WATERSHED RESTORATION ACTION STRATEGY (WRAS)

FOR THE GRAND LAKE WATERSHED

Prepared By:

Oklahoma Conservation Commission

INTRODUCTION:

In keeping with the 1998 mandates of the *Clean Water Action Plan* (CWAP), which establishes goals and implementation schedules for numerous strategies dealing with pollution sources, states are required to develop a *Unified Watershed Assessment* (UWA) strategy. Oklahoma's UWA is a document that was developed and will be implemented based on directives of the state's UWA Working Group. The UWA Working Group is made up of Oklahoma State, Federal, and local environmental agencies. The UWA process is intended to focus the efforts of various agencies to work more cooperatively on the most significantly impaired watersheds in the state. Through the UWA process, the Working Group identified several Category I watersheds in Oklahoma that are recognized as significantly impaired and in need of immediate federal and state funding to target restoration activities. The Grand Lake Watershed was one of these high priority watersheds.

Following the requirements of the CWAP, a *Watershed Restoration Action Strategy* (WRAS) must be developed for each of the priority watersheds. This *Watershed Restoration Action Strategy for the Grand Lake Watershed* will summarize the efforts necessary and mechanisms by which restoration and protection activities will be pursued in the Grand Lake Watershed.

Grand Lake is an exceptional case due to the fact that the Watershed includes portions of four states. Streams and rivers in the watershed are listed on the 303(d) lists of three of those states. Because of the watershed's spread into four different political boundaries and between two different EPA regions, coordination of restoration activities is challenging.

Grand Lake's designated beneficial uses include public and private water supply, warm water aquatic community, agriculture, municipal and industrial uses, hydroelectric power generation, primary body contact recreation, and aesthetics. The reservoir supports a substantial tourist industry and is one of the few in Oklahoma where landowners can have waterfront homes. The Grand Lake basin encompasses portions of Arkansas, Kansas, Missouri, and Oklahoma, draining a total area of 10,298 square miles. Three major rivers, the Neosho River, the Spring River, and the Elk River drain into the lake. The lake itself covers 46,500 surface acres and holds 1,672,000 acre-feet of water. Recently, concerns have arisen that changing land uses within the Grand Lake basin may be contributing to decreased water quality within the basin. In nearby areas of the state, runoff from areas with high concentrations of confined animal operations have been shown to contribute significant quantities of nutrients to receiving streams. Nutrient loading in these streams has reduced their quality as well as that of downstream reservoirs.

A 1995 Oklahoma State University and Oklahoma Water Resources Board (OWRB) Clean Lake Study showed the lake was eutrophic and experiencing nuisance algal blooms in certain areas. The Clean Lakes Study also showed metals contamination in sediments in the upper end of the lake; however, toxic levels were not shown to be released from the sediment under typical lake conditions. Various studies have indicated biological, chemical, and habitat degradation within different parts of the Grand Lake Watershed. Sixteen

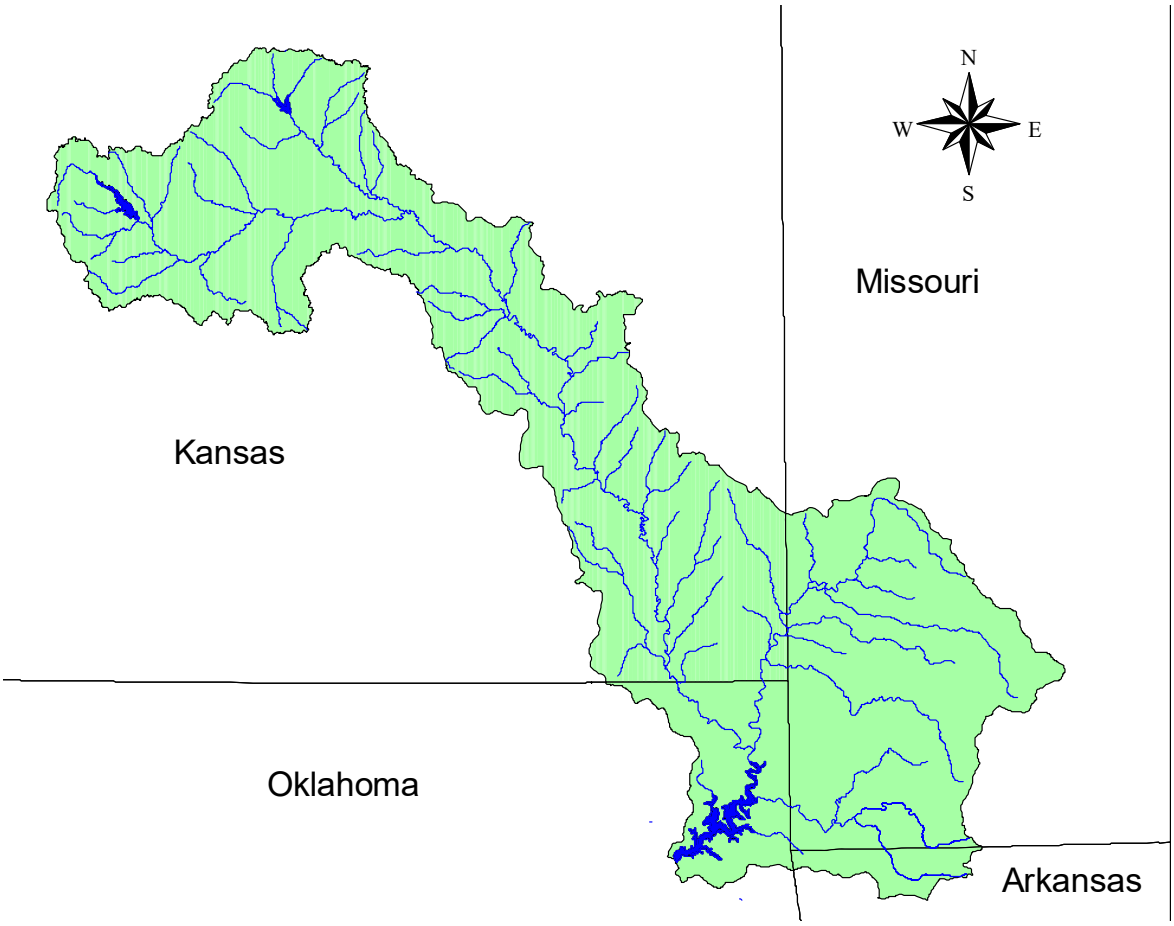


Figure 1. Grand Lake Watershed.

segments associated with Grand Lake and its watershed are listed as Category V Waters (impaired and in need of a TMDL) in Oklahoma's 2002 Integrated Report as being impaired by low dissolved oxygen, cause unknown, chloride, lead, pathogens, pH, sulfates, TDS, and turbidity. Eighty segments in the Grand Lake Basin are listed on the 1998 Kansas 303(d) list as being impaired by low dissolved oxygen, eutrophication, pH, siltation, fecal coliform, cadmium, hydro (insufficient flows, insufficient inflows, surface areas chronically below planned pool levels, and inadequate volume and depth, which impact designated uses), zinc, ammonia, selenium, chlordane, sulfate, lead, metals, copper, and organic enrichment. Twenty segments in the Grand Lake Basin are listed on the Missouri 1998 303(d) list as being impaired by zinc, nutrients, BOD, fecal coliform, algae, sediment, ammonia, and suspended solids. One segment is listed on the Arkansas 1998 303(d) list for heavy metals.

Considerable efforts have been made to identify the causes and extent of water quality threats and impairments in the basin and extensive work is planned towards identification of sources and remedial efforts for the near future. Previous efforts include studies of the reservoir and watershed conducted by the Kansas Department of Health and Environment

(KDHE), the Missouri Department of Natural Resources (MDNR), Oklahoma Conservation Commission (OCC), the Oklahoma Department of Environmental Quality (ODEQ), Oklahoma Water Resources Board (OWRB), the U.S. Army Corps of Engineers (USACE), the U.S. Fish and Wildlife Service (USFWS), and the U.S. Geological Survey (USGS), among others. These studies identified the causes, extent, and some of the sources of water quality impairment in the watershed. Additional work includes volunteer and education programs developed by the OWRB, the Grand Lake Association, the Missouri Department of Natural Resources (MDNR),_____, and the Oklahoma Conservation Commission (OCC), and various programs to reduce nonpoint source loading from various sources in the watershed. More work is needed to characterize extent and magnitude of the sources. Much of this work will be accomplished through the development of Total Maximum Daily Loads (TMDL) for the watershed, due to be completed in 200X. These programs are incorporated into the framework of the WRAS for the Grand Lake Watershed.

In 2003, the Oklahoma legislature amended Senate Bill 408 with a mandate to the Secretary of Environment (OSE) to direct a comprehensive study of the Grand Lake Watershed to identify factors that may impact the economic growth and environmental beneficial use of the lake and its tributaries for the existing area residents and the expected population growth of the area. OSE must, with the assistance of numerous State agencies, prepare a report detailing agency rules and policies affecting the watershed; population densities, growth, and economic viability within the watershed; identifying quantities of natural and introduced contaminants in the watershed that currently or in the future effect beneficial use support; and provide a clean lake study and bathymetric map of the lake. In addition, OSE may appoint a subcommittee of interested stakeholders to assist in the completion of the study. The efforts devoted to and results develop from this study will be incorporated into the WRAS and vice versa.

The WRAS for the Grand Lake Watershed has been developed as a dynamic document that will be revised, when necessary, to incorporate the latest information, address new strategies, and define new partnerships between watershed shareholders following this initial documentation. Also, it is understood that the water quality goals set forth in this WRAS, as well as the technical approach to address the goals, may not be comprehensive and it may be necessary to revise or expand them in the future.

Federal and state funding allocations for future water quality projects designed to address the Grand Lake Watershed problems should not be based solely upon their inclusion in this WRAS, rather the WRAS should be considered a focal point for initial planning and strategy development.

In order for this WRAS to become an integral part of the entire watershed restoration program, it must be amenable to revision and update. It is anticipated that at least biannual revisions may be necessary, and that the responsibility for such revisions will rest primarily with the OCC with support from the Office of the Secretary of the Environment (OSE) and the UWA Working Group.

The following six items are based upon EPA Guidance and have been designated by OSE as the essential components of each WRAS.

I. PUBLIC OUTREACH:

This section identifies agencies and organizations responsible for the development of the WRAS and implementation of the public outreach components. The main groups responsible for public outreach activities in the watershed include the local conservation districts, the Natural Resources Conservation Service (NRCS), Oklahoma Cooperative Extension Service, the Oklahoma Conservation Commission, (*Kansas Agency(ies)*) *(Arkansas Agency(ies))*, and *(Missouri Agency(ies)).* Additional agencies such as the Oklahoma Water Resources Board (OWRB), the Oklahoma Department of Environmental Quality (ODEQ), Oklahoma Department of Agriculture, Food, and Forestry (ODAFF), the Oklahoma Corporation Commission (Corp. Comm.), and groups such as the Farm Bureau, the Farmers' Union, and the Wildlife Federation (*Arkansas, Missouri, and Kansas groups here*) also contribute to public outreach efforts associated with their programs.

Public outreach efforts will need to be extended in order to reach the water quality goals of restoring beneficial use support and attaining water quality standards in the watershed. The Conservation Districts, partnered with the NRCS, are among the primary agencies responsible for public outreach in the watershed. The districts and NRCS work one-on-one with citizens of the watershed to reduce pollution and educate about the importance of protecting water resources. The districts and NRCS also organize or participate in seminars, training sessions, and meetings to interact with local people and provide technical assistance and information.

The Grand Lake Association, partnered with the OWRB, has supported an Oklahoma Water Watch citizen monitoring group since 1993. In addition to monitoring water quality on the lake and some of its tributaries, the group conducts litter clean up programs, acts as a "watch-dog" for other types of pollution, and works to educate citizens of Grand Lake concerning water quality. The group has collected more than 10,000 data points since 1993 with more than 90 volunteers. Their monitoring program has collected information at more than 90 sites, 48 of which are currently active.

(Paragraphs about Missouri, Kansas, and Arkansas public outreach efforts)

The Arkansas Watershed Advisory Group assists interested citizens and organizations by promoting local voluntary approaches to watershed management and conservation. Arkansas Watershed Planning Guide is due out Summer 2003. Through grants, the Group has helped coordinate watershed awareness events, TMDL workshops, assisted in forming citizen-based watershed groups statewide and hosted a statewide watershed conference.

The Friends of Big Sugar Creek is a Missouri-based Volunteer Monitoring Group that monitors water quality of Big Sugar Creek in the Elk River Watershed. The purpose of their efforts is to bring awareness of the effects of nonpoint source pollution related to factory farming in the area.

The Missouri Watershed Information Network (MoWIN) is a partnership of state and federal agencies, non-governmental organizations, business, industry, citizen-based watershed groups, local government and natural resources interest groups, working together to assist citizens in locating and accessing watershed information for Missouri watersheds. In 2002, MoWIN Staff and Partners were directly involved in grassroots activities in a series of sixteen watershed Information Workshops across Missouri. Approximately 300 participants from various entities participated, over 40 individuals volunteered time and effort to plan, design and present various water and watershed-related topics. The original goal of 8 workshops was exceeded. MoWIN Staff held additional workshops for science teachers at the Missouri Environmental Education Conference, USDA Rural Development staff and 319 Nonpoint Source Pollution grant applicants. MoWIN staff participated in state, regional, national and international conference presentations to inform and educate citizens about water and the environment.

The Oklahoma Cooperative Extension Service (OCES) is another leader in promoting water quality education efforts in the State, working closely with the ODAFF, conservation districts and the NRCS to promote water quality awareness. The OCES provides one-on-one meetings and education with landowners along with group presentations and other forms of technical assistance to improve awareness in the watershed. The OCES also holds public meetings and workshops to educate landowners on topics such as pesticide and fertilizer management, animal waste issues, and general Best Management Practices (BMPs).

Youth education is another significant effort pursued by OCES, NRCS, conservation districts, the OCC, and OWRB. Most youth education activities focus on general water quality maintenance and improvement and include activities such as 4-H group water quality monitoring and education, “Earth-Day-Every-Day” activities fair where hundreds elementary school children and some of their parents are exposed to environmental education, and various other training sessions.

Newspaper articles and other media are a method that can be used to inform citizens of the watershed about programs focused on water quality. The Grand Lake Association, OCES, Conservation Districts, and NRCS often contribute articles that were released to local papers, covering a wide range of topics related to water quality, and more specifically, advertising education events and programs. Many articles serve as promotions for various upcoming trainings or other events. Other media related activities such as radio spots and logo contests can be used to further the efforts of the program. However, in using media and advertising in education programs, efforts must focus on measureable results. An information article about water quality is not enough; the article must be associated with some additional effort that is likely to change behaviors. Information alone doesn’t often change people’s behaviors; people must be persuaded to change their behavior. Persuasion is more likely to occur as part of a program of repeated contact and interaction than as the result of a well-written article in a newspaper.

Because a significant amount of the water quality problems in the watershed are due to the effects of nonpoint source pollution, the OCC (as Oklahoma=s technical lead nonpoint source agency) will work through the Delaware, Ottawa, Mayes, and Craig County Conservation Districts to sustain the public outreach program throughout the Oklahoma portion of watershed. Also integral in the Oklahoma portion of this program will be the interaction of the Watershed Advisory Group (WAG), assembled by the conservation districts. The WAG will be made up of local shareholders in the watershed (including private citizens, representatives of local industries, and local government) who will help direct the program based on information supplied to them by technical agencies and their knowledge of the needs of the watershed residents. The WAG is developed to help insure that the program most effectively works towards reducing water quality impacts, but at the same time, meets the needs of and is acceptable to the local producers and other land owners.

Current outreach programs in the watershed will need to expand and perhaps partially redirect their public outreach efforts to work towards more measurable results. Although current education efforts are valuable programs, efforts may need to be expanded to insure that the target audience is being reached. The target audience will need to include people whose change of behaviors could have the most substantial benefits to water quality. In other words, the target audience in the Grand Lake Watershed should include people such as county commissioners and road maintenance crews, agricultural producers, lakefront property owners, and people in the poultry industry, among others. Existing and planned outreach programs will need to coordinate among themselves and with other ongoing efforts in the watershed in order to educate more watershed citizens and more importantly, change behaviors of land users in the watershed.

A. WRAS DEVELOPMENT:

Several organizations have been actively involved in development of the WRAS for the Grand Lake Watershed protection program. The role of each is described below:

1. Oklahoma Unified Watershed Assessment Working Group (UWA-WG)

This statewide working group was established by the OSE to facilitate implementation of the EPA Clean Water Action Plan and other state water quality programs, particularly with respect to non-point sources and TMDLs. The UWA-WG is providing technical support and leadership in development of all WRAS programs in the state. The UWA-WG and OSE conduct meetings, set WRAS development schedules, and assist with WRAS development guidance. Currently, NRCS has committed to updating the UWA for Oklahoma based on the 2002 Integrated Report.

2. Oklahoma Conservation Commission (OCC)

The OCC is the primary agency responsible for development of the WRAS for the Grand Lake Watershed. The draft WRAS will be forwarded for peer review to project cooperators

from Kansas, Missouri, and Arkansas and to members of the Oklahoma=s Nonpoint Source Working Group to insure its consistency with other agency programs. The OCC staff is coordinating the development of many of the WRAS documents for Oklahoma and will insure that all document formats are consistent and that all items are adequately addressed.

3. Oklahoma Office of the Secretary of Environment (OSE)-

The Office of the Secretary Environment plays a pivotal role in coordinating the activities of environmental agencies and programs in the State of Oklahoma. In addition to the work they performed under the direction of Senate Bill 408 (discussed later in the document), OSE helped solicit input on the WRAS from the other State agencies to better summarize historical, ongoing, and planned activities in the watershed.

4. *Kansas Agency(ies)/groups*

5. *Missouri Agency(ies)/groups*

6. *Arkansas Agency(ies)/groups*

B. WRAS IMPLEMENTATION:

The success of water quality protection programs in the Grand Lake Watershed depends on the approval and cooperation of the local landowners and various government agencies in each of the four states. Each State will likely have a different mechanism to insure implementation of restoration activities. Although each State will utilize a different mechanism, they all work towards a common goal, restoration of beneficial use support and protection of water resources in the Grand Lake Watershed.

In Oklahoma, the Watershed Advisory Group (WAG) (or similar body) should be the primary mechanism through which this is accomplished and its composition should be developed to insure the success of this function. A WAG is a group made up of local stakeholders who represent the local interests in the watershed. Potential WAG members for the Grand Lake WAG would include agricultural producers, county commissioners, municipal representatives, Conservation District representatives, representatives of recreational interests, mining industry representatives, etc. The WAG will be one of the primary mechanisms to accomplish public outreach in the Grand Lake Watershed. These efforts will be supplemented substantially through the activities of the Conservation Districts, NRCS, OWRB, and the OCC. In addition, other state and federal programs provide public involvement and education that will complement these efforts.

In Kansas….

In Missouri….

In Arkansas…

It may be beneficial for a WAG to be developed with representatives from stakeholders in all four states. One difficulty in assembling such a group would be in finding willing volunteers from the different states with the time to travel to a centralized location necessary to conduct the meetings.

A number of studies have been completed that focused on identifying the causes and extent of water quality impairments in the Grand Lake Watershed. Some of these studies also included efforts to identify sources of pollution. The data from these studies is being incorporated by agencies in the different states into numerous TMDLs to set target goals for reduction necessary to improve water quality in various portions of the watershed. These goals will address both point source and nonpoint source reductions. These TMDLs should also help suggest types of nonpoint sources (such as overgrazed wheat pasture or county road erosion) that are the most significant sources of the problem.

Considerable work will soon begin in Oklahoma through public outreach and implementation efforts to address the water quality and related concerns in the watershed. Projects are pending and ongoing to educate and to reduce pollution impacts to the resource. These efforts include education programs led by the Grand Lake Association, Conservation Districts, NRCS, OWRB, OCC, ODAFF, implementation of BMPs through participation in cost-share programs, permit upgrades and reallocation of various point source discharges in the watershed, and numerous efforts by other groups to reduce water quality impacts. These education and implementation efforts will be adapted as necessary, following the completion of the TMDL for Grand Lake, to work towards the goal of the TMDL.

Most efforts to date in Oklahoma have focused on development of reliable data to assess the extent and cause of water quality-related problems in the watershed. New Public Outreach will focus more on stakeholder participation in implementation of BMPs throughout the watershed to reduce nutrient loadings and other water quality problems in the watershed.

Many local efforts, as well as state and federal agencies and other organizations, are collectively contributing to the Public Outreach efforts in the Grand Lake Watershed. The roles of these groups and programs are summarized below:

<u>Oklahoma Implementation Efforts</u>

1. Delaware, Ottawa, Mayes, and Craig County Conservation Districts

These agencies are critical to ensuring participation of local landowners in water quality improvement programs. Local Conservation Districts and local NRCS offices are generally the most effective means to bring a large federal or state program to private citizens because the local agencies know the local people. Local agencies often have the most accurate knowledge concerning current land management practices and local needs. In

addition, these agencies have existing programs and mechanisms directed towards the goals of the goals of the WRAS.

2. Total Maximum Daily Loads (TMDLs)

   The ODEQ is developing TMDLs to protect the Grand Lake Watershed and Grand Lake. The TMDLs will set limits on the permissible nutrient, metals, sediment, priority organics, and pesticide loads to the lake and help determine the necessary loading reductions to be contributed by point sources and nonpoint sources. Success of the TMDLs will require that both mandatory and recommended practices be implemented to achieve identified reductions. .

   The ODEQ has established a Water Quality Office in Grove, Oklahoma. Activities in the Grand Lake Watershed are the primary function of this office. Through this office and their Oklahoma City office, ODEQ is cooperating with various agencies to conduct additional monitoring necessary to complete the TMDLs for the Grand Lake Watershed.

3. Watershed Advisory Group (WAG)-

   The Grand Lake WAG will provide essential guidance towards the direction of the project- a locally-led effort to solve local problems. The purpose of the WAG is to give guidance to the 319 program that the OCC will implement in the Grand Lake Watershed. The OCC 319 program is a demonstration and implementation project that will give landowners the opportunity to implement BMPs to protect water quality. The WAG will also put into place an educational program that will take the "show and tell" approach to the public in the entire watershed. The WAG is made up of representative watershed stakeholders including various industries, civic groups, landowners, etc.

   Senate Bill 408 suggests that the Secretary of Environment may establish a local advisory group to assist in the completion of this study. This group could function as the WAG for future implementation efforts, although some changes in group structure might be necessary.

4. The Oklahoma Conservation Commission (OCC)

   Due to Grand Lake's status as a priority watershed, the OCC will devote substantial monies towards a program to educate citizens and implement best management practices to reduce nonpoint source pollution in the watershed. A portion of these funds will support the WAG, a portion will be devoted to monitoring the success of the program, and another portion will be devoted towards education, but the majority of the funds will provide cost-share assistance to landowners to implement WAG-recommended and OCC approved best management practices to protect the water resources of the watershed. The OCC=s main function will be to provide oversight for successful completion of the program. To do this, they will provide technical guidance and final approval to the WAG and local conservation districts for implementation of the BMPs. The OCC will implement an education program targeted towards citizens of the watershed who's change in behavior could have the most

substantial impacts on water quality. The OCC will also be responsible for monitoring the success and providing administrative support for the project. The Abandoned Mine Land Program (AML) of the Oklahoma Conservation Commission has also been participating in efforts to address environmental and public health issues related to the Tar Creek Superfund site. AML will focus federal monies in the watershed to reduce the impacts of the historical mining industry in the watershed.

5. NRCS Local Offices

   The United States Department of Agriculture Natural Resource Conservation Service (USDA/NRCS) in Oklahoma has several programs active or that could be expanded in the Grand Lake Watershed. These programs include the Environmental Quality Incentives Program (EQIP), Conservation Reserve Program (CRP), Wildlife Habitat Incentives Program (WHIP), and the Wetlands Reserve Program (WRP). These programs are employed by the NRCS to help landowners protect natural resources.

6. Oklahoma Corporation Commission (Corp. Comm.)

   Corp. Comm., as the state agency with jurisdiction over oil and gas mining activities, has ongoing efforts in the watershed to identify and reduce impacts from oil and gas activities. These include efforts to identify location and severity of erosion, salt, and oil seeps related to well sites and pipelines, followed by cleanup by the operators and pipeline companies. .Corp. Comm. also restricts certain oil and gas related activities within sensitive areas. For example, salt water injection wells are not permitted within a well-head protection area.

7. Oklahoma Department of Agriculture, Food, and Forestry-

   The Oklahoma Department of Agriculture, Food, and Forestry (ODAFF) is the state agency with jurisdiction over Confined Animal Feeding Operations. In Poultry-producing areas of the State (such as Grand Lake), ODAFF licenses the Poultry Feeding operations (PFOs) and Poultry Litter Applicators who land apply poultry waste. ODAFF maintains a database of PFO activities, litter application rates and locations and conducts annual inspections of these activities. ODAFF collects soil samples in the area for soil Phosphorus Index (STP) analyses in order to determine whether litter can be applied in certain areas. ODAFF's Forestry Office in Jay, Oklahoma provides technical assistance such as forest management, tree planting, and wildlife habitat improvements to landowners in the area.
8. other Oklahoma agencies as appropriate…

<u>Missouri Implementation Efforts</u>

<u>Kansas Implementation Efforts</u>

1. Total Maximum Daily Loads

   The Kansas Department of Health and Environment has completed over 60 TMDLs in

the Neosho River Watershed and is preparing to complete TMDLs in the Spring River Watershed.

Arkansas Implementation Efforts

II. MONITORING / EVALUATION ACTIVITIES:

This section describes the water quality goals and expected outcomes for the watershed. All monitoring and data collection will be done according to formal quality assurance planning. All data used to evaluate the effectiveness of the implementation efforts will be collected under EPA-approved Quality Assurance Project Plans.

In Oklahoma, all watershed activities will have detailed budget information provided to OCC and the WAG, and all project outputs and milestones will be submitted to EPA. The OCC will maintain a database of OCC data that will be used to track the progress of all watershed activities, including fund allocations and sources, milestones, and accomplishments. The OCC will prepare periodic summaries of this database for management and make project information available to the public, to all work groups, and to government agencies and private companies, as requested. The Office of the Secretary of the Environment will oversee coordination of the various monitoring efforts ongoing in the basin.

In Kansas…

In Missouri…

In Arkansas…

A. GOALS AND OUTCOMES:

The following Goals (in no specific order of importance) have been established for the Grand Lake Watershed Program. These goals are directed at preserving and protecting not only the beneficial uses of the water resources, but at protecting the value of the resource as a whole, including natural, cultural, and socioeconomic resources. Many of these goals have already been met or are presently being addressed by multiple agencies and interest groups.

1. Establish ***Data Quality Objectives*** and draft ***Quality Assurance Project Plans*** for all monitoring efforts.

2. Reduce ***non-point source nutrient loadings*** to the Grand Lake Watershed by supporting and implementing appropriate nutrient and sediment management strategies and Public Outreach initiatives.

3. Develop the necessary ***TMDLs*** for Grand Lake Watershed based upon results from current

water quality studies, and recommend implementation strategies after completion of the TMDLs.

4. Modify ***municipal NPDES permit allocations***, as necessary.
5. Monitor, and enforce regulations, as necessary, the activities of **Poultry Feeding Operations** and Litter Spreading Operators in the Watershed.

5. ***Coordinate monitoring efforts*** in the basin to better meet the needs of all water quality agencies and maximize quantity and quality of data that can be obtained in the watershed.

6. Support collection of ***soils and land use data*** for use with water quality assessments and development of Nutrient Management and Farm Plans.

7. Create a ***common database*** for all water quality data and other information, provide backup to all databases, and link all data geospatially into a GIS system.

8. Establish a water quality ***Trend Monitoring Program*** after completion of intensive studies.

9. Develop a ***Comprehensive Watershed Based Plan*** or other similar watershed planning tool (e.g. WRAS) to establish water quality improvement goals, schedules, activities, milestones, outputs, funding and resource options, participants, and education goals.

10. In Oklahoma, establish a ***Watershed Advisory Group*** to advise on which BMPs, regulatory efforts, and public outreach/education will most effectively reduce NPS pollution in the watershed, and provide other directives to facilitate cost-share-assisted programs. The WAG should consist of members representing different NPS interests in the watershed such as interests such as each of the Conservation Districts, local agriculture, local municipalities, the Master Conservancy District, County Commissioners, tribes, and other entities.

11. Implement ***Best Management Practices*** (BMPs) and other Point Source and Non-Point Source control strategies to control nutrients and reduce erosion in the watershed and reduce delivery to Grand Lake.

12. Implement an effective ***Riparian Management Plan*** to develop, manage, and protect riparian zones in the watershed that function as nutrient filters and reduce streambank erosion. This plan will include efforts to minimize impacts of development and construction in the floodplain, promote riparian buffer development and protection, and evaluate streambank destabilization and efforts to reduce streambank erosion.

13. Support ***nutrient management*** activities in the watershed, such as supporting the development of water quality based Animal Waste Management Plans, supporting incentive payments through EQIP programs, developing programs to encourage the use of filter strips, buffer strips, and related practices to keep nutrients out of runoff, and other targeted mechanisms to control the most significant sources of nutrients.

14. Develop and support ***Public Outreach*** and ***Education*** programs in the watershed to promote implementation of nutrient and sediment management strategies, awareness of water quality issues, and overall protection of the resource.

15. Promote activities to reduce the impacts of rural unpaved roads on sediment delivery to streams in the watershed.

16. Promote remedial actions to reduce adverse impacts from acid mine drainage.

17. Evaluate regulatory options on the basis of a cost-benefit analysis to determine efficacy. Identify regulatory programs that may be relevant to activities occurring in the watershed, identify enforcement/complaint issues, track progress made on these issues.

18. Others???

B. ASSESSING PROGRESS:

Multiple efforts conducted by multiple agencies, funded by several sources are concurrently ongoing in the Grand Lake Watershed. All projects have the same ultimate goal, protecting water resources, but the various jurisdictional responsibilities of the various agencies lends itself to less than optimal expenditures of effort and resources. Effective communication is one of the most difficult problems of managing multiple projects being conducted concurrently by different organizations. A number of avenues are being established by the EPA and various agencies from each of the four states to help relieve this potential problem.

1. Regular communication between members of the multi-state committee.

2. In Oklahoma, the ODEQ houses the State's Database that is available through the internet. OWRB, OCC, USGS, ODAFF, and other agencies also house data from the Grand Lake Watershed.

3. In Oklahoma, written reports and technical presentations to the WAG, the Oklahoma State Water Quality Monitoring Council, and the State Nonpoint Source Working Group.

4. In Missouri..
5. In Kansas…
6. In Arkansas…

III. CLEARLY DEFINE WATER QUALITY PROBLEMS:

A. PROBLEMS:

Grand Lake's designated beneficial uses include private and public water supply, warm

water aquatic community, agriculture, hydroelectric power, municipal and industrial uses, primary body contact recreation, and aesthetics. The reservoir is the primary drinking water source numerous communities around the lake. In addition, Grand Lake supports a recreation industry estimated to bring over $28 million dollars in tourism-related revenues to the Grand Lake area (OK Dept. of Tourism and Recreation 1987). Landuse in the watershed includes agricultural fields (cropland including wheat, sorghum, soybeans, and corn;) rangeland, pasture and grassland, forests, rural and urban communities, poultry and dairy operations. The watershed also contains abandoned mining operations. Discharges from seeps and abandoned mineshafts, in this region, release hazardous substances, including toxic metals such as lead, cadmium, zinc, and other contaminants.. The nation's top superfund site, Tar Creek, is located in the watershed.In addition to the negative water quality impacts from Tar Creek, this Superfund site and mining activity with the Tri-State Mining District has also contributed to contaminated sediments soils in several small towns in the area. Most soils in the upper portions of the watershed are moderately to well-drained dark silts, loams, and clays. Soils closer to the lake are characterized by a high percentage of chert fragments, low fertility, and rapid drainage capacity. The water quality of the reservoir and its tributaries have been of concern for more than a decade and considerable resources have been devoted to studying the system in order to address the water quality problems.

ODAFF records indicate that there are 65 Poultry Feeding Operations (PFOs) in the Oklahoma portion of the watershed, raising 5,204,300 chickens per year. Based on reports submitted to ODAFF by Land Applicators during the period from 11/2000 to 12/2003, 18906 tons of litter was applied on approximately 10,518 acres of land in the watershed. It is noted that several reports on land application activities in 2003 have not been received by ODAFF at this time. Thus, the amount of litter applied presented above only reflects part of the litter application that occurred in 2003.

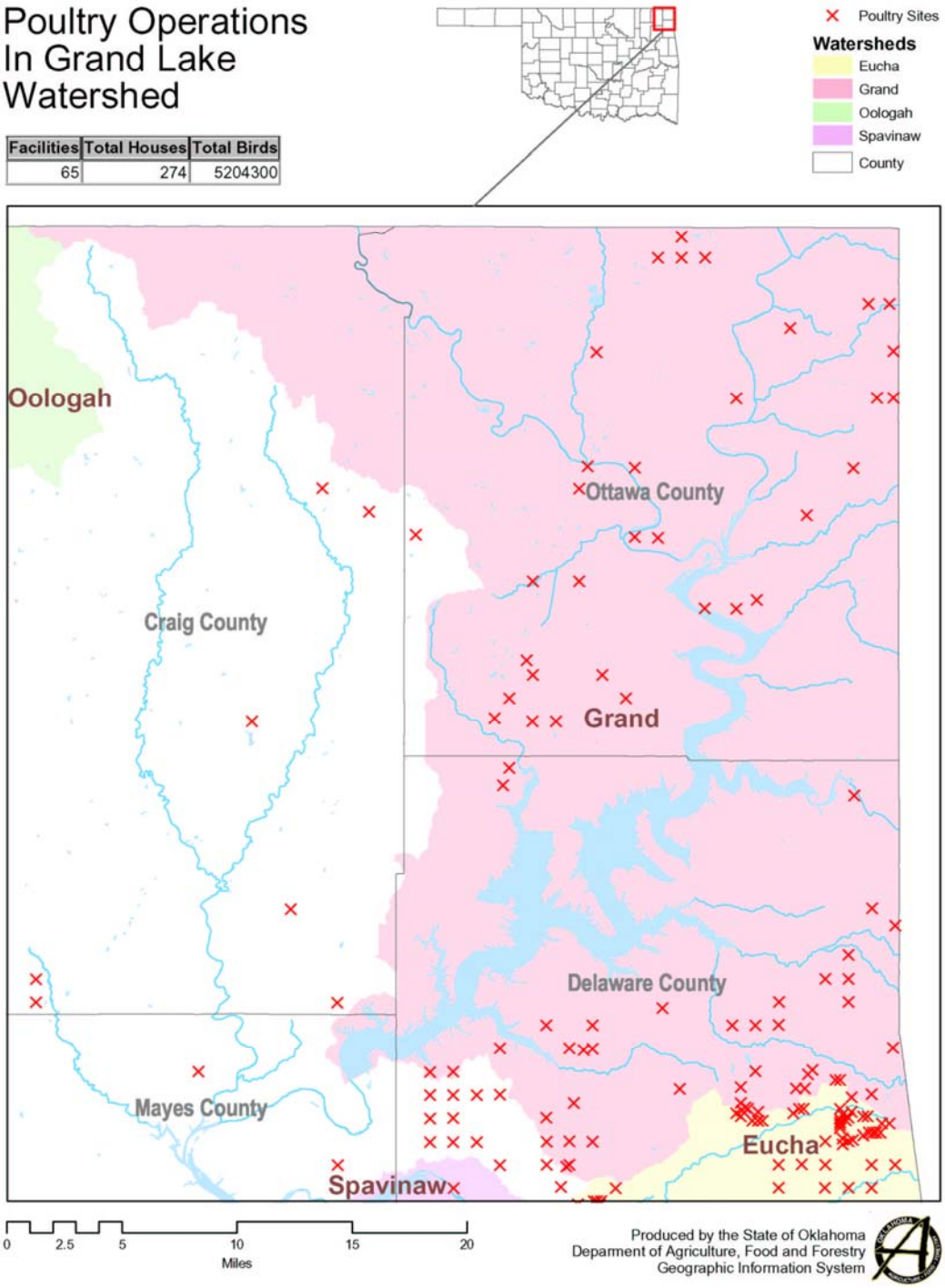
ODAFF randomly sampled soil samples in the area for Phosphorus Index (STP) analyses. Fifteen (15) samples were collected by ODAFF inspectors from eleven (11) PFO's land application sites. Three of the sites, or 27.3 %, had STP indexes exceeding 400, the threshold limiting phosphorus application. The ODAFF Water Quality Services Division informed the three poultry operators that they could not apply any poultry waste to the fields that had soil sample lab results exceeding the 400 Phosphorus level. However, since the samples were randomly collected, the results could be interpreted that approximately 27% of the available land for litter application in the Grand Lake watershed is at the threshold for Phosphorus.

A Clean Lakes Study conducted by Oklahoma State University (OSU) in coordination with the Oklahoma Water Resources Board (OWRB) found that Grand Lake is experiencing accelerated eutrophication as a result of ever increasing nutrient loadings (Burks et al., 1995). The study also determined that the algal growth in the lake was phosphorous limited. In other words, according to the report, reducing the phosphorous loading to the lake will decrease the productivity more than reducing the nitrogen loadings. In fact, large reductions in the nitrogen loadings were seen to have little, if any, effect on lake productivity.

Sixteen segments associated with Grand Lake and its watershed are listed as Category V Waters (impaired and in need of a TMDL) in Oklahoma's 2002 Integrated Report as being impaired by low dissolved oxygen, cause unknown, chloride, lead, pathogens, pH, sulfates, TDS, and turbidity. Tributaries to Grand Lake are also listed on Kansas' and Missouri's 303 (d) list. _____ segments in the Grand Lake Watershed are listed on the Kansas 303(d) list as being impaired by _____. _____segments are listed on the Missouri 303(d) list as being impaired by _____.

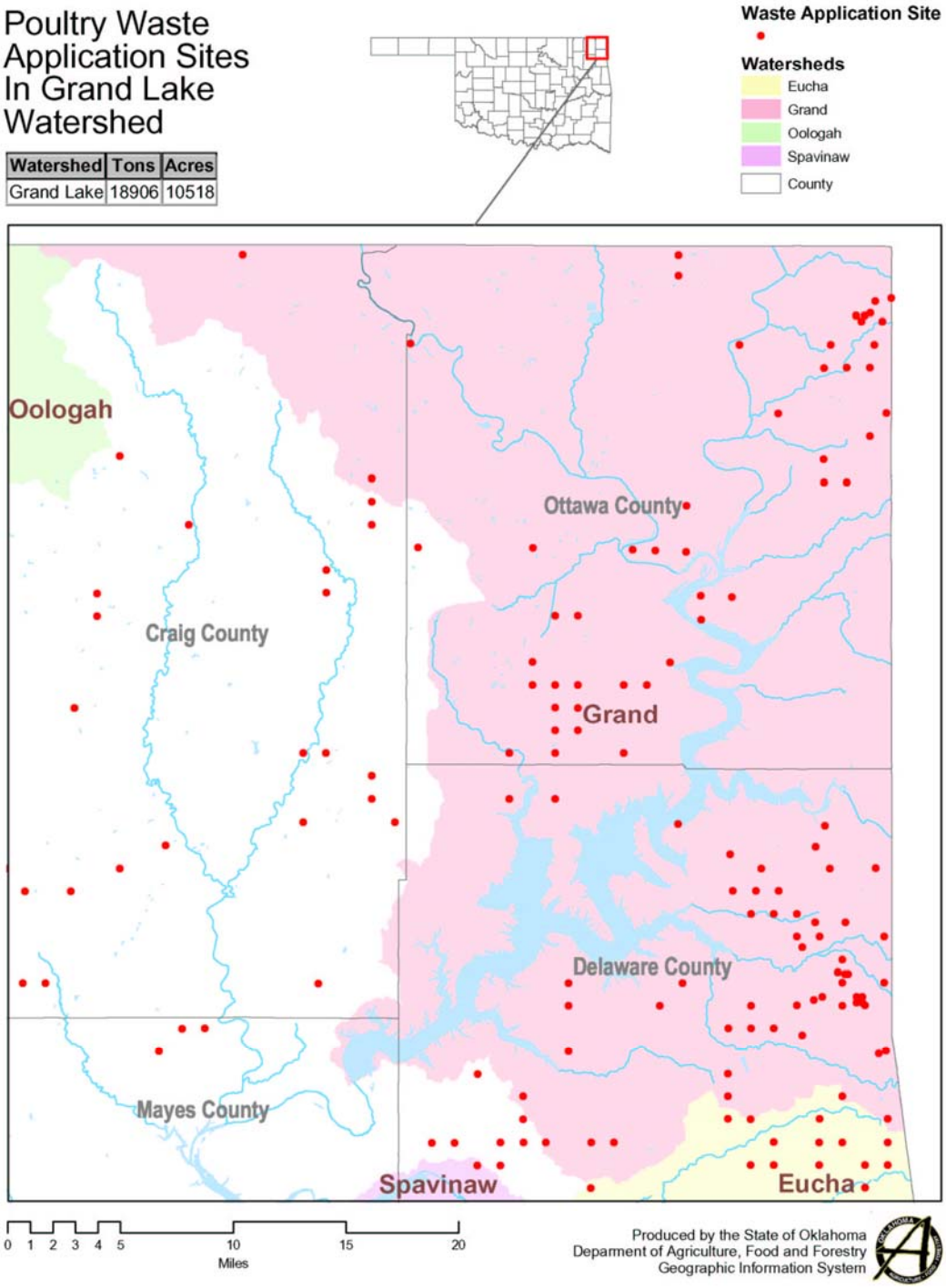
Poultry Operations In Grand Lake Watershed

Facilities	Total Houses	Total Birds
65	274	5204300



Poultry Waste Application Sites In Grand Lake Watershed

Watershed	Tons	Acres
Grand Lake	18906	10518



The following principal water quality problems (in no particular order) must be addressed by the WRAS:

1. Eutrophication in the Grand Lake.
2. Excess nutrient loadings from watershed (principally phosphorus and nitrogen).
3. Contaminated mine drainage.
4. Loss of aquatic habitat in streams due to sedimentation.
5. Continued decline in water quality (e.g.turbidity, aesthetics, productivity, eutrophication, and unknown toxicity) in the Watershed.
6. Pesticide contamination in surface and groundwater.
7. Metals contamination.
8. Fecal coliform contamination.

B. SOURCES AND THEIR CONTRIBUTIONS:

The extensive research in the basin identified various sources as having potential impacts on the water resources of the basin. Although it is recognized that some sources have less substantial impacts than others, it is believed that substantial effort is necessary on the part of all potential sources to protect the resource and insure its longevity. Efforts are already underway to control some of these sources, nevertheless, additional work will be necessary. The following potential sources (in no particular order) have been identified as contributors to pollutants in the watershed:

1. Production of livestock (cattle, hogs, poultry).
2. Reduced or poorly maintained riparian zones.
3. Streambank erosion.
4. Poorly functioning private septic systems.
5. Permitted point source dischargers.
6. Improper application and use of fertilizers and pesticides.
7. Nutrient and sediment loadings from soil erosion.
8. Pasture and Rangeland maintenance.

9. Oil and gas exploration activities, plus erosion along pipelines and lease roads and around production pads.

10. County road maintenance.

11. Crop production activities.

12. Mine drainage from abandoned mines.

13. others?

IV. SPECIFY ACTION PLAN AND WATER QUALITY GOALS:

A number of studies and programs have been conducted or are planned or underway to address the water quality problems discussed above.

In Arkansas, _____. In Kansas, _____. In Missouri, _____. In Oklahoma, The ODEQ is developing a TMDL to protect the resource. The OWRB, OCC, Corp. Comm., and USGS continue to monitor streamflow and water quality in the basin.

These studies are described in Item VI and address the following action items:

A. Characterize NPS contributions from various sources and background contributions.

B. Evaluate nutrient and sediment impacts and dynamics in the watershed.

C. Evaluate point source discharger contributions.

D. Develop public education and outreach programs for both the general public and ones targeted to specific operators and land users in the watershed.

E. Designate priority areas and practices for implementation based on contribution to overall water quality problems.

F. Develop TMDLs and Pollutant Target Values for the Watershed.

G. Develop overall nutrient management programs.

H. Establish riparian management and implementation programs. Included in this program will be an effort to encourage proper floodplain management.

I. Develop implementation programs to reduce the effects of nonpoint source pollution associated with pasture, range, and crop production management.

J. Evaluate the effects of streambank erosion in the watershed and implement programs to reduce those effects.

K. Evaluate the impacts from acid mine drainage in the watershed and develop effective mechanisms to reduce those impacts.

L. Evaluate the impacts of oil and gas exploration and develop effective mechanisms to reduce those impacts.

M. Evaluate sediment loading to the watershed and develop programs to reduce that loading.

N. Evaluate the need for septic system upgrades and establish support funding.

O. Encourage adoption of state and federal legislation, as needed, to protect the watershed.

P. Implement a Comprehensive Watershed Management Plan or WRAS to manage the watershed.

Q. Establish long-term water quality trend monitoring programs.

R. Evaluate the effects of and develop programs to reduce threats and impacts from fertilizer and pesticide use in the watershed associated with agriculture, golf courses, and public and private residences.

S. Assess economics and demographics in the watershed to predict costs/benefits associated with implementation or lackthereof.

V. IMPLEMENTATION SCHEDULE

The following table provides a summary of projects that have been completed, are currently underway or are being considered for the near future. This is not an exhaustive list, but focuses on the major problems and sources in the watershed. Included in the table is a reference to which specific goal listed in section IV the particular study addresses.

Lead Agency (ies)	Project(s)/Activities	Dates	Section IV Goal(s) Reference	Status
OSU and OWRB	Clean Lakes Phase I Study on Grand Lake	1995	A, B, C, E, K, M, N	Completed
OCC	Grand Lake Basin Management Plan	1997	A, B, C, E, F, M, N, P, Q, R	Ongoing
ODEQ	Recent PDES Improvements in Grand Lake Watershed	2003	C, E, F, O, P, Q	Ongoing
OSE	Tar Creek Superfund Task Force Final Report	2000	A, D, E, F, K, O, P, Q	Completed
OCC	Grand Lake Basin Management Plan: Phase I: Identification of Critical Area	1996	A, B, C, E, F, M, N, P,	Completed
OWRB	Grand Lake Demographics Study- including Bathymetric Map and Clean Lakes Study	2003	B, C, E, K, M, N, S	Ongoing
ODEQ	TMDL for Lytle Creek and Tar Creek (organic enrichment and low DO)	2002	F, P	Draft completed
ODEQ	Spring River TMDL (organic enrichment and low DO)	2001	F, P	Draft completed
ODEQ	Neosho River TMDL (organic enrichment and low DO)	2001	F, P	Draft completed
ODEQ	Sand Creek TMDL (organic enrichment and low DO)	2001	F, P	Draft completed
ODEQ	Tributary to Muskrat Hollow Creek TMDL (organic enrichment and low DO)	1997	F, P	Completed
OWRB	Beneficial Use Monitoring at Grand Lake	2003	B, F, M, N, Q	Ongoing
OWRB	Oklahoma Water Watch Volunteer Monitoring Program (1993 – 2001)	2003	B, D, Q,	Ongoing
ODEQ	Fish Tissue Metals Analysis in the Tri-State Mining Area	2003	D, E, F, K, O, Q	Completed
USGS	Quality of Water in Abandoned Lead and Zinc Mines in Ottawa County	2003	A, E, F, K, O	Completed
ODAFF	Poultry Feeding Operator and Poultry Litter Applicator Licensing-includes: • Soil sampling for application of soil Phosphorus index • Maintenance of a database of operator and application activities • Annual inspections	1998-current		Ongoing
USGS	Reconnaissance of hydrology, water quality, and sources of bacterial and nutrient contamination in the Ozark Plateaus aquifer system and Cave Springs Branch of Honey Creek, Delaware County, Oklahoma, March	2001	A, B, E, F, N, Q	Completed

	1999 - 2000			
OK Tar Creek Environmental Effects Subcommittee	Effects of Acid Mine Drainages from Tar Creek on fishes and benthic macroinvertebrates in Grand Lake, OK	1982	A, E, F, K, O	Completed
OSU	Water Quality and sediments of an area receiving acid-mine drainage in northeastern Oklahoma	1985	A, E, F, K, O	Completed
OSU	Estimating Watershed Level Nonpoint Source Loading for the State of Oklahoma	2000	A, B, F, M	Completed
OCC	Reconnaissance and Preliminary Stream Classification of the Major Tributaries of the Grand Lake O' the Cherokees	1998	A, E, F, J, Q	Completed
OCC	Interim Report II: Statistical Summary of Grand Lake Data (June 1998 – May 2000)	2000	A, B, E, F, Q	Completed
OCC	Report of the Findings of an Intensive Biological Investigation of Cave Springs Branch and Honey Creek in Delaware County, Oklahoma	2001	B, C, E, F	Completed
ODEQ	Cave Springs Branch and Honey Creek Water Quality Monitoring	1996-2004	B, C, E, F, Q	Ongoing
OCC, OWRB, Nature Conservancy	Twin Cave Water Quality and Pollution Source Assessment	2002	A, E, F, R	Completed
ODEQ and USGS	Assessment of Ground Water Flow and Recharge in the Boone Aquifer in Ottawa County, OK	2003		Draft Completed
ODEQ and USGS	Quality of Water in Abandoned Lead and Zinc Mines in Ottawa County, OK	2003		Completed
ODEQ	Evaluation of Private Water Supplies for Lead Levels Within the Tar Creek Watershed	2003		Completed
ODEQ and USGS	Tar Creek Water Quality, Flow & Sediment Monitoring	2004		Ongoing / Proposed
ODEQ and OCC	Monitoring a Chat Filled Subsidence	2003		Ongoing
USGS- KS	Channel Stability of the Neosho River Downstream from John Redmond Dam, Kansas	1999	A, B, E, J, M	Completed
KDWP	Sub-Watershed Report: Biological Assessment: Neosho River Basin	1995-1997	A, B, E, F, M, Q,	Completed
KDHE	Neosho River Riparian Restoration	1995	A, B, E, J, M	Completed
MDC	Spring River Watershed Inventory and Assessment	2000	A, B, C, D, E, F, M, N, O, P, Q, R	Completed
MDC	Elk River Watershed Inventory and Assessment	2000	A, B, C, D, E, F, M, N, O, P, Q, R	Completed

VI. FUNDING NEEDS:

The information presented below pertains to recently completed, existing and proposed contracts for water quality projects in the Grand Lake Watershed that support the WRAS goals. A brief outline of each contract's purpose is presented in Section V above. An extensive amount of effort has already been expended in the watershed that is not reflected below. Countless studies and millions of dollars have been expended towards support of goals that have been summarized in this WRAS.

1. Water Quality Sampling in the Grand Lake Watershed (OWRB) (Ongoing and Future)

Task	Federal	State	Total
Beneficial Use Monitoring- Rivers (annual basis*) Six additional sites	-0-	$162,408	$162,408
Beneficial Use Monitoring- Lakes Assessment Sampling- quarterly (annual basis*) Additional sites, 10 months/year	-0-	$70,000	$70,000
SB 408: Clean Lakes Study- Bathymetric Survey			Survey cost- $75,000 Clean Lakes Study Cost- $200,000
Oklahoma Water Watch Volunteer Monitoring- implement chlorophyll-a, bacteria, and phosphorus monitoring	$100,000	$66,666	$166,666

*OWRB will continue to monitor Grand Lake and its Watershed in an annual basis as part of its Beneficial Use Monitoring Program

2. TMDL Development (ODEQ, MDNR, etc.) (Ongoing and Recent Projects)

Task	Federal	State	Total
TMDL Development for Grand Lake Watershed: Phase I Water Quality Monitoring- ODEQ	$66,156	$21,244	$87,400
Bioassessment of 303(d) Streams Listed for Unknown Toxicity and Total Toxics	$		$84,054
Improved monitoring at point source dischargers to include continuous total P monitoring at key			

dischargers			

3. Implementation of BMPs in the Grand Lake Watershed to Restore Beneficial Uses (OCC, ODAFF, NRCS, MDNR, KDHE, etc.)(Future Projects)

Task	Federal	State	Total
Grand Lake Watershed Implementation Project- Oklahoma- Demonstration Project	$1,662,000	$1,108,000	$2,770,000*
EQIP Program			
ODAFF- implementation of Soil Phosphorus Index for Litter application			
ODAFF seedling planting (distributes 3,000-5,000 annually in the watershed)			$10,000 annually**

*estimated based on similar projects

4. Grand Lake Watershed Initiative Project- to formalize and strengthen a watershed organization, target pollution sources, educate communities, youth and businesses, review NPDES permits, demonstrate BMPs, and monitor for key water quality parameters. (ODEQ, OSU, OSE, OWRB, OCC, etc) (Proposed)

Task	Federal	State	Total
Organizational Capacity Building			
Target Nonpoint Source Pollution	$189,320	$63,107	$252,427
Grand Lake Watershed Education Program			
NPDES Permit Review			
Grand Lake Monitoring Program	$281,250	$93,750	$375,000
BMP Demonstration	$150,000	$50,000	$200,000
Total			

5. Inhofe plan (is this appropriate to include?)- $45,000,000
   Passive Treatment
   Stream Channel Dredging
   Road paving/capping
   Land Restoration

Monitoring

6. Continuing/Expanding Education Programs

Task	Total
Poultry Growers & Litter Applicators Education Programs	??- annually

8. NPS Loading Estimates and Source Allocations

Task	Total
Use ODAFF database values for litter application to estimate NPS pollution from this source	??

9. Additional Monitoring (Future)

Task	Federal	State	Total
USGS			
ODEQ			
OCC Rotating Basin			
Total			

10. Inventory of Septic Systems to estimate upgrade needs

11. Infrastructure upgrades to address wastewater issues