 Commercial Marinas
  - Shoreline Property
    - >\$1,000/foot
  - Boat Fuel Taxes
    - > 50% from Grand Lake.



Grand Lake's development contributes to a broad tax base.

# Tourism ...

*Providing vital revenue for state, county and local communities...*



Data Provided by:  
Travel Industry Association of America; Washington, D.C, 2005.

# Blue-Green Algae Bloom

Grand Lake, 2011 (Horse Creek, Unfinished Bridge)





**Microcystin Data Report**  
Project: Grand River Dam Authority

Sample Identification      Sample Collection Date

Horse Creek (Tow)	110627
Horse Creek (Grab)	110628
Duck Creek (Tow)	110628
Duck Creek (Grab)	110628

**Toxin – Microcystin (MC)**

**Sample Prep** – The samples were ultra-sonicated to lyse cells and release toxins. Sample dilutions (10x & 100x) were necessary to accommodate the calibrated range for ELISA analysis.


**Analytical Methodology** – A microcystins enzyme-linked immunosorbent assay (ELISA) was utilized for the quantitative and sensitive congener-independent detection of MCs. The current assay is sensitive to down to a LOD/LOQ of 0.15 µg/L for total MCs. The average recovery of the lab fortified blank (LFB) spiked with 1 µg/L MCLR was 85%.

Liquid chromatography/mass spectrometry (LC/MS) was utilized for the determination of four of the most common microcystin variants and their relative abundance. The [M+H]<sup>+</sup> ions for LR (m/z 995.5), RR (m/z 519.5), YR (m/z 1045.6) and LA (m/z 910.5) provided both specificity and sensitivity. Microcystin-LR was found to be the dominant variant present in the Horse Creek (tow) sample with a small level of MCRR present as well.

**Summary of MC Results**

<u>Sample</u>	<u>MC levels</u> (µg/L)
Horse Creek (Tow)	≈ 125
Horse Creek (Grab)	≈ 49
Duck Creek (Tow)	≈ 358
Duck Creek (Grab)	≈ 10

LOD/LOQ = 0.15 µg/L

Submitted by:   
Mark T. Aubel, Ph.D.  
Date: 6/30/11

# Test Results

## Summary of MC Results

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**World Health Organization 2003:  
Warns of High Probability of Adverse  
Health Effects When Microcystin ≥ 20ug/L**

# News Headlines

## Public warned of algae at Bernice

### Staff Reports

An Oklahoma Department of Environmental Quality (DEQ) recommendation to temporarily avoid body contact with water at Bernice State Park is prompting the Grand River Dam Authority to remind lake enthusiasts to take extra precaution on Grand Lake this summer. The state park is putting up signage to notify the public.

DEQ made the recommendation after the GRDA Ecosystems Management's water lab confirmed blue green algae (BGA) was in the waters near the park, and in portions of Horse Creek and the back of Duck Creek.

BGA are microscopic organisms that are naturally

present in lakes and streams, usually in low numbers. However, the algae can become abundant in shallow, warm water that receives heavy sunlight. While most BGA are not toxic, toxins can be produced in some algae blooms. Results of the tests of BGA water samples taken by the GRDA Ecosystems Management Department will not be available until early next week. However, as a precaution DEQ made its recommendation to avoid body contact.

GRDA joins with the DEQ in urging lake users to practice caution and use common sense when



Courtesy Photo

This blue green algae has appeared near Bernice State Park.

See, *ALGAE*, page 9

**Grove Sun: June 28, 2011**

## DEQ issues Grand Lake algae warning

• Tests are being run to determine the toxin level of the blue-green algae.

BY RANDY KREHBIEL  
World Staff Writer

BERNICE — The presence of a potentially dangerous algae caused the Oklahoma Department of Environmental Quality to

**'In the interest of public safety, we are just asking lake users to be careful and vigilant.'**

Justin Alberty  
corporate communications  
director for the GRDA

Results of tests to determine the toxin level of the

the public's help in that regard. If you see areas of the lake where you believe blue-green algae is present, please contact GRDA."

Blue-green algae might look like thick pea soup, green paint, or bluish, brownish or reddish-green paint. When it washes up on shore, it may appear to look like a thick green mat that falls apart when handled.

The more common green algae are stringy and made

**Tulsa World: June 25, 2011**



# News Headlines

## Governor quick to respond to warning about Grand Lake

TULSA (AP) — Oklahoma officials said Friday they are discouraging swimming in Grand Lake because of potentially dangerous blue-green algae — a statement that drew a quick response from the governor, who was concerned about the effect on tourism over the holiday weekend.

Gov. Mary Fallin said she was extremely concerned about the economic damage that could result if people canceled trips to the north-eastern Oklahoma lake at the last minute.

"There are still a lot of great things to do at the lake, even though there are concerns about the quality of the water," Fallin told The Associated Press.

Public pools are available for swimming, and there's golf courses, fireworks, an

air show, free concerts, a carnival and numerous tourist attractions in the towns near the lake, including Grove, Pryor, Salina, Langley and Miami.

"I've had calls from businesses at the lake expressing concern about the effect on business and revenue," Fallin said. "Grand Lake is a wonderful tourism spot for Oklahoma. There's a lot of economic activity at the lake. We need to do all we can to support the lake."

Fallin's family had already planned a trip to Grand Lake over the Independence Day weekend and "we're still going," she said.

The GRDA is "strongly discouraging" swimming or other activities that would bring people into contact with the water, agency spokesman Justin Alberty



THE TULSA WORLD, TOM GILBERT

This aerial photograph shows Oklahoma officials said Friday Grand Lake because of potential statement that drew a quick concerned about the effect

said. The agency issued advisory because of rapidly changing levels of green algae in the lake said.

The agency's board of directors scheduled an emergency meeting in Tulsa Friday afternoon to discuss the situation.

Blue-green algae are microscopic organisms that are naturally present in lakes and streams, usually in low numbers. However, the algae can become a dominant in shallow, warm w

## DEQ Issues Algae Alert

By CAREY HEAD  
News Lifestyles Editor

OKLAHOMA CITY — An Oklahoma Department of Environmental Quality recommendation to temporarily avoid body contact with water at Bernice State Park and a few other areas of Grand Lake is prompting the Grand River Dam Authority to remind lake enthusiasts to take extra precaution on Grand Lake this summer. The state park is putting up signage to notify the public.

Blue green algae, or BGA has been found in the waters near Bernice State Park, in portions of Horse Creek and the back of Duck Creek — all popular destinations for tourists enjoying the waters of Grand Lake. The DEQ made the recommenda-

tion to avoid body contact with water in these areas after BGA was found there.

Toxins produced by BGA, or cyanobacteria, may cause allergic reactions, damage to the liver and other internal organs, as well as damage to the central nervous system and the brain.

According to Justin Alberty, corporate communications director with GRDA, the area on Duck Creek where the BGA was found was at the back of

the creek beyond the popular Thunder Bay restaurant.

Alberty explained the biggest area of concern is Bernice State Park and Horse Creek. Tests conducted June 17 found the largest amounts were in Horse Creek, "but over the weekend, the strong southerly winds helped it dissipate."

Over a busy holiday weekend, such as the Fourth of July, the population of Grand Lake proper swells to the third largest in Oklahoma,

according to Grand Lake area Chambers of Commerce.

Visitors are advised to avoid areas where the water is shallow, still and warm. "We've not had this on Grand Lake before," Alberty said. "We don't want to panic anybody but still advise everyone to swim in the main lake."

Three magnets attracting boaters are Woodward Hollow, Big Hollow and Dripping Springs.

(See ALGAE, Page 3)



IN THIS PHOTO provided by State of Washington Department of Ecology, a blue green algae bloom washed up along the shoreline in Long Lake, Thurston County, Washington. The bluish color means that some of the algae are starting to decompose leaving the blue pigment. Some forms of blue green algae, or BGA, are toxic to humans, pets and livestock. The Oklahoma Department of Environmental Quality and the Grand River Dam Authority have issued a warning to visitors to Grand Lake that BGA has been found in the waters of Bernice State Park, Horse Creek and Duck Creek on Grand Lake.

**Lawton Constitution: July 2, 2011**

**Ponca City News: June 28, 2011**



# News Headlines

## Okla. agency discourages swimming in Grand Lake

TULSA (AP) — Oklahoma officials said Friday they are discouraging swimming in Grand Lake because of dangerous blue-green algae — drew a quick response from a man who was concerned about people to go and enjoy the lake over the weekend, but they reiterated their concern.

### GRAND LAKE

Officials discourage swimming in Grand Lake, because of potentially dangerous blue-green algae

Page 3A



*McAlester News: July 3, 2011*



# Blue-Green Algae Bloom

Grand Lake, 2011 (Duck Creek)



# Blue-Green Algae Bloom

Grand Lake, 2011 (Horse Creek)





# Lake Managers Perspective

(Long-Term Economic Benefits and Ecosystems Services)

- How Do We Mitigate/Prevent HAB's



- How Do We Address Active Bloom
  - Health & Public Safety
    - Monitoring
  - Economic/Rec Impacts

*Ada Evening News: July 21, 2011*

## Heat wave fosters toxic algae in touristy lakes

OKLAHOMA CITY (AP) — A prolonged heat wave in the central U.S. has fostered the growth of a dangerous form of algae in lakes and ponds, threatening swimmers and livestock and scaring away tourists during the busy summer season.

Blue-green algae are actually bacteria that produce toxins

harmful to humans and livestock. It flourishes in warm, stagnant, sunlit water, and this year's heat wave combined with Oklahoma's worst drought since the Dust Bowl have created what one water official called a "perfect storm" for its growth. Officials have issued a series of warnings, telling boaters and

swimmers at lakes in northeast Oklahoma, southern Kansas and Nebraska to avoid contact with the toxic gunk. The issue attracted national attention earlier this month when Oklahoma Sen. James Inhofe blamed a respiratory illness on a swim in **Grand Lake** in Ketchum Hollow. The bad publicity has had dire

consequences for some businesses in Oklahoma where tourism is the third largest industry with an estimated annual impact of \$6.2 billion. Oklahoma's numerous lakes are a "huge economic engine" driving that industry, said Leslie Blair, a spokeswoman for the Department of Tourism and Recreation.

Problems on **Grand Lake** have subsided, the **Grand River Dam Authority** said. Advisories remained in effect Wednesday for portions of Keystone, Fort Gibson and Eufaula lakes in Oklahoma, Marion and Big Hill lakes in Kansas, and Willow Creek Lake in northeast Nebraska.

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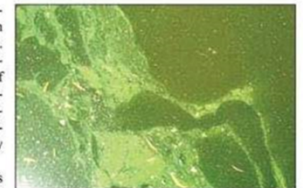
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See, **ALGAE**, page 9



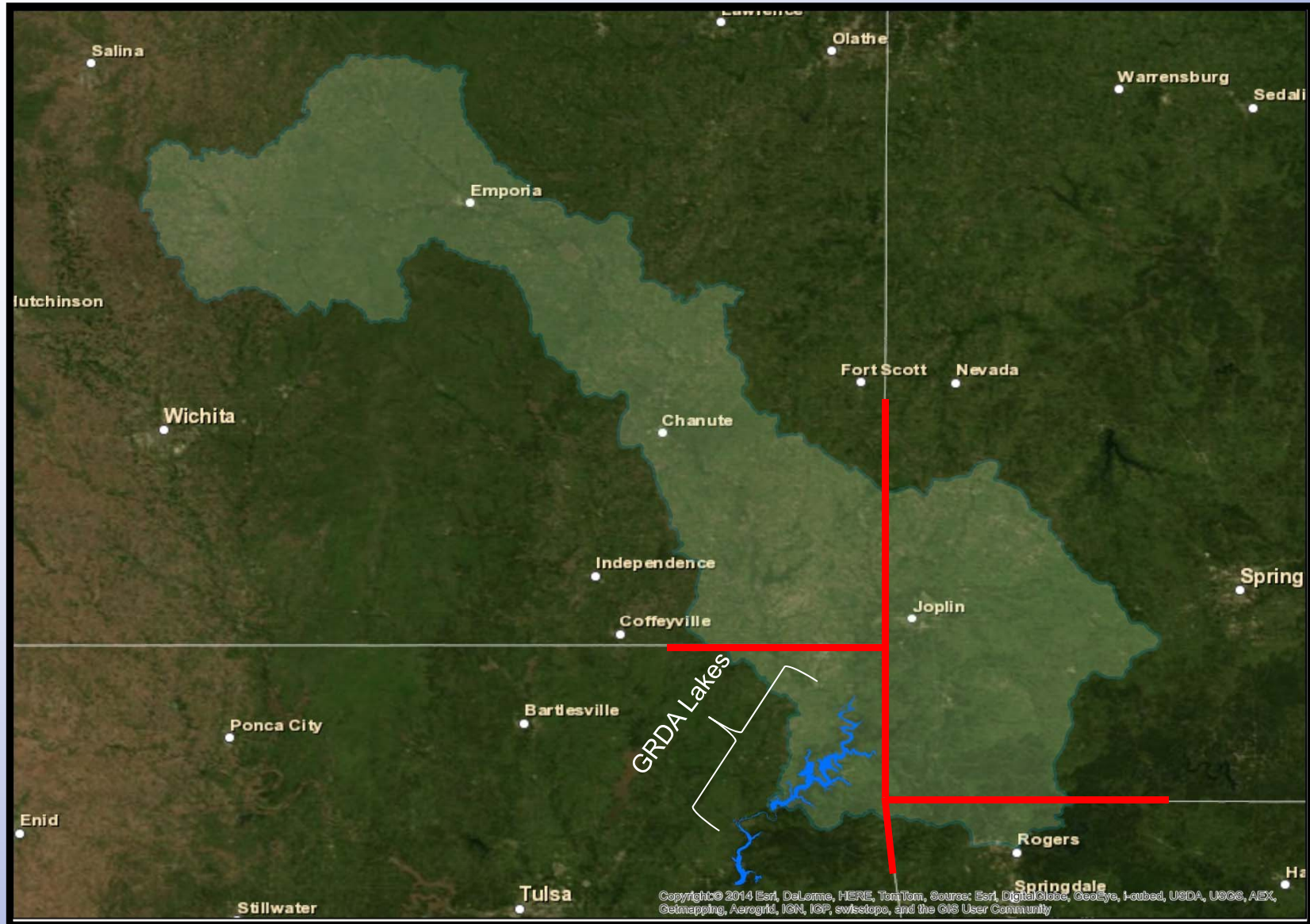
Courtesy Photo

This blue green algae has appeared near Bernice State Park.

*Grove Sun: June 28, 2011*

# Mitigate/Prevent

(Grand Lake Watershed)





# Lake Managers Perspective

(Long-Term Economic Benefits and Ecosystems Services)

- How Do We Mitigate/Prevent HAB's



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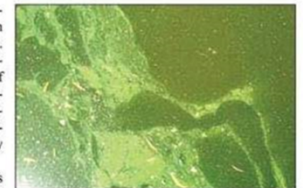
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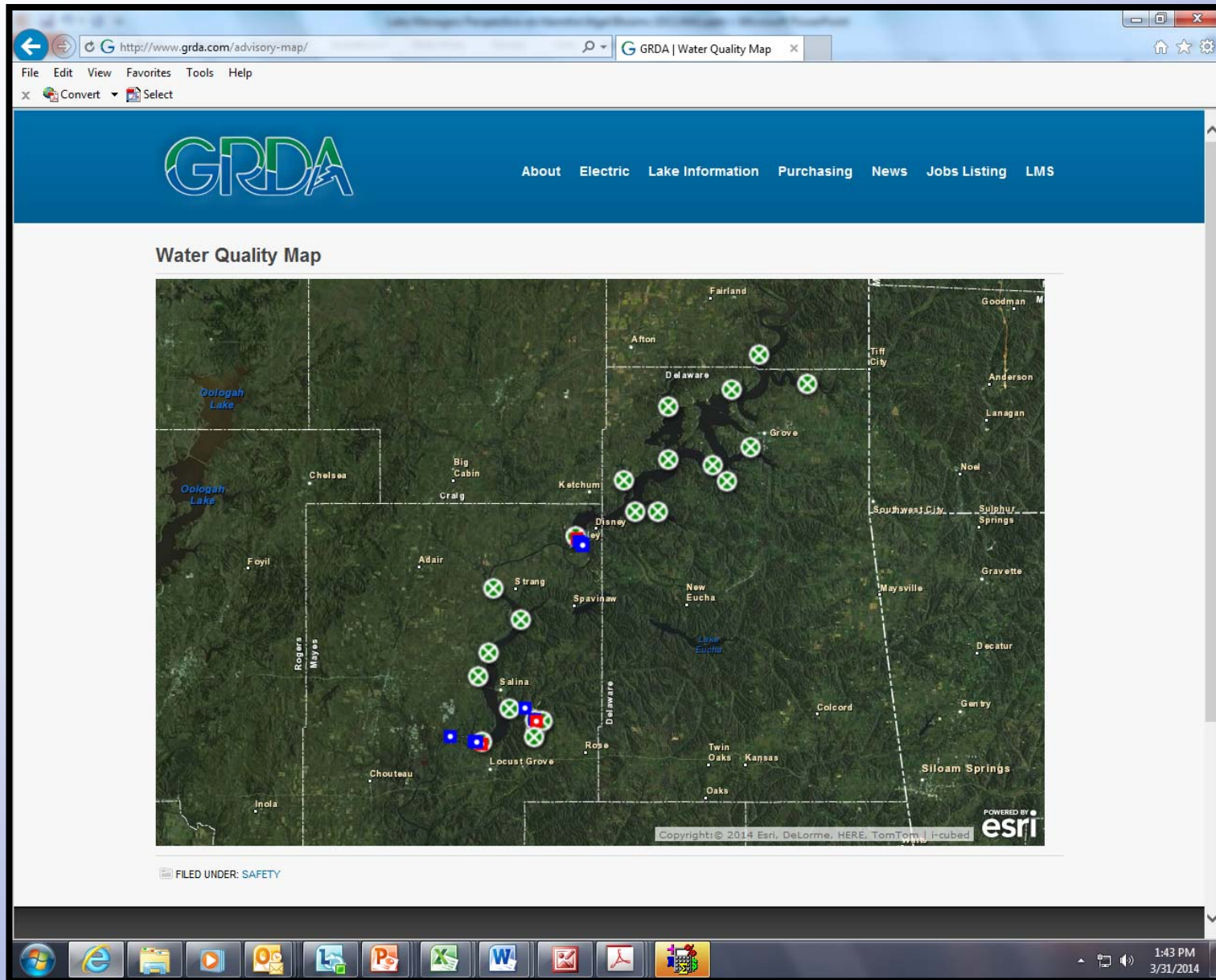


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*Grove Sun: June 28, 2011*

# Monitoring



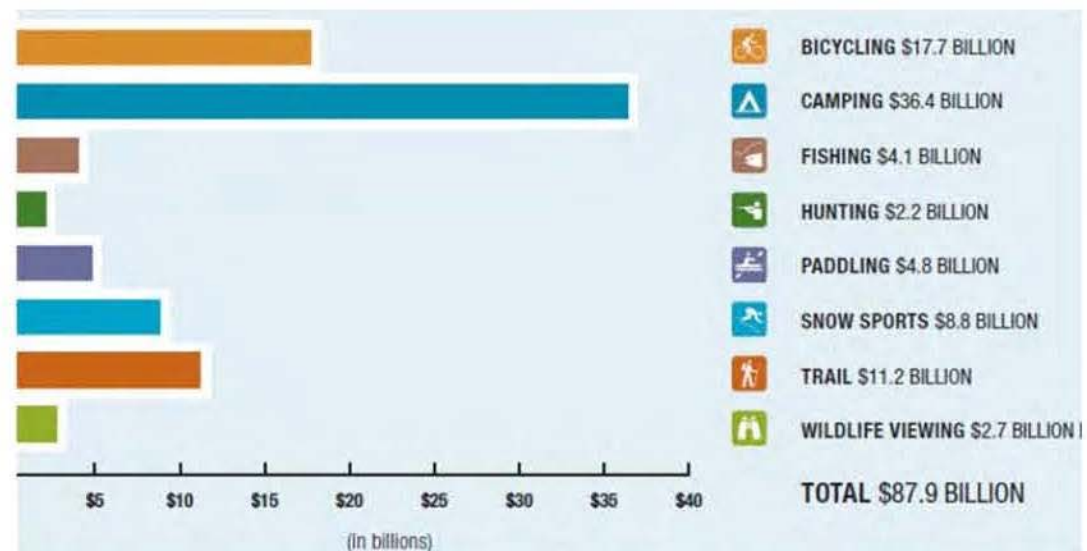


# Recreational Benefits

## Recreation and tourism

Recreation and tourism are billion-dollar industries in the United States. According to the American Sportfishing Association, there are over 30 million anglers in the U.S., generating over one million jobs and over \$45 billion in retail sales annually. Healthy intact ecosystems are essential to the viability of both commercial and recreational fishing. More people in the U.S. fish (30 million) than play golf (24.2 million) or play tennis (10.2 million).

In a 2003 study, the Outdoor Industry Foundation found that the outdoor recreation economy contributed \$730 billion annually to the economy, supported 6.5 million jobs and generated \$88 billion in state and federal tax revenues. Wildlife watchers in The Chesapeake Bay region spend about \$3 billion annually on trip-related expenses and equipment; this estimate does not include job creation and multiplier effects from these activities. Rural areas near forest land and other types of open space often depend on tourist spending to help support their local economies. Outdoor recreation and eco-tourism are large economic forces whose foundation rely on the maintenance of healthy watersheds and the protection of open space.



Federal and state tax revenues generated by recreational activity  
*Outdoor Industry Foundation 2003*

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