Statement of Qualifications

Oklahoma Scenic Rivers
Joint Phosphorus Criteria Study

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KU KANSAS BIOLOGICAL SURVEY
The University of Kansas

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I. Introduction

The Central Plains Center for BioAssessment (CPCB), a core program of the Kansas Biological Survey at the University of Kansas, focuses its research and field work on the precise issue being addressed in the Oklahoma Scenic Rivers study: the health and function of aquatic ecosystems. Its central mission is to provide scientific expertise on aquatic resources in the Central Plains. Scientists at CPCB have worked with many partners in Kansas, neighboring states and the mid-continent region in identifying and quantifying disturbances and impacts on rivers, streams, lakes and wetlands in this region. CPCB has put together a team (described below) with specific and outstanding qualifications for the Oklahoma Scenic Rivers study.

The Center's research design and techniques are used to assess terrestrial and aquatic ecosystems and their interaction with landscapes. Our scientists use chemical, biological and physical data in waterbody assessments and in the modeling of watersheds, lakes and streams. We employ a variety of methods, including GIS, remote sensing, data searches and data to gather site-specific and landscape-level information on watershed water quality, hydrology, land use/land cover, pollution sources and natural community assemblages. We also maintain a large GIS and relational database with chemical, biological and physical data, as well as state-of-the-art laboratories with equipment capable of analyzing an array of chemical and biological constituents in water, soil and sediment. CPCB scientists employ a variety of graphical techniques and advanced statistical procedures to quantify abiotic and biotic relationships.

The Kansas Biological Survey, formally established at KU in 1911, is a nonregulatory research and service unit of the university. It houses a variety of core environmental research programs and manages the 3,400-acre KU Field Station, now designated as one of 60 sites that make up the National Science Foundation's National Ecological Observatory Network (NEON Inc.) Other programs of the Kansas Biological Survey, including the Kansas Applied Remote Sensing program (KARS), as well as the resources available through the Field Station, support CPCB's work. KARS specializes in GIS and the development of highly complex data mapping, including flood inundation modeling and other water resource-related data modeling. KARS most recently provided core support in the three-year development of the Western Governors Crucial Habitat Assessment Tool, a map of crucial habitat across 16 western states; this is the first time a collaborative effort of this scope has taken place.

Gathering and providing information on conditions of waterbodies, and the factors leading to those conditions, is an ongoing area of research for the Kansas Biological Survey that involves several of its core programs, including CPCB. In keeping with this priority, the Survey has just completed the Atlas of Kansas Lakes, a compendium of data on nearly 80 lakes studied by the Survey thus far.

In developing a team for the Oklahoma Scenic Rivers study, CBCB and the Survey are bringing four of their own scientists together with Val Smith, KU Prof. of Ecology and Evolutionary

Biology, and Jack Jones, the J. Michael Dunmire Professor and Chair of the Department of Fisheries and Wildlife at the University of Missouri. These two imminent scholars have devoted more than 30 years to the study of nutrient enrichment to various waterbodies, with much of that work focused on aquatic ecosystems of this region. CPCB scientists have worked with both of these scientists throughout the years, and collectively this team is one of the most talented groups to work on cultural eutrophication. Jones in particular has done many nutrient-related studies of Ozark and Ozark-type streams. Members of our team were leaders and primary contributors to the U.S. EPA Region 7 lead effort to define a process for the identification of benchmark values (i.e., suggested criteria values) for total phosphorus, total nitrogen and chlorophyll. Two regionally applicable documents were produced (one in final draft form) that listed regional benchmark values that were agreed upon by all contribution state agencies and regional scientists. These are provided as the examples of summary reports requested by the oversight committee for the Oklahoma Scenic Rivers study.

II. Descriptions of experience with similar projects, including two examples of summary reports

1.
The U.S. EPA Regional Technical Assistance Group (RTAG) to determine total nitrogen and total phosphorus criteria for streams, lakes, and wetlands (1998-present)

Client: U.S. EPA Region 7
Partners: Federal, state, tribal and educational agencies within U.S. EPA Region 7 (Iowa, Kansas, Nebraska, Missouri)
Services required: Data acquisition, data quality control, database development, data analyses, facilitation of meetings and work group activities, report writing.
Purpose: The Nutrient Criteria Workgroup, also called the "U.S. EPA Region 7 Regional Technical Assistance Group," was formed to establish nutrient criteria for lakes, streams and wetlands of the U.S. EPA Region 7 and the Central Plains region.

Project summary: CPCB facilitated meetings by members including scientists from federal, state and tribal agencies. For each of the three waterbody types, CPCB assembled a large database of chemical, physical and biological parameters obtained from agencies, universities and citizen groups, and analyzed the data to determine ecoregionally based statistics that guided decisions by workgroup scientists whose mandate was to determine scientifically defensible nutrient criteria without consideration for economic or social feasibility. The stream database was the largest of the three, with chemistry records of 54,393 sampling events from 1965 to 2003, at 2,400 waterbodies.

We also assembled a database of fish collections (2,369 sampling events, 1,325 sites, 1984 to 2003, more than 200 taxa) and a database of macroinvertebrate collections (1,874 sampling events, 1,151 sites, 1984 to 2003, more than 1,200 taxa) in U.S. EPA Region 7 as potential indicators of biotic integrity. We initially assembled data from Oklahoma and Arkansas streams located in ecoregions shared with U.S. EPA Region 7 but later excluded those from analyses. Additional quality control included vetting the data sources, determining collection and analytical methods, and setting detection limits to create the most scientifically defensible database possible.

Potential data relationships were examined using a number of stressor-response techniques correlation, regression and various threshold analyses. In addition, comparisons between reference and variously impacted systems were examined to identify stressor levels and biological indicator responses (e.g., sestonic and attached algae, fish and macroinvertebrate community variables). Final nutrient stream benchmarks were determined by the RTAG using a weight-of-evidence approach and operating on group consensus basis. More specifically, nutrient stream benchmarks were derived from reference stream values, 25th percentile values, trisection reference values, a range of literature values and results of stressor-response analyses.

Databases, presentations and reports are posted to the RTAG website to facilitate comment and study by members and others. http://cpcb.ku.edu/workgroups/nutrient-criteria/

The final report for lake nutrient benchmark values is downloadable at:
http://cpcb.ku.edu/media/uploads/work/Lake_RTAG_2011Jun.pdf

The draft report (anticipated to be completed in spring 2014) for stream nutrient benchmark values is downloadable at:
http://cpcb.ku.edu/media/cpcb/research/assets/Stream%20benchmark%20study%20draft%20report.pdf

These two reports are provided as the requested samples of summary reports for similar projects.

2.
Identification and characterization of reference conditions of wadeable streams within U.S. EPA Region 7 using Environmental Monitoring and Assessment Program (EMAP) methodology (2005-2006)

Client: U.S. EPA Region 7
Partners: Various state agencies provided sampling locality data.
Services required: Sample collection, taxonomic identification and enumeration, data quality control, database development, data analyses, report writing.
Purpose: Provide a standardized, regionwide reference stream database.

Project summary: The goal of this project was to standardize and enhance data from 47 reference sites in Iowa, Kansas and Nebraska by using EPA EMAP methods to collect a suite of physical, chemical and biological "indicators" in 2005 and 2006. The resulting data was used by the U.S. EPA Region 7 Biocriteria workgroup www.cpcb.ku.edu/progwg/html/biologicalwg.htm to develop core biological reference conditions (e.g., fish and macroinvertebrates) for the region. The database also was made available to the state agencies within the region so they could compare the results collected using EMAP methodology to their own data collected from the same reference site. This enabled them to determine whether different sampling methodologies produce similar results. It also encouraged states and tribes to adopt, when possible, more consistent methodologies to allow more meaningful use of regional reference sites and conditions when within-state sites are limiting or nonexistent. The CPCB website provides more information on the project, including reports and databases:
http://cpcb.ku.edu/research/reference-streams/

3.
Acquisition and assessment of nutrient data: An ecoregion approach with an emphasis on streams (1999-2002)

Client: U.S. EPA Region 7
Partners: None
Services required: Sample collection, chemical and biological analysis of samples, data quality control, database development, data analyses, report writing.
Purpose: To increase the temporal and spatial robustness of nutrient data for streams occurring in various ecoregions within Region 7.

Project summary: In this RTAG effort, CPCB sampled 94 reference streams from all ecoregions throughout the four states of U.S. EPA Region 7. This includes nine ecoregions that U.S. EPA Region 7 shares with Oklahoma and Arkansas. Streams were sampled each year during the spring, summer and fall for chemical, physical and biological parameters. This study was conducted to help identify the degree of temporal variation within abiotic and biotic data related to nutrient enrichment of streams within ecoregions occurring entirely or partially within U.S. EPA Region 7. Determination of temporal variation within and among nutrient variables is essential to understanding short- and long-term relationships. The CPCB website provides more information on the project: http://cpcb.ku.edu/research/nutrient-streams-project/

4.
Determination of regional reference conditions, tiered aquatic life applications and inter-regional calibration of community assessment methods (2003-present)

Client: U.S. EPA Region 7
Partners: Federal, state, tribal and educational agencies within U.S. EPA Region 7 (Iowa, Kansas, Nebraska, Missouri)
Services required: Data acquisition, data quality control, database development, data analyses, facilitation of meetings and work group activities, report writing.

Purpose: Determine how regionally identified reference streams and watersheds fit within the tiered aquatic life paradigm. Various state agencies and organizations often determine reference conditions based on available data and other resources; because their resources vary, there often is no standard across natural regions and geopolitical areas. This project provided a standardized approach to the examination of reference conditions and tiered aquatic life applications across a broad region. Outcomes related to biological condition were examined to assess their commonality and to integrate state-determined variables into a regional analysis of reference conditions within ecoregions. These ecoregion conditions represented differing points along the tiered aquatic life continuum.

Purpose: Closely aligned with the nutrient criteria effort, this reference condition effort focuses on creation and upkeep of a database to refine regional reference condition guidelines that may be applied to streams throughout Region 7. A Biocriteria Workgroup that meets in parallel to this RTAG nominated 250 candidate reference streams in Region 7; CPCB created and maintains the database of physical, chemical, habitat and biological data for the reference streams determined by the Biocriteria Workgroup. To standardize and guide the decision of which streams should be on this list, the workgroup chose 11 factors to evaluate to determine whether a stream meets reference status. Currently CPCB is working with the group to refine these regional reference condition guidelines so that they may be applied to streams throughout the region. More information is available at: http://cpcb.ku.edu/workgroups/biocriteria/

III. Specific qualifications of research team—overview

The Central Plains Center for BioAssessment and the Kansas Biological Survey are fortunate to have access to researchers who singularly and collectively possess vast experience and knowledge regarding nutrient impacts on aquatic ecosystems and how this information is used to identify protective nutrient criteria for regional stream and lake ecosystems. For the Oklahoma Scenic Rivers Study, we have brought together a team of six scientists, each of whom will provide specific, targeted expertise and experience to the project. Four of the six team members served on the U.S. EPA Regional Technical Assistance Group that established a process for identifying regionwide nutrient criteria of Region 7 (Iowa, Kansas, Missouri and Nebraska) and carried out the identification process.

Donald Huggins, Ph.D., and Debra Baker, M.S., as lead scientists within CPCB, provided all data needs of the nutrient RTAG effort and facilitated all meetings during a period of more than 10 years. They are deeply familiar with all aspects of multi-investigator efforts that require large-scale, coordinated data acquisition; data quality control; data assessment; and the generation of consensus-based outcomes. Huggins and Baker have a proven track record in providing constructive project oversight within large multiple-investigator projects of this nature.

Frank (Jerry) deNoyelles, Ph.D., is an established phycologist and limnologist who will lead all efforts to identify meaningful algal community shifts related to nutrient enrichment in selected stream ecosystems. DeNoyelles' entire career has focused on algal community dynamics and anthropogenic stressors that affect algal community structure and function. For more than 40 years, he has both taught and conducted research related to algal dynamics in aquatic systems in the Great Plains and peripheral regions, and Canada. His taxonomic training and experience is essential in correctly identifying which community and population shifts are related to stream eutrophication.

Val Smith, Ph.D., has long-term experience in determining causes and consequences of nutrient enrichment and cultural eutrophication both in lakes and, to a lesser degree, in stream systems.

John (Jack) Jones, Ph.D., is a highly talented limnologist and aquatic ecologist with vast experience in Ozark and high quality stream systems. Jones has done the research and published much of the information that regional and national resources managers and researchers currently rely upon to understand how elevated nutrients, including total phosphorus, can impact algal stream communities associated with naturally low-nutrient stream systems.

Jude Kastens, Ph.D., provides this team with the landscape and remote sensing science aspects that will be required to identify and select appropriate "reference" stream/watershed systems necessary for establishing the most meaningful comparisons in using the stressor-response approach to determine phosphorus criteria for these special stream systems.

IV. Detailed qualifications of individual team members

Donald Huggins, Ph.D.

Broad credentials and current position—Donald Huggins has been the Director of the ecotoxicology program and the Central Plains Center for BioAssessment (CPCB) at the Kansas Biological Survey since their inceptions in 1990 and 1999, respectively. He has authored more than 100 technical articles and reports and written several book chapters, and he regularly consults with industry. His expertise has been sought repeatedly by the State of Kansas, and he has been a member of several committees including the Planning and Advisory Committee and the Technical Planning Committee of the Kansas Water Quality Plan Task Force, which was responsible for establishing state water quality standards.

Expertise targeted to Oklahoma Scenic Rivers Study—A major portion of Huggins' latest research and project efforts has focused on the impact of nutrients of both lakes and streams in the Central Plains region and surrounding areas. While most recent publications concern nutrient impacts and relationships in lakes and reservoirs, Huggins and CPCB were major contributors to U.S. EPA Region 7's efforts to produce lake and stream documents that, in part, identified potential total phosphorus and nitrogen criteria for Region 7. These Nutrient RTAG (Regional Technical Assistance Group) documents (one completed and one in final draft form) used a "weight of evidence" approach to determine scientifically defensible nutrient criteria of Region 7 while examining ecoregion-specific criteria. CPCB facilitated all RTAG meetings and work efforts, including the use of stressor-response approaches (multiple regression analyses and threshold analyses, e.g., piece-wise regression, nonparametric changepoint analysis) These were included in the weight of evidence procedures in helping to identify nutrient criteria values, including chlorophyll *a* threshold values.

Additional relevant experience—Huggins and CPCB also facilitated EPA Region 7 states' (Iowa, Nebraska, Missouri and Kansas) efforts to establish a number of workgroups. Among these was a Biological Criteria workgroup that developed a general regional protocol for identifying reference streams/watersheds within various ecoregions, including the Ozark Highlands ecoregion. CPCB maintains the regionwide listing of reference streams (and candidate streams) while continuing to assist the states and EPA on further development of bio-assessment monitoring and evaluation tools that are broadly applicable to the central portion of the U.S.

Relevant service—Since 1985, Huggins has been a member of two joint task groups (10500-Benthic Macroinvertebrates and 10900-Identification of Aquatic Invertebrates) for the American Public Health Association and others charged with the review of methodologies published in the text *Standard Methods for the Examination of Water and Wastewater*. He received the 2010 KU Research Achievement Award ($10,000 in research funds) and with CPCB received the 2012 Vision Award from the National Water Quality Monitor Council.

Academic background—Huggins holds an M.S. in fisheries biology (minor in water resources) from Iowa State University and a Ph.D. in environmental health sciences from the School of Engineering at the University of Kansas. He is a member of the KU graduate faculty and has been on the staff of the Kansas Biological Survey for 43 years. In addition to his appointment

with the Survey, he has an adjunct or courtesy appointment in the departments of civil engineering, and ecology and evolutionary biology at KU.

Deborah Baker, M.S.

Broad credentials and current position—Baker has served as CPCB Assistant Director and database manager since 2000. She coordinates CPCB's project activities that include the recruitment and training of field crews and the development, adaptation and documentation of project methodologies. She also performs and oversees field work, develops project reports and acts as the quality assurance officer on most projects.

Expertise targeted to Oklahoma Scenic Rivers Study— Baker has acted as the point of contact and responsible party for all U.S. EPA National Aquatic Resources Surveys (NARS) that CPCB has participated in since the inception of the NARS program in 2004. This experience and the obligor EPA training that accompanies all of the surveys of the last decade have provided Baker the opportunity to become extremely knowledgeable and experienced with nearly all U.S. EPA methodologies related to the collection and processing of abiotic and biotic variables. In addition, as the point of contact and quality assurance officer within CPCB, Baker is well-versed in all aspects of large study organization and execution. She also has developed a keen sense for the data quality control and documentation that is a necessary part of studies that may form the basis of policy. Baker has a great breath of knowledge and expertise in the development and maintenance of large, multifaceted databases that include both abiotic and biotic study elements. She created CPCB's database in MSAccess and was instrumental in developing the U.S. EPA Region 7 RTAG nutrient criteria databases from state, academic, regional and national lake, stream and wetland survey and assessment data. This was an imposing task that required bringing together data that varied in format and unit of measure, and that was inconsistent due to methodology differences, detection limit issues and other problems inherent in integrating large, disparate datasets.

Additional relevant experience—Baker is well versed in most common graphical and statistical techniques. She drew upon these skills in statistical analyses to generate the nutrient criteria benchmark values for the RTAG nutrient project. She also brings organizational and interpersonal skills that will be essential to the overall function and success of this team.

Relevant service—Baker has been the informatics specialist for CPCB since its inception. In that capacity, she has organized and more than 30 professional and public meetings and workshops. These workshops and work group meetings have covered a variety of topics, including identification of reference quality streams and lakes, determination of nutrient criteria, and use of biological indicators to determine anthropogenic impacts to aquatic ecosystems.

Academic background—Baker holds an M.S. in wildlife biology from the University of Nebraska, Lincoln, as well as an M.S. in historical administration and museum studies (emphasis in natural history) from the University of Kansas. She earned a B.S. in biology from Grove City College, Grove City, Pa.

Frank (Jerry) deNoyelles, Ph.D.

Broad credentials and current position—DeNoyelles has been a Professor of Aquatic Ecology at the University of Kansas since 1975 and Deputy Director of the Kansas Biological Survey, a state agency and research center at the university, since 1986. He also is the director of the KU Experimental Pond Facility at the KU Field Station. He has conducted research on aquatic habitats, focusing particularly on the ecology and species identification of algae, in the U.S. and Canada since 1962. He has contributed more than 100 scientific publications and technical reports. His recent research includes comparisons of the ecology of reservoirs in Kansas with that of natural lakes from the Rocky Mountains to the East Coast and north into Canada. This work focuses on the impacts of sedimentation in reservoirs and how conditions compare with those of natural lakes without such anthropogenic stresses. DeNoyelles' other research areas continue to include the ecology of plants and animals in streams and larger rivers as impacted by changing physical and chemical conditions.

Expertise targeted to Oklahoma Scenic Rivers Study—From 1967 to the present, deNoyelles has collaborated with many investigators in research involving the development and use of methods for studying the effects of environmental stress on aquatic ecosystems using field monitoring and experimentally manipulated conditions. Locations for such collaborations—which often involve deNoyelles' expertise for studying algae communities in lakes and streams—have included natural and experimental aquatic systems at Cornell University; Hubbard Brook watershed program in New Hampshire; the University of Oklahoma; the University of Kansas; the Kansas River reach used for sand dredging; EPA Federal Laboratories in Corvallis, Ore. and Duluth, Minn.; and the Experimental Lakes Area in Ontario, Canada. Collaborations using natural and experimentally manipulated ecosystems have led to relating the distribution of algae to conditions including acidification, eutrophication, dredging, and point- and non-point source contaminants including pesticides, heavy metals, and human and farm animal wastes. Other recent collaborations at the KU Field Station with federal and state agencies, as well as public organizations, have led to the first large-scale rearing of the federally endangered stream fish, Topeka shiner (*Notropis topeka*), in experimental ponds. Methods and fish for research and reintroduction have been shared with researchers and conservation managers throughout the U.S.

Additional relevant experience—DeNoyelles has pursued many related research topics involving algae and other types of aquatic organisms studied at the KU Field Station. Here, since 1976, only a short distance from the University of Kansas main campus in Lawrence, deNoyelles has developed one of the largest experimental pond facilities in the U.S., with nearly 200 experimental ponds, outdoor tanks and other types of experimental systems including a 3-hectare, 12-meter-deep reservoir. These systems most often use controlled natural aquatic communities to serve as surrogates of those for which management or basic ecology questions are addressed. This facility also has been used recently for culturing and harvesting algae for use in manufacturing biofuels, with a particular emphasis leading to the harvest of algae from lakes and rivers where their excess growth would be best removed.

Relevant service—Since coming to Kansas, deNoyelles has maintained continuous interactions with state and federal agencies in Kansas and surrounding states to address Kansas and regional water-related issues. Over the past decade, he has made many presentations to a wide variety of

groups concerning issues of water supply quantity and quality for the state and the region. These groups include legislators, public officials, water resource managers and private citizens representing natural resources, urban and rural drinking water supplies, soil conservation programs, and engineered water impoundments and their upstream and downstream river systems. Current presentation titles include: "Reservoir sedimentation: Understanding the past and recognizing the future to act wisely now"; "Reservoir sedimentation: As resources vanish, more challenges appear"; and "Reservoir sedimentation: Understanding and addressing vanishing resources."

Academic background—DeNoyelles joined the University of Kansas Department of Systematics and Ecology (now the Department of Ecology and Evolutionary Biology) in 1975 after serving for three years as an Assistant Professor in the Zoology Department at the University of Oklahoma. He completed the doctorate in Aquatic Ecology at Cornell University in 1971. He received an M.S. from the University of Nebraska-Lincoln in 1966 and an A.B. from Gettysburg College in 1963.

Val Smith, Ph.D

Broad credentials and current position—Smith's research program focuses on relationships between resource supplies and the structure and function of aquatic systems. During the past four decades he has developed objective, predictive empirical models that currently are in use across the globe for eutrophication management and control. He has developed models to predict the effects of nutrient enrichment on the proliferation of nuisance algal species, and he is recognized worldwide as an authority on nuisance blooms of blue-green algae. His 1983 paper on cyanobacteria (blue-green algae) was chosen for the John Martin Award by the Association for the Sciences of Limnology and Oceanography in February 2013, and this paper was judged to be one of the most important contributions to eutrophication science of 20th century. During the past 15 years he also has authored three highly cited reviews on the current status of eutrophication science.

Expertise targeted to Oklahoma Scenic Rivers Study—Smith has extensive experience in the eutrophication and management of freshwater rivers and streams. He has developed quantitative tools to predict the responses of freshwater streams and rivers to nutrient enrichment, in collaboration with his colleague Walter Dodds at Kansas State University. Together, Smith and Dodds developed models to identify the nutrient targets required to control benthic algal biomass levels in the Clark Fork River (Montana), and these models have been highly influential in stream eutrophication management. In addition, Smith and Dodds performed critical assessments of the environmental factors that control dominance by the nuisance green alga *Cladophora glomerata*.

Additional relevant experience—Smith has received several million dollars in local, regional and federal grant support during the past 30 years to support his research program. He was hired by the City of Wichita, Kansas, to perform an 18-month water quality assessment of Cheney Reservoir, the city's primary source of drinking water. He also was hired by the South Florida Water Management District to develop new models for the management of coastal zone eutrophication in the state of Florida. In addition, he and Dodds were hired by the Montana

Department of Health and Environmental Sciences to help manage excess chlorophyll levels in the Clark Fork River with nutrient controls.

Relevant service—Smith has participated in the DEP/EPA Meeting on Estuarine/Coastal Nutrient Criteria; the Working Group on Taste and Odor Problems in Kansas Reservoirs; and the U.S. EPA Marine Nutrient Criteria Meeting. He is a member of the Regional Technical Assistance Group for Water Quality Assessment and Criterion Development, Midwestern Region, and a member of the National Committee on Phosphorus from Agricultural Runoff. In addition, he has served as an expert witness in a water quality trial in East Lansing, Michigan.

Academic background— Smith has been a faculty member in the Department of Ecology and Evolutionary Biology at the University of Kansas since 1993. He also holds an adjunct faculty position with KU's Department of Civil, Environmental and Architectural Engineering, and an adjunct faculty position with Arizona State University's School of Life Sciences. He holds bachelor's degrees in chemistry and biology from the University of Kansas, an M.S. in ecology from Rutgers, and a Ph.D. in ecology from the University of Minnesota, Twin Cities.

John (Jack) R. Jones, Ph.D.

Broad credentials and current position—Jones has taught limnology and related courses at the University of Missouri, Columbia, since 1975. Based on his research contributions, he was awarded the title of Curators' Professor in 2012. With colleagues, he has authored some 125 scientific papers. In addition to research in the Midwest, Jack has been involved with nutrient-algal studies in Central America, Alaska and Asia (Nepal, Thailand and South Korea).

Expertise targeted to Oklahoma Scenic Rivers Study—Jones' research has focused on quantifying how nutrients and physical factors regulate algal biomass in streams, reservoirs and lakes. Using concepts from landscape ecology, he has demonstrated how watershed size and land cover (primarily cropland and forest) determine nutrient concentrations and suspended solids levels in streams and reservoirs in the Midwest. He has worked with graduate students to determine how nutrients and stream flow determine the biomass of attached and suspended algae in streams.

Additional relevant experience—As early as the 1980s, Jones was examining factors related to algal biomass in Missouri Ozark streams, as builds of algae in these scenic, high quality streams pose both ecological and aesthetical concerns. He has followed this initial Ozark work with Ozark stream studies that explore the impacts of nitrogen enrichment, phosphorus-chlorophyll relations, flood frequency relative to algal biomass accumulation, temporal variation in stream algae and other community elements.

Relevant service—Jones has served as an Associate Editor of *Lake and Reservoir Management* (journal of the North American Lake Management Society) and currently is the editor of *Inland Waters* (journal of the International Society of Limnology). He was a contributing author to the "Nutrient Criteria Technical Guidance Manual: Lakes and Reservoirs" (2000, EPA-822-B00-001) and a member of the U.S. EPA Region 7 effort to produce total phosphorus and nitrogen criteria for regional lakes and reservoirs. Along with two colleagues, Jones published a suggested classification of stream trophic state, which has contributed to our understanding of stream types

based on nutrient and chlorophyll levels. Jones is an active participant in the State of Missouri's efforts to establish numeric nutrient criteria for lakes and streams in Missouri aquatic regions.

Academic background—Jones holds Ph.D. and M.S. degrees in zoology (limnology, with minors in water resources) from Iowa State University.

Jude Kastens, Ph.D.

Broad credentials and current position—Kastens is an Assistant Research Professor at the Kansas Applied Remote Sensing (KARS) program, where he has been a full-time staff member since 1999. KARS is a research sub-unit of the Kansas Biological Survey. Kastens has authored 13 peer-reviewed journal articles, including two "best paper" award winners in the remote sensing journal *PE&RS*. He also has been instrumental in securing more than $1 million in external funding since completing his Ph.D. in 2008.

Expertise targeted to Oklahoma Scenic Rivers Study—Kastens' research has focused on using remote sensing and other GIS data primarily for agricultural and hydrologic applications and study. He has extensive experience analyzing stream and wetland chemical and biological data, both statistically and in a GIS framework. His development of a flood prediction model using remotely sensed geomorphic and hydrological characteristics has proven to be a novel and readily applicable tool for assessing large stream and river reaches.

Additional relevant experience—Since 2008, Kastens has applied his expertise in elevation data (including the use of LiDAR and IfSAR remote sensing technologies) to conduct and oversee 12 projects making use of these data at small to large spatial scales. Eleven of these projects focused on surface water hydrology as it relates to reservoirs, wetlands, streams and floodplains. Kastens also has done extensive work in land cover mapping and analysis and was a key contributor to the development of the RESonate model for mapping functional process zones in river systems.

Relevant service—Kastens serves on the Water Resources Technical Advisory Committee of the Kansas GIS Policy Board. He has advised numerous KU faculty members, staff members and students regarding agricultural and hydrological analysis of GIS data and numerical analysis. He also has worked with Huggins, deNoyelles and others at CPCB and the Kansas Biological Survey in support of their needs to determine land use/land cover change impacts on aquatic ecosystems.

Academic background—Kastens holds Ph.D., M.A. and B.A. degrees in mathematics and a B.S.E. in secondary mathematics from the University of Kansas. His graduate thesis work focused on time-frequency analysis, small sample statistics and floodplain modeling.

V. Selected publications

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