



CENTER FOR THE
MANAGEMENT,
UTILIZATION
AND
PROTECTION
OF WATER
RESOURCES

WHAT'S INSIDE

- Message to the Stakeholders
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- Accomplishments/Awards
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ANNUAL REPORT

FY2022-23

TENNESSEE TECH

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MESSAGE TO THE STAKEHOLDERS

Dear Stakeholders,
Over the past year, our Water Center has continued its growth in both the scope and depth of its water-related research and supporting activities. We have consistently improved our collaborations with faculty across campus and increased the Center support of undergraduate and graduate research. Our ongoing projects for this year encompass a vast spectrum of topics, ranging from quantifying microplastics in Tennessee's wastewater treatment plants, molecular surveillance of fish larvae, species assessments of mussels along with their habitat suitability models, TWRA-funded investigations of invasive Asian carp in our rivers, USDA funded research to maintain aquatic resource quality in agricultural ecosystems, TDEC funded research on watershed management, landscape connectivity for waterfowls, adaptive management of game species to machine learning models for detecting water bodies and early warning systems for floods. Water Center faculty members have also initiated collaborations with international organizations to establish pathways for research collaboration and student exchange activities. Undertakings of this nature provide a robust foundation, allowing the Center to maintain a leading

position in safeguarding and managing water resources at regional and national levels.

In the upcoming year, we plan to continue to grow our support of graduate student education, faculty research endeavors, and engagement with the community. We are also committed to actively seek additional connections within the Tennessee Tech community, achieving this through new collaborations with researchers from our School of Environmental Sciences, Earth Sciences and Agriculture departments, along with other Tennessee Tech centers. Furthermore, we will strive to enhance our collaboration with state and federal partners, positioning ourselves to effectively tackle the most urgent challenges that confront Tennessee and our surrounding region.

We extend our gratitude for your continued support as we advance our mission to enhance water resources and better cater to the needs of water stakeholders at the state, national, and global levels.

CENTER AT A GLANCE 2022-2023

- State appropriation of \$1.3 million
- External grants totaling \$2.1 million (total includes direct and indirect costs)
- Return per state dollar: \$1.63
- Five staff members
- Three faculty focus area leaders
- Twelve faculty principal investigators
- 50 graduate students
- 31 hourly student workers
- 12 peer reviewed publications
- 33 professional presentations



ACCOMPLISHMENTS & AWARDS

Carla Hurt's Team: January 2023 – As part of an NSF grant on Alpheus biodiversity, we assisted with the filming of a documentary produced by WildStar films for National Geographic. This film will feature one of the species of snapping shrimp we are focusing on for our study.

Alfred Kalyanapu: 2023, Stonecom Radio Station, interview with Betsy Scarisbrick on low-cost real-time flood sensors. 2023, Stonecom Radio Station, interview with Betsy Scarisbrick on "TRITON" flood simulator. The research team's sensors project was also highlighted by News Channel 5 Nashville in November: <https://www.newschannel5.com/news/tennessee-professor-designs-water-gauge-that-could-help-warn-communities-like-waverly-about-floods>

TN FISHERY RESEARCH CENTER

CELEBRATING 50 YEARS

The Tennessee Cooperative Fishery Research Unit has a 50-year history of excellence in research and management of fishery resources in Tennessee. Our predecessors built bridges that led to the cooperation with all of our partners, and the history and impact of the Fishery Research Unit are evident at local, regional, and national scales. We look forward to many more years assisting our Cooperators with research needs to enhance the stewardship of Tennessee's remarkable, unique, and incredibly diverse aquatic and fishery resources.

Established in 1935, the CUnit mission is our North Star: meet the actionable science needs of our cooperators, provide technical assistance, and develop the future workforce through graduate education and mentorship. Although both of us have been in Tennessee less than a decade, we have been able to work with cooperators to build research programs in Tennessee

focused on a variety of fishery and conservation topics. Through the history of the Unit, research needs have ebbed and flowed across sport fisheries, invasive species, and conservation needs. Current focuses revolve around invasive carps, investigation of tailwater trout fisheries and black bass recreational fisheries, nongame fish, and freshwater mussels of conservation importance. Most rewarding has been seeing our students complete their research topics and move on to exciting careers in fisheries. We were fortunate to inherit a long history of successful research from our predecessors (chronological order): Don Estes, Mike Van Den Avyle, Jim Layzer, Phil Bettoli, and their 181 graduated students and projects. The Tennessee Cooperative Fishery Research Unit continues this legacy through strong partnerships and cooperators. We hope in this meeting to discuss our plans for future directions as well as review our current projects and progress.

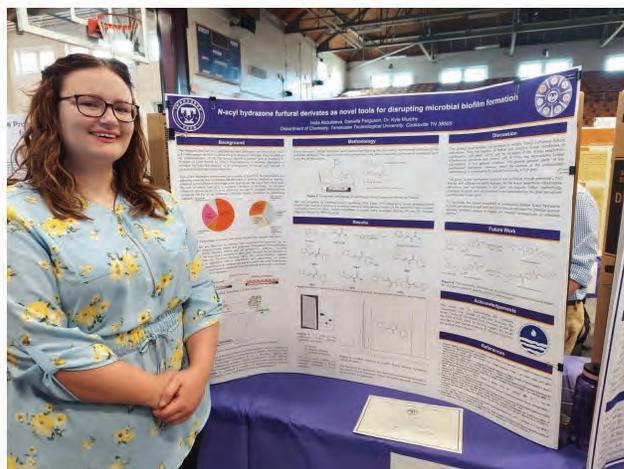


MURPHY LAB

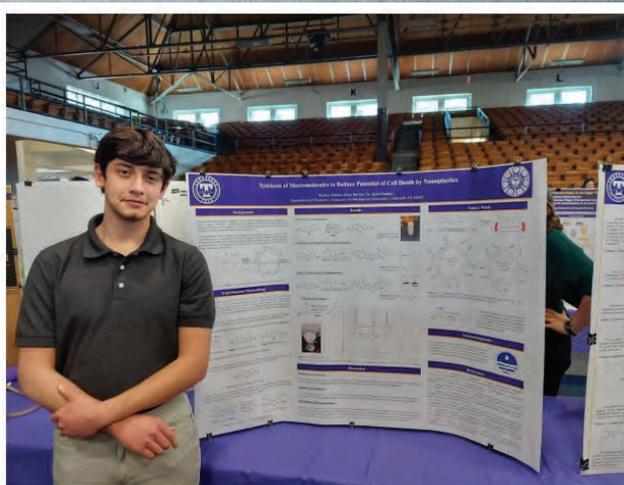
The Water Center has provided the Murphy Lab with \$20K for the 2022-2023 fiscal year for the following: to assist with the purchase of a BUCHI Flash Column Chromatography System instrument to assist with the purification of important synthesized molecules (\$12,000), and to support two undergraduate researchers (Wesley Gibson and Danielle Ferguson) over the summer in the Murphy Lab to continue their work on water-related projects (\$4,000 each).

The aforementioned instrument has been a great boon to the Murphy Lab to help in the purification of compounds that we make. Thus, it is utilized in the ongoing projects that undergraduate students are working on. These projects include: (1) the synthesis of well-defined macromolecules for untangling polystyrene-based nanoplastics in aqueous mediums as well as (2) N-acyl hydrazone furfural derivatives as antimicrobial agents to combat bacterial biofilms and antibiotic resistance bacteria in wastewater.

RANIL GURUSINGHE CHEMISTRY



Danielle Ferguson, with her poster presentation at TTU's 2023 Research Day on furfural derivatives to combat biofilms.



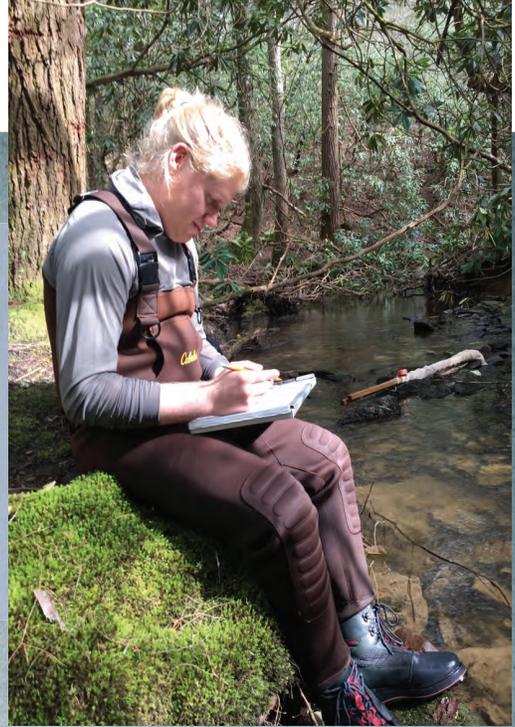
Wesley Gibson, with his poster presentation at TTU's 2023 Research Day on synthesizing macromolecules to untangle nanoplastics.

Dr. Gurusinghe, assistant professor of Chemistry, used Water Center support to purchase an Arbitrary Waveform Generator. One of the main applications of this spectrometer will be understanding the three-dimensional structures of complexes that water molecules form with molecules. One of the first projects would be determining the precise geometry of the guaiacol-water complex and the effect of inter- and intra-molecular hydrogen bonding interactions on molecular geometry. FTMW spectroscopy will provide a better understanding of the hydrogen bonding in water from a molecular and quantum mechanical point of view. Students Rusiru Rajapaksha (first-year chemistry, M.S.), Mitchell Swann (first-year undergrad, chemistry), Cadence Miller (third-year undergrad, chemistry and chemical engineering), and Vasilisa Zhukova (first-year undergrad, chemistry) have been part of the project.

RESEARCH HIGHLIGHTS

HAYDEN MATTINGLY BIOLOGY

*Dr. Hayden Mattingly, biology professor, and his research team focus their energies on conservation and support of recovery implementation for the Hardin Crayfish and Pristine Crayfish, including genetics, life history, and species status assessment. They are also developing a population monitoring plan for Brawleys Fork Crayfish, *Cambarus williami*. Much of his work is funded by the Tennessee Wildlife Resources Agency and is motivated by informing conservation efforts of at-risk species.*



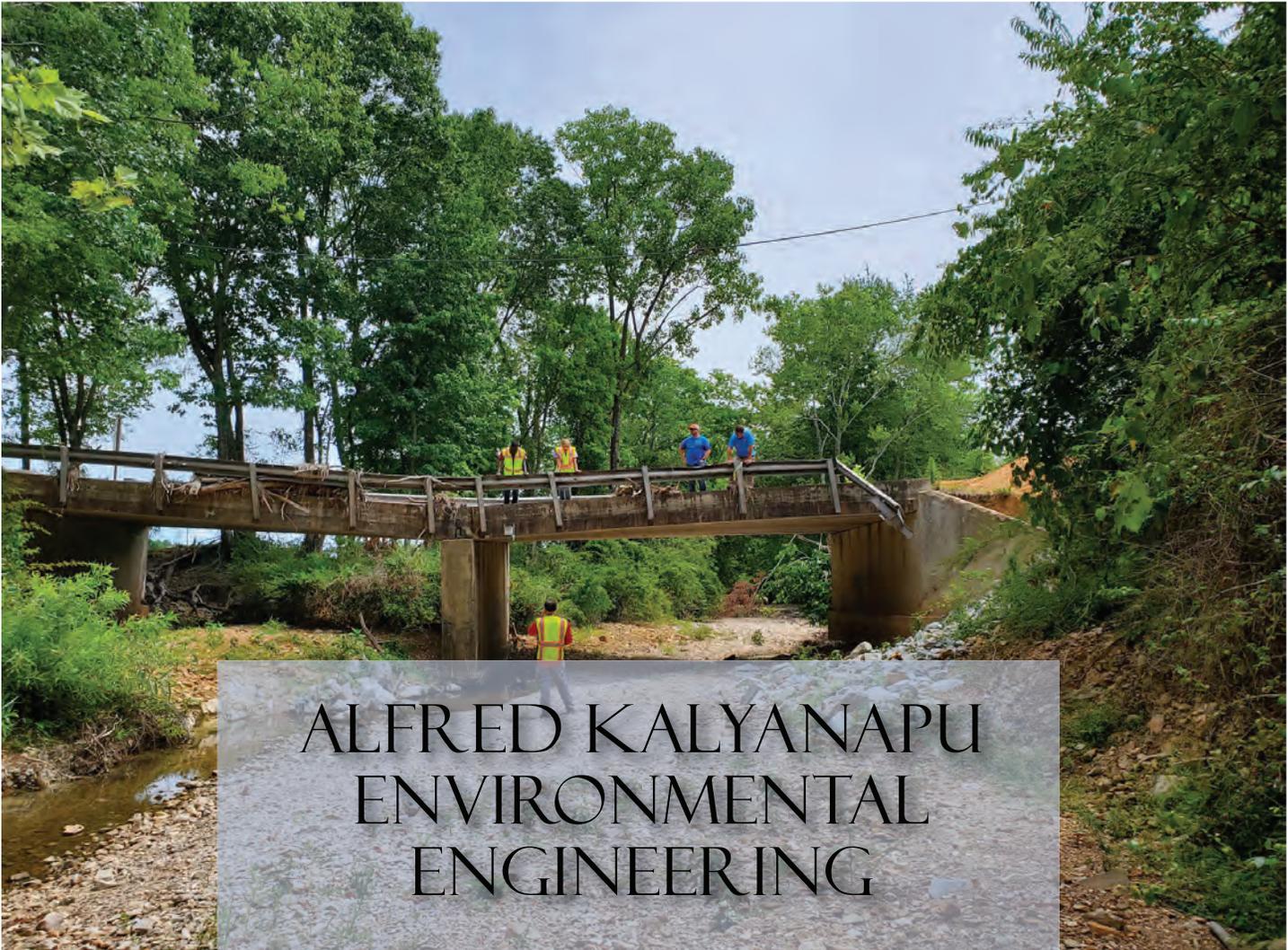




CARLA HURT BIOLOGY

Dr. Carla Hurt and her students engage in a broad range of research topics on Tennessee's aquatic biodiversity, but her research portfolio is international. She recently traveled to Guam to examine the genetics of marine snapping shrimp. That work is supported by the National Science Foundation. This photo was taken during August 2022.





ALFRED KALYANAPU ENVIRONMENTAL ENGINEERING

The City of Waverly, TN experienced devastating flood in August 2021 and due to high flows in Trace Creek. To help them, Alfred Kalyanapu, professor of civil and environmental engineering, and his research team installed two low-cost real-time water level sensors developed at TTU, along Trace Creek in Waverly, TN. The installation project, funded by Office of Research Faculty Research Grant and by Water Center, installed two sensors in Waverly, to help the City of Waverly to use them for early warning for floods in the future. This is a small step towards a long process of flood mitigation and risk management.

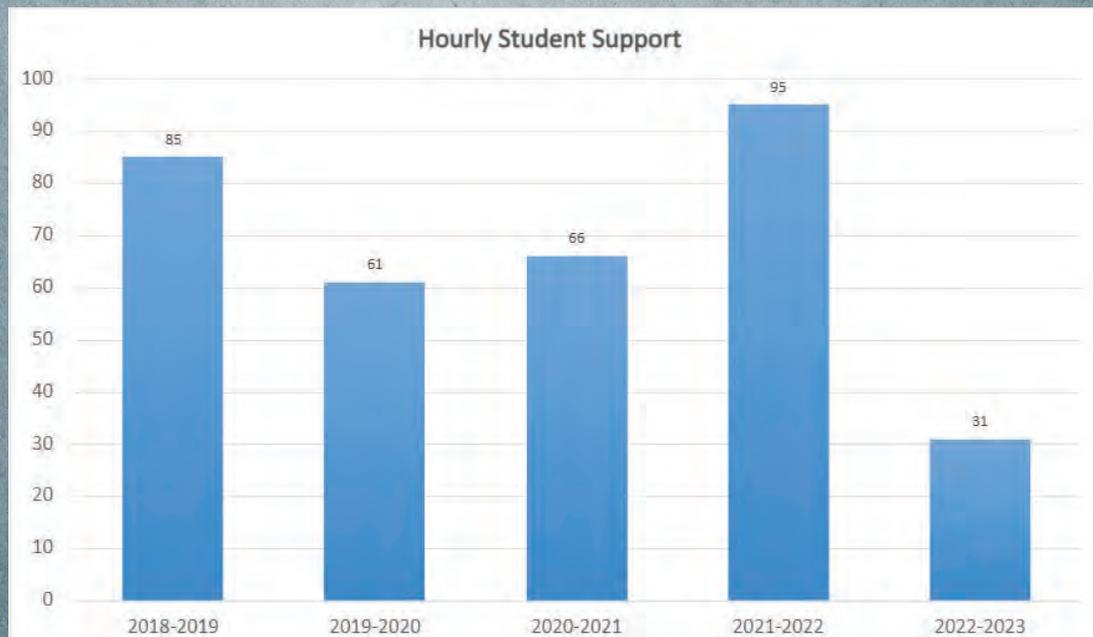
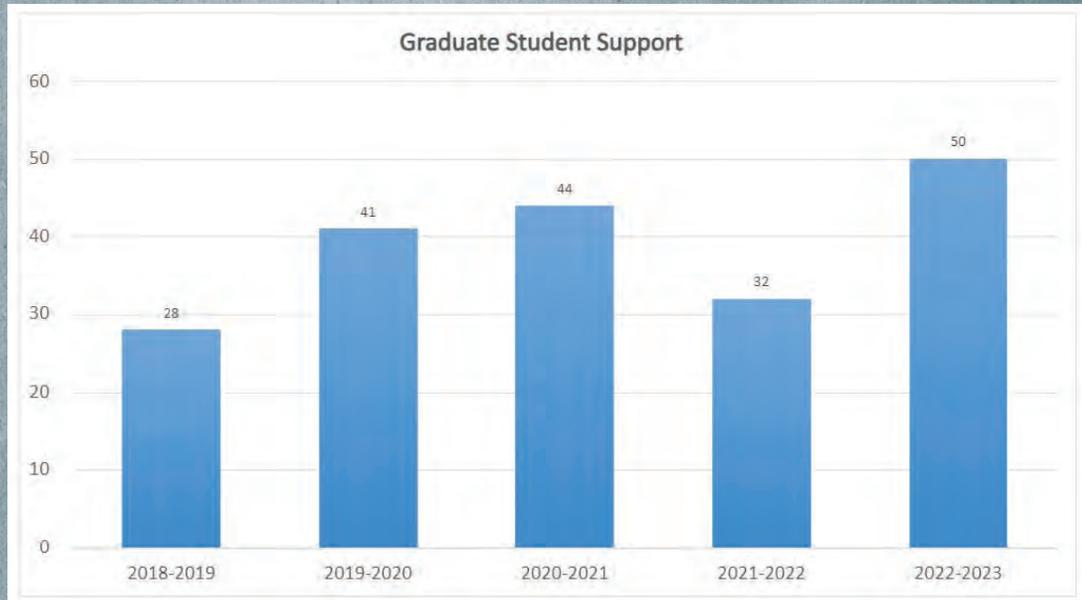
On July 13, 2022, in partnership with the West Tennessee River Basin Authority (WTRBA) and the City of Waverly, a group of students along with Dr. Kalyanapu visited Waverly and installed the real-time sensors. These sensors measure water level every 15 minutes and transmit the data over the internet using a cellular connection. Here are some photos taken from the installation. We thank Mr. David Blackwood, Director of WTRBA and Mr. Kris Gordon, engineer from WTRBA for helping us with the installation. We also thank the support from Police Chief Grant Gillespie for coordinating during this project and Officer Wilkins for providing us traffic detail during the installation.

Thanks to students Collins Owusu, Sarah Finkle, Caroline Grace Hitchcock and Kelly Boren for helping with the installation.



ENHANCING EDUCATION & RESEARCH

NUMBERS OF STUDENTS SUPPORTED



GRADUATE STUDENTS SUPPORTED

Ph.D.

Name	Advisor
Samantha Allen, EVS	Hayden Mattingly
Peter Blum, EVS	Justin Murdock
Robert Brown, EVS	Justin Murdock
Shrijana Duwadi, EVS	Justin Murdock
Brooke Grubb, EVS	Hayden Mattingly
Cory Highway, EVS	Bradley Cohen
Rachel Kaiser, EVS	Tania Datta
Nicholas Masto, EVS	Bradley Cohen
Collins Owusu, ENGR	Alfred Kalyanapu
Sahar Salimi, EVS	Mostafa Rahnama
Sara Watkins, EVS	Bradley Cohen
Spencer Womble, EVS	Justin Murdock

MASTER'S

Name	Advisor
Maci Arms, CEE	Tania Datta
Connor Ballard, BIOL	Mark Rogers
Josh Cary, BIOL	Amanda Rosenberger
Joelle Ciriacy, BIOL	Kit Wheeler
Brady England, CEE	Tania Datta
Jack Fetters, BIOL	Amanda Rosenberger
George Fordjour, CEE	Alfred Kalyanapu
Andrew Gable, BIOL	Mark Rogers
Mateo Gannod, CSC	Brad Cohen
Holly Gothard, BIOL	Carla Hurt
Will Green, EVS	Peter Li
Kendell Hamm, BIOL	Hayden Mattingly
Caroline Hitchcock, CEE	Tania Datta
Cole Howard, BIOL	Brad Cohen
Rachael Irby, BIOL	Mark Rogers
Benjamin Lane, EVS	Peter Li
Kathlyn Mealio, ChE	Holly Stretz
Catherine Murphy, ChE	Laura Arias-Chavez
Faria Nurr, CEE	Alfred Kalyanapu
Haley Ortner, BIOL	Hayden Mattingly
Abigail Riggs, BIOL	Brad Cohen
Mark Rine, WFS	Kitt Wheeler
Katelynn Sallack, BIOL	Amanda Rosenberger
Anchita Sanan, BIOL	Carla Hurt
Hannah Swain, BIOL	Amanda Rosenberger
Jared Thompson, BIOL	Carla Hurt
Julia Thulander, BIOL	Josh Hall

PROFESSIONAL SERVICE

- Hayden Mattingly, biology professor, was a federally appointed member of the Bluemask Darter Technical Team, U.S. Fish and Wildlife Service-Tennessee Field Office. He was also a federally appointed member of the Elk River Multiple Species Recovery Planning Group of the U.S. Fish and Wildlife Service-Tennessee Field Office. Mattingly has a professional society membership in the American Fisheries Society and Southeastern Fishes Council. He also served as a manuscript reviewer, providing journal manuscript peer reviews for *Ichthyology and Herpetology*, *Southeastern Naturalist*, and *Bulletin of the Peabody Museum of Natural History*. Also for the *Southeastern Naturalist*, Mattingly was an editorial board member, manuscript editor, and special issue volume co-editor with Jeffrey W. Simmons.

ANALYTICAL CAPABILITIES

The Water Center offers unique analytical capabilities through its state-certified consulting lab including the following services:

- Industrial wastewater treatment process analysis design
- Drinking water and wastewater treatability studies
- Wastewater characterization studies
- Wastewater treatment unit process evaluation using nonstandard analytical techniques including particle size distribution analysis, solids oxygen demand determination, and long-term biochemical oxygen demand
- Aerobic and anaerobic biological wastewater treatment process pilot studies
- Coagulation process optimization using zeta potential measurements
- Activated carbon absorption studies
- GIS capabilities for field study design

The environmental quality lab continues to support faculty and student research, as well as the surrounding community by offering stand-alone analytical services at a reasonable cost. These include:

- Drinking water regulatory parameters
- Conventional wastewater pollutants
- Metals
- Bacteriological analyses
- GC for THMs and HAAs

The Water Center Laboratory also offers field sampling and monitoring capabilities including:

- Composite field sampling for local businesses
- Stream velocity measurements
- Field-dissolved oxygen, pH, temperature, conductivity, and ORP measurements
- GPS position logs of all sampling sites

The lab is staffed by analyst Phillip Burr.

SUPPORT STAFF

Our staff brings years of expertise in their respective areas of work, and they include Michelle Holm, office manager, who administers the financial reporting for the Center. Sandy Dodson, administrative associate 3, provides support in preparing travel claims, administering the Motor Pool, and purchasing supplies. Shannon Strahan, grants specialist, provides bookkeeping support for faculty grants. Phillip Burr is an academic support associate and leads commercial testing for the Water Center Analytical Lab. Center staff are recognized across campus for excellence in their respective duties.

ADMINISTRATION AND FACULTY

Dr. Jeff Schaeffer
Dr. Tania Datta

Director
Research Focus Area Leader,
Associate Professor of Civil and
Environmental Engineering
Research Focus Area Leader,
Associate Professor of
Environmental Engineering
Research Focus Area Leader,
Associate Professor of Biology

Dr. Alfred Kalyanapu

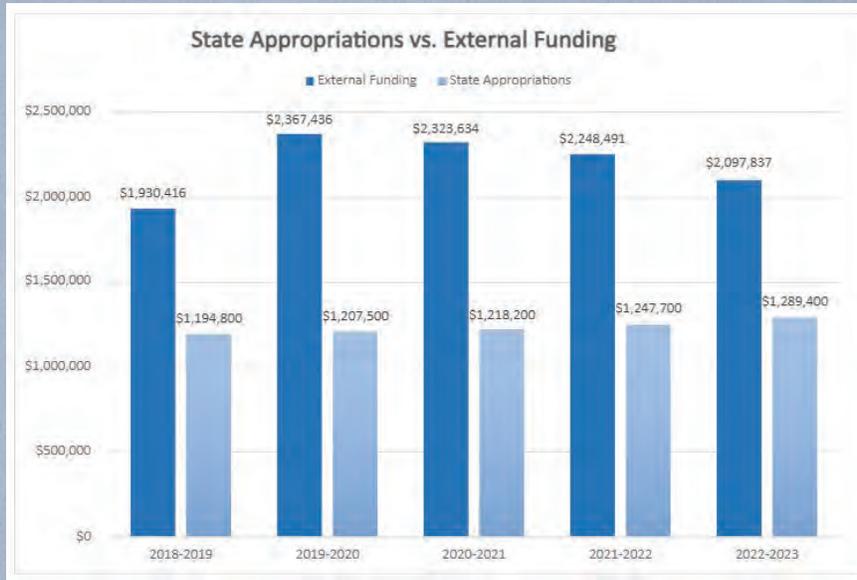
Dr. Justin Murdock

SUPPORT STAFF

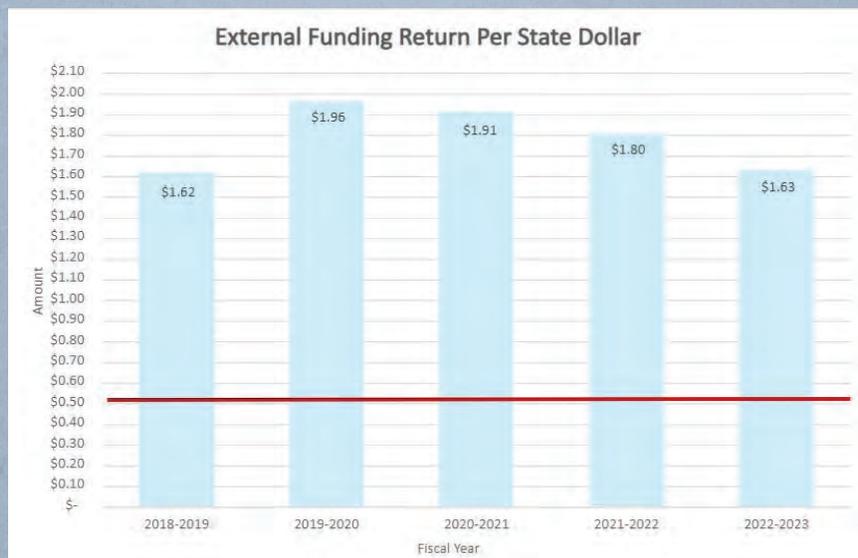
Michelle Holm
Phillip C. Burr
Sandy Dodson
David Hobbs
Shannon Strahan

Manager
Academic Support Associate
Administrative Associate 3
Laboratory Support
Grants Specialist

STATE APPROPRIATIONS VS. EXTERNAL FUNDING

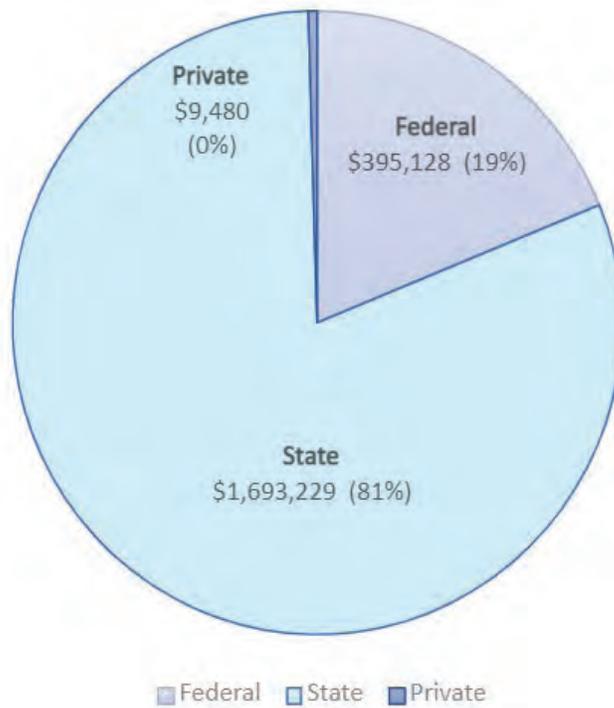


**The total external funding includes both direct and indirect costs awarded.*



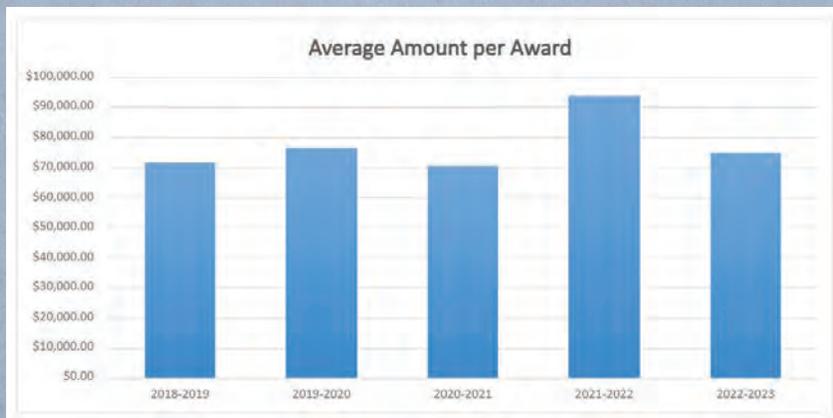
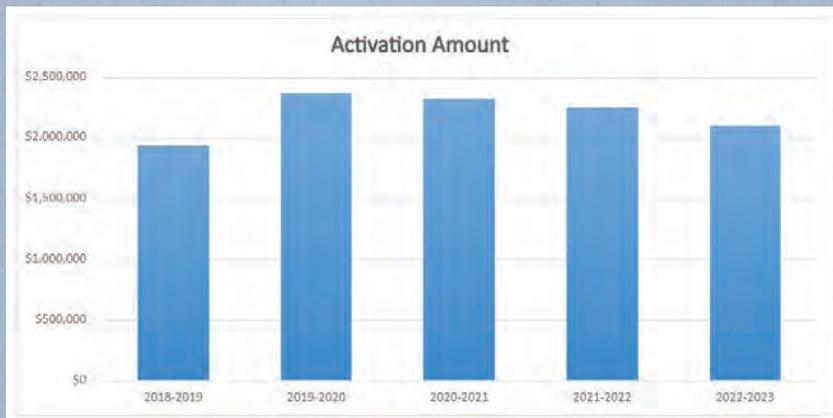
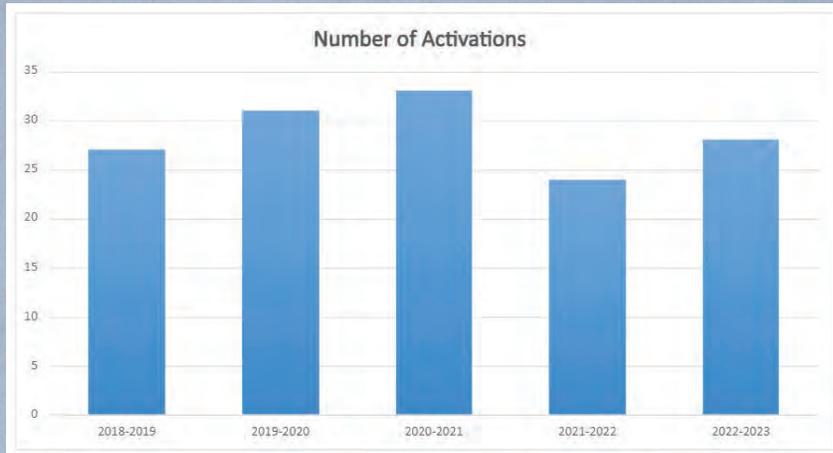
SOURCES OF EXTERNAL FUNDING

Sources of External Funding



NUMBER OF ACTIVATIONS, AMOUNT AND VALUE

**The total activations includes both direct and indirect costs awarded.*



EXTERNALLY
FUNDED
PROJECTS
ACTIVATED
IN FISCAL YEAR
2022-2023

Aquatic Research-Sport Fish
Restoration
Mark Rogers/TWRA
Activation This Year: \$106,000

ARB in Urban Groundwater
System
Tania Datta/USGS via
UT-TWRRC
Activation This Year: \$26,000

A Resurvey of the Mussel-Fauna
Wolf River
Amanda Rosenberger/USGS
Activation This Year: \$78,000

Asian Carp Controls
Mark Rogers/USGS
Activation This Year: \$5,000

Bighead and Silver Carp
Population
Mark Rogers/USGS
Activation This Year: \$25,000

Brawley's Fork Crayfish
Hayden Mattingly/TWRA
Activation This Year: \$15,000

Environmental DNA Surveillance
of the Chucky Madtom
Amanda Rosenberger/TWRA
Activation This Year: \$54,000

Environmental Triggers of Harmful
Algal Blooms
Justin Murdock/Marshall
University
Activation This Year: \$143,000

Factors Affecting Mallard
Distribution, Habitat
Brad Cohen/Private
Activation This Year: \$9,500

Freshwater Mussel Distributions -
Hatchie River
Amanda Rosenberger/TDEC
Activation This Year: \$55,000

Hardin Pristine Crayfish
Hayden Mattingly/USFWS
Activation This Year: \$20,000

Mallards Sanctuary Use
Brad Cohen/USFWS
Activation This Year: \$12,000

Mallard Use TN Wetlands
Brad Cohen/TWRA
Activation This Year: \$204,000

Microplastics from TN Wastewater
Treatment Plants
Tania Datta/USGS
Activation This Year: \$26,000

Modeling for Dam Breach Analysis
Alfred Kalyanapu/TDEC
Activation This Year: \$25,000

Multi-State Gobbler Harvest
Brad Cohen/KDFWR
Activation This Year: \$42,000

Reassessment of the Status and
Distribution of Pale Lilliput
Amanda Rosenberger/TWRA
Activation This Year: \$27,100

Reclaiming Val. Res. from Ind.
Wastewater
Laura Chavez/NSF
Activation This Year: \$36,000

EXTERNALLY
FUNDED
PROJECTS
ACTIVATED
IN FISCAL YEAR
2022-2023

River Chubs as Keystone Species
in the Little TN River Basin
Kit Wheeler/TVA
Activation This Year: \$8,000

Streamside Salamanders
Carla Hurt/TWRA
Activation This Year: \$47,000

TN Secretive Marshbird
Monitoring Project
Brad Cohen/TWRA

Activation This Year: \$20,000

Waterfowl Monitoring Protocols
Brad Cohen/USFWS
Activation This Year: \$23,000

Waterfowl Rest Areas-Connectivity
Brad Cohen/PR via TWRA
Activation This Year: \$480,000

Watershed Plan for Falling Water
River Watershed
Tania Datta/TDEC
Activation This Year: \$28,000

Wild Turkey Reproduction Study
Brad Cohen/KDFWR
Activation This Year: \$334,000

REFEREED PUBLICATIONS

Allen SA, Wells WG, Mattingly HT. 2022. A large-scale MaxEnt model for the distribution of the endangered Pygmy Madtom, *Noturus stanauli*. *Journal of Fish and Wildlife Management* <https://doi.org/10.3996/JFWM-21-057>.

Hubbs, N.W., Hurt, C.R., Niedzwiecki, J., Leckie, B. and Withers, D. (2022) Conservation Genomics of Urban Populations of Streamside Salamander (*Ambystoma barbouri*). *PLoS one* 17 e0260178.

Hurt, C. Hildreth P, Williams C. (2022) A Genomic Perspective on the Conservation Status of the Endangered Nashville Crayfish (*Faxonius shoupi*). *Conservation Genetics* 23: 589-604.

Kaiser, R. A., Polk, J. S., Datta, T., Keely, S. P., Brinkman, N. E., Parekh, R. R., & Agga, G. E. (2023). Occurrence and prevalence of antimicrobial resistance in urban karst groundwater systems based on targeted resistome analysis. *Science of the Total Environment*, 874, 162571.

Kaiser, R. A., Polk, J. S., Datta, T., Parekh, R. R., & Agga, G. E. (2022). Occurrence of Antibiotic Resistant Bacteria in Urban Karst Groundwater Systems. *Water*, 14(6), 960.

Kalyanapu, A., Owusu, C., Wright, T., & Datta, T. (2023). Low-Cost Real-Time Water Level Monitoring Network for Falling Water River Watershed: A Case Study. *Geosciences*, 13(3), 65.

Kalyanapu, A., Owusu*, C., Wright, T., and Datta T. (2023). "Low-Cost Real-Time Water Level Monitoring Network for Falling Water River Watershed: A Case Study." *Geosciences*. 2023; 13(3):65. <https://doi.org/10.3390/geosciences13030065>.

Krosnick SE, Thacker JH, Mattingly HT, Call GP, Maynard SC, Adams DS, Wheeler, K. 2022. Ecological correlates of reproductive output in a Tennessee population of Short's Bladderpod, *Physaria globosa* (Brassicaceae). *Castanea* 87(1):20–38.

Masto, N.M., O. Robinson, M. Brasher, A.G. Blake-Bradshaw, C.J. Highway, A.C. Keever, J.C. Feddersen, H.M. Hagy, D.C. Osborne, and B.S. Cohen. 2022. Using citizen science to understand avian responses to extreme climatic events. *Global Change Biology* 29:5469-5479.

Nelson, S.D., A.C. Keever, P.H. Wightman, N.W. Bakner, B.A. Collier, M.J. Chamberlain, and B.S. Cohen. 2022. Fine-scale resource selection and behavioral tradeoffs of eastern wild turkey broods. *Journal of Wildlife Management* 86:e2222.

Sava, E., Cervone, G., and Kalyanapu, A. (2023). Multiscale Observation Product (MOP) for Temporal Flood Inundation Mapping of the 2015 Dallas Texas Flood. *Remote Sensing*, 15(6), 1615. <https://doi.org/10.3390/rs15061615>

Thoma, R.T., Hurt C.R., Williams C., and Withers D. (2023) *Cambarus nyx* (Decapoda: Cambaridae) A new species of crayfish with insights on the evolution and conservation of burrowers. *Journal of Crustacean Biology*. 43 (1) ruac066.

PRESENTATIONS

Blake-Bradshaw, A.G., C.J. Highway, A.C. Keever, N. M. Masto, J.C. Feddersen, H.M. Hagy, and B.S. Cohen. 2022. Influence of experimental disturbance on waterfowl movements and hunter harvest opportunity. Summer Mississippi Flyway Council Meeting. Orange Beach, Alabama, USA.

Blake-Bradshaw, A.G., N.M. Masto, C.J. Highway, A.C. Keever, J.C. Feddersen, H.M. Hagy, and B.S. Cohen. 2022. Ruffling feathers: effects of experimental disturbance on mallard space use and movements. 54th Annual Conference of the Tennessee Chapter of the Wildlife Society [virtual]. Awarded "Best Student Presentation"

England*, B. Arms*, M. Brackins*, J. Kalyanapu, A.J. (2022). "Flood Risk Education in the Trace Creek Watershed Using HEC-RAS and ArcGIS Story Maps". 2022 Kentucky/Tennessee Water Professionals Conference, KY/TN Section of AWWA and CWP-KT, Lexington, KY.

England, B. and T. Datta (2023). Quantifying Disparities in Public Potable Water and Wastewater Treatment Systems in Tennessee using a Disparity Index. Presented at 2023 Tennessee Water Resources Symposium.

Gangrade, S., Ghimire, G. R., Kao, S. -C., Hernández, M. M., Kelleher, M., and A. J. Kalyanapu, A. J. (2022), Towards the Development of a High-Resolution Historical Flood Inundation Reanalysis Dataset for the Conterminous United States, American Geophysical Union 2022 Fall Meeting, December 12-16, 2022, Chicago, IL.

Greenwalt, A.C., P. Garrettson, C. Howard, B.S. Cohen, and H.M. Hagy. 2022. Wood duck banding in eastern United States. Mississippi Flyway Council Meeting [virtual].

Grubb B and Mattingly HT. "Habitat characteristics at multiple spatial scales for a narrow endemic crayfish, *Faxonius wrighti*." Oral presentation at Southeastern Fishes Council Annual Meeting, Athens, GA. November 2022.

Hamm KJ and Mattingly HT. "Life history of Pristine Crayfish, *Cambarus pristinus*." Poster presentation at Southeastern Fishes Council Annual Meeting, Athens, GA. November 2022.

Highway, C.J., A.G. Blake-Bradshaw, N.M. Masto, A.C. Keever, J.C. Feddersen, H.M. Hagy, D.L. Combs and B.S. Cohen. 2022. Ducky days – linking temporal and environmental factors to mallard activity patterns. 54th Annual Conference of the Tennessee Chapter of the Wildlife Society [virtual].

Highway, C.J., N.M. Masto, A.G. Blake-Bradshaw, A.C. Keever, J.C. Feddersen, H.M. Hagy, D.L. Combs, and B.S. Cohen. 2022. Abundance and depletion of unharvested flooded corn. Winter Mississippi Flyway Council Meeting, Orange Beach, AL, USA.

Hildreth P., Hurt C., Simmons, J, and Williams C. – Species delimitation in *Faxonius placidus*. Oral Presentation Association of Southeastern Biologists, Winston-Salem NC March 2023.

Holiman, H.L., A. G. Blake-Bradshaw, A. C. Keever, D. Hanni, and B. S. Cohen. 2022. Secretive marsh bird monitoring in Tennessee. Mississippi Flyway Council Meeting. Orange Beach, AL.

Keever, A.C., J.D. Kelly, and B.S.Cohen. 2022. Estimating abundance of white-tailed deer using harvest data and integrated population models. 45th Southeast Deer Study Group [virtual].

Lane, B., and Asante J., (2022) Evaluating water quality pollution from zinc mine watershed – Nyrstar zinc mine Gordonsville. Geological Society of America Abstract with Programs Vol. 54, No. 5, 2022. <https://gsa.confex.com/gsa/2022AM/meetingapp.cgi/Paper/383906>

PRESENTATIONS (CONT.)

Lane, B., and Asante J., (2022) Evaluating water quality pollution from zinc mine watershed – Nyrstar zinc mine Gordonsville. Geological Society of America Abstract with Programs Vol. 54, No. 5, 2022. <https://gsa.confex.com/gsa/2022AM/meetingapp.cgi/Paper/383906>

Maci Young, Tania Datta, and Alfred Kalyanapu (2023). Evaluating Flood Hazards in Rural Tennessee Watershed through a Community-University Partnership. Presented at 2023 Tennessee Water Resources Symposium.

Masto, N.M., A.G. Blake-Bradshaw, C.J. Highway, A.C. Keever, J.C. Feddersen, H.M Hagy, D.L. Combs, and B.S. Cohen. 2022. Winter fidelity and distribution of individually marked mallards. 54th Annual Conference of the Tennessee Chapter of the Wildlife Society [virtual].

Masto, N. M., A.G. Blake-Bradshaw, C.J. Highway, A.C. Keever, J.C. Feddersen, H.M Hagy, D.L. Combs, and B.S. Cohen. 2022. Local winter distributions and fidelity of GPS-marked mallards. Winter Mississippi Flyway Council Meeting, Orange Beach, AL, USA.

Masto, N. M., O. J. Robinson, M. G. Brasher, A. C. Keever, A. G. Blake-Bradshaw, J. C. Feddersen, H. M. Hagy, D. C. Osborne, D. L. Combs, and B. S. Cohen. 2022. Citizen science reveals waterfowl responses to extreme winter. Lower Mississippi Valley Joint Venture Waterfowl Science Conference. Memphis, TN, USA.

Masto, N. M., A. C. Keever, A. G. Blake-Bradshaw, C. J. Highway, P. T. Link, J. C. Feddersen, H. M. Hagy, D. C. Osborne, D. L. Combs, and B. S. Cohen. 2022. Spring migration strategies of mallards in the Mississippi Alluvial Valley. Lower Mississippi Valley Joint Venture Waterfowl Science Conference. Memphis, TN, USA.

Mattingly HT. Ichthyology Guest Lecturer. "Fish conservation research in the School of Environmental Studies at Tennessee Tech University." Department of Biology, The University of the South, Sewanee, TN. October 2022.

Owusu, C., N. M. Masto, A. J. Kalyanapu, and B. S. Cohen. 2022. An easy-to-use Python-Google Earth Engine Toolbox for wetland hydrologic monitoring: Applications for waterbird conservation planning and delivery. Lower Mississippi Valley Joint Venture Waterfowl Science Conference. Memphis, TN, USA.

Palk, H. Hurt C. –Transcriptome sequencing in the Hardin Crayfish. Poster presentation at the Tennessee Tech Research Day. April 2023

Walker A. Hurt, C. and Wheeler K. Population genetics of the Striated Darter. Oral presentation at Southeastern Fishes Council Annual Meeting, Athens, GA. November 2022.

Wheeler, C., and R. Hudson. Do potamodromous suckers deliver nutrient subsidies to an oligotrophic Blue Ridge stream?; 2022 Sicklefin Redhorse Conservation Committee annual meeting

Wheeler, C., and J. Caudle. Evaluating temporal change in freshwater stream fish communities. 2022 Tennessee chapter, American Fisheries Society annual meeting

Wheeler, C., and C. Hurt, and Bajo-Walker, A. Development and application of an eDNA assay to delineate the distribution of the imperiled Striated Darter (*Etheostoma striatulum*) in the Duck River, Tennessee 2022 Tennessee chapter, American Fisheries Society (awarded 2nd place for best student presentation).

PRESENTATIONS (CONT.)

Wheeler, C. Assembling the conservation jigsaw: a case study with Striated Darter in the Duck River. Department of Biology at Austin Peay State University, Spring 2022 semester.

Wheeler, C. A new dimension of aquatic connectivity? Nutrient transport by migratory fishes. 2022 Tennessee River Basin Network annual meeting (invited presentation).

Wheeler, C., Etchison, L., and Gibbs, J. Dam good opportunities: making the most of increasing interest in dam removals. 2022 Southeastern Fishes Council annual meeting (invited presentation).

Wheeler, C., and Hudson, R. Can migratory suckers subsidize their spawning streams? 2022 Southeastern Fishes Council annual meeting (2nd place for best student presentation).

Wheeler, C., Bajo-Walker, A. and Hurt, C. Population structure and genetic diversity of the imperiled Striated Darter (*Etheostoma striatulum*). 2022 Southeastern Fishes Council annual meeting.

Wheeler, C., and Ciriacy, J. Quantitative evaluation of River Chub as a potential keystone species in the Little Tennessee basin. 2022 Southeastern Fishes Council annual meeting.

PUBLICATIONS IN PRESS/ PENDING

Hildreth, P., Hurt C.R., Simmons, J.W., Williams, C.E. and Leckie B. (2023) Species Delimitation Reveals Fine-Scale Endemism in the Cryptic Species Complex *Faxonius placidus* (Hagen 1870) (*Decapoda: Astacidea: Cambaridae*). *Journal of Crustacean Biology*, Accepted.

HOURLY STUDENT SUPPORT

Name	Major
Kennedy Anderson	WFS
Abigail Blake-Bradshaw	BIOL
Kelly Boren	CEE
Matthew Boyd	EARTH SCI
Isabel Brickner	AGRI
Robert Brown	BIOL
Benjamin Burns	CEE
Lydia Burton	EVS
Meghan Campbell	WFS
Chase Carden	CEE
Gabriela De Almeida	EVS
Shrijana Duwadi	EVS
Jeremy Eduave	CEE
Cassandra Fink	BIOL
Sarah Finkle	CEE
Danielle Ferguson	BIOL
Makayla Fritts	WFS
Kennley Gabel	CEE
Eli Galloway	BIOL
Wesley Gibson	BIOL
William Green	EVS
Cory Highway	BIOL
Kennedy Irwin	WFS
Kaitlyn Joyce	CEE
Elizabeth McCurry	EVS
Claire Offutt	CEE
Devin Rains	CEE
Andrew Rosson	BIOL
Anna Katherine Stites	BIOL
Eduardo Toala-Hidalgo	WFS
Victoria Weldon	WFS
Annabella Wilhelm	CEE
Ian Williams	WFS
Spencer Womble	EVS

**CENTERS OF EXCELLENCE/
CENTERS OF EMPHASIS
ACTUAL, PROPOSED,
AND REQUESTED BUDGET**

SCHEDULE 7

Expenditures	FY 2022-23 Actual			FY 2023-24 Proposed			FY 2024-25 Requested		
	Matching	Apprpr.	Total	Matching	Apprpr.	Total	Matching	Apprpr.	Total
Salaries									
Faculty	\$117,940	\$122,828	\$240,768	\$67,556		\$67,556	\$89,245		\$89,245
Other Professional	\$152,203	\$223,560	\$375,763	\$221,131	\$428,685	\$649,816	\$224,659	\$400,938	\$625,597
Clerical/ Supporting	\$41,400	\$65,898	\$107,298	\$105,750	\$36,365	\$142,115	\$108,394	\$37,274	\$145,668
Assistantships	\$337,916	\$227,168	\$565,084	\$295,699	\$314,021	\$609,720	\$313,540	\$319,771	\$633,311
Total Salaries	\$649,459	\$639,454	\$1,288,913	\$690,136	\$779,071	\$1,469,207	\$735,838	\$757,983	\$1,493,821
Fringe Benefits	\$184,596	\$245,546	\$430,142	\$218,088	\$422,293	\$640,381	\$223,540	\$392,345	\$615,885
Total Personnel	\$834,055	\$885,000	\$1,719,055	\$908,224	\$1,201,364	\$2,109,588	\$959,378	\$1,150,328	\$2,109,706
Non-Personnel									
Travel	\$130,682	\$15,177	\$145,859	\$140,478	\$26,428	\$166,906	\$145,990	\$19,740	\$165,730
Software		\$15,046	\$15,046		\$12,775	\$12,775			\$0
Books & Journals		\$70	\$70			\$0			\$0
Other Supplies	\$697,778	\$134,392	\$832,170	\$570,842	\$215,689	\$786,531	\$613,655	\$188,532	\$802,187
Equipment	\$56,800	\$145,779	\$202,579	\$30,000	\$234,269	\$264,269	\$60,850	\$20,000	\$80,850
Maintenance		\$29,900	\$29,900			\$0			\$0
Scholarships	\$9,480		\$9,480			\$0			\$0
Consultants	\$93,593		\$93,593	\$186,593		\$186,593	\$93,000		\$93,000
Renovation			\$0			\$0			\$0
Other (Specify):			\$0			\$0			\$0
Seminars & Workshops		\$10,006	\$10,006			\$0			\$0
			\$0			\$0			\$0
			\$0			\$0			\$0
Total Non-Personnel	\$988,333	\$350,370	\$1,338,703	\$927,913	\$489,161	\$1,417,074	\$913,495	\$228,272	\$1,141,767
GRAND TOTAL	\$1,822,388	\$1,235,370	\$3,057,758	\$1,836,137	\$1,690,525	\$3,526,662	\$1,872,873	\$1,378,600	\$3,251,473
Revenue									
New State Appropriation		\$1,289,400	\$1,289,400		\$1,344,800	\$1,344,800		\$1,378,600	\$1,378,600
Carryover State Appropriation		\$503,786	\$503,786		\$557,817	\$557,817			\$0
New Matching Funds	\$1,822,388		\$1,822,388	\$1,836,137		\$1,836,137	\$1,872,873		\$1,872,873
Carryover from Previous Matching Funds			\$0			\$0			\$0
Total Revenue	\$1,822,388	\$1,793,186	\$3,615,574	\$1,836,137	\$1,902,617	\$3,738,754	\$1,872,873	\$1,378,600	\$3,251,473



Budget Note: The Center for the Management, Utilization and Protection of Water Resources requests a five percent budget increase for the 2023-2024 fiscal year to accommodate potential increases in salaries and other supplies and equipment expenses.

Center Directors and Contributors/Editors/Writers: Drs. Justin Murdock, Alfred Kalyanapu, and Tania Datta

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We express our appreciation to Tania Datta, Alfred Kalyanapu, and our other faculty associates for their assistance in the production of this report.

August 2023

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