

**Project: 3 (Formerly FY 05/6/7 Project 4)**

**Agency:** Oklahoma Water Resources Board

**Title:** Development of a Probability Survey Design for Lakes and Reservoirs

**Description:**

The EPA recently released guidance establishing the Elements of a State Water Monitoring and Assessment Program. This document states that a “State monitoring program will likely integrate several monitoring designs (e.g., fixed station, intensive and screening-level monitoring, rotating basin, judgmental and probability design) to meet the full range of decision needs. The State monitoring design should include probability-based networks (at the watershed or state-level) that support statistically valid inferences about the condition of Oklahoma’s water types, over time. EPA expects the State to use the most efficient combination of monitoring designs to meet its objectives.” Currently, Oklahoma meets these requirements for lakes through the Oklahoma Water Resources Board’s (OWRB) Beneficial Use Monitoring Program (BUMP), through an extensive sampling program, monitoring approximately 130 of the largest reservoirs in Oklahoma quarterly on a bi-annual basis.

BUMP lakes sampling is the backbone of Oklahoma’s Water Quality Assessment Integrated Reporting system for reservoir beneficial use attainment, by sampling reservoirs throughout all 11 level III ecoregions including 4 of the 6 level II ecoregions in Region VI EPA in Oklahoma. Current BUMP reservoir sampling and reporting is a \$400,000 annual program supported solely by state appropriations. Sampled reservoirs range from shallow, wind swept lakes, to deep lakes that are well protected from silt and high dissolved solids, to pH sensitive lakes with low dissolved solids, to turbid clay dominated lakes, and lastly to clear scuba diving type lakes. Although the lake sampling methodology currently covers approximately 87% of the available reservoir surface areas in Oklahoma, these 130 lakes comprise only 1.5% of the total number of reservoirs over 1 hectare in size in the state. This fact highlights one drawback to the current Oklahoma lake sampling scheme: some 9,000 reservoirs between 1 and 80 hectares in size are not sampled by any entity. This large segment of the total population comprises the majority of small municipal reservoirs providing multiple beneficial uses in Oklahoma.

Harmful Algal Blooms (HABs) have recently become another focus for many water quality discussions. Cyanobacteria, also known as Blue Green algae, has properties of both algae and bacteria. These properties allow the algae to become not only an aesthetic problem but a health hazard within a short amount of time. It is unknown how many reservoirs in the state of Oklahoma are affected by algal toxins and how beneficial uses are or may be affected in the future.

The Oklahoma Water Resources Board (OWRB) proposes to implement a demonstration project employing a probabilistic survey approach for assessing lakes and reservoirs in Oklahoma. Oklahoma will perform a state level lakes survey patterned and executed in conjunction with the national lakes survey. Oklahoma has 35 lakes in the national draw requiring the state to pick up only 18 more lakes to complete a state level probabilistic survey. For the purposes of this survey the definition of target population (what is a lake in Oklahoma) methodology of sampling and data interpretation will follow that of the National Survey. One distinct difference this means for the State of Oklahoma is that oxbow (Oklahoma’s natural) lakes will be included in the population as well as smaller lakes or ponds (10 acres is the

minimum size). Other questions such what kinds of algae and algal toxins are present within the reservoir should and will be addressed during this survey.

Execution of both sample regimes would cost more than either EPA or the State of Oklahoma could fund independently. The OWRB's intent is to integrate the proposed probabilistic sampling initiative into the current state sampling regime. Here grant monies would be used to conduct probabilistic sampling activities on lakes where sampling is not currently occurring while state monies would be used to integrate probability based monitoring into the existing state sampling program of larger Oklahoma reservoirs. These actions will allow a far greater level of sampling to occur without a concomitant increase in costs to the proposed probabilistic sampling program.

BUMP Lakes comprise the bulk of the water resources in Oklahoma used for recreational (primary body contact and fishing) and water supply purposes. A probabilistic monitoring program would enhance the current program by not only assessing the top 130 largest reservoirs but also assessing smaller high use reservoirs across the state that have never been monitored. These data collected on a statewide basis covering all regions of the state and trophic conditions provides a solid data set to initiate the development of biocriteria for lakes.

| <b>Tasks</b> | <b>Due Date</b> |
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|--------------|-----------------|

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|----------------------------------|--|
| <b>1. QAPP and Survey Design</b> |  |
|----------------------------------|--|

Survey design will extend the Oklahoma lakes draw for the National Lakes Survey to meet the minimum 50 lakes. This number represents a relatively high confidence for assessing the quality of Oklahoma's lakes, reservoirs and ponds and includes the range of trophic levels from oligo- to hyper-eutrophic. Survey design will also include reconnaissance of all sample lakes (including the 35 lakes in the National Lakes Survey) to ensure that all sites fall within the sampling guidelines. Oklahoma will concur and follow the finalized QAPP developed for the National Lakes Probabilistic Survey with an addendum to note deviations. Oklahoma's survey will not include macroinvertebrate benthos and sediment diatom analysis (two parameters included in the National Lakes Survey).

Time Frame: November 2006 – March 2007

Cost: \$40,256.00 Federal

November – June Cost: \$40,256.00

July – September Cost: None

**Deliverable:** Approved National Survey QAPP

|  |  |
|--|--|
| <b>2. Implementation with State Partners</b> |  |
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The Oklahoma Water Resources Board (OWRB) proposes to complete a probabilistic survey for assessing lakes and reservoirs in Oklahoma. Sampling will be coordinated with the OWRB's BUMP lakes program to increase efficiency and avoid duplication.

Time Frame: March 2007 – September 2007

Cost: \$102,904.00 Federal

January – June Cost: \$32,273.00

July – September Cost: \$70,631.00

**Deliverable:** None

|                            |  |
|----------------------------|--|
| <b>3. Analysis of Data</b> |  |
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Probabilistic data analysis will utilize recommendations from the USEPA's Corvallis Research Lab and those of the National Lakes Survey Steering Committee. For this sampling round, trophic state will be the primary measure of lake health. Supporting measures will include algae and algal toxin identification, along with nutrient (nitrogen and phosphorus series) measures. Physical measures such as Secchi disk depth,

turbidity, and multi-probe (oxygen, pH, etc.) will also be taken. Although initial sampling will not meet Oklahoma Water Quality Standards' USAP requirements, overlap with previously assessed lakes will allow this evaluation the ability to agree with USAP conclusions based on one-time summer sampling events.

Time Frame: June 2007 – December 2007

Cost: \$26,640 Federal

January – June Cost: \$8,880

July – December Cost: \$17,760

**Deliverable:** None

**4. Draft Final Document**

Project results and conclusions will be compiled into a final report. Future steps to address beneficial use assessments for small waterbodies in Oklahoma will be outlined. The report will focus on parameters that are most frequently used when reporting on Oklahoma's waters. These parameters include but are not limited to chlorophyll-a, dissolved oxygen, nitrogen, pH, and total phosphorus.

Time Frame: November 2007 – March 2008

Cost: \$100.00 Federal

November 2006 – September 2007 Cost: None

November 2007 – March 2008 Cost: \$100.00

**Deliverable:** Draft Final Document for Review

**Milestone Schedule and Cost Estimate Itemized by State Fiscal Year**

| <u>Milestone</u>                              | <u>Due Date</u> | <u>Cost Estimate</u> |           |
|---|-----------------|----------------------|-----------|
|   |                 | FY07                 | FY08      |
| 1. Planning and Coordination of Survey Design | Sep-07          | \$ 40,256            | \$ -      |
| 2. Implementation                             | Sep-07          | \$ 32,273            | \$ 70,631 |
| 3. Analysis of Data                           | Dec-07          | \$ 8,880             | \$ 17,760 |
| 4. Draft Final Document                       | Mar-08          | \$ -                 | \$ 100    |
|   |                 | \$ 81,409            | \$ 88,491 |

**Outcomes:**

Establish methodology for lakes probabilistic sampling in Oklahoma to enhance current statewide 305(b) reporting:

- Demonstrate the efficacy of probabilistic lakes assessment in Oklahoma
- Produce a statistically based trophic state assessment in Oklahoma
- Provide a probabilistic assessment of risk to Oklahoman's from HABs
- Provide a step toward satisfying Sub-objective 2.2.1 (improve water quality monitoring) of EPA's Strategic Plan under the objective 2.2; Protecting Water Quality

Specifically address recommendations made by Region VI EPA in their draft evaluation of Oklahoma's Water Quality Monitoring and Assessment Strategy – Fiscal Year 2005:

- Element 1– re-evaluate use of section 106 funding to implement missing monitoring components
- Element 3 – Continue efforts to integrate monitoring designs for small reservoirs
- Element 10 – To the extent possible address emerging environmental issues like harmful algal blooms

**Budget:**

Total Project: \$169,900

Spent from FY 07 grant (I-006400-05): \$72,626

**FY 08 Budget**

| <b>STATE PROJECT BUDGET</b>   |                    |                              |
|---|--------------------|------------------------------|
| <b>Personnel</b>  | <b>Person Yrs.</b> | <b>FY08</b>                  |
| Environmental Programs Specialist II  | 0.31               | 4,325                        |
| Environmental Programs Specialist I   | 0.70               | 10,748                       |
| Carl Albert Executive Fellow  | 0.43               | 4,781                        |
| <b>Total Person Years =</b>   | <b>1.44</b>        | <b>Sub-total = \$ 19,854</b> |
| <b>Benefits</b>   |                    |                              |
| 56.68% of Salary for Fringe Benefits  |                    | \$ 11,253                    |
| 71.18% of Salary for Indirect Costs   |                    | \$ 14,132                    |
|   |                    | <b>Sub-total= \$ 25,385</b>  |
| <b>Lodging &amp; Per Diem</b>   |                    |                              |
| Travel & Per Diem (Per State Travel Act)  |                    | \$ 6,422                     |
| <b>Other - EPA Contract Lab Services (18 sites)</b>   |                    | \$ 36,000                    |
| <small>*Lab Analysis <u>not</u> included: Sediment Diatom Analysis and Macroinvert ID</small> |                    |                              |
| <b>Equipment</b>  |                    |                              |
| Water Quality Monitoring Field Equipment  |                    | \$ 8,232                     |
| Equipment Rental  |                    |                              |
|   |                    | <b>Sub-total= \$ 8,232</b>   |
| <b>Supplies</b>   |                    |                              |
| Project Supplies and Materials  |                    | \$ 1,381                     |
| Equipment Maintenance   |                    |                              |
| Report Costs, Data Management & Printing Costs  |                    |                              |
|   |                    | <b>Sub-total= \$ 1,381</b>   |
| <b>TOTAL PROJECT COSTS = \$ 97,274</b>  |                    |                              |