WaterSMART Cooperative Watershed Management Program for Phase 1 for Fiscal Years 2023 and 2024 – Task C

Funding Opportunity Announcement No. R23AS00362
CFDA No. 15.554

Improving the Water Quality in the Lake Thunderbird Watershed through the Design of Stormwater Detention Pond Retrofits

Applicant
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Executive Summary

Date: September 3, 2024
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This is a proposal for a project with a Task C applicant, Lake Thunderbird Watershed Alliance, Inc. (LTWA), located in Cleveland County, Norman, Oklahoma.

Work Proposed: To assess water quality conditions of Liz's Pond and the Main Pond in the Carrington neighborhood (see Figure 2) and design solutions that will address bank erosion and improve water quality throughout the Lake Thunderbird watershed. With these designated sites representing the headwaters of the watershed, improvement will be realized within the ponds and in the water being discharged from their locations. A watershed is a complex ecosystem of land that drains rainfall and streams to a 'pour point' which is often a reservoir in Oklahoma. The Lake Thunderbird watershed is in the Cross Timbers Ecoregion of central Oklahoma and drains 256 square miles in Oklahoma and Cleveland Counties including areas within the municipalities of Norman, Oklahoma City and Moore, as well as small parts of unincorporated Oklahoma and Cleveland Counties. Major tributaries to Lake Thunderbird are the Little River to the west, Dave Blue Creek to the southwest, and Hog Creek to the north. The Little River starts in the northwestern portion of the watershed and drains a substantial amount of the City of Moore before entering Lake Thunderbird. This serves as the longest flow path through the watershed. Lake Thunderbird itself was created by the United States Bureau of Reclamation (BOR) as authorized by Congress in 1960 and is known as the Norman Project. Lake Thunderbird is a sensitive water supply lake and drinking water source serving the Cities of Norman, Midwest City, and Del City in central Oklahoma. Secondary benefits include flood control, recreation, and fish and wildlife habitat.

Population within the watershed has increased significantly since the completion of the Norman Project in 1965. In August 2010, Lake Thunderbird was placed on the Oklahoma Department of Environmental Quality's 303(d) List of Impaired Waterbodies for impaired beneficial uses of public/private water supply and warm water aquatic community.[1] The Total Maximum Daily Load (TMDL) Report recommended watershed-specific controls and Best Management Practices (BMP) be identified and implemented through a separate stakeholder-involved process.

In 2021, the Lake Thunderbird Watershed Alliance (LTWA) was established to bring together a diverse group of stakeholders to work collaboratively to implement BMPs. In 2022, LTWA began working with the Carrington Property Owners Association, the Oklahoma State University College of Engineering, Blue Thumb Oklahoma, Oklahoma Conservation Commission, Central Oklahoma Master Conservancy District, the City of Norman, Thunderbird Sailing Club, watershed residents, and others to identify potential locations for implementation of watershed-specific controls. Carrington, which is in the upper reaches of the Lake Thunderbird watershed, was identified as a possible location to design and implement retrofits for several stormwater detention ponds with the goal of improving water quality in these headwater ponds and positively impact the stormwater they discharge into the remaining watershed. This project will include gathering water quality data, conducting hydraulic modeling and designing water quality retrofits for the Carrington detention ponds to determine a current contaminant profile and implement solutions which will reduce the negative impact on downstream water quality for drinking water use, health of aquatic life and public recreation. This project will also include educational opportunities which will allow LTWA to partner with the overall watershed population and Carrington neighbors about the importance of sustainable landscaping, green infrastructure, and other conservation practices that can be implemented by

[1]Oklahoma Department of Environmental Quality 2013 https://www.deq.ok.gov/wp-content/uploads/water-division/LakeThunderbirdFinalTMDL_ReportNov2013.pdf

individual businesses and homeowners to reduce stormwater pollution within the watershed. Depending upon the success of this project, LTWA intends to implement identified retrofits in the numerous subdivision stormwater detention ponds throughout the watershed.

Project's Proposed Duration: 3 years from start of grant contract

Estimated Completion Date for Project: September 30, 2028

Location on a Federal Facility: Lake Thunderbird is a federally owned water resource administered by the BOR and operated by Central Oklahoma Master Conservancy District (COMCD), and Oklahoma Department of Tourism and Recreation. The BOR owns 12,987 acres within the watershed and Tinker Air Force Base has approximately 350 acres. The State of Oklahoma leases approximately 1,874 acres in the watershed for Lake Thunderbird State Park. The project will focus on two detention ponds, known as the Main Pond and Liz's Pond, located on the northern boundary of Carrington.

Project Location

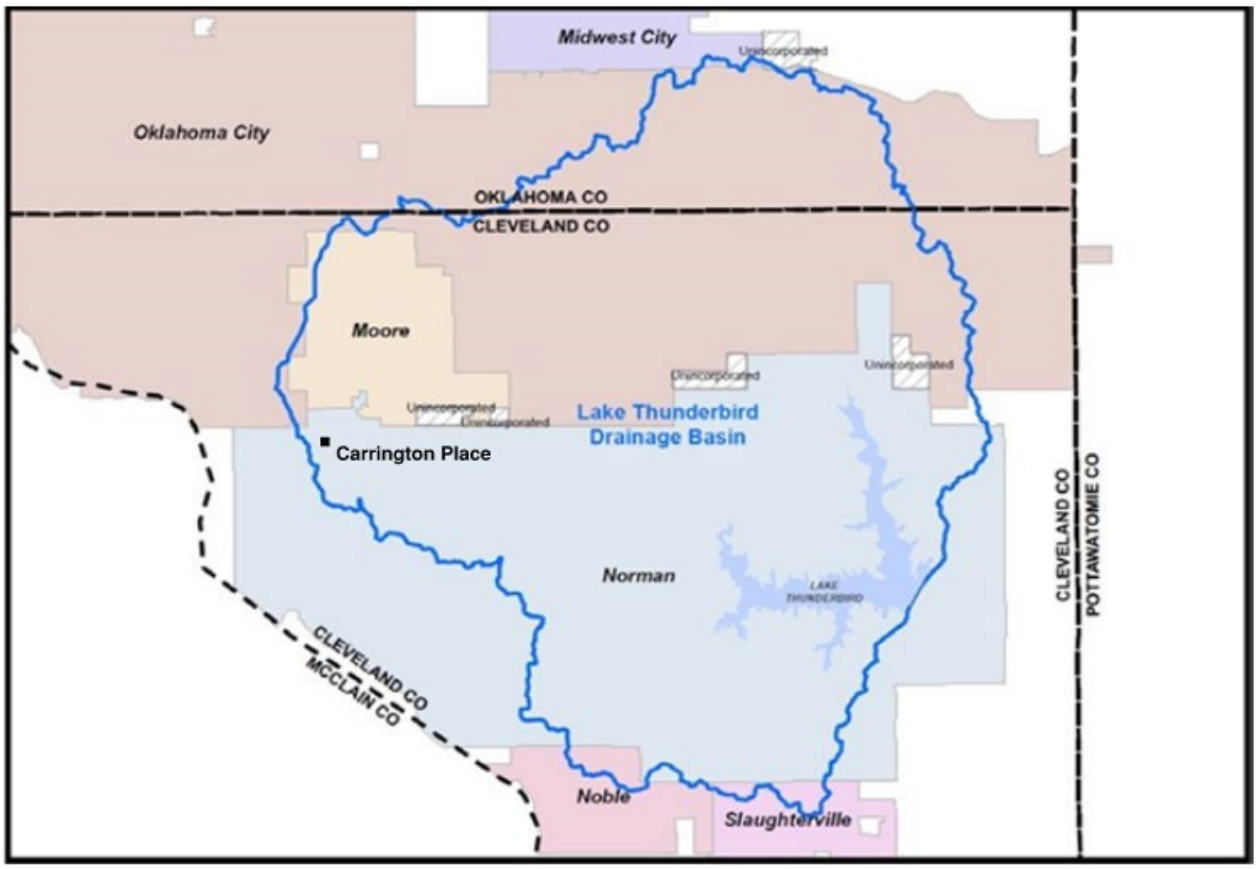

Figure 1: Lake Thunderbird Watershed

The Lake Thunderbird watershed (HUC 11090203) is in central Oklahoma and drains 256 square miles in Oklahoma and Cleveland Counties including Norman, Oklahoma City, and Moore, as well as small parts of unincorporated Oklahoma and Cleveland Counties as shown in Figure 1. Carrington is a 240-acre residential neighborhood on the western side of the Lake Thunderbird watershed in northwest Norman, Oklahoma. The

project will focus on the Carrington Main Pond and Liz's Pond, located at 35°16'33.96" N, 97°30'07.36" W as shown in Figure 2 below. '

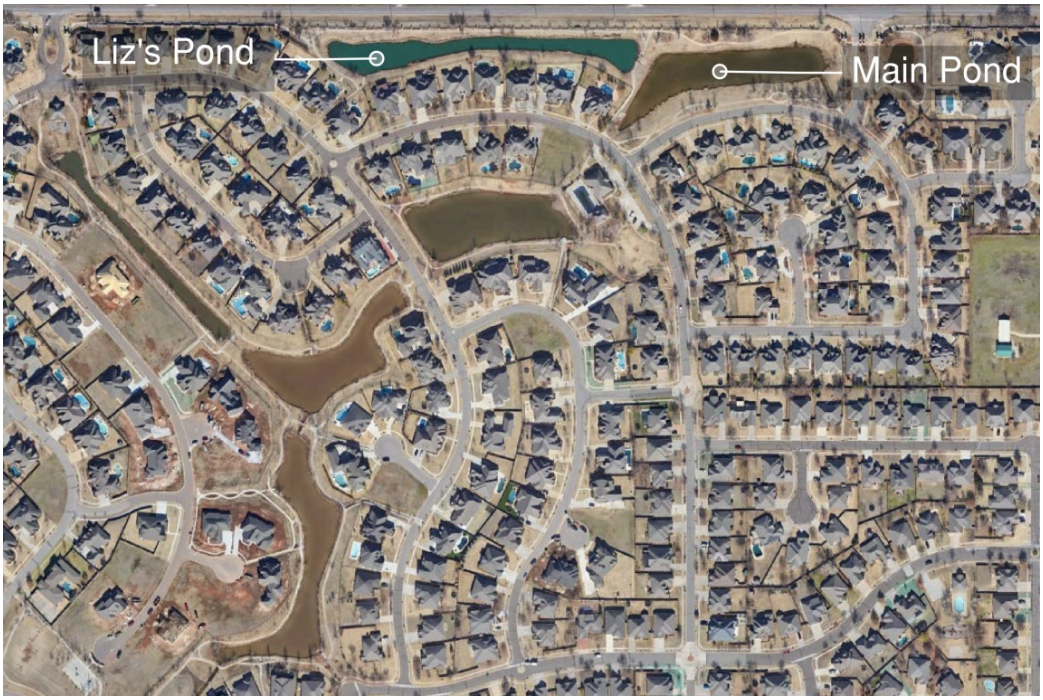

Figure 2 Carrington Ponds

Applicant Category

Funding was received through a Bureau of Reclamation Cooperative Watershed Management Program (CWMP) FY 2019 Phase I grant to establish the Lake Thunderbird Watershed Alliance (LTWA), and the organization is seeking funding as an **Existing Watershed Group**. LTWA was an established 501(c)(3) nonprofit organization in 2021 with a mission to collaborate with residents, communities, and other stakeholders representing the full geographic extent of the watershed to protect the water quality and quantity of Lake Thunderbird. These two key factors are critical to the Lake as it is categorized as a sensitive water supply to several local systems, supports the health of aquatic life and other riparian species, and is a source of public recreation.

The Board of Directors is made up of members of several municipalities, state agencies, recreational groups, residents, and other stakeholders who live and/or work in the Lake Thunderbird watershed (Figure 3). In 2021, as part of its formation, LTWA hosted an open house event to launch their educational outreach initiatives and introduce the community to the newly formed organization. Past public education events include DIY rain barrel workshops, residential rain garden workshops, and educational days exploring the bugs and fish in and around Lake Thunderbird. LTWA hosts ongoing litter cleanup events at Lake Thunderbird State Park and other locations throughout the watershed in conjunction with its partner organizations and has created a website (www.ltwaok.org), social media pages, and a YouTube resource page (www.youtube.com/@lakethunderbirdwatershedal7009) to share information and raise awareness about water quality and conservation.

Eligibility of Applicant

LTWA is a grassroots, non-regulatory 501(c)(3) nonprofit entity that addresses water availability and quality issues within the watershed, promotes the sustainable use of water resources in the watershed through a dedicated YouTube channel and outreach programs, makes decisions on a consensus basis, and represents a diverse group of stakeholders, including the Cities of Norman, Moore, Oklahoma City, Del City, and Midwest City, Oklahoma Water Resources Board, Oklahoma Department of Environmental Quality, Thunderbird Sailing Club, Central Oklahoma Master Conservancy District (COMCD), University of Oklahoma Gallogly College of Engineering Center for Restoration of Ecosystems and Watersheds, Oklahoma State University Cleveland County Extension, Oklahoma State University and residents within the watershed (Figure 3). As an established watershed group, LTWA serves as the clearinghouse for information about Lake Thunderbird including implementation projects, research, and outreach material.

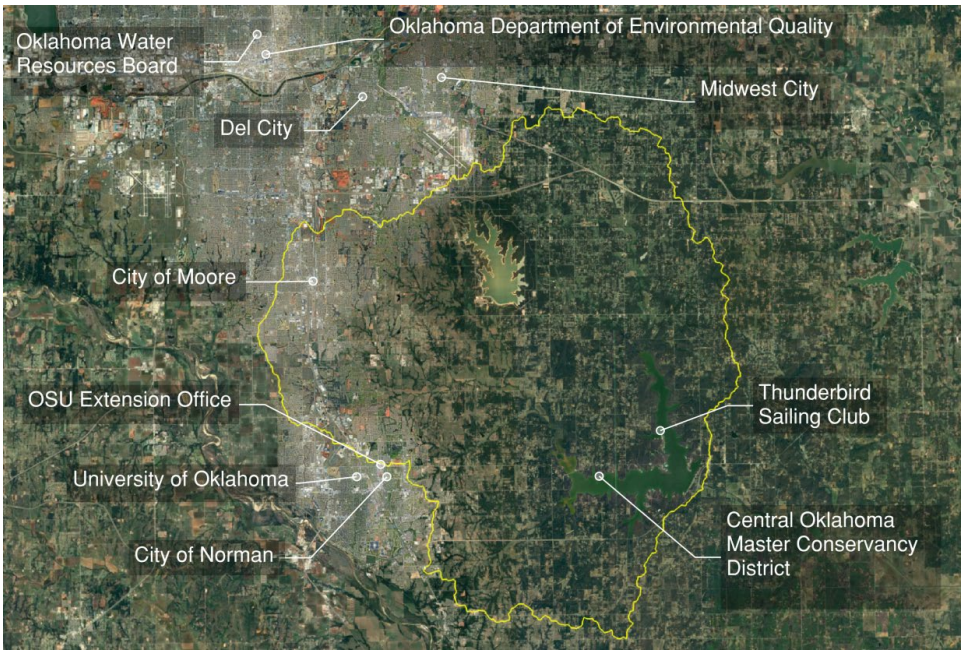

Figure 3: Stakeholder Proximity to Lake Thunderbird Watershed

Project Description

Most channels within the Lake Thunderbird watershed are highly unstable due to streambank and bed erosion, and the lake has several reaches of shoreline with category 5 erosion. Consequently, sediment accumulation within the conservation pool at Thunderbird Lake has been estimated to be occurring at a rate of 400-acre feet per year. Excessive sediment and resultant turbidity can adversely impact aquatic life and fisheries, degrade source waters for drinking water supplies, and decrease recreational value. Under anoxic conditions, excessive sediment can contribute to higher levels of nutrients and subsequent eutrophication of the lake, which is measured through chlorophyll-a, a proxy of algal biomass. Sediment also often carries pollutants such as heavy metals, PCBs, PAHs, and phthalates. Therefore, removal of suspended sediment from runoff can also reduce sediment-bound pollutants. The major causes of streambank and bed erosion are increased velocities and flows from urban areas.

Nutrients, such as nitrogen and phosphorus, in urban stormwater runoff from fertilizers, animal waste, oil/grease, and road salt are a major contributor to the water quality issues in Lake Thunderbird. Increased input of nutrients

into streams eventually leads to lake algae growth and an increase in oxygen demand, resulting in elevated chlorophyll-a levels and lower dissolved oxygen, as well as taste and odor complaints. To begin addressing these issues, LTWA is applying for a CWMP Phase I grant as an **Existing Watershed Group** under **Task Area C: Watershed Management Project Design.**

LTWA was founded using funds from a CWMP Phase I grant received by the City of Norman, OK. As part of this grant, LTWA created an Integrated Watershed Management Plan to serve as a guidance document for future water quality improvement efforts. This project seeks to build upon the planning efforts undertaken as part of the formation of LTWA by designing structural control measures to address bank erosion, excessive sediment, and elevated nutrient levels within the watershed. This will be the first step in LTWA's ongoing efforts to promote and fund tangible pollution mitigation measures to improve water quality in the Lake Thunderbird watershed.

The goal of this project is to assess the current conditions of Liz's Pond and the Main Pond in the Carrington neighborhood (Figure 2) and design solutions that will address bank erosion and improve water quality both within these headwater ponds and the fluvial systems they feed within the watershed. This focus is critical as Lake Thunderbird is designated as a sensitive water supply to several area systems with the full watershed supporting the health of aquatic life and other riparian species and is a source of public recreation. The objectives of the project include: 1) collecting data to develop a baseline performance metric and a hydrologic-hydraulic model of the project sites using the Personnel Computer Storm Water Management Model (PCSWMM); 2) determining the type of detention pond retrofits that will have the greatest positive impact on bank stability and effluent water quality; and 3) engaging the watershed population and stakeholders through meetings, workshops, and public participation events to educate about project details and status and to share stormwater pollution and water quality best management practices to foster a partnership in addressing these vital issues. Input and feedback from these events will provide guidance in retrofit design development and modification.

Objective 1: Collecting data to develop a baseline performance metric and PCSWMM models

Stormwater runoff from the Carrington neighborhood in northwest Norman, OK, flows through a series of detention ponds before being released into the Upper Little River and eventually into Lake Thunderbird. The Integrated Watershed Management Plan prioritized the Upper Little River for future pollutant reduction measures due to potentially high nutrient levels and total suspended solids (TSS). It recommended further research to identify the best management practices for addressing bank erosion and degraded water quality in this portion of the watershed.

To determine the current water quality concerns in the Carrington drainage basin, LTWA will work with water quality experts to install monitoring stations at the Main Pond. Each monitoring station will be set up to include both an automatic sampler and a bubbler flow meter that will determine a water level to flow relationship to quantify inflows and outflows from each detention pond. A rain gauge will be installed at one monitoring station to monitor local precipitation. Monitoring locations will also be equipped with multiple probes to measure pH, dissolved oxygen, and turbidity continuously. Automatic samplers and grab samplers will be used to collect samples from at least 15 unique runoff-producing events. Samples will be analyzed for a range of water quality constituents including TSS, total dissolved solids, nitrite, ammonia, Total Kjeldahl nitrogen, Total phosphorous, metals, carbonaceous biochemical oxygen demand, and alkalinity. If winter precipitation allows, chloride concentrations will be monitored while road de-icing occurs. Monitoring may continue beyond 15 events to capture seasonal fluctuations if project timeline, budget, and equipment allocation are allowed. The results of the sampling efforts will be summarized and used to establish a baseline performance metric, aid in source-tracking efforts, and

calibrate a PCSWMM hydrologic-hydraulic model. The model will be used to describe the fate and transport of stormwater pollutants in the Carrington drainage basin and will inform the design of the stormwater detention pond retrofits.

Objective 2: Determining the nature of pond retrofits for improved water quality at discharge.

After data collection and model development, a preliminary design will be developed. The preliminary design will begin as set of potential stormwater detention pond retrofits that will provide bank stabilization, reduce the concentration of nutrients and sediment in the discharge from the Main Pond, and address any recreational and aesthetic concerns of the Carrington neighborhood. As part of this process, preliminary plans, specifications, and a cost estimate for the selected alternative(s) will be developed. LTWA will meet periodically with the Carrington POA to collaborate on the design and provide feedback for improvements to the final design.

Objective 3: Engaging stakeholders through workshops and public participation events.

As mentioned in the Applicant Eligibility section above, LTWA has held a series of successful public outreach events since becoming an established organization. In collaboration with watershed partners such as the City of Norman, City of Midwest City, Oklahoma Conservation Commission, Blue Thumb Oklahoma, and the OSU Cleveland County Extension, events such as litter cleanups, DIY rain barrel workshops, and Lake Appreciation Month workshops have resulted in several thousand pounds of litter being removed from Lake Thunderbird watershed and hundreds of people being educated on the actions they can take to improve water quality in the Lake Thunderbird watershed. Age-appropriate science, technology, engineering, and math (STEM) programs have been offered, and overall public awareness of water quality and conservation has been positively affected through these efforts.

In partnership with the Carrington Property Owners Association (POA) and Carrington, LLC, LTWA will host public outreach meetings within the Carrington neighborhood to identify stakeholder concerns and encourage the community to actively engage in the design process. These meetings will also be used to educate the community on ways they can positively impact water quality within the Carrington drainage basin and the Lake Thunderbird watershed through simple changes in how they fertilize their lawns, dispose of yard waste, and the plants they use to landscape their yards.

Evaluation Criteria

E.1.1. Evaluation Criteria A – Watershed Group Diversity and Geographic Scope

E.1.1.1. Sub-Criterion A1 - Watershed Group Diversity

LTWA is a grassroots, nonprofit entity that addresses water availability and quality issues within the watershed, promotes the sustainable use of water resources in the watershed through a dedicated YouTube channel and outreach programs, makes decisions on a consensus basis, and represents a diverse group of stakeholders, including the Cities of Norman, Moore, Oklahoma City, Del City, and Midwest City, the Oklahoma Water Resources Board, Oklahoma Department of Environmental Quality, Thunderbird Sailing Club, Central Oklahoma Master Conservancy District (COMCD), University of Oklahoma Gallogly College of Engineering Center for Restoration of Ecosystems and Watersheds, Oklahoma State University Cleveland County Extension, Oklahoma State University, and residents throughout the watershed area. All stakeholders are affected by water quality and quantity issues of the Lake Thunderbird watershed. Through their current partnerships, LTWA consistently offers public outreach opportunities and will continue their efforts to engage all residents, businesses, organizations,

and, overall, impacted communities through public meetings, events, and educational opportunities. LTWA is also pursuing a dialogue with local tribal representatives to foster participation as designated stakeholder groups within the Alliance and identified enhanced outreach to the Absentee Shawnee Tribe as a priority for the organization in FY 2024/2025.

Lake Thunderbird is a federally owned water resource administered by the Bureau of Reclamation and operated by Central Oklahoma Master Conservancy District (COMCD) and Oklahoma Department of Tourism and Recreation. In addition, the U.S. Army Corps of Engineers manages the flood control elements of Lake Thunderbird. The Oklahoma Water Resources Board (OWRB) is responsible for managing and improving the state's water resources to ensure clean and reliable water supplies, a strong economy, and a safe and healthy environment, while the Oklahoma Department of Environmental Quality (ODEQ) is responsible for managing the quality of the state's water resources by administering the Oklahoma Pollutant Discharge Elimination System (OPDES) and Total Maximum Daily Loads (TMDL) programs. Blue Thumb Oklahoma is a statewide citizen science program under the Oklahoma Conservation Commission that trains volunteers to monitor creeks and streams and share their knowledge of water quality with others. The goal of Blue Thumb is to empower people to protect water in their region from nonpoint source pollution. Oklahoma Water Survey and the School of Civil Engineering and Environmental Science within the University of Oklahoma work to study the state's water resources through collecting, analyzing, interpreting, and sorting research-based information for distribution to industry professionals, researchers, students, teachers, citizens, governments, and collaborators. The Thunderbird Sailing Club is a nonprofit corporation established in 1969 and is affiliated with the United States Sailing Association and Central States Sailing Association whose purpose is to promote water safety; to encourage the pursuit of sailing as a recreational activity and as a competitive sport; to teach the rules of sailing; to engender a spirit of sportsmanship among its members, their families and within the community; and to promote the teaching of the methods, techniques and sciences of sailing to young people. The Lake Thunderbird watershed supports the health of aquatic life and other riparian species and serves as a sensitive water supply to several area systems, both within and outside the watershed, whose residents and businesses receive their drinking water from the lake after it is treated by their municipalities. The watershed's largest water consumption comes from the residents of Norman, Del City, and Midwest City who share an allocation of 21,6000 acre-feet annually. Norman has 43.8%, Midwest City has 40.4%, and Del City has 15.8% of the allocation to address their drinking water need from Lake Thunderbird. These cities and local businesses benefit from tourism to the area, and the lake itself offers opportunities for recreation. Each group listed has a direct interest in improving the water quality and quantity of the Lake Thunderbird watershed. Letters of support from COMCD, ODEQ, OWRB, Blue Thumb, City of Norman, City of Norman Environmental Control Advisory Board, University of Oklahoma Center for Restoration of Ecosystems and Watersheds, Oklahoma State University School of Civil and Environmental Engineering, as well as the Carrington POA and Carrington, LLC are included with this application.

The Cities of Norman, Midwest City, Del City, Moore, and Oklahoma City are within the watershed boundaries and/or rely upon Lake Thunderbird as a drinking water source. Each municipality and COMCD is allowed one permanent position on the LTWA Board of Directors. The remaining Board positions are held by recreational interest representatives and at-large members voted on by LTWA's general membership. Membership is open to residents and landowners in the Lake Thunderbird watershed, higher education professors, PK-12 educators, scientists, and business representatives with an interest in the purpose, goals, mission, and outcomes of LTWA. Initial LTWA members were recruited by the Board of Directors while new members are recruited through public meetings, watershed events, and through other media outlets, including social media.

LTWA offers continued opportunity for input from watershed residents through the interactive site set up during the planning process and LTWA's website. The interactive site uses GIS technology to allow citizens to mark and describe issues they notice at locations throughout the watershed. Based on this input, LTWA identifies where restoration work or best management practices may be most effective. This interactive site, the LTWA website, and YouTube page provide general knowledge on stormwater quality, watershed dynamics, and educational videos. Individuals can also access educational resources on how to begin improving stormwater quality within their households and communities such as guides on how to build a residential rain garden and identifying plants to attract pollinators. To further broaden their reach, LTWA works with local organizations, watershed communities, and COMCD to host seasonal educational and hands-on events, hold stakeholder and member meetings, coordinate youth water quality themed activities, provide watershed displays for members or local groups, and participate in city-sponsored watershed events, county fairs, and other community outreach events. This project encourages watershed group diversity by furthering public-private partnerships within the community and fostering continued conversations among the diverse watershed stakeholder membership.

According to the Climate and Economic Justice Screening Tool, 73% of the population within the Census tract that includes the project ponds in Carrington, is between the ages of 10 to 64. This demographic range includes community members that are impacted by current issues facing the watershed as well as those who will face future watershed issues if current impairments are not addressed. LTWA focuses to address and encourage watershed stakeholders who have diverse education levels, and socioeconomic statuses through education opportunities that engage a full range of generations. A recent LTWA "Love Your Lakes Week" day of learning held on July 27, 2024, included participants ranging in age from 6 to 73 years, showing the desire from community members to learn more about protecting the delicate ecosystem throughout the watershed.

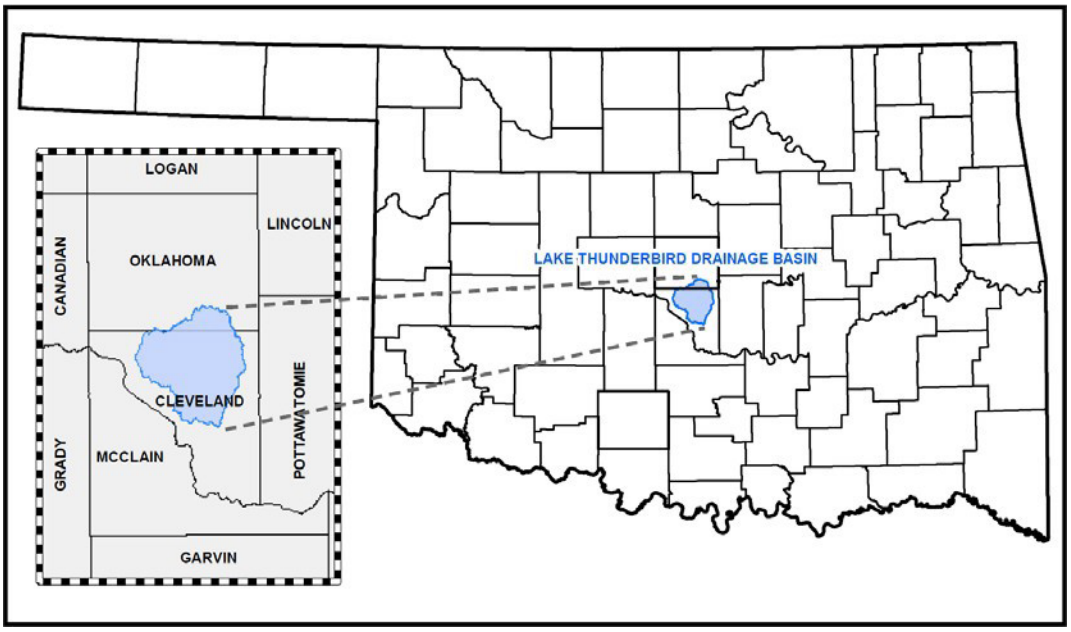

Figure 4: Lake Thunderbird within State of Oklahoma

E.1.1.2. Sub-Criterion No. A2 - Geographic Scope

Lake Thunderbird's watershed has a modified Hydrologic Unit Code (HUC) 8, (11090203), recognized as a subbasin being similar in size to medium-sized river basins. LTWA works across the full geographic extent of the watershed and represents multiple stakeholders throughout the area in its entirety (Figure 3). Its goal is to include and consider the complete watershed in outreach and action and to partner with as many groups and agencies as possible.

When considering where to begin implementing structural controls to improve water quality, several factors played a role. One was the existence of a willing partner. As LTWA worked to find a suitable location, conversations were held with the current leadership of the Carrington Homeowner's Association (HOA). They, in conjunction with the neighborhood's developer, Carrington, LLC, expressed an interest in the work LTWA was doing within the watershed and volunteered their neighborhood's network of detention ponds (Figure 2) as a location for LTWA's first water quality improvement project. As these ponds form the headwaters of Little River, a main tributary of the entire watershed, they provide a logical starting point where site specific planning and strategic implementation may provide benefit locally as well as throughout the downstream portion of the watershed. This project is interior to the HOA, which limits the impact of the project to only nutrients and other pollutants coming from the housing addition, which offers an exciting opportunity to work on a micro-scale to create a template for duplication across other HOAs in the watershed. While each of these would reduce pollutant loading to the watershed, only from their localized area, it is indicative of most urbanized land within the watershed. Though this individual project's scope is limited, future work will become easier, and more streamlined to expand its impact.

Water quality monitoring within Carrington ponds will provide performance metrics for selected best management practices (BMP) to be duplicated throughout the watershed. Since Lake Thunderbird Watershed impairments (turbidity, chlorophyl-a) are mirrored in Carrington ponds, it is predicted that the most effective BMPs in Carrington ponds will be selected for application throughout the water body. Additionally, developing a contaminant profile for the Carrington ponds through water quality monitoring will create a reference for future studies throughout the full geographic extent of the watershed, helping to target nonpoint source origination sites contributing to downstream impairment.

LTWA also gathered feedback from watershed residents to understand their level of knowledge of watershed management and to request input on key issues facing the watershed. Visitors to the LTWA interactive site named subdivisions and construction sites, erosion, and trash as key concerns. This project addresses two of the three key topics found through stakeholder feedback.

E.1.2. Evaluation Criterion B - Developing Strategies to Address Critical Watershed Needs

E.1.2.1 Sub-Criterion No. B1 – Critical Watershed Needs or Issues

The primary issues occurring within the Lake Thunderbird watershed involve water quality and quantity. These factors are critical as the watershed supports the health of aquatic life and other riparian species and is a source of public recreation while Lake Thunderbird is named as a sensitive water supply to three area systems. Lake Thunderbird serves as a drinking water source for the Cities of Norman, Del City, and Midwest City. In August 2010, Lake Thunderbird was placed on ODEQ's 303(d) List of Impaired Waterbodies. This led to the establishment of a Total Maximum Daily Loads (TMDL) determination by ODEQ in November of 2013. The Lake is impaired for its beneficial uses due to high concentration of chlorophyll-a, low concentration of dissolved

oxygen, and a high concentration of biochemical oxygen demand. The pollutants of concern for monitoring purposes are Total Nitrogen, Total Phosphorus, and Total Suspended Solids. As of the 2022 Oklahoma Integrated Water Quality Report, biochemical oxygen demand was removed from the listed impairments while turbidity and mercury were added[2].

Aquatic Life and other riparian species inhabit and dwell throughout the Lake Thunderbird Watershed. Federally endangered species such as the Whooping Crane are essential to a healthy watershed ecosystem. These species rely on the water body's water quality and quantity for their very existence. Lake Thunderbird's placement on ODEQ's 303 (d) List of Impaired Waterbodies in 2010 increases ecosystem degradation and habitat fragmentation for the species within the watershed. These serious factors further support LTWA's effort to study present water quality impairments and research productive solutions to educate stakeholders and partner toward successful implementation of individual behavioral changes or BMPs for improved watershed health.

E.1.2.2 Sub-Criterion No. B2 – Project Benefits

The Carrington drainage basin, found near the western edge of the Lake Thunderbird watershed, serves as a headwater point flowing into Little River, the main tributary to Lake Thunderbird. This project will address critical watershed issues by improving water quality through design of stormwater detention pond retrofits which will then discharge water into the full geographic extent of the watershed. The primary local pollutants in Carrington are Total Nitrogen (TN), Total Phosphorus (TP), and Total Suspended Solids (TSS). TN and TP are associated with using fertilizers on residential lawns while lot development and erosion of pond banks contributes TSS to stormwater runoff. Reducing nutrient and TSS loadings at the headwaters of Little River is anticipated to improve downstream water quality and biodiversity. Removal of TSS will decrease turbidity that can harm aquatic life and fisheries, source waters for drinking supplies, and recreational uses. Particulates also often carry other pollutants such as heavy metals, PCBs, PAHs, and phthalates. Therefore, removal of TSS from runoff can also reduce sediment-bound pollutants. Due to the interrelationships between causal (both nitrogen and phosphorous inputs) and response (*chlorophyll-a* and clarity) variables, EPA guidance recommends addressing both challenges simultaneously. This approach partnered with wetland community and stakeholder education will facilitate a deepened understanding of the impact in water quality from these ponds to pollutant loading of the full watershed. These educational opportunities will be provided through meetings, workshops, and public participation events.

The project design includes water quality sampling, hydrologic and hydraulic modeling, community outreach events, and engineering design to improve the water quality in Carrington drainage basin. Since the watershed has no permitted point-source discharges, addressing non-point source pollution at the headwaters of the drainage basin is a critical step to improve downstream conditions. As Lake Thunderbird is impaired due to *chlorophyll-a* and turbidity, reducing nutrient and sediment load contributions from the Little River drainage basin may contribute to overall improved water quality.

The anticipated best management practices (BMP) for watershed water quality improvement include streambank stabilization, critical area planting, wetland detention, rain barrels, and behavior modification. Streambank stabilization is used to minimize the erosion of streambanks and channels to reduce the amount of sediment and nutrients from eroding banks that enter the stream. Practices can include vegetative or structural protection measures. Critical area planting is the planting of grasses, legumes, or other vegetation to stabilize slopes in small, severely eroded areas. Although the primary goal is erosion control, the vegetation can provide nesting cover for birds and small animals. Wetland detention uses a detention basin planted with wetland vegetation, also known as a treatment wetland. The wetland vegetation can improve the quality of stormwater released from the

[2] lahoma Department of Environmental ualit . 2022 . lahoma Integrated Water ualit Report. Retrieved from h ps .deq.o .gov ater-qualit -division atershed-planning integrated-report

basin more effectively than dry detention and typical wet detention because the wetland vegetation takes up nutrients; settling and mechanical filtration by wetland plants also reduce suspended solids and turbidity. Wetland detention basins have a permanent pool of water and microtopography that encourages a longer residence time in the wetland to allow for more treatment. Rain barrels are stormwater harvesting devices designed to capture and store rooftop runoff for later reuse opportunities such as watering gardens or lawns. Rain barrels are effective at reducing peak flow rates during precipitation events, lowering runoff velocities, and reducing potential for erosion. Behavior modifications are the result of educational outreach programs and can include decreased application of fertilizers, adoption of rain barrels, sustainable landscaping, and other conservation measures.

This watershed management project will also encourage public engagement of stakeholders within Carrington and throughout the watershed. The sampling efforts will produce quantifiable data on the water quality conditions of the Carrington detention ponds. The design will provide the information necessary to construct detention pond retrofits that will improve water quality in this part of the Lake Thunderbird watershed.

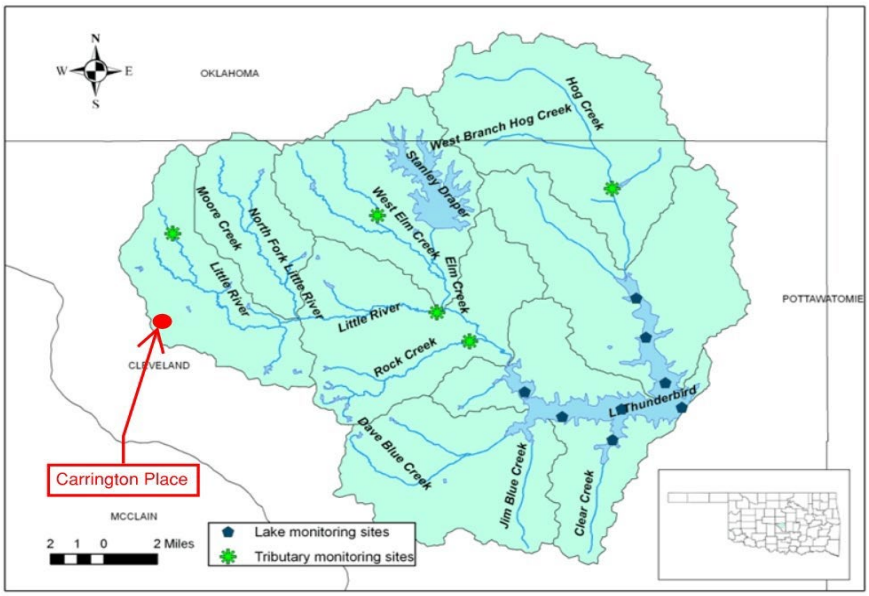

Figure 5: Carrington Location with Respect to Tributaries and Monitoring Sites

E.1.3. Evaluation Criteria C – Readiness to Proceed

Preliminary Project Schedule

Objective 1: Collecting data to develop a baseline performance metric and PCSWMM models.

Task	Responsible for Task	Timeline
1.a Install Monitoring Equipment	OSU	June 2025 – July 2025
1.b Water Quality Sampling	OSU	July 2025 – June 2026

Preliminary Project Budget

Task		Budget
1.a	Install Monitoring Equipment	$20,000
1.b	Water Quality Sampling	$72,182

Estimated Start and End Dates: June 2025 to June 2026
Estimated Cost: $92,182

To achieve this objective, a water quality consultant will be hired to conduct monitoring activities at Liz's Pond and the Main Pond in Carrington, Norman, Oklahoma. The purpose of the monitoring activities is to establish a baseline water quality and flow attenuation performance metric, aid in source-tracking efforts, and collect data to calibrate PCSWMM models. Total cost for monitoring, measurement, and fieldwork does not exceed 50% of the requested grant funding.

To achieve this goal, LTWA is requesting funding to:

1. Characterize pond performance
    a. Install monitoring stations at defined inlets and outlets as identified in Figure 6 below.
        i. Each monitoring station will be instrumented with an ISCO 6700 series automatic sampler (Teledyne-ISCO, Lincoln, Nebraska) to collect samples, and a bubbler flow meter (model 730; ISCO, Lincoln, Nebraska) that will produce a level to flow relationship to quantify inflows and outflows.
        ii. An ISCO 674 rain gauge will be installed at MS 01 to monitor precipitation locally.
        iii. The WQ Monitor location will have multiple probes that will monitor the level, pH, dissolved oxygen, and turbidity in the pond continuously.
        iv. Sampling points WQ A and WQ B will be fitted with ISCO 6700 series automatic samplers; however, due to irregular channel geometries, these locations will not be fitted with flow meters. Instead, inflow from these locations will be quantified from the level fluctuations in the pond using mass balance, with consideration of the other flow metering locations.
    b. Collect samples from a minimum of 15 runoff-producing storm events.
        i. Monitoring will continue until at least 15 unique runoff-producing are captured and characterized to ensure maximum efficiency and to collect data across various climate events including spring rains, summer droughts, and fall precipitation.
        ii. Monitoring may continue beyond 15 events to capture seasonal fluctuations, if the project timeline, budget, and equipment allocation allow.

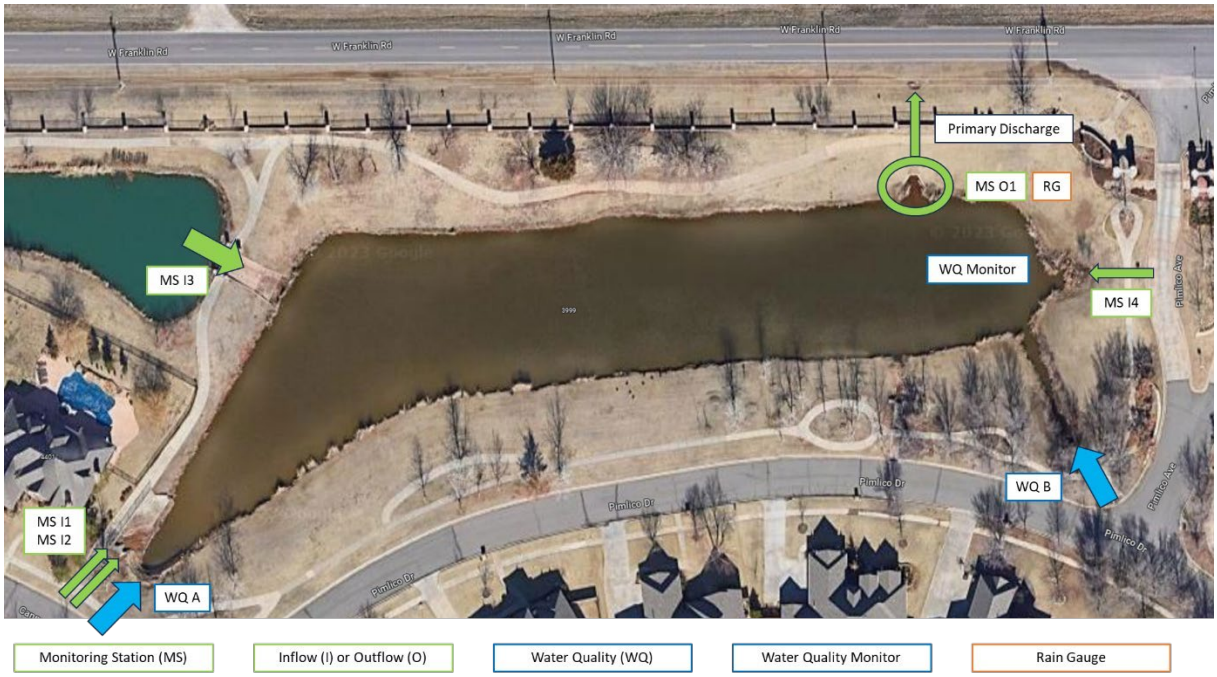

Figure 6: Monitoring Locations at Carrington Main Pond

Objective 2: Determining the nature of pond retrofits for improved water quality.

Task		Responsible for Task	Timeline
2.a	Preliminary Design	Garver	July 2026 – December 2026
2.b	Final Design	Garver	December 2026 – March 2027
2.c	Conduct Water Quality Analyses	OSU	March 2026 – July 2026
2.d	Complete Hydrologic-Hydraulic Modeling	OSU	March 2026 – July 2026

Task		Budget
2.a	Preliminary Design	$60,000
2.b	Final Design	$50,000
2.c	Conduct Water Quality Analyses	$31,000
2.d	Complete Hydrologic-Hydraulic Modeling	$30,158

Estimated Start and End Dates: July 2026 to March 2027
Estimated Cost: $171,158

To achieve this objective, a design consultant will be hired to use model results produced during completion of Task 2.d. to inform areas for design improvements within Carrington's Main Pond and Liz's Pond. The purpose of this objective is to design and construct water quality retrofits for existing stormwater detention ponds to reduce their impact on the watershed.

To achieve this goal, LTWA is requesting funding to:

1. Preliminary Design Alternatives.
    a. Engineering Report with design alternatives.

b. Preliminary design for selected alternative, to include plan and profile sheets, construction details, estimated quantities, and an opinion of probable construction cost (OPCC), including contingency.
c. Anticipated OPCC accuracy for this level of design is in the range of -20 percent to +30 percent.
d. Preliminary design phase will represent approximately 60 percent of final construction contract plans.

2. Final design.
    a. Conduct a final field inspection.
    b. Hold a design review meeting.
        i. Include a field review.
        ii. Include changes based on preliminary design comments
    c. Initiate final design
        i. Include construction plans and specifications
        ii. Include final construction details and quantities,
        iii. Include special provisions.
        iv. Include OPCC.
    d. The final design submitted to LTWA will consist of the construction documents required to advertise for bids.
        i. General Construction notes will be included to require the contractor to prepare, implement, and maintain a construction erosion control plan.
        ii. Include the necessary Notice of Intent with the Oklahoma Department of Environmental Quality (ODEQ).
3. Conduct water quality analyses.
    a. Water quality constituents of interest include total suspended solids, total dissolved solids, nitrite, ammonia, and Total Kjeldahl Nitrogen, metals, and alkalinity, and will be analyzed from the auto-collected samples.
    b. Carbonaceous biological oxygen demand will be determined from hand samples that are collected and analyzed in the same day.
    c. If the precipitation allows, hand samples will be taken during road de-icing events to characterize chloride concentrations.
4. Complete hydrologic-hydraulic modeling.
    a. Modeling will be completed using the PCSWMM platform.
    b. Data sets for the site model in PCSWMM will include:
        i. Rainfall and water quality data, collected from the described monitoring efforts
        ii. Drainage network, collected from Carrington POA
        iii. Digital Elevation Model and land use within Carrington POA, determined by photogrammetry from OSU Unmanned Systems Research Institute
        iv. Soil properties from USDA-NRCS SSURGO (30 m resolution)

Objective 3: Engaging stakeholders through workshops and public participation events.

Task		Responsible for Task	Timeline
3.a	Educational Outreach	LTWA	June 2025 – June 2027
3.b	Educational Workshop Events	LTWA	July 2026 – June 2027

Task		Budget
3.a	Educational Outreach	$16,000
3.b	Educational Workshop Events	$20,660

Estimated Start and End Dates: June 2025 to June 2027
Estimated Cost: $36,660

To achieve this objective, LTWA is requesting funding to:

1. Conduct Stakeholder meetings and workshops.
    a. Critical to identifying recreational and aesthetic preferences of the watershed population.
    b. Promote a full understanding of project detail, anticipated outcomes, and on-going project status. Opportunity to share public workshop or event detail and/or available marketing.
2. Hire a Design Consultant to conduct workshops and public participation events.
    a. Target wetland area residents and the Carrington neighborhood by providing project detail, anticipated outcomes, and on-going project status during workshops and events.
    b. Tie Lake Thunderbird's watershed quality and overall health to best homeowner and business implementation practices through sustainable landscaping, green infrastructure, and other conservation methods to reduce contamination within the waterbody.
    c. Engage Stakeholders throughout the design process.
3. Compile and analyze information from Stakeholder meetings.
    a. Guide the design process.
    b. Proactively address suggestions or concerns regarding project progress.

New Policies or Administrative Actions Required

There are no new policies required to implement this project. General administrative action will be required to schedule and coordinate project targeted meetings and workshops for stakeholders and the watershed public. Additionally, the project's water sampling phase will require a coordinated effort between LTWA and the Carrington POA to access Liz's Pond and Main Pond.

E.1.4. Evaluation Criteria D – Presidential and Department of the Interior Priorities

E.1.4.1. Climate Change

This project will address climate change within the watershed through public education and outreach opportunities that encourage all ages to actively engage in watershed improvements. It focuses primarily on the Carrington neighborhood/drainage basin and will work to increase best practices for watershed management as well as provide residential mitigation resources to reduce the pollutant load that flows downstream into Lake Thunderbird. Per the Climate and Economic Justice Screening Tool, this tract is identified as "Partially Disadvantaged" and is in the 93rd percentile of expected agricultural loss within the Climate Change indicator. A strategy to strengthen water supply sustainability and increase resilience to climate change includes the use of rain barrels. This

approach uses stormwater harvesting devices designed to capture and store rooftop runoff for later reuse opportunities such as watering gardens or lawns. Rain barrels are effective at reducing peak flow rates during precipitation events, lowering runoff velocities, and reducing potential for erosion. Sustainable landscaping and other behavior-modified, conservation measures will be encouraged during public engagement opportunities with watershed stakeholders to protect our lands and waters while addressing public health.

This project will address water quality and quantity of the Lake Thunderbird watershed directly protecting public health. The sampling efforts will produce quantifiable data on the water quality conditions of the Carrington POA detention ponds. This data will provide the information necessary to construct detention pond retrofits that will improve water quality in this portion of the Lake Thunderbird watershed. This action's anticipated result will strengthen water supply sustainability to increase resilience to climate change. The proposed project will enable LTWA and residential homeowners to identify the pollutants that flow into the watershed from typical suburban neighborhoods and ways they can reduce their impact on water quality through behavioral changes and structural best management practices. With the current water quality impairment issues facing Lake Thunderbird, any reduction in household and residential runoff will benefit the entire watershed.

E.1.4.2. Benefits to Disadvantaged, Underserved, and Tribal Communities

Disadvantaged and Underserved Community Benefits:

The Lake Thunderbird watershed is *in the Cross Timbers Ecoregion of* central Oklahoma and drains 256 square miles in Oklahoma and Cleveland Counties including areas within the municipalities of Norman, Oklahoma City and Moore, as well as small parts of unincorporated Oklahoma and Cleveland Counties. Lake Thunderbird is a sensitive water supply lake and drinking water source serving the City of Norman, Midwest City, and Del City in central Oklahoma.

Due to the size and diverse use of the Lake Thunderbird Watershed and Lake Thunderbird's designation as a sensitive water supply for three water systems, a broad view was used in determining disadvantaged and underserved community benefit to this project. Lake Thunderbird, proper, is located approximately 50% within a disadvantaged census tract area according to the Climate and Economic Justice Screening Tool as seen in Figure 7 . This designation would include a considerable number of watershed residential and business stakeholders with whom LTWA is working. Additionally, two of the three systems who receive drinking water from Lake Thunderbird, Del City and Midwest City (Figure 8), have disadvantaged census tract areas within their communities. LTWA's project will improve public health and safety to these multiple population segments by addressing water quality and quantity concerns within the Lake Thunderbird Watershed.

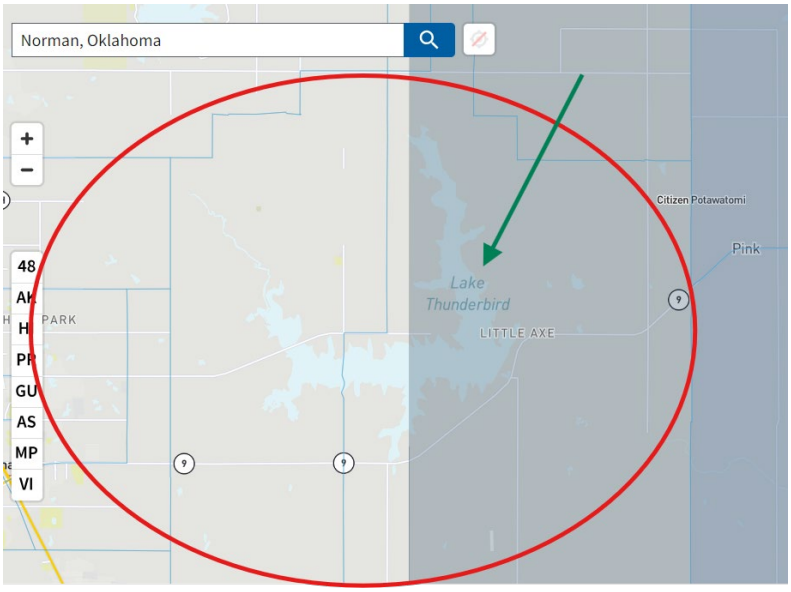

Figure 7: Disadvantaged Census Tract Data Surrounding Lake Thunderbird

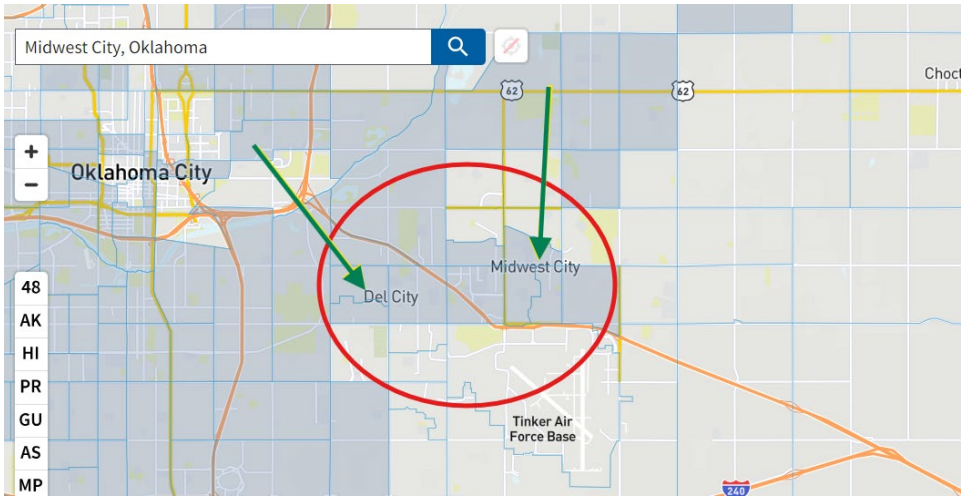

Figure 8: Disadvantaged Census Tract Data for Del City and Midwest City

Tribal Benefits

The Absentee-Shawnee Tribe's boundary extends into the eastern part of the watershed, shown below in Figure 9, and includes the Little Doctor Homestead, a historic Absentee-Shawnee homestead on the east side of Lake Thunderbird. This project is located at the northernmost point of the watershed and through sampling and identification of pollutants at this source, LTWA will identify and work to mitigate pollutants that eventually make their way to the Absentee-Shawnee Tribe's boundaries. Reducing pollutants will positively affect soil, water quality, public health and reduce streambank erosion within the watershed. Educational resources and events sponsored by LTWA can also be used to encourage tribal members to become more engaged in the watershed. LTWA is also pursuing a dialogue with local tribal representatives to foster participation as designated stakeholder groups within the Alliance and identified enhanced outreach to the Absentee Shawnee Tribe as a priority for the organization in FY 2024/2025.

Figure 9: Lake Thunderbird Watershed and Absentee-Shawnee Boundaries

Environmental and Cultural Resources Compliance

As this project is focused on stakeholder education, hydrologic-hydraulic modeling, and water quality monitoring, the proposed impact on the surrounding environment is considered to be negligible. With respect to impacts of the work on the surrounding environment, automatic sampling devices will be used and occupy a small footprint within area.

This is not considered a designated critical habitat as the project area has been disturbed previously as part of the detention pond and subdivision development. Detention pond construction occurred in 2004 to 2005. No wetlands or other surface waters that potentially fall under CWA jurisdiction as "Waters of the United States" have been identified inside the project boundaries.

No modifications or effects specific to irrigation systems are expected.

There are no known archeological sites in the proposed project area, and a review of the State Historic Preservation Office's Oklahoma Interactive National Register Map (Oklahoma National Register Web Map (okstate.edu)) indicated that there were no buildings, structures, or features eligible for listing on the National Register of Historic Places in this location.

Required Permits or Approvals

No permits or other approvals are required for the project scope included in this proposal.

Overlap or Duplication of Effort Statement

There is no overlap between the proposed project and any other active or anticipated proposals or projects in terms of activities, costs, or commitment of key personnel.

Uniform Audit Reporting Statement

LTWA was not required to submit a Single Audit report for the most recently closed fiscal year.

Conflict of Interest Disclosure Statement

No actual or potential conflicts of interest existed at the time this application was submitted.

Unique Entity Identifier

LTWA is registered on Grants.gov under UEI No. UG24QJSXHA95 and maintains an active SAM registration.

Project Budget

The Budget Detail spreadsheet is uploaded to Grants.gov as an additional attachment. Table 1 summarizes the funding sources of this project.

LTWA expects to complete this project using contracted services. A team of water resources scientists and engineers will be hired to execute this project.

Total cost for the 3-year funding cycle is $300,000, as shown in Table 2. We have researched water quality and design consultant cost estimates from Oklahoma State University and Garver to estimate project costs.

Total cost for monitoring, measurement, and fieldwork does not exceed 50% of the requested grant funding.

Table 1: Summary of Non-Federal and Federal Funding Sources

FUNDING SOURCES	AMOUNT
Federal Entities	
1. U.S. Bureau of Reclamation	$ 300,000.00
Federal Subtotal	$ 300,000.00
Non-Federal Entities	
1.	$ 0.00
Non-Federal Subtotal	$ 0.00
REQUESTED RECLAMATION FUNDING	$ 300,000.00

Table 2: Budget Summary (Attachment A Spreadsheet)

Summary Figures in this summary table are calculated from entries made in subsequent categories, only blank white cells require data entry.			
6. Budget Object Category	**Total Cost**	**Federal Estimated Amount**	**Non-Federal Estimated Amount**
a. Personnel	**$0**		
b. Fringe Benefits	**$0**		
c. Travel	**$0**		
d. Equipment	**$0**		
e. Supplies	**$0**		
f. Contractual	**$300,000**		
g. Construction	**$0**		
h. Other Direct Costs	**$0**		
i. Total Direct Costs	**$300,000**		
i. Indirect Charges	**$0**		
Total Costs	**$300,000**	**$300,000**	**$0**
	Cost Share Percentage	**100%**	**0%**

a. Personnel
   No personnel expenses are included in the budget as all the personnel used for the project will be under contract as detailed in Attachment B spreadsheet.
b. Fringe Benefits
   No fringe benefits are included in the budget.
c. Travel
   No travel is included in the budget.
d. Equipment
   No equipment is included in the budget.
e. Supplies
   No supplies are included in the budget.
f. Contractual
   LTWA expects to complete this project using contracted services. A team of water resources scientists and engineers will be hired to execute this project. Total cost for the 3-year funding cycle is $300,000, as shown in Table 3. We have researched water quality and design consultant cost estimates from Oklahoma State University and Garver to estimate project costs. Total cost for monitoring, measurement, and fieldwork does not exceed 50% of the requested grant funding.
g. Construction
   No construction will be part of this project nor budget.
h. Other Direct Costs
   Non-applicable
i. Total Direct Costs
   $300,000 is the total cost as specified in Table 3 and 4 and the attached spreadsheet.
j. Indirect Charges
   Non-applicable

Appendix A: Letters of Support

OKLAHOMA
CONSERVATION
COMMISSION
Our Land • Our Heritage • Our Future

August 23, 2024

Bureau of Reclamation
Water Resources and Planning Office
Attn: Ms. Robin Graber
Mail Code: 86-6300
P.O. Box 25007
Denver, CO 80225

Re: Bureau of Reclamation WaterSMART Cooperative Watershed Management Program Phase I Grant Application from the Lake Thunderbird Watershed Alliance Inc, Oklahoma (FOA No. R23AS00362)

To Whom It May Concern:

The Blue Thumb Program of the Oklahoma Conservation Commission would like to go on record supporting the Lake Thunderbird Watershed Alliance's Bureau of Reclamation WaterSMART Cooperative Watershed Management Program Phase I grant application to design site-specific water quality retrofits for several existing detention ponds in the Carrington Place subdivision located in the Lake Thunderbird watershed, Norman, Oklahoma.

Lake Thunderbird serves as a drinking water source for the Cities of Norman, Del City, and Midwest City and was constructed by the U.S. Bureau of Reclamation in 1965 to impound the upper reaches of Little River and several tributaries east of Norman, Oklahoma north of State Highway 9. The watershed drains 256 square miles in Oklahoma and Cleveland Counties including Norman, Oklahoma City and Moore, as well as small parts of unincorporated Oklahoma and Cleveland Counties. In August 2010, the Environmental Protection Agency placed Lake Thunderbird on its 303(d) List of Impaired Waterbodies. This led to the establishment of a Total Maximum Daily Load by the Oklahoma Department of Environmental Quality in November of 2013. The Lake is considered to be impaired for its beneficial uses due to high concentration of chlorophyll-a, low concentration of dissolved oxygen, and a high concentration of biochemical oxygen demand. In November 2016, representatives from the Cities of Norman, Moore, and Oklahoma City began discussing the formation of a Technical Workgroup consisting of personnel in each City's stormwater program with TMDL compliance-related duties. This ultimately led to the creation of the Lake Thunderbird Watershed Alliance Inc., a non-profit watershed organization whose goal is to share information and leverage resources for the benefit of the Lake Thunderbird watershed and its residents.

Because the Lake Thunderbird watershed is such a vital resource to not only the municipalities within the watershed but to numerous other agencies, organizations, and community groups within this region, it is important to support projects that improve water quality and quantity of Lake Thunderbird and its tributaries. Therefore, Blue Thumb is in full support and will actively participate in this effort to improve the water quality and quantity in Lake Thunderbird for all water users.

We look forward to working with the Lake Thunderbird Watershed Alliance Inc. on this vital watershed management project.

Sincerely,

Rebecca Bond

Rebecca Bond, Ph.D.
Blue Thumb Director
Oklahoma Conservation Commission

August 30, 2024

Bureau of Reclamation
Water Resources and Planning Office
Attn: Ms. Robin Graber
Mail Code: 86-6300
P.O. Box 25007
Denver, CO 80225

Re: Bureau of Reclamation WaterSMART Cooperative Watershed Management Program Phase 1 Grant Application from the Lake Thunderbird Watershed Alliance Inc., Oklahoma City (FOA No. R23AS00362)

To Whom It May Concern:

The Carrington Development Team as well as the Property Owners Association (POA) serving the Carrington community would like to go on record supporting the Lake Thunderbird Watershed Alliance's Bureau of Reclamation WaterSMART Cooperative Watershed Management Program Phase 1 grant application to design site-specific water quality retrofits for several existing detention ponds in the Carrington community located in the Lake Thunderbird watershed, Norman, Oklahoma.

Lake Thunderbird serves as a drinking water source for the Cities of Norman, Del City and Midwest City and was constructed by the US Bureau of Reclamation in 1965 to impound the upper reaches of Little River and several tributaries east of Norman, OK and north of State Highway 9. The watershed drains 256 square miles in Oklahoma and Cleveland Counties, including Norman, Oklahoma City, and Moore as well as small parts of unincorporated Oklahoma and Cleveland Counties. In August 2010, the Environmental Protection Agency placed Lake Thunderbird on its 303(d) List of Impaired Waterbodies. This led to the establishment of a Total Maximum Daily Load by the Oklahoma Department of Environmental Quality in November of 2013. The Lake is considered to be impaired for its beneficial uses due to high concentration of chlorophyll-a, low concentration of dissolved oxygen, and a high concentration of biochemical oxygen demand. In November 2016, representatives from the Cities of Norman, Moore, and Oklahoma City began discussing the formation of a Technical Workgroup consisting of personnel in each City's stormwater program with TMDL compliance related duties. This ultimately led to the creation of the Lake Thunderbird Watershed Alliance Inc., a non-profit watershed organization whose goal is to share information and leverage resources for the benefit of the Lake Thunderbird watershed and its residents.

Because the Lake Thunderbird watershed is such a vital resource to not only the municipalities within the watershed but to numerous other agencies, organizations, and community groups within this region, it is important to support projects that improve the water quality and quantity of Lake Thunderbird and its tributaries. Therefore, Carrington, LLC (Developer) and the Carrington POA are in full support and will actively participate in this effort to improve the water quality and quantity in Lake Thunderbird for all water users.

We look forward to working with the Lake Thunderbird Watershed Alliance Inc. on this vital watershed management program.

Sincerely,

Richard McKown
Managing Partner
Carrington, LLC

Liz McKown
Community Development Manager &
POA Liaison, Carrington, LLC

The City of
NORMAN

201 West Gray • P.O. Box 370
Norman, Oklahoma • 73070

OFFICE OF THE CITY MANAGER
Phone: 405-366-5402

August 23, 2024

Bureau of Reclamation
Water Resources and Planning Office
Attn: Ms. Robin Graber
Mail Code: 86-6300
P.O. Box 25007
Denver, CO 80225

Re: Bureau of Reclamation WaterSMART Cooperative Watershed Management Program Phase I Grant Application from the Lake Thunderbird Watershed Alliance Inc, Oklahoma (FOA No. R23AS00362)

To Whom It May Concern:

The City of Norman would like to go on record supporting the Lake Thunderbird Watershed Alliance's Bureau of Reclamation WaterSMART Cooperative Watershed Management Program Phase I grant application to design site-specific water quality retrofits for several existing detention ponds in the Carrington Place subdivision located in the Lake Thunderbird watershed, Norman, Oklahoma.

Lake Thunderbird serves as a drinking water source for the Cities of Norman, Del City, and Midwest City and was constructed by the U.S. Bureau of Reclamation in 1965 to impound the upper reaches of Little River and several tributaries east of Norman, Oklahoma north of State Highway 9. The watershed drains 256 square miles in Oklahoma and Cleveland Counties including Norman, Oklahoma City and Moore, as well as small parts of unincorporated Oklahoma and Cleveland Counties. In August 2010, the Environmental Protection Agency placed Lake Thunderbird on its 303(d) List of Impaired Waterbodies. This led to the establishment of a Total Maximum Daily Load by the Oklahoma Department of Environmental Quality in November of 2013. The Lake is considered to be impaired for its beneficial uses due to high concentration of chlorophyll-a, low concentration of dissolved oxygen, and a high concentration of biochemical oxygen demand. In November 2016, representatives from the Cities of Norman, Moore, and Oklahoma City began discussing the formation of a Technical Workgroup consisting of personnel in each City's stormwater program with TMDL compliance-related duties. This ultimately led to the creation of the Lake Thunderbird Watershed Alliance Inc., a non-profit watershed organization whose goal is to share information and leverage resources for the benefit of the Lake Thunderbird watershed and its residents.

Because the Lake Thunderbird watershed is such a vital resource to not only the municipalities within the watershed but to numerous other agencies, organizations, and community groups within this region, it is important to support projects that improve water quality and quantity of Lake Thunderbird and its tributaries. Therefore, the City of Norman is in full support and will actively participate in this effort to improve the water quality and quantity in Lake Thunderbird for all water users.

We look forward to working with the Lake Thunderbird Watershed Alliance Inc. on this vital watershed management project.

Sincerely,

Darrel Pyle
City Manager
City of Norman

12500 ALAMEDA NORMAN, OKLAHOMA 73026
(405) 329-5228

August 22nd, 2024

Bureau of Reclamation
Water Resources and Planning Office
Attn: Ms. Robin Graber
Mail Code: 86-6300
P.O. Box 25007
Denver, CO 80225

Re: Bureau of Reclamation WaterSMART Cooperative Watershed Management Program Phase I Grant Application from the Lake Thunderbird Watershed Alliance Inc, Oklahoma (FOA No. R23AS00362)

To Whom It May Concern:

The Central Oklahoma Master Conservancy District (COMCD) would like to go on record supporting the Lake Thunderbird Watershed Alliance's Bureau of Reclamation WaterSMART Cooperative Watershed Management Program Phase I grant application to design site-specific water quality retrofits for several existing detention ponds in the Carrington Place subdivision located in the Lake Thunderbird watershed, Norman, Oklahoma.

Lake Thunderbird serves as a drinking water source for the Cities of Norman, Del City, and Midwest City and was constructed by the U.S. Bureau of Reclamation in 1965 to impound the upper reaches of Little River and several tributaries east of Norman, Oklahoma north of State Highway 9. The watershed drains 256 square miles in Oklahoma and Cleveland Counties including Norman, Oklahoma City and Moore, as well as small parts of unincorporated Oklahoma and Cleveland Counties. In August 2010, the Environmental Protection Agency placed Lake Thunderbird on its 303(d) List of Impaired Waterbodies. This led to the establishment of a Total Maximum Daily Load by the Oklahoma Department of Environmental Quality in November of 2013. The Lake is considered to be impaired for its beneficial uses due to high concentration of chlorophyll-a, low concentration of dissolved oxygen, and a high concentration of biochemical oxygen demand. In November 2016, representatives from the Cities of Norman, Moore, and Oklahoma City began discussing the formation of a Technical Workgroup consisting of personnel in each City's stormwater program with TMDL compliance-related duties. This ultimately led to the creation of the Lake Thunderbird Watershed Alliance Inc., a non-profit watershed organization whose goal is to share information and leverage resources for the benefit of the Lake Thunderbird watershed and its residents.

Because the Lake Thunderbird watershed is such a vital resource to not only the municipalities within the watershed but to numerous other agencies, organizations, and community groups within this region, it is important to support projects that improve water quality and quantity of Lake Thunderbird and its tributaries. Therefore, COMCD is in full support and will actively participate in this effort to improve the water quality and quantity in Lake Thunderbird for all water users.

We look forward to working with the Lake Thunderbird Watershed Alliance Inc. on this vital watershed management project.

Sincerely,

Kyle Arthur, Manager
Central Oklahoma Master Conservancy District

Robert Singletary
Executive Director

OKLAHOMA Environmental Quality

Kevin Stitt
Governor

August 26, 2024

Bureau of Reclamation
Water Resources and Planning Office
Attn: Ms. Robin Graber
Mail Code: 86-6300
P.O. Box 25007
Denver, CO 80225

Re: Bureau of Reclamation WaterSMART Cooperative Watershed Management Program Phase I Grant Application from the Lake Thunderbird Watershed Alliance Inc, Oklahoma (FOA No. R23AS00362)

To Whom It May Concern:

The Oklahoma Department of Environmental Quality would like to go on record supporting the Lake Thunderbird Watershed Alliance's Bureau of Reclamation WaterSMART Cooperative Watershed Management Program Phase I grant application to design site-specific water quality retrofits for several existing detention ponds in the Carrington Place subdivision located in the Lake Thunderbird watershed, Norman, Oklahoma.

Lake Thunderbird serves as a drinking water source for the Cities of Norman, Del City, and Midwest City and was constructed by the U.S. Bureau of Reclamation in 1965 to impound the upper reaches of Little River and several tributaries east of Norman, Oklahoma north of State Highway 9. The watershed drains 256 square miles in Oklahoma and Cleveland Counties including Norman, Oklahoma City and Moore, as well as small parts of unincorporated Oklahoma and Cleveland Counties. In August 2010, the Environmental Protection Agency placed Lake Thunderbird on its 303(d) List of Impaired Waterbodies. This led to the establishment of a Total Maximum Daily Load by the Oklahoma Department of Environmental Quality in November of 2013. The Lake is considered to be impaired for its beneficial uses due to high concentration of chlorophyll-a, low concentration of dissolved oxygen, and a high concentration of biochemical oxygen demand. In November 2016, representatives from the Cities of Norman, Moore, and Oklahoma City began discussing the formation of a Technical Workgroup consisting of personnel in each City's stormwater program with TMDL compliance-related duties. This ultimately led to the creation of the Lake Thunderbird Watershed Alliance Inc., a non-profit watershed organization whose goal is to share information and leverage resources for the benefit of the Lake Thunderbird watershed and its residents.

Because the Lake Thunderbird watershed is such a vital resource to not only the municipalities within the watershed but to numerous other agencies, organizations, and community groups within this region, it is important to support projects that improve water quality and quantity of Lake Thunderbird and its tributaries. Therefore, the Oklahoma Department of Environmental Quality is in full support and will actively participate in this effort to improve the water quality and quantity in Lake Thunderbird for all water users.

We look forward to working with the Lake Thunderbird Watershed Alliance Inc. on this vital watershed management project.

Sincerely,

Shellie R. Chard, Director
Water Quality Division
Oklahoma Department of Environmental Quality

August 26, 2024

Bureau of Reclamation
Water Resources and Planning Office
Attn: Ms. Robin Graber
Mail Code: 86-6300
P.O. Box 25007
Denver, CO 80225

Re: Bureau of Reclamation WaterSMART Cooperative Watershed Management Program Phase I Grant Application from the Lake Thunderbird Watershed Alliance Inc, Oklahoma (FOA No. R23AS00362)

To Whom It May Concern:

The City of Norman Environmental Control and Advisory Board (ECAB) would like to go on record supporting the Lake Thunderbird Watershed Alliance's Bureau of Reclamation WaterSMART Cooperative Watershed Management Program Phase I grant application to design site-specific water quality retrofits for several existing detention ponds in the Carrington Place subdivision located in the Lake Thunderbird watershed, Norman, Oklahoma.

Lake Thunderbird serves as a drinking water source for the Cities of Norman, Del City, and Midwest City and was constructed by the U.S. Bureau of Reclamation in 1965 to impound the upper reaches of Little River and several tributaries east of Norman, Oklahoma north of State Highway 9. The watershed drains 256 square miles in Oklahoma and Cleveland Counties including Norman, Oklahoma City and Moore, as well as small parts of unincorporated Oklahoma and Cleveland Counties. In August 2010, the Environmental Protection Agency placed Lake Thunderbird on its 303(d) List of Impaired Waterbodies. This led to the establishment of a Total Maximum Daily Load by the Oklahoma Department of Environmental Quality in November of 2013. The Lake is considered to be impaired for its beneficial uses due to high concentration of chlorophyll-a, low concentration of dissolved oxygen, and a high concentration of biochemical oxygen demand. In November 2016, representatives from the Cities of Norman, Moore, and Oklahoma City began discussing the formation of a Technical Workgroup consisting of personnel in each City's stormwater program with TMDL compliance-related duties. This ultimately led to the creation of the Lake Thunderbird Watershed Alliance Inc., a non-profit watershed organization whose goal is to share information and leverage resources for the benefit of the Lake Thunderbird watershed and its residents.

Because the Lake Thunderbird watershed is such a vital resource to not only the municipalities within the watershed but to numerous other agencies, organizations, and community groups within this region, it is important to support projects that improve water quality and quantity of Lake Thunderbird and its tributaries. Therefore, we are in full support and will actively participate in this effort to improve the water quality and quantity in Lake Thunderbird for all water users.

We look forward to working with the Lake Thunderbird Watershed Alliance Inc. on this vital watershed management project.

Sincerely,

Dane Heins
Chair
City of Norman Environmental Control Advisory Board

COLLEGE OF ENGINEERING, ARCHITECTURE AND TECHNOLOGY

School of Civil and Environmental Engineering
248 Engineering North
Stillwater, OK 74078
Phone: 405-744-5189

August 22, 2024

Bureau of Reclamation
Water Resources and Planning Office
Attn: Ms. Robin Graber
Mail Code: 86-6300
P.O. Box 25007
Denver, CO 80225

Re: Bureau of Reclamation WaterSMART Cooperative Watershed Management Program Phase I Grant Application from the Lake Thunderbird Watershed Alliance Inc, Oklahoma (FOA No. R23AS00362)

To Whom It May Concern:

Oklahoma State University would like to go on record supporting the Lake Thunderbird Watershed Alliance's Bureau of Reclamation WaterSMART Cooperative Watershed Management Program Phase I grant application to design site-specific water quality retrofits for several existing detention ponds in the Carrington Place subdivision located in the Lake Thunderbird watershed, Norman, Oklahoma.

Lake Thunderbird serves as a drinking water source for the Cities of Norman, Del City, and Midwest City and was constructed by the U.S. Bureau of Reclamation in 1965 to impound the upper reaches of Little River and several tributaries east of Norman, Oklahoma north of State Highway 9. The watershed drains 256 square miles in Oklahoma and Cleveland Counties including Norman, Oklahoma City and Moore, as well as small parts of unincorporated Oklahoma and Cleveland Counties. In August 2010, the Environmental Protection Agency placed Lake Thunderbird on its 303(d) List of Impaired Waterbodies. This led to the establishment of a Total Maximum Daily Load by the Oklahoma Department of Environmental Quality in November of 2013. The Lake is considered to be impaired for its beneficial uses due to high concentration of chlorophyll-a, low concentration of dissolved oxygen, and a high concentration of biochemical oxygen demand. In November 2016, representatives from the Cities of Norman, Moore, and Oklahoma City began discussing the formation of a Technical Workgroup consisting of personnel in each City's stormwater program with TMDL compliance-related duties. This ultimately led to the creation of the Lake Thunderbird Watershed Alliance Inc., a non-profit watershed organization whose goal is to share information and leverage resources for the benefit of the Lake Thunderbird watershed and its residents.

Because the Lake Thunderbird watershed is such a vital resource to not only the municipalities within the watershed but to numerous other agencies, organizations, and community groups within this region, it is important to support projects that improve water quality and quantity of Lake Thunderbird and its tributaries. Therefore, Oklahoma State University is in full support and will actively participate in this effort to improve the water quality and quantity in Lake Thunderbird for all water users.

We look forward to working with the Lake Thunderbird Watershed Alliance Inc. on this vital watershed management project.

Sincerely,

Jaime C. Schussler, Ph.D.
Assistant Professor
School of Civil and Environmental Engineering
Oklahoma State University

The UNIVERSITY of OKLAHOMA®
School of Civil Engineering and Environmental Science

August 26th, 2024

Bureau of Reclamation
Water Resources and Planning Office
Attn: Ms. Robin Graber
Mail Code: 86-6300
P.O. Box 25007
Denver, CO 80225

Re: Bureau of Reclamation WaterSMART Cooperative Watershed Management Program Phase I Grant Application from the **Lake Thunderbird Watershed Alliance Inc, Oklahoma (FOA No. R23AS00362)**

To Whom It May Concern:

I am writing to support the Bureau of Reclamation WaterSMART Cooperative Watershed Management Program Phase I grant application from the Lake Thunderbird Watershed Alliance (LTWA) Inc. for site-specific water quality retrofit designs for several existing stormwater detention ponds in the Carrington Place subdivision, located in the Lake Thunderbird watershed, Norman, Oklahoma.

Lake Thunderbird was constructed by the U.S. Bureau of Reclamation in 1965 to impound the upper reaches of Little River and several of its tributaries east of Norman, Oklahoma. The multiuse reservoir serves as a crucial drinking water source for the Cities of Norman, Del City, and Midwest City. The lake's watershed drains 256 square miles in Oklahoma and Cleveland Counties and includes parts of Norman, Oklahoma City and Moore, as well as small portions of unincorporated Oklahoma and Cleveland Counties. In August 2010, the Environmental Protection Agency placed Lake Thunderbird on its 303(d) List of Impaired Waterbodies, a designation leading to establishment of a Total Maximum Daily Load (TMDL) by the Oklahoma Department of Environmental Quality in November 2013. Beneficial uses of the lake are impaired due to elevated concentrations of chlorophyll-a and biochemical oxygen demand and low concentrations of dissolved oxygen. In November 2016, representatives from the Cities of Norman, Moore, and Oklahoma City began discussing the formation of a technical workgroup consisting of personnel with TMDL compliance-related duties from each City's stormwater program. This effort ultimately led to the creation of LTWA, a non-profit watershed organization

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with the goals to share information and leverage resources for the benefit of the Lake Thunderbird watershed and its residents.

Because the Lake Thunderbird watershed is such a vital resource to not only local municipalities but to numerous other agencies, organizations, and community groups within the watershed, it is critically important to support projects that address water quality and quantity challenges in the watershed. My research team at the University of Oklahoma, the Center for Restoration of Ecosystems and Watersheds (CREW), works with LTWA on these efforts. LTWA leadership is committed to sound science and stakeholder engagement. CREW focuses on development and evaluation of nature-based solutions for global water challenges. We fully support and will actively participate in the proposed effort to improve water quality and quantity in Lake Thunderbird for all water users. We look forward to working with LTWA on this vital watershed management project.

Sincerely,

Robert W. Nairn, PhD, BCES
Robert W. Hughes Centennial Professor of Engineering
David L. Boren Distinguished Professor
Sam K. Viersen Family Foundation Presidential Professor
School of Civil Engineering and Environmental Science
Director, Center for Restoration of Ecosystems and Watersheds
Associate Director, Water Technologies for Emerging Regions Center

August 22, 2024

Bureau of Reclamation
Water Resources and Planning Office
Attn: Ms. Robin Graber
Mail Code: 86-6300
P.O. Box 25007
Denver, CO 80225

Re: Bureau of Reclamation WaterSMART Cooperative Watershed Management Program Phase I Grant Application from the Lake Thunderbird Watershed Alliance Inc, Oklahoma (FOA No. R23AS00362)

To Whom It May Concern:

The Oklahoma Water Resources Board would like to go on record supporting the Lake Thunderbird Watershed Alliance's Bureau of Reclamation WaterSMART Cooperative Watershed Management Program Phase I grant application to design site-specific water quality retrofits for several existing detention ponds in the Carrington Place subdivision located in the Lake Thunderbird watershed, Norman, Oklahoma.

Lake Thunderbird serves as a drinking water source for the Cities of Norman, Del City, and Midwest City and was constructed by the U.S. Bureau of Reclamation in 1965 to impound the upper reaches of Little River and several tributaries east of Norman, Oklahoma north of State Highway 9. The watershed drains 256 square miles in Oklahoma and Cleveland Counties including Norman, Oklahoma City and Moore, as well as small parts of unincorporated Oklahoma and Cleveland Counties. In August 2010, the Environmental Protection Agency placed Lake Thunderbird on its 303(d) List of Impaired Waterbodies. This led to the establishment of a Total Maximum Daily Load by the Oklahoma Department of Environmental Quality in November of 2013. The Lake is considered to be impaired for its beneficial uses due to high concentration of chlorophyll-a, low concentration of dissolved oxygen, and a high concentration of biochemical oxygen demand. In November 2016, representatives from the Cities of Norman, Moore, and Oklahoma City began discussing the formation of a Technical Workgroup consisting of personnel in each City's stormwater program with TMDL compliance-related duties. This ultimately led to the creation of the Lake Thunderbird Watershed Alliance Inc., a non-profit watershed organization whose goal is to share information and leverage resources for the benefit of the Lake Thunderbird watershed and its residents.

Because the Lake Thunderbird watershed is such a vital resource to not only the municipalities within the watershed but to numerous other agencies, organizations, and community groups within this region, it is important to support projects that improve water quality and quantity of Lake Thunderbird and its tributaries. Therefore, the Oklahoma Water Resources Board is in full support and will actively participate in this effort to improve the water quality and quantity in Lake Thunderbird for all water users.

We look forward to working with the Lake Thunderbird Watershed Alliance Inc. on this vital watershed management project.

Sincerely,

Bill Cauthron

Bill Cauthron

WATER Division Section Head
The Oklahoma Water Resources Board