CHEROKEE VILLAGE, ARKANSAS: LAKE MANAGEMENT REPORT

INTIAL EVALUATION- Report dated May, 28th 2024

The following report is a preliminary detailed look at the existing conditions of the Cherokee Village Arkansas lakes. It is broken down into seven main categories that cover some of the primary management issues facing all of the lakes here in Cherokee Village. Its purpose is to provide the necessary preliminary information regarding the current conditions and future needs of the lakes and begin the process of creating a sufficient operating budget for the future. Lake management is an ongoing, long-term endeavor and we recommend planning, budgeting, and implementing the program over the next 10 years, while continuing to monitor and amend the plan as needed as you progress.

Lake Descriptions:

NAME	ACERAGE/TYPE	DEPTH	SHORELINE
Lake Aztec	**21.024 Acres/Fishing**	**Max 40 Feet**	**.987 Miles**
Lake Chanute	**55.612 Acres/Fishing**	**Max 40 Feet**	**2.273 Miles**
Lake Cherokee	**37 Acres/Fishing**	**Max 40 Feet**	**1.416 Miles**
Lake Navajo	**34 Acres/Fishing**	**Max 25 ft at Dam**	**1.06 Miles**
Lake Omaha	**142.216 Acres/Fishing, Boating, Skiing**	**Max 40 ft at Dam**	**4.7 Miles**
Lake Sequoyah	**75.5 Acres/Fishing, Boating**	**Max 55 ft at Dam**	**2.361 Miles**
Lake Thunderbird	**264 Acres/Fishing, Boating, Skiing**	**Max 75 ft at Dam Avg 25 Feet**	**7.2 Miles**

DAMS: Obviously the dams are an extremely important part of the lake management program, and its maintenance is regulated by the state. Although these Dams have all been recently inspected by the S.I.D. staff, we have also briefly inspected all seven dams and have observed the following potential issues:

Significant leaking on the downstream slope of Lake Sequoyah.

Some unwanted tree saplings and vegetation in isolated areas of several Dam slopes.

Multiple animal burrows along with other holes and surface irregularities.

Keeping both the upstream face and the downstream face of each dam well maintained is critical to the long range management plan. Allowing trees, burrowing animals or erosion issues to go unchecked can lead to future issues with the overall integrity of the dams.

Regular inspections are necessary to monitor these potential negative issues. Regular mowing and tree removal is necessary. Properly timed and approved Herbicide and Growth Regulators, applied by a licensed applicator, will also be an important part of the management program needed to properly maintain these dams.

Specialized Outdoor Services can provide quotes for Herbicide and Growth Regulators and/or Mowing Services as needed.

LAUNCH RAMPS: The boat launch ramps are certainly outdated and quite narrow and short. Some are in need of repair to the concrete. Parking is limited in most situations. However, with the small size of some of the lakes, increased parking areas are probably not too important overall. Repairing deteriorated concrete, enlarging the ramp itself or increasing parking should be future considerations and could be performed during lake level draw downs related to dam repairs and/or dredging operations.

SEDIMENT MANAGEMENT: This is a major concern for the lakes and has been overlooked for decades. Large amounts of silt and organic matter have been flowing into the lakes unchecked for 50 years or more, depending on the individual lake. This sediment is detrimental to the overall health and condition of the lakes. This sediment is one of the causes of invasive aquatic vegetation and algae in lakes. It can tie up large amount of nutrients that can diminish the overall water quality and lower fish and forage production capacity. It also displaces the overall water volume and can make some areas so shallow that boat traffic is limited in certain areas. In some cases it can make boat navigation and access into docks difficult and eventually impossible. It also diminishes recreational uses, such as swimming. In addition, this sediment is detrimental to game fish populations as these fish require a hard bottom to successfully build their spawning beds and produce fry each year. Although the "Average Sediment Depth's" are less than I expected, the current sediment depth is limiting game fish production as well as some of the forage fish production.

We have done extensive depth checking of the sediment in each lake and have mapped out some of the areas that are most affected. Although there is sediment in all of the lake bottoms, we have focused on the inflows, around marinas, parks and boat ramps for this initial evaluation.

Some areas have a substantial amount of rock and gravel mixed into the sediment and other areas are more silt and organic debris without much rock or gravel mixed in it.

Unfortunately, this will be one of the most difficult, time consuming and costly parts of the future lake management issues in Cherokee Village.

Dredging is the only way to remove this unwanted material and can be a very extensive process. I have been involved in several methods of dredging and have observed a considerable amount of dredging operations and methods. Most dredging operations tend to revolve around the concept that they will be completely removing all the sediment down to the hard pan within certain selected, generally broad areas.

Mechanical Dredging using various types of dredging equipment is the most common method used in these types of lakes.

Hydraulic Dredging is used when accessing the lakes and is an issue for the equipment that's used in most mechanical operations.

Accessing our lakes will be a challenge due to the lack of common property suited to bring the necessary land equipment and material in and out of the lake bottom. In that situation, hydraulic dredging from a floating barge is the common recommendation. It requires that the material collected be put into large, perforated bags that will drain out the water. Then these bags are offloaded from the collection barge and stockpiled along the lakeshore and /or Dam for removal when dried. Then generally another contractor is required to haul the material out, unless it can be accomplished with S.I.D. employees and equipment. Hydraulic dredging is going to be the most expensive method and will require out-of-state contractors. In most cases, you will end up on a long waiting list. The last 200 acre lake in Arkansas that I know of, who contracted a hydraulic dredging contractor, spent over $500,000.00. And the contractor went way past the projected time of completion. Although this method can be very effective in many situations, it may not be feasible here at this time.

Mechanical dredging will be somewhat less costly and easier to find contractors or own the necessary equipment. However, accessing the lakes will be an issue as well as stockpiling the material removed. Without common areas that are practical (not too steep or heavily wooded) to bring equipment and material in and out, it will be a very long and limited process and will increase cost. And the material we haul out will require months to dry out along the lakeshore somewhere, before it can be hauled away. The cost of this process would be calculated and quoted by most contractors based on the cubic yards of material removed from the lake bottom. Due to the time considerations of this process, multiple contractors are usually required to complete the process in a timely manner.

Lake Drawdown: The mechanical dredging process will require a drawdown of the lakes. Based on our findings we would need to have access out to the 6-10 foot contour lines to make any significant differences. This would require lowering the lakes down 8-12 feet to be able to access the target areas with bulldozers, track hoes, backhoes, skid loaders and small dump trucks. This process will take approximately 1 month to lower the lake, 1-2 months to dry out the bottom enough to work in it, 1-2 months to remove material and 1 to 2 months to refill the lake. All of this is dependent upon the total area selected to dredge and the depth of material removed as well as the amount of precipitation received during the entire process, which can make the project timeframe vary significantly in either direction.

Generally, a schedule of lowering the lake beginning in late September or early October, working through the late fall and winter is the best strategy to plan for. Then we would normally receive enough precipitation in March, April and May to refill the lake.

This basic mechanical method of dredging would be feasible for the most part here, but still difficult due to the limited access and the areas available to stockpile the material removed.

Recommendations: After assessing the situation here in Cherokee Village, I would make the following recommendations for a long-term dredging plan. I would advise a targeted approach in order to get the most benefit from your budget and remove the most amount of material where it is needed. This approach will also widen your available timeframe, allow more flexibility, and reduce the overall inconvenience to the property owners.

I recommend scheduling each lake for drawdown every seven years. In your situation, that puts each lake lowered and dredged as needed once every eight years. This would also allow homeowners to address any concerns they have with their shoreline property needs or dock repairs, etc., within the guidelines of the S.I.D. However, with the following method, the lakes would not have to be lowered out to the 8-12 foot contour lines. Lowering the lakes to the 6-8 foot contour would be sufficient in most of the lakes.

I recommend using a combination of conventional excavating equipment where accessible, preferably utilizing this equipment working in the larger areas within the inlet creeks and larger flat coves, if access is obtainable.

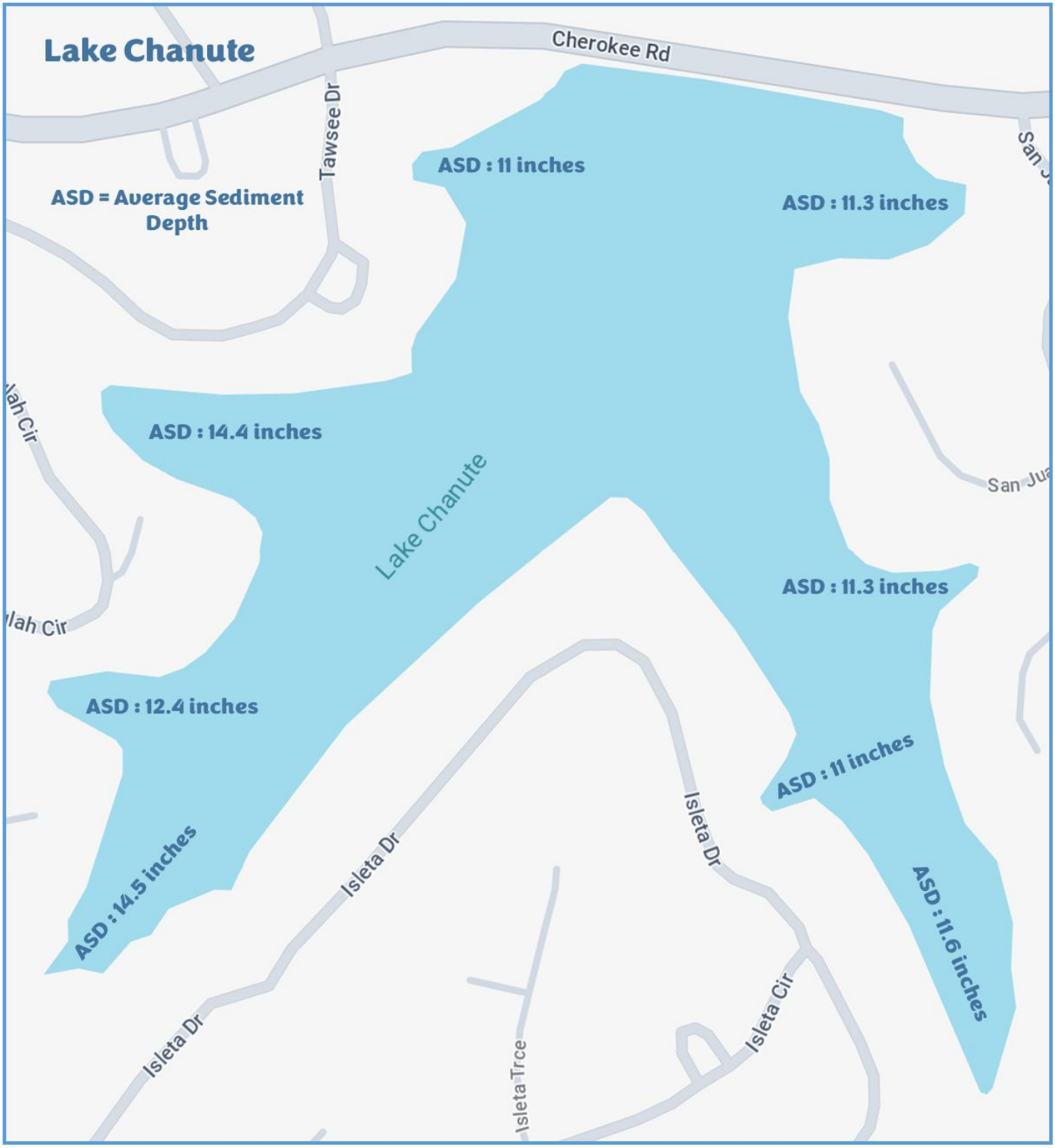
The remainder of the dredging along the lake shoreline would be targeted specifically around docks, marinas, parks and boat ramps using an **Amphibious Excavator**. This will allow you to target these areas, precisely and as specifically as needed. It will also help reduce the overall total cubic yards of material removed, thus reducing cost. This process will make sure each dock has a clear channel to the deeper water. This will also reduce weed and algae populations in those areas and increase other recreational activities around the docks, parks and marinas as well as make vital spawning habitat for game fish, providing ample cover is available for them. (See fish habitat section). This process will also allow the entire work timeframe to increase. This equipment can work both on land and in up to 4-6 feet of water depending on equipment size. The material removal process can begin before full lake drawdown is achieved and go on well into the refilling process. The material still has to be loaded on to a floating barge and then unloaded on shore. Then it will still need drying time before final removal. This material can be used for other fill needs or projects once it is dry. Or it could be sold, added to compost, or donated.

With the upcoming repair needed on the Sequoyah dam, a significant lake drawdown will be required. Scheduling any dredging operations would be best scheduled to coincide with the dam repair project on that lake.

Specialized Outdoor Services can provide quotes as needed on Amphibious Excavator dredging or conventional equipment mechanical dredging.

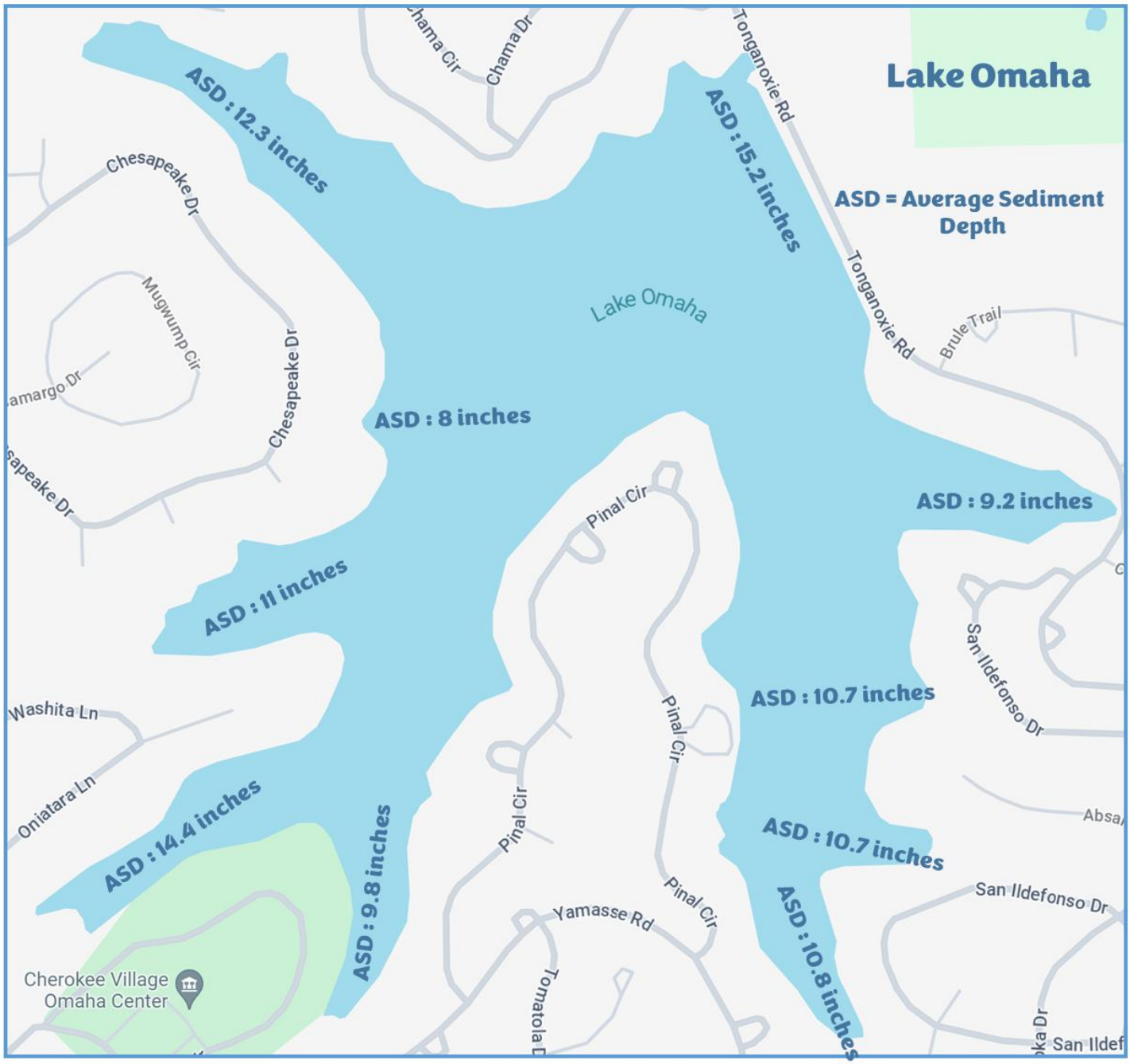
I have attached some maps indicating some of the sediment locations and depths in the lakes.

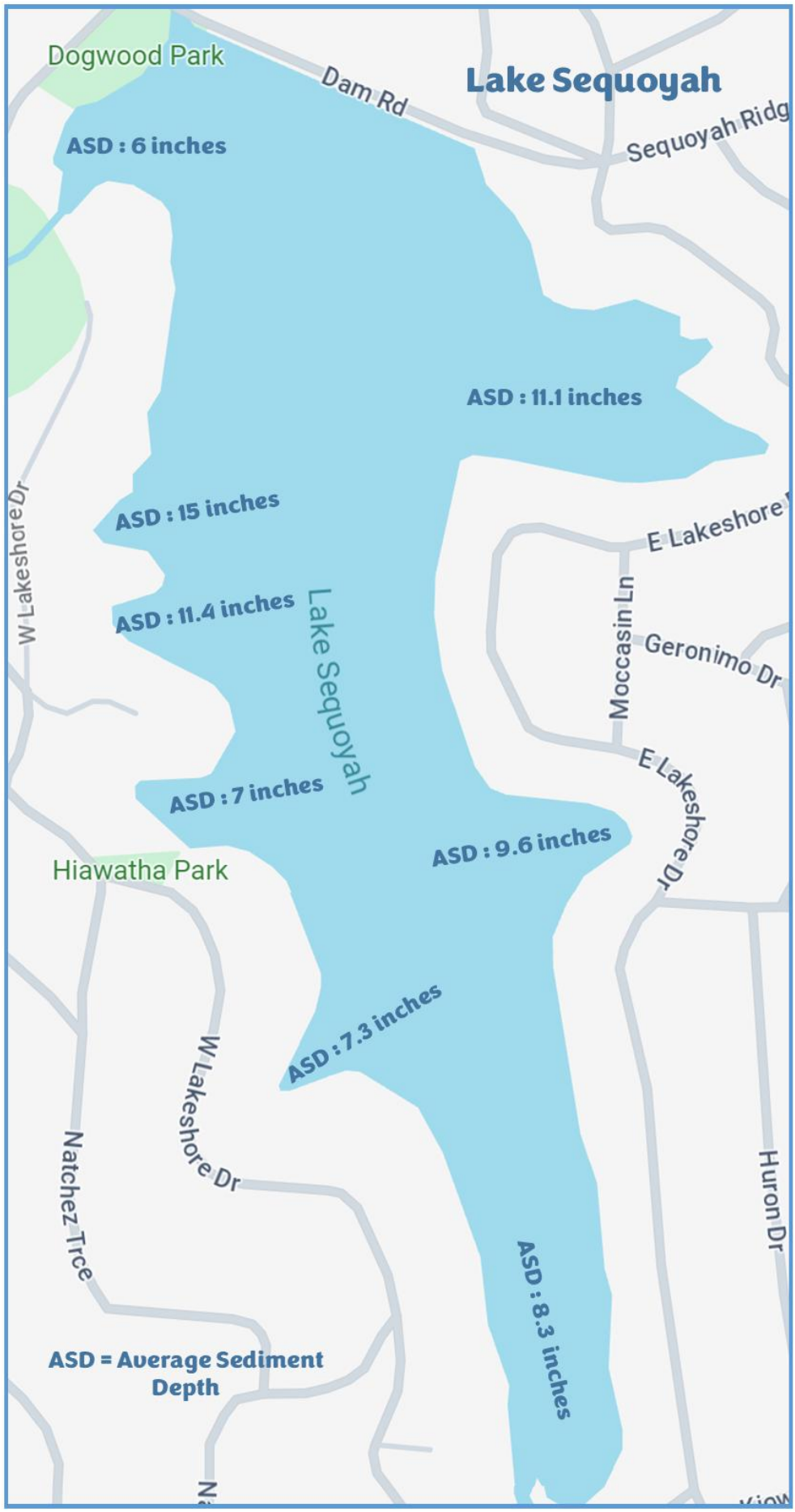

Lake Aztec
ASD = Average Sediment Depth
ASD : 13.3 inches
ASD : 9.5 inches
Cherokee Rd
175
Kamiakin Cir
Kamiakin Cir
Kamiakin Cir
Lake Paradise Records
Dulastur
Hualapi Dr
Hualapi Dr
ASD : 17.5 inches
ASD : 23 inches

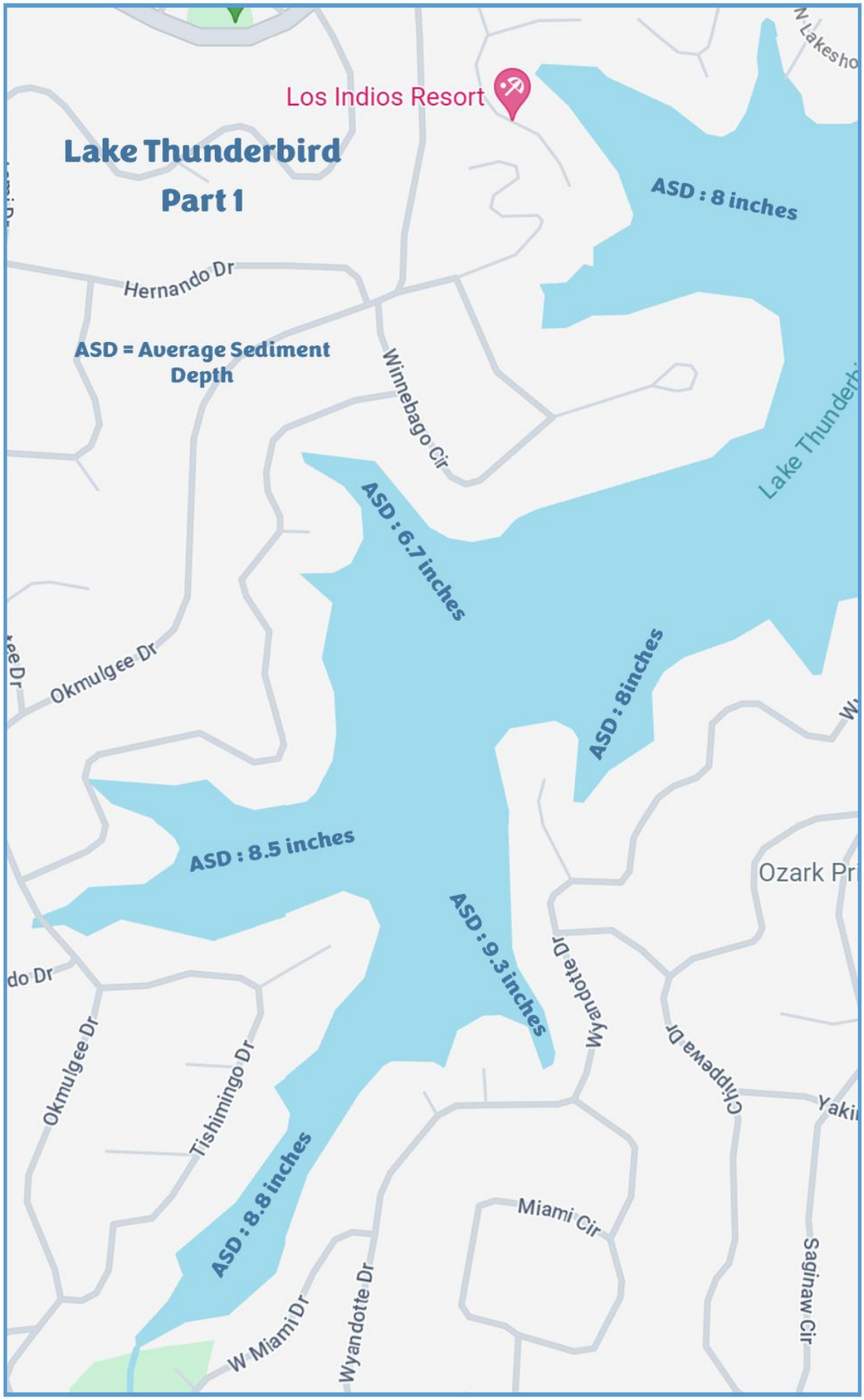

Lake Chanute
Cherokee Rd
Tawsee Dr
ASD = Average Sediment Depth
ASD : 11 inches
ASD : 11.3 inches
ASD : 14.4 inches
Lake Chanute
ASD : 11.3 inches
ASD : 12.4 inches
ASD : 11 inches
ASD : 14.5 inches
ASD : 11.6 inches
Isleta Dr
Isleta Dr
Isleta Dr
Isleta Cir
Isleta Trce

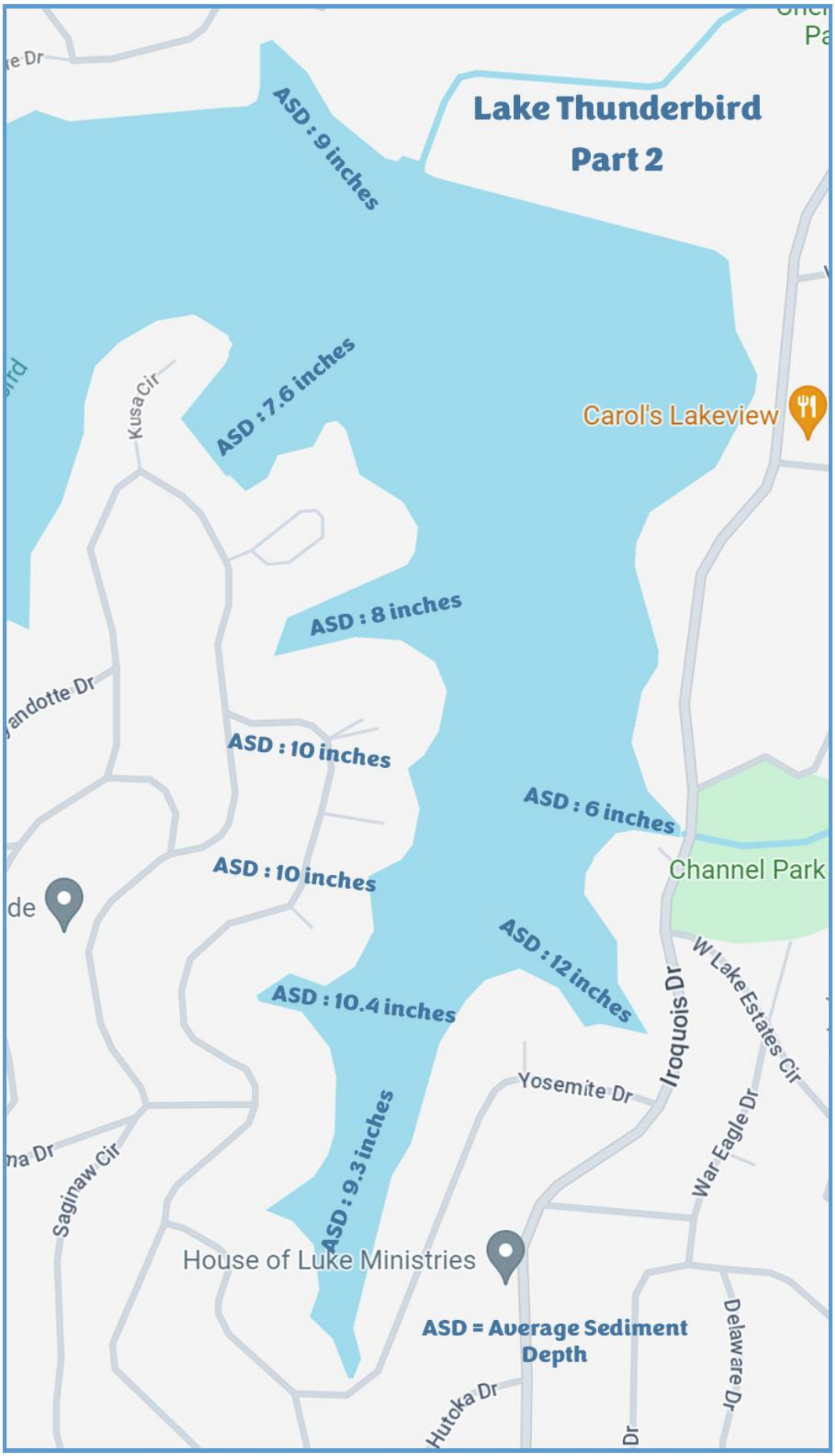

Lake Cherokee
ASD : 12.6 inches
ASD = Average Sediment Depth
Lake Cherokee
ASD : 9 inches
E Lakeshore Dr
ASD : 15.7 inches


Navajo Park
Enid Cir
Lake Navajo
Mena Dr
Enid Dr
ASD = Average Sediment Depth
ASD : 9.6 inches
Monongahela Dr
ASD : 16.8 inches
Enid Dr
ASD : 13.3 inches
Monongahela Dr
Monongahela Dr
ASD : 14.9 inches
Iuka Dr
Monongahela Dr


Lake Omaha
ASD = Average Sediment Depth
ASD : 12.3 inches
ASD : 15.2 inches
ASD : 8 inches
ASD : 9.2 inches
ASD : 11 inches
ASD : 10.7 inches
ASD : 14.4 inches
ASD : 9.8 inches
ASD : 10.7 inches
ASD : 10.8 inches
Lake Omaha
Tonganoxie Rd
Chama Cir
Chama Dr
Chesapeake Dr
Mugwump Cir
Brule Trail
Pinal Cir
San Ildefonso Dr
Washita Ln
Oniatara Ln
Yamasse Rd
Tomatola Dr
Cherokee Village Omaha Center


Dogwood Park
Dam Rd
Lake Sequoyah
Sequoyah Ridg
ASD : 6 inches
ASD : 11.1 inches
ASD : 15 inches
W Lakeshore Dr
E Lakeshore
ASD : 11.4 inches
Lake Sequoyah
Moccasin Ln
Geronimo Dr
E Lakeshore Dr
ASD : 7 inches
ASD : 9.6 inches
Hiawatha Park
ASD : 7.3 inches
W Lakeshore Dr
Natchez Trce
Huron Dr
ASD : 8.3 inches
ASD = Average Sediment Depth


Los Indios Resort
Lake Thunderbird
Part 1
ASD = Average Sediment Depth
ASD : 8 inches
ASD : 6.7 inches
ASD : 8inches
ASD : 8.5 inches
ASD : 9.3 inches
ASD : 8.8 inches
Hernando Dr
Winnebago Cir
Okmulgee Dr
Tishimingo Dr
Wyandotte Dr
Chippewa Dr
Miami Cir
W Miami Dr
Saginaw Cir
Ozark Pr
Lake Thunderb


Lake Thunderbird
Part 2
ASD : 9 inches
ASD : 7.6 inches
ASD : 8 inches
ASD : 10 inches
ASD : 6 inches
ASD : 10 inches
ASD : 12 inches
ASD : 10.4 inches
ASD : 9.3 inches
Carol's Lakeview
Channel Park
House of Luke Ministries
ASD = Average Sediment Depth
Kusa Cir
Yosemite Dr
Iroquois Dr
W Lake Estates Cir
War Eagle Dr
Saginaw Cir
Hutoka Dr
Delaware Dr

EROSION CONTROL: Controlling erosion around the lake shore is an important component of managing the sediment coming into the lakes. Construction on the lake shore needs to be monitored and properly regulated in the form of mandatory erosion control methods with the approved materials and installation methods. If not already in place, I would consider implementing mandatory guidelines for controlling erosion to lake shore construction sites and/or enforcing rules already in place. The state has some guidelines on this subject if needed.

I have included a picture of a lot cleared this past winter on Omaha and is a great example of what should not be allowed. This is how more and more sediment will get into the lakes, and it is one of the few ways erosion happens that you can control to a large degree.

Specialized Outdoor Services can professionally install or sell erosion control products if needed.

WATER QUALITY: Each lake has had a basic water test done for Nutrient loads, PH, Alkalinity, Hardness, Conductivity, Carbonates and Bicarbonates. All of the Cherokee Village lakes fall within the normal parameters of lakes within this region and no serious problems exist.

Although none are expected due to the low nutrient loads, we have not tested for Cyanobacteria at this time. If testing is done, I recommend taking samples during the warmer months when surface water temperatures are above 80 degrees. These bacteria can consume oxygen from the lakes, reduce the microorganisms, promote non beneficial or toxic algae, diminish the food chain and can produce toxins unsafe for animals and humans. These Cyanobacteria are not normally an issue on these types of lakes in this region, and I have no reason to believe they will be a problem in the future.

I have attached the individual laboratory results for each lake to this report.

Arkansas Water Resources Center
Water Quality Laboratory

Analytical Report

Lab Phone: 479-502-9843 | Office Phone: 479-502-9854 | Website: arkansas-water-center.uark.edu

In Cooperation with Arkansas Cooperative Extension Service (501) 671-2000

Jeff Klein
400 Church St
Hardy, AR, 72542

Analytical Package	Fish_Pond
Entered By	Machaela Morrison
Date Received	4/24/2024
Date Reported	5/2/2024
Date Sampled	4/22/2024
County:	Sharp

Sample Number: 240652-06
Sample ID: AZT

Parameter		Result	Units	Method	Analyzed	MDL	RL
Carbonate (calc.)		1.3	mg/L as CaCO3	calculation	04/30/2024	-	-
Hardness (calc.)		205.7	mg/L as CaCO3	APHA 2340 B		-	-
pH		7.9		EPA 150.1	04/25/2024	-	-
Sulfate		2.431	mg/L	EPA 300.0	04/29/2024	0.213	0.500
Conductivity		503.0	µS/cm	EPA 120.1	04/29/2024	1.1	-
Alkalinity		192.0	mg/L as CaCO3	APHA 2320B	04/25/2024	-	2.0
Bicarbonate (calc.)		190.7	mg/L as CaCO3	APHA 2320B	04/30/2024	-	-
Fluoride		0.068	mg/L	EPA 300.0	04/29/2024	0.040	0.050
Chloride		2.813	mg/L	EPA 300.0	04/29/2024	0.292	0.500
Nitrate-N	E	0.000	mg/L	EPA 300.0	04/29/2024	0.036	0.050
SRP	E	0.002	mg/L	EPA 365.1	04/26/2024	0.005	0.006
Manganese	E	0.012	mg/L	EPA 200.7	04/29/2024	0.017	0.050
Iron	E	0.003	mg/L	EPA 200.7	04/29/2024	0.024	0.050
Ammonia-N	E	0.000	mg/L	EPA 351.2	04/26/2024	0.018	0.050
Nitrite-N	E	0.001	mg/L	4500-NO2-B	04/26/2024	0.011	0.005
Calcium		40.232	mg/L	EPA 200.7	04/29/2024	0.209	0.250
Magnesium		25.560	mg/L	EPA 200.7	04/29/2024	0.017	0.050

An "E" next to the result valve indicates the value reported is less than the Reporting Limit (RL) and should be viewed as an estimate.

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Jeff Klein
400 Church St
Hardy, AR, 72542

Analytical Package: Fish_Pond
Entered By: Machaela Morrison
Date Received: 4/24/2024
Date Reported: 5/2/2024
Date Sampled: 4/22/2024
County: Sharp

Sample Number: 240652-05
Sample ID: CHAN

Parameter		Result	Units	Method	Analyzed	MDL	RL
Carbonate (calc.)		1.2	mg/L as CaCO3	calculation	04/30/2024	-	-
Hardness (calc.)		155.0	mg/L as CaCO3	APHA 2340 B		-	-
pH		8.0		EPA 150.1	04/25/2024	-	-
Sulfate		2.429	mg/L	EPA 300.0	04/29/2024	0.213	0.500
Conductivity		370.0	µS/cm	EPA 120.1	04/29/2024	1.1	-
Alkalinity		148.0	mg/L as CaCO3	APHA 2320B	04/25/2024	-	2.0
Bicarbonate (calc.)		146.8	mg/L as CaCO3	APHA 2320B	04/30/2024	-	-
Fluoride		0.063	mg/L	EPA 300.0	04/29/2024	0.040	0.050
Chloride		2.686	mg/L	EPA 300.0	04/29/2024	0.292	0.500
Nitrate-N	E	0.000	mg/L	EPA 300.0	04/29/2024	0.036	0.050
SRP	E	0.004	mg/L	EPA 365.1	04/26/2024	0.005	0.006
Manganese	E	0.012	mg/L	EPA 200.7	04/29/2024	0.017	0.050
Iron	E	0.003	mg/L	EPA 200.7	04/29/2024	0.024	0.050
Ammonia-N	E	0.000	mg/L	EPA 351.2	04/26/2024	0.018	0.050
Nitrite-N	E	0.000	mg/L	4500-NO2-B	04/26/2024	0.011	0.005
Calcium		30.849	mg/L	EPA 200.7	04/29/2024	0.209	0.250
Magnesium		18.934	mg/L	EPA 200.7	04/29/2024	0.017	0.050

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Jeff Klein
400 Church St
Hardy, AR, 72542

Analytical Package: Fish_Pond
Entered By: Machaela Morrison
Date Received: 4/24/2024
Date Reported: 5/2/2024
Date Sampled: 4/22/2024
County: Sharp

Sample Number: 240652-01
Sample ID: CHE

Parameter		Result	Units	Method	Analyzed	MDL	RL
Carbonate (calc.)		1.8	mg/L as CaCO3	calculation	04/30/2024	-	-
Hardness (calc.)		220.1	mg/L as CaCO3	APHA 2340 B		-	-
pH		8.0		EPA 150.1	04/25/2024	-	-
Sulfate		2.699	mg/L	EPA 300.0	04/29/2024	0.213	0.500
Conductivity		558.0	µS/cm	EPA 120.1	04/29/2024	1.1	-
Alkalinity		212.0	mg/L as CaCO3	APHA 2320B	04/25/2024	-	2.0
Bicarbonate (calc.)		210.2	mg/L as CaCO3	APHA 2320B	04/30/2024	-	-
Fluoride		0.067	mg/L	EPA 300.0	04/29/2024	0.040	0.050
Chloride		4.660	mg/L	EPA 300.0	04/29/2024	0.292	0.500
Nitrate-N	E	0.000	mg/L	EPA 300.0	04/29/2024	0.036	0.050
SRP	E	0.003	mg/L	EPA 365.1	04/26/2024	0.005	0.006
Manganese	E	0.012	mg/L	EPA 200.7	04/29/2024	0.017	0.050
Iron	E	0.007	mg/L	EPA 200.7	04/29/2024	0.024	0.050
Ammonia-N	E	0.003	mg/L	EPA 351.2	04/26/2024	0.018	0.050
Nitrite-N	E	0.000	mg/L	4500-NO2-B	04/26/2024	0.011	0.005
Calcium		42.403	mg/L	EPA 200.7	04/29/2024	0.209	0.250
Magnesium		27.728	mg/L	EPA 200.7	04/29/2024	0.017	0.050

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Hardy, AR, 72542

Analytical Package	Fish_Pond
Entered By	Machaela Morrison
Date Received	4/24/2024
Date Reported	5/2/2024
Date Sampled	4/22/2024
County:	Sharp

Sample Number: 240652-04
Sample ID: NAV

Parameter		Result	Units	Method	Analyzed	MDL	RL
Carbonate (calc.)		1.0	mg/L as CaCO3	calculation	04/30/2024	-	-
Hardness (calc.)		164.0	mg/L as CaCO3	APHA 2340 B		-	-
pH		7.8		EPA 150.1	04/25/2024	-	-
Sulfate		3.289	mg/L	EPA 300.0	04/29/2024	0.213	0.500
Conductivity		444.0	µS/cm	EPA 120.1	04/29/2024	1.1	-
Alkalinity		164.0	mg/L as CaCO3	APHA 2320B	04/25/2024	-	2.0
Bicarbonate (calc.)		163.0	mg/L as CaCO3	APHA 2320B	04/30/2024	-	-
Fluoride		0.065	mg/L	EPA 300.0	04/29/2024	0.040	0.050
Chloride		8.117	mg/L	EPA 300.0	04/29/2024	0.292	0.500
Nitrate-N	E	0.000	mg/L	EPA 300.0	04/29/2024	0.036	0.050
SRP		0.047	mg/L	EPA 365.1	04/26/2024	0.005	0.006
Manganese	E	0.012	mg/L	EPA 200.7	04/29/2024	0.017	0.050
Iron	E	0.003	mg/L	EPA 200.7	04/29/2024	0.024	0.050
Ammonia-N	E	0.035	mg/L	EPA 351.2	04/26/2024	0.018	0.050
Nitrite-N	E	0.000	mg/L	4500-NO2-B	04/26/2024	0.011	0.005
Calcium		34.599	mg/L	EPA 200.7	04/29/2024	0.209	0.250
Magnesium		18.844	mg/L	EPA 200.7	04/29/2024	0.017	0.050

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Jeff Klein
400 Church St
Hardy, AR, 72542

Analytical Package: Fish_Pond
Entered By: Machaela Morrison
Date Received: 4/24/2024
Date Reported: 5/2/2024
Date Sampled: 4/22/2024
County: Sharp

Sample Number: 240652-07
Sample ID: OMA

Parameter		Result	Units	Method	Analyzed	MDL	RL
Carbonate (calc.)		1.1	mg/L as CaCO3	calculation	04/30/2024	-	-
Hardness (calc.)		159.3	mg/L as CaCO3	APHA 2340 B		-	-
pH		7.9		EPA 150.1	04/25/2024	-	-
Sulfate		1.619	mg/L	EPA 300.0	04/29/2024	0.213	0.500
Conductivity		409.0	µS/cm	EPA 120.1	04/29/2024	1.1	-
Alkalinity		168.0	mg/L as CaCO3	APHA 2320B	04/25/2024	-	2.0
Bicarbonate (calc.)		166.9	mg/L as CaCO3	APHA 2320B	04/30/2024	-	-
Fluoride		0.062	mg/L	EPA 300.0	04/29/2024	0.040	0.050
Chloride		2.287	mg/L	EPA 300.0	04/29/2024	0.292	0.500
Nitrate-N	E	0.000	mg/L	EPA 300.0	04/29/2024	0.036	0.050
SRP	E	0.002	mg/L	EPA 365.1	04/26/2024	0.005	0.006
Manganese	E	0.012	mg/L	EPA 200.7	04/29/2024	0.017	0.050
Iron	E	0.005	mg/L	EPA 200.7	04/29/2024	0.024	0.050
Ammonia-N	E	0.000	mg/L	EPA 351.2	04/26/2024	0.018	0.050
Nitrite-N	E	0.001	mg/L	4500-NO2-B	04/26/2024	0.011	0.005
Calcium		29.681	mg/L	EPA 200.7	04/29/2024	0.209	0.250
Magnesium		20.678	mg/L	EPA 200.7	04/29/2024	0.017	0.050

An "E" next to the result valve indicates the value reported is less than the Reporting Limit (RL) and should be viewed as an estimate.

For further questions, contact the University of Arkansas Division of Agricultural Cooperative Extension specialist, Mike Daniels at mdaniels@uada.edu.

Arkansas Water Resources Center
Water Quality Laboratory

Analytical Report

Lab Phone: 479-502-9843 | Office Phone: 479-502-9854 | Website: arkansas-water-center.uark.edu

In Cooperation with Arkansas Cooperative Extension Service (501) 671-2000

Jeff Klein
400 Church St
Hardy, AR, 72542

Analytical Package	Fish_Pond
Entered By	Machaela Morrison
Date Received	4/24/2024
Date Reported	5/2/2024
Date Sampled	4/22/2024
County:	Sharp

Sample Number: 240652-03
Sample ID: SEQ

Parameter		Result	Units	Method	Analyzed	MDL	RL
Carbonate (calc.)		1.9	mg/L as CaCO3	calculation	04/30/2024	-	-
Hardness (calc.)		215.8	mg/L as CaCO3	APHA 2340 B		-	-
pH		8.0		EPA 150.1	04/25/2024	-	-
Sulfate		2.805	mg/L	EPA 300.0	04/29/2024	0.213	0.500
Conductivity		546.0	µS/cm	EPA 120.1	04/29/2024	1.1	-
Alkalinity		212.0	mg/L as CaCO3	APHA 2320B	04/25/2024	-	2.0
Bicarbonate (calc.)		210.1	mg/L as CaCO3	APHA 2320B	04/30/2024	-	-
Fluoride		0.070	mg/L	EPA 300.0	04/29/2024	0.040	0.050
Chloride		4.349	mg/L	EPA 300.0	04/29/2024	0.292	0.500
Nitrate-N	E	0.000	mg/L	EPA 300.0	04/29/2024	0.036	0.050
SRP	E	0.005	mg/L	EPA 365.1	04/26/2024	0.005	0.006
Manganese	E	0.012	mg/L	EPA 200.7	04/29/2024	0.017	0.050
Iron	E	0.003	mg/L	EPA 200.7	04/29/2024	0.024	0.050
Ammonia-N	E	0.004	mg/L	EPA 351.2	04/26/2024	0.018	0.050
Nitrite-N	E	0.000	mg/L	4500-NO2-B	04/26/2024	0.011	0.005
Calcium		42.628	mg/L	EPA 200.7	04/29/2024	0.209	0.250
Magnesium		26.568	mg/L	EPA 200.7	04/29/2024	0.017	0.050

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In Cooperation with Arkansas Cooperative Extension Service (501) 671-2000

Jeff Klein
400 Church St
Hardy, AR, 72542

Analytical Package: Fish_Pond
Entered By: Machaela Morrison
Date Received: 4/24/2024
Date Reported: 5/2/2024
Date Sampled: 4/22/2024
County: Sharp

Sample Number: 240652-02
Sample ID: THU

Parameter		Result	Units	Method	Analyzed	MDL	RL
Carbonate (calc.)		1.5	mg/L as CaCO3	calculation	04/30/2024	-	-
Hardness (calc.)		177.1	mg/L as CaCO3	APHA 2340 B		-	-
pH		8.0		EPA 150.1	04/25/2024	-	-
Sulfate		2.591	mg/L	EPA 300.0	04/29/2024	0.213	0.500
Conductivity		459.0	µS/cm	EPA 120.1	04/29/2024	1.1	-
Alkalinity		172.0	mg/L as CaCO3	APHA 2320B	04/25/2024	-	2.0
Bicarbonate (calc.)		170.5	mg/L as CaCO3	APHA 2320B	04/30/2024	-	-
Fluoride		0.066	mg/L	EPA 300.0	04/29/2024	0.040	0.050
Chloride		3.386	mg/L	EPA 300.0	04/29/2024	0.292	0.500
Nitrate-N	E	0.000	mg/L	EPA 300.0	04/29/2024	0.036	0.050
SRP	E	0.001	mg/L	EPA 365.1	04/26/2024	0.005	0.006
Manganese	E	0.012	mg/L	EPA 200.7	04/29/2024	0.017	0.050
Iron	E	0.003	mg/L	EPA 200.7	04/29/2024	0.024	0.050
Ammonia-N	E	0.001	mg/L	EPA 351.2	04/26/2024	0.018	0.050
Nitrite-N	E	0.000	mg/L	4500-NO2-B	04/26/2024	0.011	0.005
Calcium		36.451	mg/L	EPA 200.7	04/29/2024	0.209	0.250
Magnesium		20.893	mg/L	EPA 200.7	04/29/2024	0.017	0.050

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AQUATIC VEGETATION AND ALGAE MANAGEMENT: The lakes in Cherokee Village do not have a substantial aquatic weed population. However, management is still necessary to maintain a good balance of beneficial vegetation, while not allowing them to become overpopulated. If left untreated, they can overgrow and consume too much oxygen from the lakes, restrict boat travel, swimming, fishing and other recreational activities as well as become unsightly.

A selective aquatic weed control program was implemented on all of the lakes in 2023 and will continue in 2024 with some additional areas being included this year.

The primary plants we have in the lakes are American Water Willow and Water Lilies. Both do provide several benefits to the lakes. They help stabilize bottom sediment, consume nutrients from the sediment, stabilize shoreline soils and provide cover for microorganisms, insects and forage fish as well as cover for spawning game fish and their fry.

We do have some very isolated areas of Water Primrose as well, and it also does provide some benefits to the overall eco system of a healthy lake.

The American Water Willow is the most prevalent weed we have and is found along the shoreline of all of the lakes growing from the shoreline out to as much as 3 feet of depth.

The Water Lily is not as prevalent, however can be more invasive in nature, due the fact that it can completely cover the surface of large areas, if left unmanaged. (In 2022 Lake Cherokee did have a large population on the south end of the lake that covered about 4 acres in a solid mat. We have cleaned that up and reduced the population by 95% at this time.).

The proper aquatic weed control program should be selective and balanced. Allowing as many areas of the lake to support a managed population of beneficial aquatic vegetation helps promote a healthy lake and productive fishery.

Targeting the areas around docks, parks, Dams and other high use recreational areas, while allowing the less developed or undeveloped areas to remain intact and untreated, will provide a good balance for these lakes.

Selecting the proper chemistry, application timing, rates and methods are all critical to environmental safety and weed control effectiveness, and we do not recommend allowing unlicensed applicators or property owners to apply any chemicals to the lakes.

There are several types of algae that occur in the lakes with Chara Algae being the most abundant. The Chara does have some ecological benefits similar to some aquatic plants. It does provide some sediment stabilization, cover for small aquatic animals, invertebrates and forage species as well as small game fish. Chara also provides food for some fish and waterfowl. However, an over abundance of this algae can be an issue with oxygen consumption as well restricting boat navigation, swimming, fishing and other recreational activities.

Another type of algae present in the lakes is Filamentous Algae. These algae grow in long strands from the lake bottom until eventually trapping gases, breaking loose and floating to the surface. This generally happens in the mid to late summer. Although there are some ecological benefits to the lakes food chain from these algae, an over abundance can become an unsightly nuisance as well as cause oxygen depletion and in some cases release toxins into the water body.

Both of these types of algae are promoted by excessive nutrients in the sediment collected on the lake bottom and are extremely difficult and somewhat costly to control without addressing the sediment issues.

In 2023 we targeted several areas on the lakes and treated multiple times with an approved Algaecide and will be expanding those treatments in 2024.

We also have some amount of Planktonic Algae, but due to the low amounts of soluble nutrients in the water column, not enough is present for good fish production. This is the most beneficial algae we have in the lakes. This algae floats within the water column and is sometimes confused with dirty water. Planktonic algae are the base of the food chain. They are fed by zooplankton (microscopic animals), which in turn, become food for forage fish species. Lakes with abundant planktonic algae are often able to support large populations of fish that grow more quickly. This type of algae can be manipulated with precise nutrient applications to the lakes and will be discussed further in the fisheries management section of this report.

Some of the lakes aquatic plant and algae issues are promoted by old septic systems around the lake shores that allow excessive nutrients such as Phosphorous into the lake and those nutrients settle into the bottom sediment and encourage weed and algae growth. Although, neither Phosphorous or Nitrogen were at problematic levels in our water samples as a soluble form in the water column, bottom sediment will have some amount of these nutrients tied up, and we have tested for that, but are still awaiting the results at the time of this report.

Grass Carp: (White Amur) When lake managers are discussing aquatic weed and algae control, the subject of grass carp comes up on a regular basis. These carp are not something that I recommend for your lakes. Although sterile fish are available to purchase, years of working with these fish has proven that their sterility is not guaranteed, and they can become an invasive species in many lakes. Like all creatures they do have preferred foods and will choose their favorite plants first and not eat other plants until they have completely depleted their preferred food source. Here in the Village lakes, we do not have any of their most favorite plants. The Chara and some of the Filamentous algae are about the only things they will consume in these lakes, and they do not consistently control either. Although the young Carp do eat a great deal and grow fast, once they reach 5-7 years of age, their eating habits are greatly reduced, and they become less and less effective overall. They are expensive to stock and eventually can become a nuisance. We do not recommend them in your lakes at this time.

The subject of a Bow Fishing Tournament has been brought up and this is an acceptable way of eliminating the large carp from the lakes. Having an organized event such as this is a good management tool for removal of these fish. However, these tournaments are done at night with boats equipped with noisy generators and bright lights, along with people talking and sometimes yelling, so the residents along the lake may not enjoy them much. I would recommend that if this removal method is considered, along with strict monitoring, having some type of fee in place would be to your benefit. Then you can utilize any monies collected from the event to put back into the lake management budget.

FISHERIES MANAGEMENT: This topic is quite comprehensive and must be managed over many years to create and maintain productivity. Although the Arkansas Game and Fish Commission have assisted in some management over the years, such as electro shock surveys, they have not done any in the recent past. Generally, the only other service they would offer outside of setting state regulations would be to offer some stocking efforts according to their electro shock survey results and their basic guidelines for fish populations.

My recommendation would be to plan and budget to maintain the lakes within the complete control of the Cherokee Village S.I.D. This strategy, although a little more costly, gives you the control to customize your entire lake management program, including fisheries management for each individual lake. It also gives you the ability to control the schedule of events and not be at the mercy of a state agency. Their approach is not going to be based on each individual lake, and they only provide their services as their schedule and budget permits.

My initial suggestion would be to consider approaching each lake individually. For example, we might choose to manage some lakes for a large population of game fish (Bass for example) and maybe one or two more lakes for trophy quality fish, using length limits and/or slot limits to allow fish to reach their full potential. Then we might choose another lake to focus more on managing pan fish like Crappie or Hybrid Brim. Of course, Catfish and Bluegill can fit into every lakes management goal. This customized strategy allows the most diverse situation and caters to a higher number of anglers within the community.

Each lake would require a slightly different approach in management and regulations. This type of strategy would also help control cost, as we can focus on priorities on a lake to lake and per acre basis. Pretty much everything we do will come down to a cost per acre situation for budgeting purposes.

The following subcategories will describe the basic components of fisheries management for your lakes.

A: **Electro Shocking Survey**: This survey is one of the primary population monitoring tools available to fisheries managers. When done properly and on an ongoing basis, it can provide a good indication of numbers, size and age classes of fish in individual lakes. Although the survey results can vary due to water temperature, barometric pressure, water clarity, habitat, bottom structure, and weather conditions. (calm conditions are best), multiple years of testing can provide valuable information and help direct the resources in the most cost-effective way. Water temperature is very important, and it can be the deciding factor in good sampling. The survey should be done at night when the surface water temperatures are between 60 and 75 degrees Fahrenheit. Typically, March-May or September- November is best. This type of survey does not injure any fish and all the fish are released back into the lake after the data is collected. The data collected over time will provide insight into the weights, sex, age classes, growth rates and production rates as well as help us evaluate the overall health of the lakes. This will provide the information necessary to make good decisions on stocking game fish and forage fish as well as making nutrient applications and habitat installation decisions.

The cost of these surveys will range between $650.00 and $1250.00 per lake depending on time spent and the size of the areas sampled. Specialized Outdoor Services can provide this service if needed.

B**: Nutrient Applications:** Applying nutrients to lakes can be a very important and productive tool in fisheries management when done correctly in the right situations. Adversely, it can have considerable negative effects when improperly applied. The food chain in the lakes starts primarily with Phytoplankton. Dissolved nutrients in the water promote blooms of microscopic Planktonic algae, which then provide food for zooplankton and other invertebrates. These organisms are eaten by young game fish and forage fish. Fertilization can manipulate and increase the naturally occurring dissolved nutrients in the lakes. These nutrients promote these desirable algae blooms resulting in increased biological productivity at every level in the lakes ecosystems. Fertilized lakes are capable of significantly increased productivity compared to infertile lakes in almost all cases.

Fertilized lakes are capable of producing 3-4 times more fish biomass compared to unfertilized lakes. As productivity increases, forage fish species thrive on the abundance of food, resulting in better growth rates for game fish.

However, there is a very specific set of criteria that needs to be carefully adhered to before any lake fertilization occurs. Each lake needs specific data collected and then a custom fertilizer program established for each lake. Selecting the proper ratio of nutrients and the best formulation is critical, as well as is applying the correct amount for the target area. Using the most effective application method and timing is also important to success. Once a custom program is designed for each individual lake, we can estimate a cost per lake.

We recommend using professionals to make these applications and we can provide this service on your lakes, if needed.

C: **Habitat Management and Installation:** Habitat is a major component in fisheries management and can be divided into two main categories for these lakes. Structure and Cover. Structure can be defined as underwater points, ledges, drop offs and other irregular lake bottom features. Cover is defined as docks, weed lines, submerged wood or rocks and any man made features. While these lakes do have an adequate amount of structure, they have a very limited amount of cover. Over the years the majority of the woody cover that was originally in the lakes, or installed throughout the years, is either completely decomposed or mostly decomposed and is of no real value to these fisheries. As a general rule, for a fishery to be productive, it needs quality cover in 15% of its total area. (Examples: Lake Cherokee is 37 acres so recommended cover area is 5.5 acres. Lake Thunderbird is 264 acres so recommended cover area is 39.6 acres). Meeting these guidelines can be an extensive undertaking and can be costly in most cases.

Installing as much cover as is possible into strategic areas and at some specific depth ranges can make a huge positive impact on fish production, recruitment and survival rates.

I recommend using artificial cover as opposed to natural cover for the majority of any cover installations you do in these lakes. However, if adequate wood cover is available for no cost, it can be used in conjunction with the artificial habitat. Submerging large amounts of natural cover into the lakes will contribute to the organic debris added to the lake bottom as they decompose over the years. And as they decompose, they are no longer good cover for the fish and forage.

The artificial habitat provides permanent cover once installed and does not have to be replenished over the years. It will not decompose and consume oxygen from the water like wood or deposit unwanted organic debris on the lake bottom. It will allow a Biofilm to form on its surfaces that will provide food for microorganisms, thus promoting the food chain and attracting more game fish and forage species. Artificial habitat is easier to install, more forgiving to angler's hooks getting hung up, thus reducing fishing line waste in the lakes and it is a one-time expense for purchase and installation.

We can provide you with an excellent artificial habitat product made here in Arkansas and install it strategically and selectively into the lakes if this highly productive management practice is adopted.

D: **Forage Introduction:** This is one of the three most important components of a productive fisheries management program. Along with habitat and the proper nutrient balance in the lake this is an important part of a healthy and productive fishery.

In the case of all of the lakes in the Village, the forage base is low. Although I am not able to base that conclusion on an actual electro fishing survey at this time, I have used sonar, basic observation and discussions with other local anglers and I am sure that the lack of forage biomass is one of the biggest limiting factors we have here with annual fry recruitment, growth rates and overall fish health.
(I have lived here and observed these lakes for 25 years)

There are multiple forage species used and recommended in this area of the country. However, I would only recommend 2 of these species. The Threadfin Shad and the Bluegill are the primary forage species I would recommend for stocking in your lakes. These species will be the most cost effective, sustainable, and productive forage you can use in these lakes.

The Threadfin shad is found in all of our Highland Reservoir lakes and provide a tremendous food source for game fish. These shad can spawn multiple times in a season, producing a large population for game fish to prey on. They rarely grow larger than 6 inches and are not excessively fast swimmers, making them fairly easy prey for most all game fish. Threadfin are sensitive to cold water and can experience some die off in water temperatures below 43 degrees Fahrenheit. They can also be difficult to purchase and typically have to be booked in the fall and stocked in the spring. They are sold in volume loads of 8,000 – 10,000 per load delivered and are recommended at 1 load per 10 acres of surface area. That rate can be adjusted up or down depending on conditions or budget.

The Bluegill is another commonly known species that thrive well in our area and are prolific producers. They are capable of spawning 4-5 times in a season and producing many pounds of food for predators such as Bass and Crappie. They typically do not need to be restocked often and sometimes can produce good forage indefinitely in a healthy eco system. The Bluegill is readily available from fish producers and can be stocked in spring or fall. Recommended stocking rates are 500-1000 per acre, but can be customized per lake as needed.

I would recommend you stock the Cherokee Village lakes with both of these species if possible.

Specialized Outdoor Services can calculate the quantity and cost for these species and get them stocked into the lakes for you, if this becomes a part of the management program.

E: **Game Fish Stocking:** Stocking game fish such as Largemouth Bass or Crappie is a good strategy for improving a fishery and is certainly something that would be helpful to the Village lakes. Typically, the decision to stock fish is based on electro fishing surveys. However, in our case, I would have no problem recommending stocking at the lower rates in these lakes, prior to having any electro fishing survey results. (Example 50, 4" Bass fingerlings/Surface Acre) This will give the current population a boost and improve future recruitment percentages.

In the current situation on these lakes, I would advise using any budget available to stock forage, install habitat and apply the proper nutrients to the lakes prior to spending too much time and money stocking game fish. Without a substantial food base, proper habitat for spawning and fry protection along with deep water survival cover, stocking efforts are generally very short lived, with limited success.

We can provide quotes from multiple fish producers for stocking Largemouth Bass, Crappie, Catfish and others if you decide to stock the lakes in the future. These prices can vary seasonally by availability.

F: **Regulations**: All state regulations are set by the Arkansas Game and Fish Commission. The Cherokee Village S.I.D. can set additional management regulations that are more strict if necessary for you to meet certain management goals or regulate certain vessels to certain lakes. (Examples: Kayaks only or Catch and Release, Lower limits or Slot limits on particular species in certain lakes)

This is just something to consider for future management of these lakes.

Suggested Lake Management Plan:

Dams: Inspect dams every 3-4 months. Implement a long-term vegetation management program. Repair any current leaks and/or other issues as soon as possible.

Launch Ramps: Repair and renovate as needed during potential draw down periods.

Sediment: Monitor sediment depth every 1-2 years and map accordingly. Implement a long-term lake draw down schedule and dredging operation plan.

Erosion Control: Create and/or enforce a mandatory erosion control policy around the lake shoreline during any construction projects or other projects subject to soil disruption.

Water Quality: Take samples on at least 2 lakes per year and test for PH, Alkalinity, Hardness, Carbonates, Bicarbonates, Soluble Nutrients and Cyanobacteria during the summer months when water temperatures are above 75 degrees Fahrenheit.

Aquatic Vegetation and Algae Control: Continue on an annual selective herbicide and algaecide application program using a qualified, licensed professional.

Consider having Bow fishing tournaments on an as needed basis to control invasive Rough fish such as Grass Carp.

Fisheries Management:

Schedule an Electro Fishing Survey when possible to begin to understand the current population of the species within the lakes. Build a data base of the fish, including health, sex, age classes, growth rates, etc. of the population and continue to monitor over the years.

Implement a lake fertilization program based on each lakes needs and goals.

Install fish habitat in strategic locations and depth intervals to increase and improve production and mortality as well as fishing opportunities.

Stock forage species such as Threadfin Shad and Bluegill to provide food for game fish.

Stock game fish like Largemouth Bass and Crappie to boost the current population and increase recruitment in the future as well as improve catch rates for anglers.

Consider any regulations needed to help obtain the management goals.

Since everything we would implement will be on a cost per acre basis and could add up to a great deal of money, it may not be feasible to consider a blanket program across all the lakes at once.

One suggestion would be to select 1 to 3 lakes and begin an aggressive fisheries management program. A good start might be Sequoyah at 75 acres in size. This is a big enough lake to make a real impact. And any progress made would allow the fish population to potentionally migrate into Lake Thunderbird, thus getting a little more value for the effort.

Another option may be Lake Chanute at 55 acres in size or even choosing a couple of the smaller lakes like Aztec at 21 acres and Navaho at 37 acres and budget for an aggressive program.

My Recommendation to improve fishing opportunities would be to fertilize the lakes as needed on an individual basis.

Install an effective amount of artificial habitat along with any easily available, but limited natural habitat.

Stock forage fish at a high-end rate and stock the desired game fish at a low end rate.

Then continue implementing the fertilization program, water testing and periodic electro shock monitoring over several years to evaluate the success prior to implementing the program on a wider scale.

Fishing Piers might be considered in the future to promote access for children or handicapped anglers.

Please understand that all of the information and recommendations within this report be considered a starting point in the long process of managing your lakes. It is designed to get the management program started and heading in the right direction as soon as possible. It is not a complete guide. This will need to be a long-term commitment with adequate resources, such as an annual operating budget. You will also need the proper equipment, knowledge and a staff or contractor to implement the plan.

Specialized Outdoor Services can help with most of the services you may need, including consulting.

Jeff Klein, Specialized Outdoor Services