A Five-Year Operational Habitat Enhancement Plan for

Lake Gaston, North Carolina and Virginia

2022 - 2026

A Proposed Partnership with:

Lake Gaston Weed Control Council

Lake Gaston Association

North Carolina State University Aquatic Plant Management Program

North Carolina Wildlife Resources Commission

Virginia Department of Wildlife Resources

North Carolina B.A.S.S Conservation

Virginia B.A.S.S Conservation

Dominion Energy

Objective: The purpose of this five-year plan is to improve physical habitat for sport fishes by diversifying and establishing self-sustaining native aquatic macrophyte communities while helping to prevent the spread of nuisance aquatic plants.

Need: Hydrilla *Hydrilla verticillata*, an invasive aquatic plant, and Lyngbya *Lyngbya* wollei, a cyanobacteria, are established throughout Lake Gaston and are currently being managed using herbicides and triploid Grass Carp *Ctenopharyngodon idella*. Native aquatic vegetation communities can compete with Hydrilla and Lyngbya and provide habitat for fish and other wildlife.

Expected Results and Benefits: We hope to improve physical habitat for fish and wildlife and suppress Hydrilla and Lyngbya growth in areas traditionally unmanaged with herbicides, and encourage reestablishment in areas where they have been eradicated.

Approach: It is requested that the Lake Gaston Weed Control Council (LGWCC) continue to partner with the Lake Gaston Association (LGA), North Carolina State University – Aquatic Plant Management Program (NCSU), the North Carolina Wildlife Resources Commission (Commission), the Virginia Department of Wildlife Resources (VDWR), North Carolina B.A.S.S Conservation, Virginia B.A.S.S Conservation, and Dominion Energy to implement the long-term Habitat Enhancement plan for Lake Gaston. Implementation will rely heavily on volunteers to build exclosures and to harvest and plant aquatic vegetation.

Location: Lake Gaston, North Carolina and Virginia

Estimated Total Project Cost: $158,920

Background

Lake Gaston covers over 20,000 acres and is located in Halifax, Northampton, and Warren counties in North Carolina and Brunswick and Mecklenburg counties in Virginia (Figure 1). It is approximately 35 miles long with over 350 miles of shoreline. The reservoir was created by impounding the Roanoke River to generate hydroelectric power in 1963. Water level is stable for piedmont reservoirs and may vary only plus or minus one foot from the normal level, except in case of emergency. The reservoir is utilized for hydropower production, flood control, water supply, and recreation including fishing, boating, and hunting. Much of the shoreline is developed as residential.

Hydrilla was first identified in Lake Gaston in 1988. At its peak in 2005, Hydrilla was estimated to cover over 3,800 acres. Since the late 1990's, an adaptive and integrated pest management strategy has been used in Lake Gaston to control invasive aquatic vegetation species. The strategy includes both herbicides and stocking triploid Grass Carp. A legacy infestation of Hydrilla over the past few decades has been managed with annual herbicide treatments and the long-term stocking of triploid Grass Carp. These methods provide a means to control Hydrilla and suppress its expansion, especially in newly infested waterbodies. Due to the prolific nature of Hydrilla and the regeneration of the plant from subterranean turions, it is necessary to manage a legacy infestation over multiple, continuous years in order to reduce Hydrilla biomass over the long-term. All portions of Lake Gaston's littoral zone have been subject to Hydrilla establishment. Hydrilla is now estimated to cover approximately 154 acres (Jessica Baumann, personal communication). These integrated control methods reduced both nuisance and native submerged aquatic vegetation throughout the reservoir.

More recently, Lyngbya has spread throughout the reservoir competing with native and nuisance vegetation. The LGWCC and NCSU are studying the most effective herbicide treatment strategies to control Lyngbya. Managing Lyngbya will likely impact existing native submerged aquatic vegetation populations. Native aquatic plant restoration is a beneficial addition to currently existing integrated management procedures.

Native aquatic plants play a major role as a food source for aquatic invertebrates and other wildlife as well as juvenile and adult fish habitat (Dibble et al. 1996). The specific benefits can be dependent on the species and abundance of both the fish and the vegetation. Aquatic plants can reduce rates of shoreline erosion and sediment resuspension (James and Barko 1995) and improve water clarity and quality (James and Barko 1990). They can also help prevent the establishment and spread of nuisance aquatic plants by providing competition for habitat and nutrients (Smart et al.1998).

In 2006, The U.S. Army Corps of Engineers started a re-vegetation demonstration project in Lake Gaston (Figure 2; Dibble, et al. DRAFT). The demonstrations have shown the viability of vegetation founder colonies using a large number of small fenced exclosures. Once established, these colonies expanded by either vegetative growth outside of a planted colony or through formation of new colonies from fragments, seeds, etc.; Smart et al. 1996, 1998). The USACE demonstration project identified several submersed and floating leaf plants that had high survival rates in areas of the lake not traditionally designated for herbicide treatment, specifically those areas not to be treated using systemic Fluridone. American pondweed *Potamogeton nodosus*, Illinois pondweed *Potamogeton illinoensis*, American lotus *Nelumbo lutea*, white waterlily *Nymphaea odorata*, watershield *Brasenia schreberi*, spatterdock *Nuphar advena*, eelgrass *Vallisneria americana*, and coontail *Ceratophyllum demersum* have all shown near 100% survival in some field demonstration exclosures. Spread outside of existing exclosures was variable but may be attributed to a lack of maintenance and consistent monitoring. Some species spread outside of exclosures to nearly 30 times original colony size. *In 2008,* emergent species such as arrowhead *Sagittaria sp*., lizard's tail *Saurus Cernuus*, pickerelweed *Pontederia cordata*, soft rush *Juncus effusus*, softstem bulrush *Schoenoplectus tabernaemontani [Scirpus validus*], squarestem spikerush *Eleocharis quadrangulata* and water willow *Justicia americana were added to the project and survival for these plants was also high*. Furthermore, establishing native vegetation has been shown to suppress Hydrilla within demonstration sites, especially when floating leaf species are present.

In 2014, the Commission, NCSU, and LGWCC partnered to transition the demonstration plantings into an operational re-vegetation program for Lake Gaston. At the time, eradication of Hydrilla in Lake Gaston was considered unlikely and there was a need for a management approach that aimed to suppress excessive Hydrilla growth, especially in areas not designated for priority herbicide control. The goal was to implement a five-year re-vegetation plan as part of the existing aquatic plant management plan. This included, but was not limited to, assessing the USACE demonstration sites, developing a native vegetation species list, identifying new vegetation sites, and expanding and maintaining existing sites during the five years of the plan. Other groups, like the LGA and VDWR were not part of the original agreement but played an important role in implementation. The Lake Gaston Association was instrumental in recruiting volunteers to help with the project and building support for re-vegetation work. The VDWR provided staff, boats and technical guidance.

Initially, the Commission and NCSU identified nine USACE demonstration sites for establishing native vegetation (Figure 1). Of those, the vegetation planted in Lizard Creek, Songbird Creek, Lyons Creek and Hubquarter Creek sites had expanded well outside the exclosures and did not need additional vegetation planting. It was determined at that time that the re-vegetation sites at Beechwood Flats, Flats, Poplar Creek and Big Stonehouse Creek could be expanded. As part of the re-vegetation project, native aquatic vegetation has been established at 14 sites throughout the reservoir (Figure 2 and Table 1). Each site has up to 12 planted areas, with a total of 68 areas either within fenced exclosures or areas without a fenced exclosure (Figures 3 – 16).

Approach

Habitat Enhancement

Native Aquatic Vegetation.—The approach outlined below is a continuation of the existing re-vegetation project and will now incorporate the establishment of fish attractors. It was initially developed as part of the 2014 Lake Gaston re-vegetation plan and has been modified based on experience.

Vegetation and fenced exclosures at the existing re-vegetation sites should be maintained and expanded. New re-vegetation sites should be selected based on location within the reservoir (coves, creek arms, and other protected areas), soils, water depth, Dominion Energy designated natural areas, existing USACE demonstration sites needing improvements, potential for fish habitat use, and water quality improvement. Areas where Hydrilla has not been managed should be prioritized. Native plants can provide competition for habitat with Hydrilla and other aquatic nuisance species. Vegetation should not be established in areas that may adversely impact landowners. Re-vegetation sites haven't been established in the lower part of the reservoir below Little Stonehouse because it is more highly developed and there is a lack of available sites.

A list of resilient native aquatic species (Table 2) has been developed based on the USACE demonstration project, past success, consultation with other state agencies, and a literature review. Re-vegetation work should focus on establishing submerged and rooted floating leaf plants, with an emphasis on plants currently found in the reservoir. Emergent plants, excluding water willow, should be used in areas lacking emergent vegetation that could be used to compete with Lyngbya. The plant species list may be modified and expanded based on public input, detailed survey results, and monitoring results. Homeowners in Great Creek requested that rapidly spreading species, like American lotus and watershield, not be planted in their cove. Species that are moderate to highly susceptible to herbivory should be planted in exclosures. Species that are not very susceptible to herbivory, like spatterdock and white-water lily can be planted outside of exclosures. These may act as a barrier to herbivores and provide some level of protection to the more susceptible species.

Partners should continue to identify clean sources of plant material within Lake Gaston that are not contaminated with aquatic nuisance species. All plant material, especially roots, should be washed thoroughly to minimize the movement of unwanted species found in the sediment. Obtaining plants from nurseries that specialize in native aquatic plants is an option. However, we found that the root stock is small and have had little success getting species like white water lily and spatterdock established in Lake Gaston.

As this project developed, we determined that smaller exclosures (25ft x 25ft, 15ft x 30ft, 5ft circular) should be used to establish native vegetation. Growth and expansion of vegetation outside of exclosures can be inhibited by herbivores. Therefore, exclosures should be placed in close proximity so they can easily be connected or surrounded with a larger exclosure if deemed beneficial in the future. This would provide a larger protected area for the vegetation to expand and has been successful at older vegetation sites. Large, independent exclosures are susceptible to being breached. If an independent large exclosure is deemed necessary, it should either be subdivided into different sections or smaller exclosures should be built within it. All exclosures, even circular ones, must have an outward facing 8in lip at the bottom to inhibit turtles and other herbivores from tunneling under the fence. It may be necessary to install fencing on top of smaller exclosures to keep turtles from climbing up and over the fence. Fencing height for exclosures may need to be increased from 5 to 6ft because of increased water elevation during flood events.

Several sites were also planted without fenced exclosures (Table 1) with limited success. It may be necessary to build a few small 5ft circular or 10ft x 10ft exclosures planted with species that are moderate to highly susceptible to herbivories to create some protected founder colonies. Low susceptible species should be planted along the outside boundary. Once established these plants may act as a natural barrier to herbivores.

To reduce navigation issues, exclosures should only be placed in near-shore areas unlikely to be utilized by boat traffic and highly visible yellow fence guards should be placed on top of the exclosures. Corners may need to be identified with tall PVC pipe with reflective tape at the top. Sites should be marked with signs letting anglers know the fencing and plants are to restore and improve aquatic habitat.

North Carolina State University developed a vegetated fish attractor design (Figure 17) to maximize the benefits of both aquatic vegetation and artificial fish attractors for improving fish habitat within Lake Gaston, while maintaining a low visual profile for waterfront homeowners. Combining these two habitat improvement methods creates complex fish habitat by integrating large, coarse, and immediate structure with the future benefits of established native vegetation. Each vegetated fish attractor design site consists of one Georgia cube fish attractor and five submersed vegetation cubes planted with eelgrass (Figure 17). The Georgia cube uses a combination of PVC pipes and corrugated drainage pipes to create large, solid, vertical surfaces that have been proven to concentrate fish. The design capitalizes on that internal open space by incorporating vegetation cages inside and directly adjacent to the artificial fish attractor.

Three vegetated fish attractor design sites were established in Lake Gaston in 2021, one by the Lees Creek boat ramp and two in Jimmie's Creek. We are proposing to establish two additional sites each year of this plan. All design sites will be approved by the Commission and permitted by Dominion Energy and will not be placed in high boat traffic areas. Additionally, each site will be marked by fish attractor buoy to reduce the level of navigational hazard.

Initially, re-vegetation sites were established to provide competition with Hydrilla in areas with little to no active management. With the reduction in Hydrilla, exclosures are providing refugia for Hydrilla. The USACE demonstration project showed Hydrilla could be controlled with low dose (selective) or shorter half-life contact herbicides while minimizing impacts to native vegetation (Lynde L. Dodd, personal communication). Several of the re-vegetation sites have been treated with herbicides with mostly positive results. However, in some cases, more sensitive species, like

pondweeds and coontail were reduced or lost entirely. The Lake Gaston Technical Advisory Committee should provide recommendations on if and how best to control Hydrilla in exclosures. Several options should be considered. One option is to open exclosures temporarily for several years to allow herbivores to reduce both the standing Hydrilla and the tuber bank. It is important that herbivores are removed before closing the exclosure and replanting. Another option is to use a low dose treatment of Fluridone, which has been effective at controlling Hydrilla in the cages. Care must be taken not to over treat a site with herbicides.

The goal to create long-term sustainable aquatic plant communities is difficult to achieve when Hydrilla and other nuisance species are being managed with herbicides and triploid Grass Carp. Fenced exclosures should be maintained as long as possible. Because of increased water levels, it may be necessary to increase the height of existing exclosures. The only reasons to remove a fenced exclosure is when it is damaged beyond repair, the LGWCC or Dominion Energy is receiving sufficient complaints from landowners, it is impeding reservoir use by landowners, or when vegetation has successfully established outside protected areas in sufficient quantities that could be considered a sustainable plant community. The metrics to define a diverse and sustainable plant community need to be further defined. To test if a site is sustainable, start by opening a few exclosures to see if the vegetation is significantly reduced or eliminated. If it is not, then continue opening several exclosures each year until all the cages can be removed.

Partnership.–The LGWCC will purchase materials needed to build and mark exclosures, purchase plant material if needed, and assist in finding volunteers to help with the effort. Dominion Energy will provide funds to purchase materials to build the vegetated fish attractor design. The Commission will provide staff time and equipment to help develop the annual workplan, assist with building exclosures, harvest and plant founder colonies, and assess the success of the project. The NCSU's Lake Gaston Coordinator position, funded by LGWCC, will help develop the annual workplan, coordinate NCSU volunteers, help build exclosures, harvest and plant founder colonies, and assess the success of the project. The LGA will help develop the annual workplan, coordinate local volunteers, help build exclosures, harvest and plant founder colonies, and assess the success of the project. The VDWR will provide staff time to help build exclosures, and harvest and plant founder colonies. The North Carolina B.A.S.S. Conservation and Virginia B.A.S.S. Conservation will help promote the project statewide and nationally and provide volunteers to help with re-vegetation efforts.

Monitoring.–The Commission and NCSU developed rapid annual monitoring methods for areas planted with aquatic vegetation after 2013 which does not include the existing USACE sites (Appendix A). Monitoring is performed at the end of growing season in September to early October to capture the vegetation's full growth potential. Site characteristics, including planted area, location within the reservoir, sun exposure and potential wave action are identified. Monitoring focuses on percent cover of vegetation within the planted area and includes expansion within and outside of the planted area, vegetation robustness, and herbivory on vegetation. This method identifies how vegetation is growing in planted areas; however, it does not quantify vegetation expansion outside the planted areas. If it is not possible to monitoring using the abovementioned methods, then an end of growing season survey should be completed to help develop the next year's workplan. The survey should identify areas needing repair, re-planting, or controlling aquatic nuisance species. Partners should consider using drones to take aerial photography once every five years to quantify expansion within planted coves. At a minimum, the 14 re-vegetation coves (Figure 2, Table 1) should be surveyed using drones. It may be beneficial to survey existing USACE sites that were successful, including Lizards Creek, Songbird Creek, and Lyons Creek using drone mapping also.

The vegetated fish attractor design will be monitored annually at the end of the growing season in September to early October to determine if eelgrass is successfully spreading outside the submersed cubes using GoPro technology.

Project Timeline

The proposed re-vegetation work is anticipated to occur over a period of five years. The LGA, NCSU and Commission will develop an annual workplan in the spring based on the previous fall monitoring and a spring assessment. End of growing season monitoring will occur on an annual basis and be summarized and presented to the Lake Gaston Technical Advisory Group and LGWCC.

Year 1 – 2022

- Assess current state of existing exclosures and develop annual workplan.
- Implement operational re-vegetation.
- Monitor year (x) expansions.
- Monitor re-vegetation sites using a drone.

Years 2,3,4 – 2023, 2024, and 2025

- Assess current state of existing exclosures and develop annual workplan.
- Implement operational re-vegetation.
- Monitor year (x) expansions.

Year 5 – 2026

- Assess current state of existing exclosures and develop annual workplan.
- Implement operational re-vegetation.
- Monitor year (x) expansions.
- Monitor re-vegetation sites using a drone.

Project Costs

The total project costs for all five years are estimated to be $155,026 with in-kind $44,195 from LGA, $35,465 from NCSU, $33,866 from NCWRC and $2,400 from VDWR (Table 3). The North Carolina B.A.S.S. Conservation and Virginia B.A.S.S. Conservation's estimated in-kind contribution is currently unknown and has not been included in the budget. The total requested amount to be funded by the **Lake Gaston Weed Control Council** is **$36,600** split over *FIVE* years and the total requested amount to be funded by **Dominion Energy** is **$2,500** as a one-time contribution.

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TABLE 1.—Existing re-vegetation sites with associated number of exclosures and planted areas and acreage planted.

Site	Number Exclosures	Planted Areas	Total Acres
Beechwood Flats	11		0.33
I-85	7		0.08
Upper Flats	4		0.05
Flats	6		0.42
Great Creek	4		0.29
Lower Poplar	7		0.34
Poplar Boat Ramp	1		0.05
Upper Poplar - West	4		0.41
Upper Poplar - East		2	0.17
Still House	6		0.03
Cove Below Stillhouse		1	0.10
Kings Branch		1	0.07
Big Stonehouse	12		0.42
Little Stonehouse	1	1	0.10
Total	63	5	2.86

TABLE 2.—Proposed aquatic plant species list.

Species Name	Common Name	Plant Type	Substrate	Planting Depth (in)	Max.Depth (ft)	Desiccation Tolerant	Susceptable to Herbivory	Individual Spacing (ft)
Pontederia cordata	Pickerelweed	Emergent		0 - 36	4	Moderate	Moderate	3 - 6
Brasenia schreberi	Watershield	Floating Rooted	Sand to muck	20 - 36	10	Moderate	Low	6 - 10
Nuphar advena [N. lutea]	Spatterdock	Floating Rooted	Sand to muck	20 - 36	6	Yes	Low	6 - 10
Nymphaea odorata	White Water Lily	Floating Rooted	Sand to muck	20 - 36	6	Yes	Low	6 - 10
Ceratophyllum demersum	Coontail	Submergent	Sand to muck	Fragments	10	No	High	3 - 6
Najas guadalupensis	Southern Naiad	Submergent	Sand to muck	12 - 48	10	No	High	3 - 6
Potamogeton nodosus	American Pondweed	Submergent	Sand to muck	12 - 48	10	Yes	High	3 - 6
Potamogeton illinoensis	Illinois Pondweed	Submergent	Sand to muck	12 - 48	10	No	High	3 - 6
Vallisneria americana	Eelgrass	Submergent	Sand to muck	12 - 48	10	no	High	3

Modified from Webb et. al. 2012

TABLE 3.—Estimated costs associated with the re-vegetation project in Lake Gaston, 2022–2026.

		Cost ($)					
Year	Activity and Materials	LGWCC	LGA[1]	NCSU	Commission	VDWR	Dominion Energy[2]
2022	Building Exclosures, Planting, Integrated design		7,500	5,973	4,340	480	
	Planting Assessment		720	1,120	1,550		
	Materials for Fence Exclosures and Integrated design	3,320					2,500
	Travel / Boats / Miscellaneous Supplies	500		1,296	1,600		
	Drone Vegetation Survey	10,000					
2023	Building Exclosures, Planting, Integrated design		7,725	5,973	4,340	480	
	Planting Assessment		742	1,120	1,054		
	Materials for Fence Exclosures and Integrated design	3,320					
	Travel / Boats / Miscellaneous Supplies	500		1,296	1,600		
2024	Building Exclosures, Planting, Integrated design		7,958	5,973	4,340	480	
	Planting Assessment		764	1,120	1,054		
	Materials for Fence Exclosures and Integrated design	3,320					
	Travel / Boats / Miscellaneous Supplies	500		1,296	1,600		
2025	Building Exclosures, Planting, Integrated design		8,443	5,973	4,340	480	
	Planting Assessment		810	1,120	1,054		
	Materials for Fence Exclosures and Integrated design	3,320					
	Travel / Boats / Miscellaneous Supplies	500		1,296	1,600		
2026	Building Exclosures, Planting, Integrated design		8,698	5,973	4,340	480	
	Planting Assessment		835	1,120	1,054		
	Materials for Fence Exclosures and Integrated design	3,320					
	Travel / Boats / Miscellaneous Supplies	500		1,296			
	Drone Vegetation Survey	10,000					
	Total Cost:	$36,600	$44,195	$35,465	$33,866	$2,400	$2,500
	TOTAL PROJECT COST:	$155,026					

[1]Numbers based on 2021 volunteer hours (274 hours) at $28.54 / hour plus inflation
[2]Dominion Energy proposes a one-time contribution

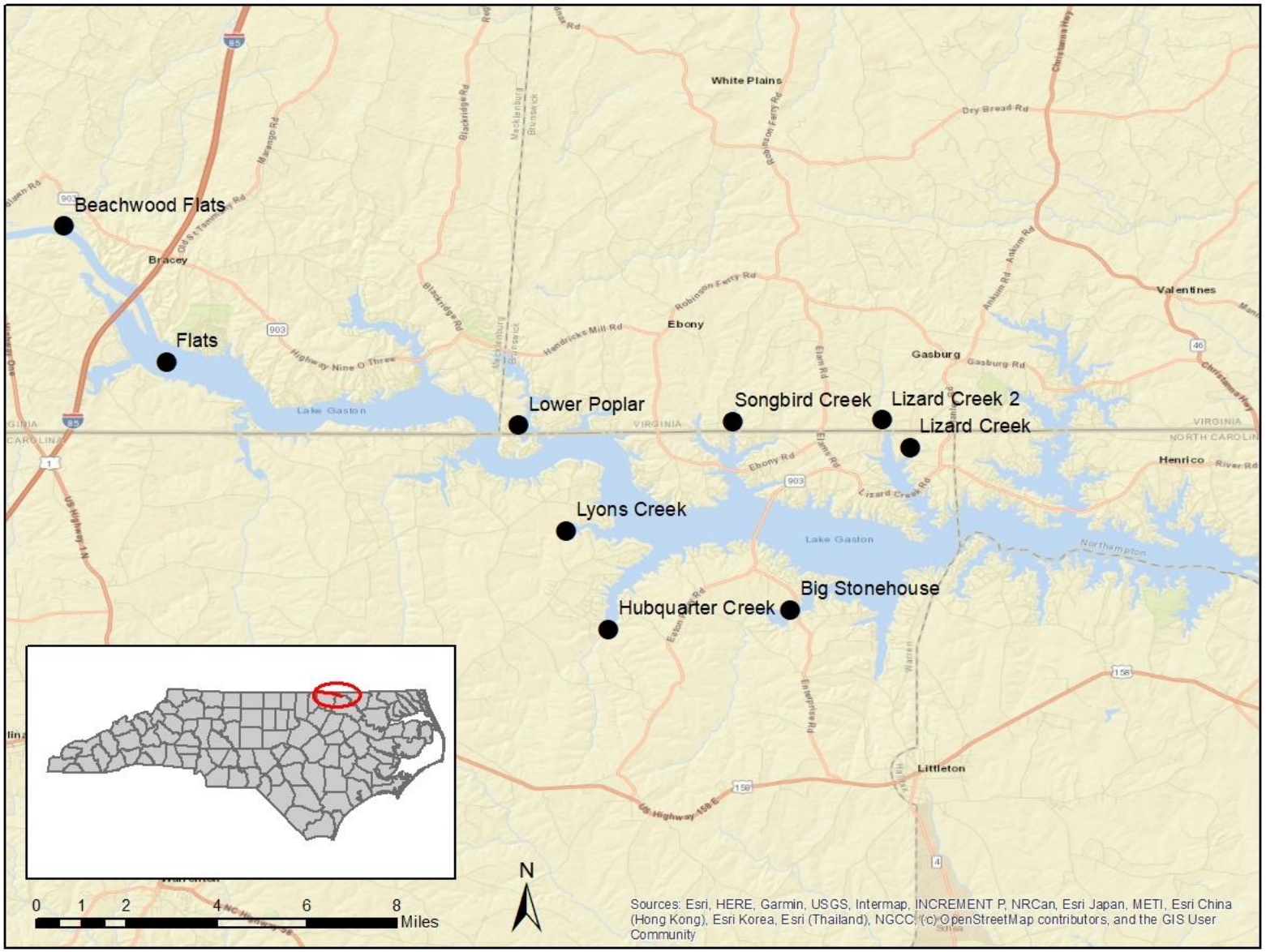

FIGURE 1.—Map showing Lake Gaston on the Virginia-North Carolina border.

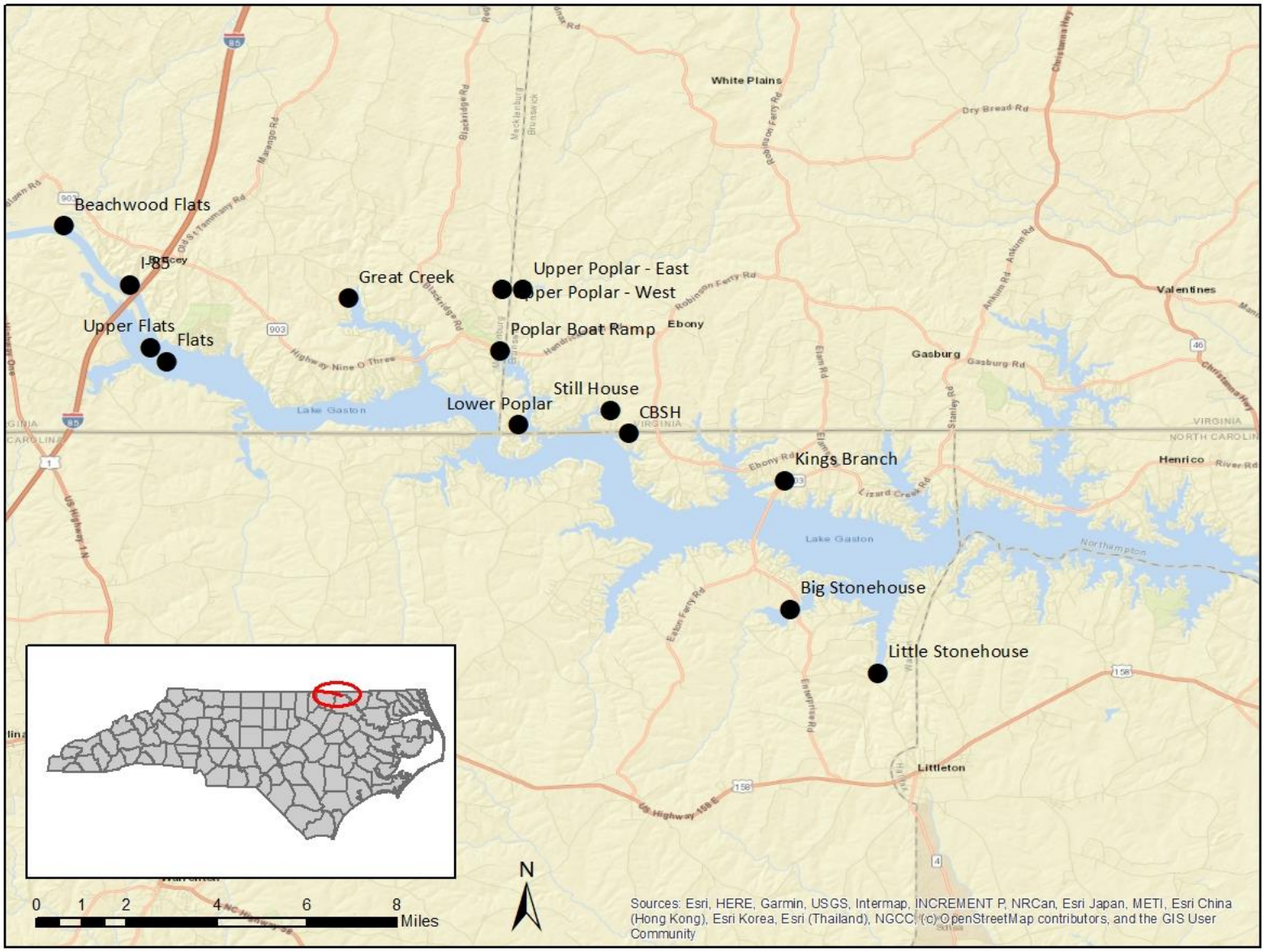

FIGURE 2.—Lake Gaston re-vegetation sites.

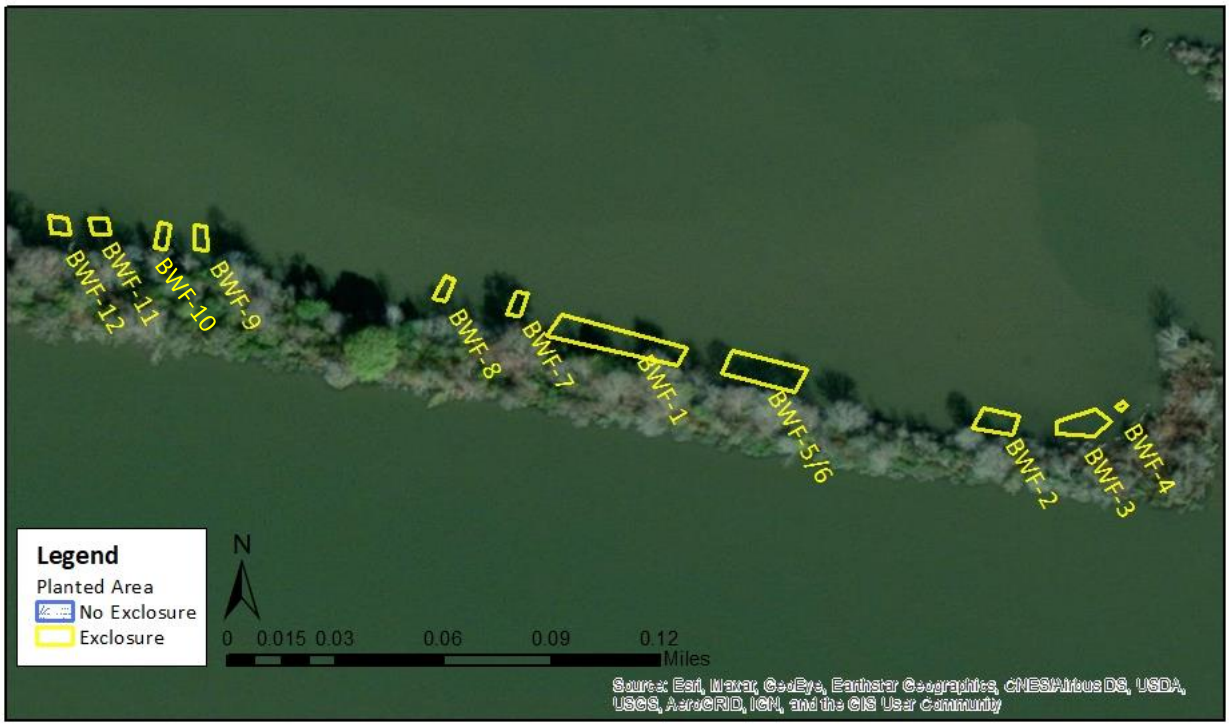

FIGURE 3.—Location of exclosures at Beachwood Flats, Lake Gaston (36.6100, -78.1852).

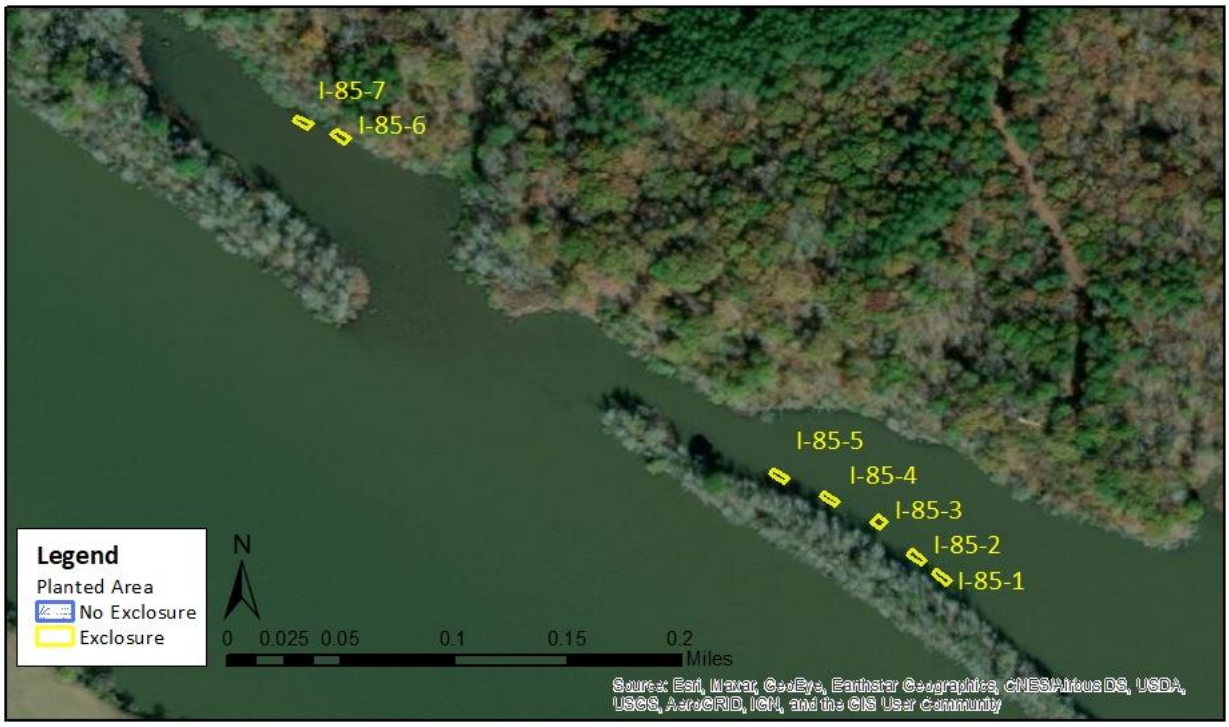

FIGURE 4.—Location of exclosures at I-85 site, Lake Gaston (36.5914, -78.1650).

FIGURE 5.—Location of exclosures at the Flats site, Lake Gaston (36.5667, -78.1489).

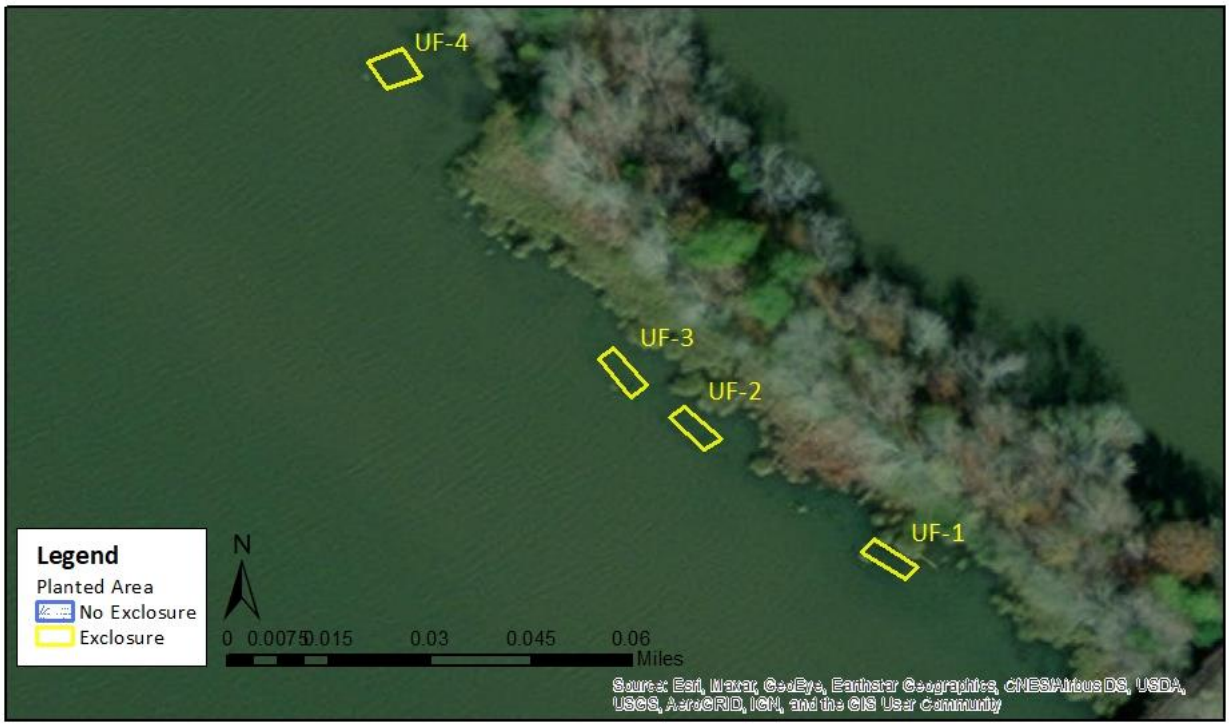

FIGURE 6.—Location of exclosures at the Upper Flats, Lake Gaston (36.5716, -78.1577).

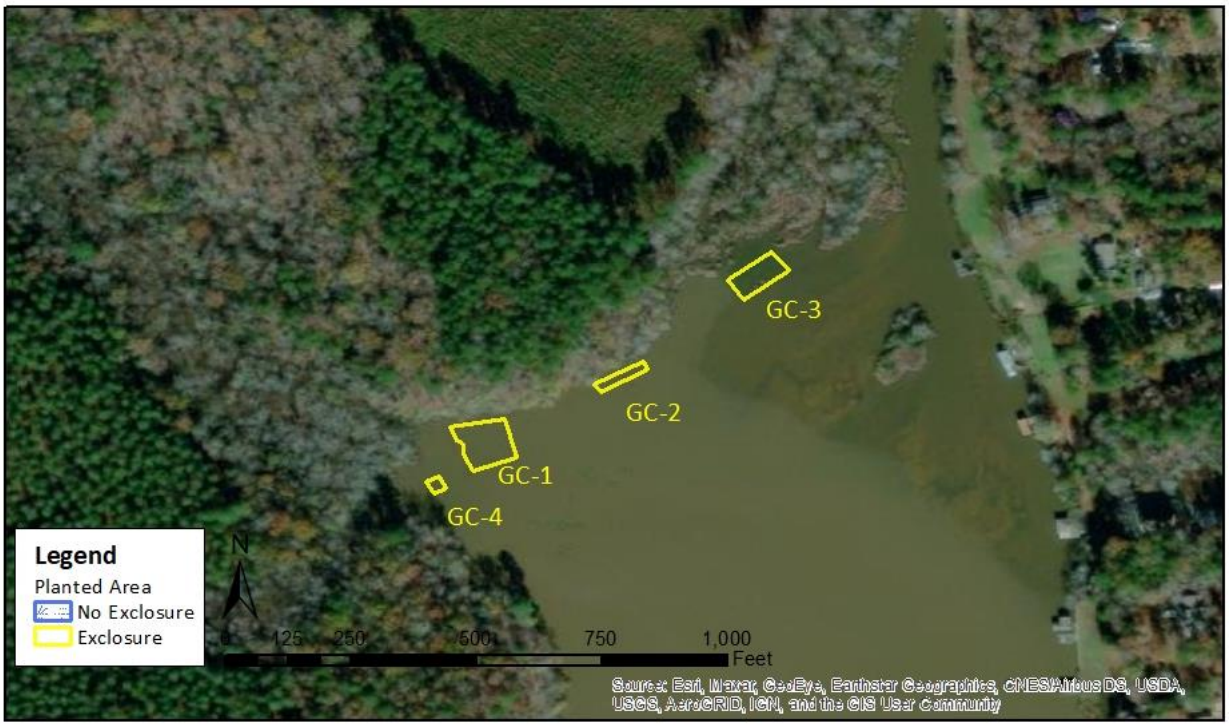

FIGURE 7.—Location of exclosures at the Great Creek, Lake Gaston (36.5876, -78.0931).

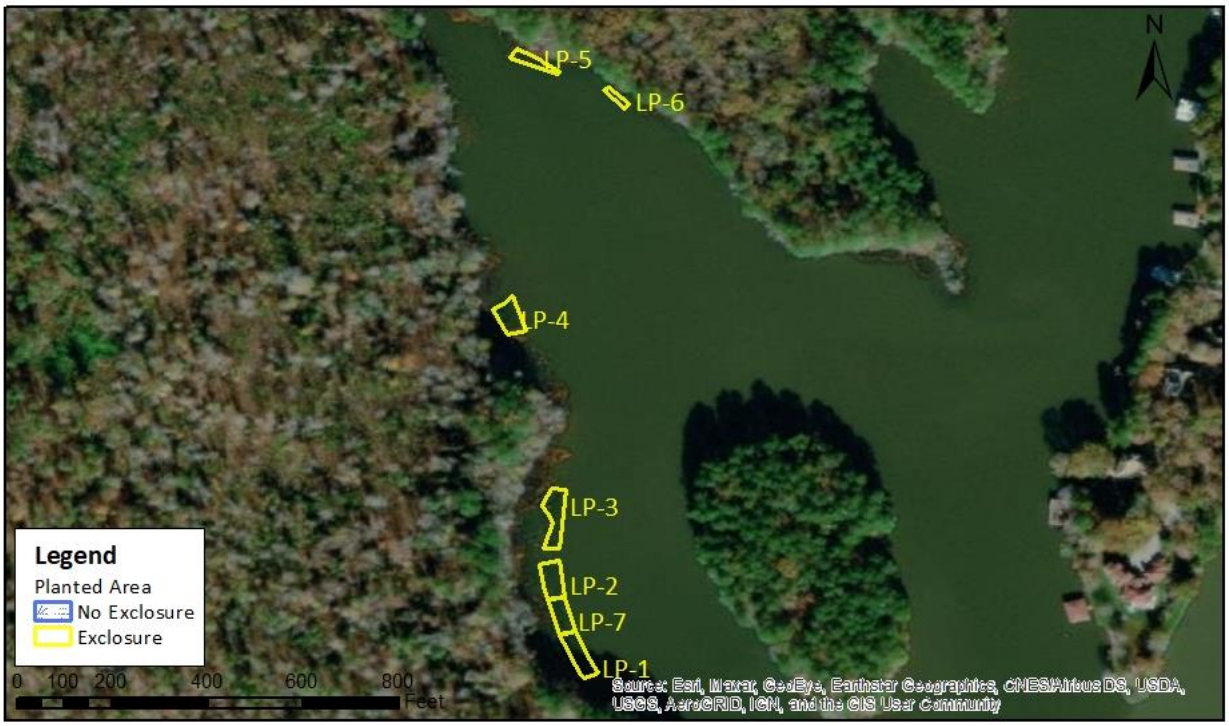

FIGURE 8.—Location of exclosures at the Lower Poplar site, Lake Gaston (36.5460, -78.0395).

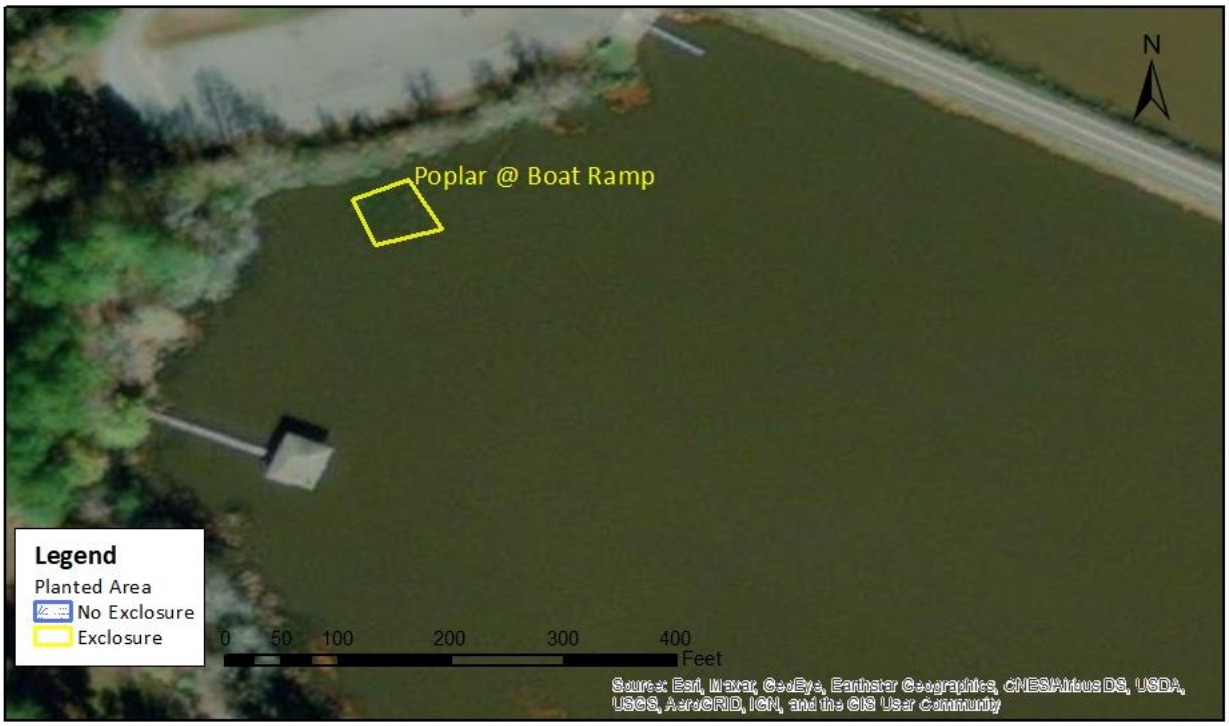

FIGURE 9.—Location of exclosures at the Poplar Boat Ramp site, Lake Gaston (36.5703, -78.0453).

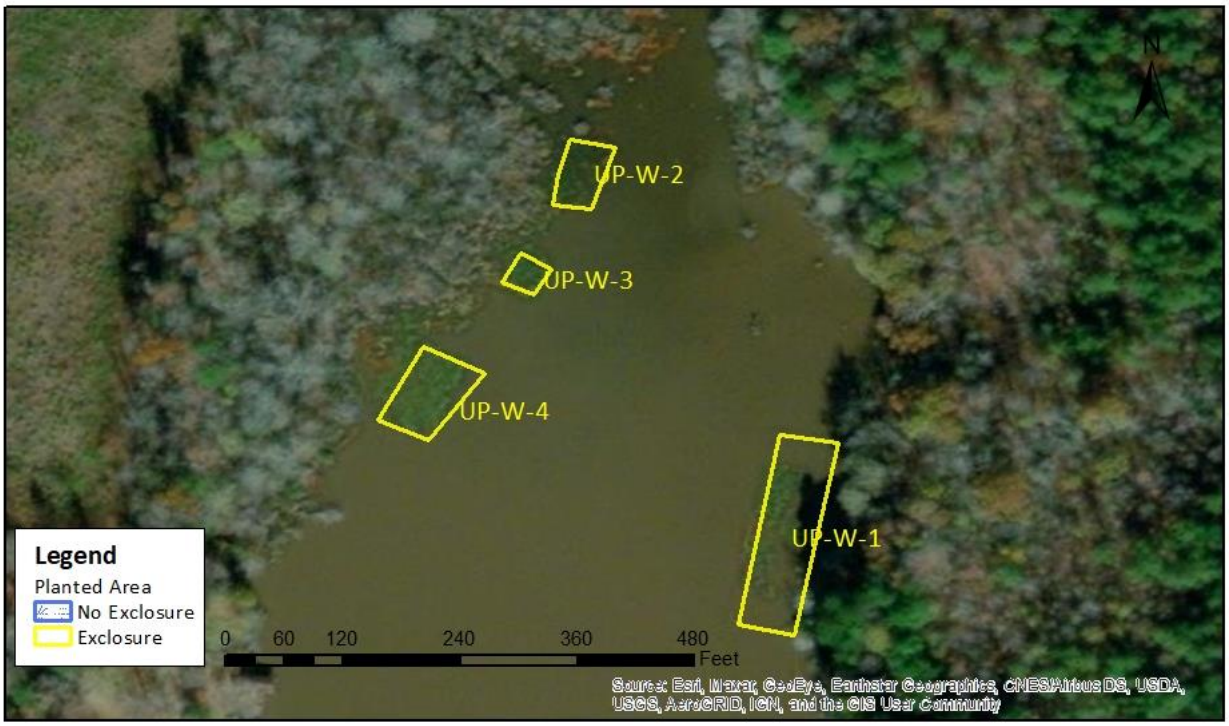

FIGURE 10.—Location of exclosures at the Upper Poplar - West, Lake Gaston (36.5901, -78.0450).

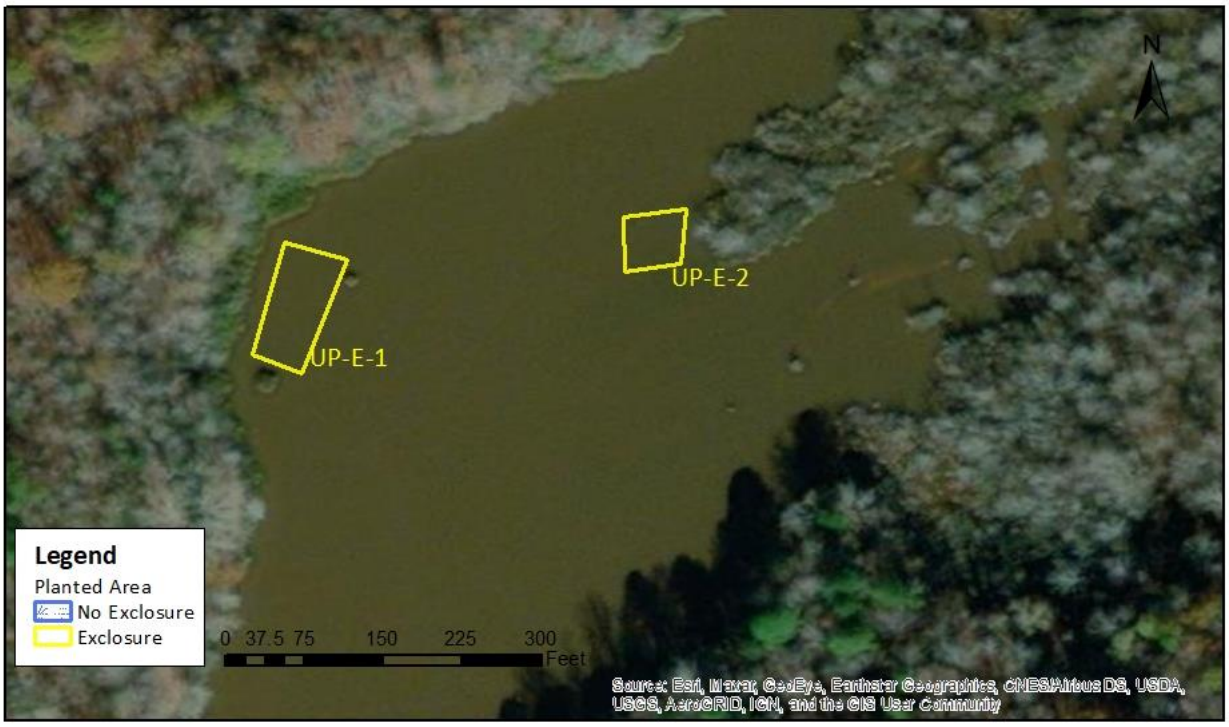

FIGURE 11.—Location of planted areas at the Upper Poplar - East, Lake Gaston (36.5896, -78.0381).

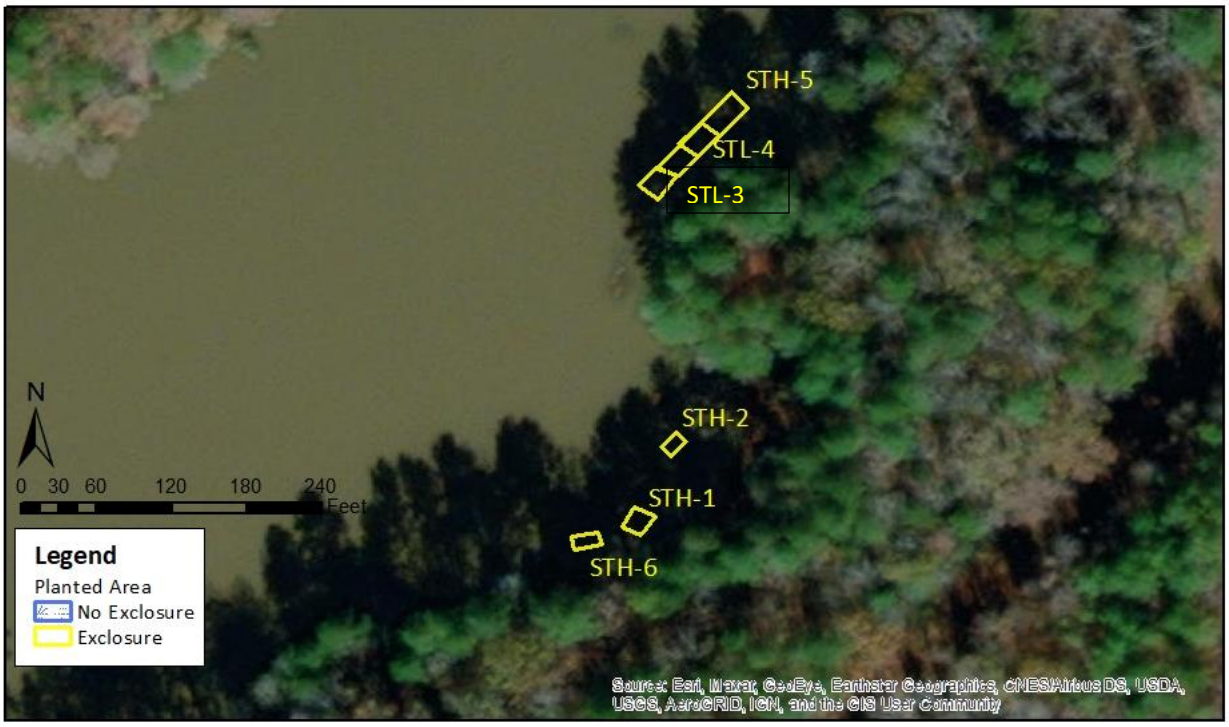

FIGURE 12.—Location of exclosures at the Stillhouse, Lake Gaston (36.5508, -78.0094).

FIGURE 13.—Location of planted area at the Cove Below Stillhouse, Lake Gaston (36.5438, -78.0039).

FIGURE 14.—Location of planted area at the Kings Branch, Lake Gaston (36.5283, -77.9546).

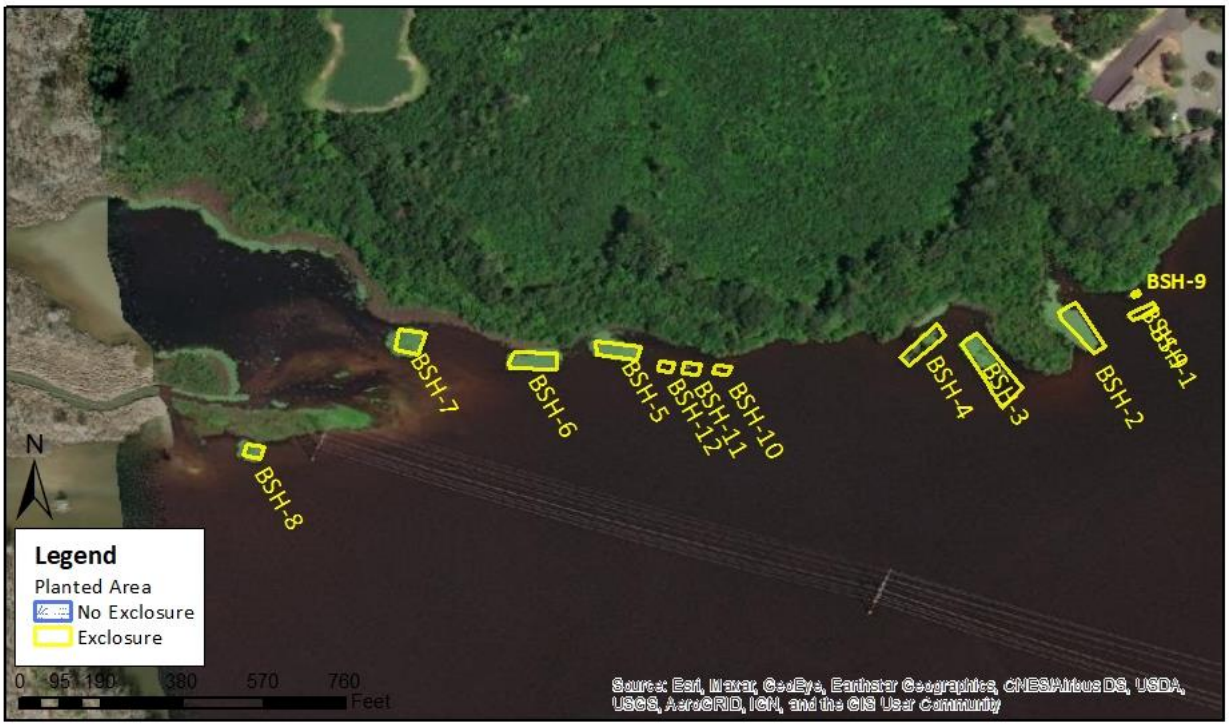

FIGURE 15.—Location of exclosures at the Big Stonehouse, Lake Gaston (36.4866, -77.9557).

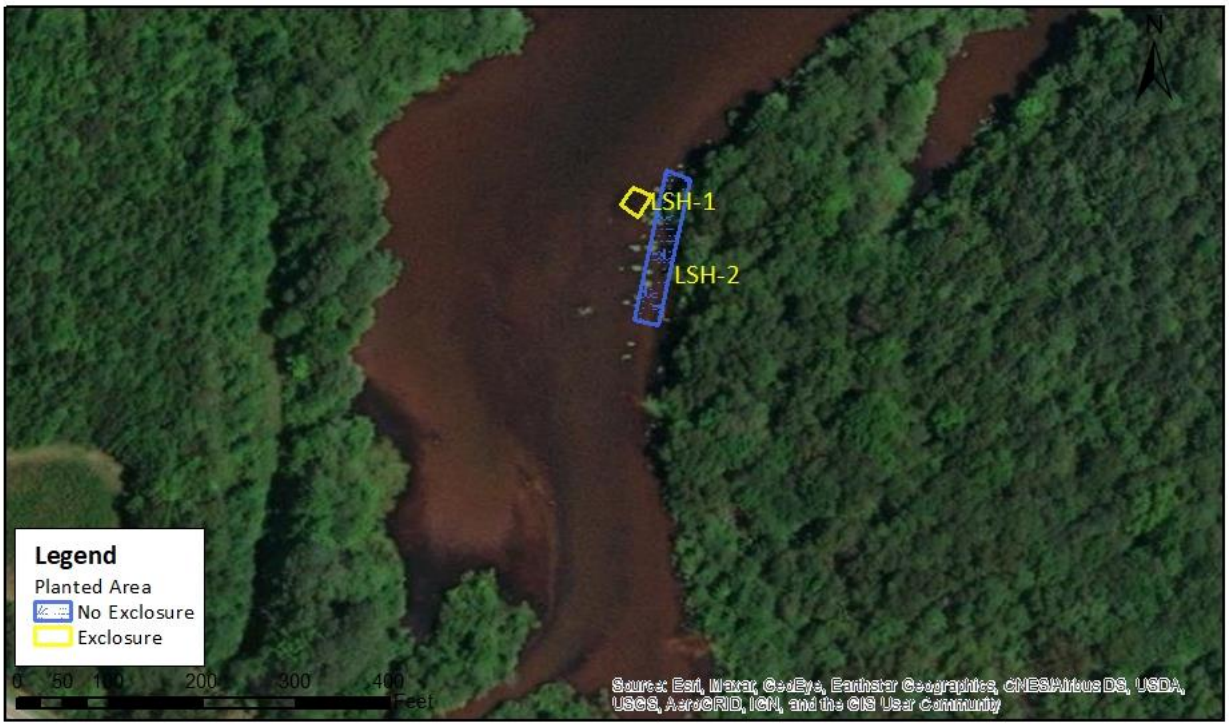

FIGURE 16.—Location of exclosure (black) and planted area (yellow) at the Little Stonehouse, Lake Gaston (36.4659, -78.9246).

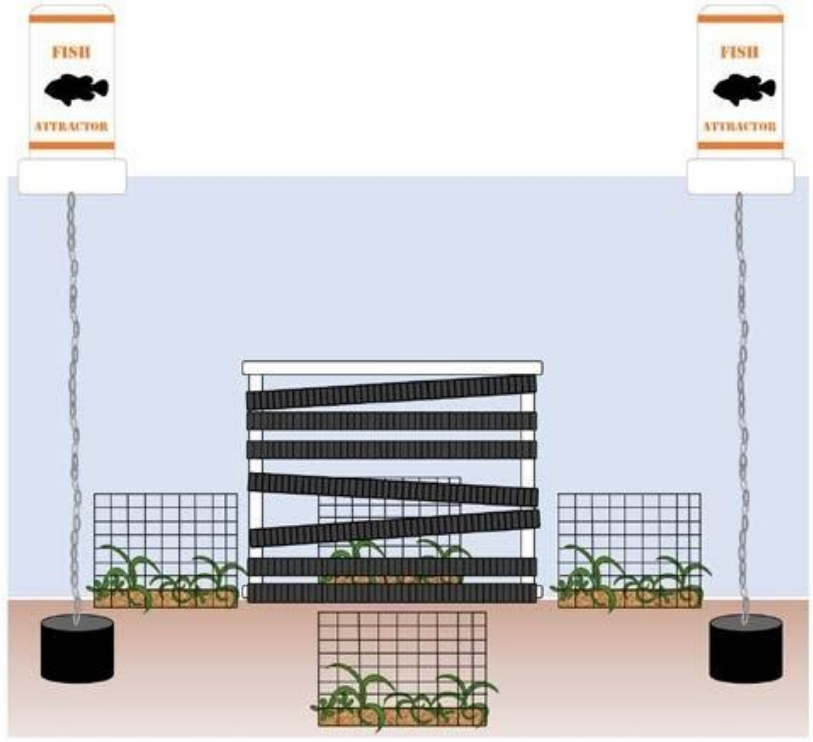

FIGURE 17.—NCSU vegetated fish attractor structure, including vegetation and artificial submersed cubes.

Appendix A – Annual Vegetation Monitoring Datasheet

		Date:		Shading: full sun, partial, full shade				Site Location: main lake, cove, other			
Cove/Site #:		Exclosure:		Exclosure Size:		Soil Type:		Wave Action: High, Med, Low			
Species Name	% Cover	Originally Planted	# first growing season	Herbivory (Y/N)	Robustness /Health (0,1,2,3)	Spread inside cage (Y/N)	New seedlings inside (Y/N)	Spread outside cage (Y/N)	seedlings outside (Y/N)	Treated (Y/N)	Comments
					Shading: full sun, partial, full shade				Site Location: main lake, cove, other		
Site/Cove #:			Exclosure:		Exclosure Size:		Soil Type:		Wave Action: High, Med, Low		
					Shading: full sun, partial, full shade				Site Location: main lake, cove, other		
Site/Cove #:			Exclosure:		Exclosure Size:		Soil Type:		Wave Action: High, Med, Low		
					Shading: full sun, partial, full shade				Site Location: main lake, cove, other		
Site/Cove #:			Exclosure:		Exclosure Size:		Soil Type:		Wave Action: High, Med, Low		
					Shading: full sun, partial, full shade				Site Location: main lake, cove, other		

Percent Cover for each species
Number of planted plants by species at time of planting
Number planted / established plants by species at end of first growing season (this will give us an idea of short term success)
Number of planted / established plants by species could be counted after the second growing season, but this could become very time consuming in the following years.
Herbivory by species (Y/N), List potential source: (turtle, deer, muskrat, etc.)
Plant robustness / health by species (3-Great condition / 2-Good-Fair / 1-Poor / 0-Dead), Describe:
Spreading w/in the exclosure by species (Y/N), Describe:
Spreading outside of exclosure by species (Y/N), Describe extent:
Permanent photographic sites should be established for each exclosure to ensure documentation of success. Site should be established that would easily show growth and expansi
Basin site description (soil type, shading, wave action)