

Santee Cooper Lakes

Lake Marion

(Calhoun, Clarendon, Orangeburg, Berkeley, and Sumter Counties)

Problem plant species

Hydrilla, Alligatorweed, Fanwort, Water willow, Water hyacinth, Slender naiad, Water primrose, Giant Cutgrass, Coontail, Filamentous algae (Lyngbya), Slender Pondweed, Crested floating Heart, Fragrant waterlily

Management objectives

Foster a diverse aquatic plant community through selective treatment of nuisance aquatic vegetation (to avoid adverse impacts to existing non-invasive plant species) and the introduction of desirable native plant species.

Manage hydrilla growth throughout the main lake and subimpoundments to minimize its spread within the lake, help prevent its spread to adjacent public waters, and minimize adverse impacts to electric power generation, agricultural irrigation withdrawals, and public use and access.

Reduce water hyacinth populations throughout the lake to enhance boating, fishing, hunting, public access and prevent spread to other areas of the lake.

Reduce Crested Floating Heart populations throughout the lake to enhance boating, fishing, hunting, public access and prevent spread to other areas of the lake.

Reduce giant cutgrass populations throughout the lake, especially in the Hickory Top Wildlife Management Area and upper lake near Lowfalls landing, to enhance wildlife habitat and hunting opportunities.

Reduce fragrant waterlily and alligatorweed populations throughout the Santee Cooper Wildlife Management Area to enhance wildlife habitat and hunting opportunities.

Reduce other nuisance aquatic vegetation in priority use areas, such as electric power generation facilities, public and commercial access sites (boat ramps, piers, swimming areas, marinas) and residential shoreline areas in the main lake and subimpoundments.

Selected control method

Problem Species	Control Agents
Hydrilla	Aquathol K, Sonar, chelated copper*, Triploid grass carp
Lyngbya	chelated copper*
Water hyacinth	Reward, Renovate 3, Clearcast
Fanwort, coontail, slender naiad, slender pondweed	Aquathol K, Sonar, Reward

Water primrose, alligatorweed, Glyphosate, Habitat, Renovate 3, Clearcast
giant cutgrass

Crested Floating Heart Aquathol K, Clearcast / Glyphosate

* May be toxic to fish at recommended treatment rates; however, precautions will be implemented to minimize the risk of fish kills.

Area to which control is to be applied

Water hyacinth - Approximately 750 acres throughout lake but mostly in the upper lake area above I-95 bridge.

Hydrilla - Approximately 500 acres in priority areas such as electric power generation facilities, public and commercial access sites (boat ramps, piers, swimming areas, marinas) and residential shoreline areas in the main lake and sub-impoundments. If conditions warrant, release triploid grass carp in close proximity to areas of the lake with the greatest hydrilla growth and use herbicide applications to provide immediate short-term control of localized growth in those areas.

Crested Floating Heart - Approximately 1000 acres in priority areas such as public and commercial access sites (boat ramps, piers, swimming areas, marinas, and residential shoreline areas in the main lake), and State and Federal wildlife management areas.

Giant Cutgrass - Approximately 100 acres along shoreline areas throughout lake system, as well as within State and Federal wildlife management areas.

Other target species - Approximately 100 acres in priority areas such as electric power generation facilities, public and commercial access sites (boat ramps, piers, swimming areas, marinas) and residential shoreline areas in the main lake and sub-impoundments.

Sub-Impoundments -

Dean's Swamp Impoundment, Potato Creek Impoundment, Church Branch Impoundment, Taw Caw Impoundment

The general management strategy is to transition from hydrilla dominant plant communities to ones dominated by native plant species, which are beneficial to wildlife, by use of aquatic herbicides. Specific control methods for the sub-impoundments will be determined cooperatively between Santee Cooper and SCDNR staffs which are consistent with both groups' interests for control of invasive plant species such as hydrilla while promoting vegetation beneficial to wildlife and waterfowl through other habitat enhancement projects.

Rate of control agents to be applied

Aquathol K - 5 up to 10 gallons per acre (dependent on water depth)

Reward - 0.5 gallon per acre for floating plants; two gallons per acre for submersed plants

Renovate 3 - 0.5 to 0.75 gallons per acre for emergent species, per label for submersed plants.

Habitat - 0.25 to 0.75 gallons per acre

Sonar AS - 0.075 to 0.15 ppm

Chelated Copper- up to 1 ppm

Glyphosate - up to 1.25 gallons per acre.

Sonar Q, Sonar PR - up to 40 ppb (approx 10 pounds/acre)

Clearcast - 0.25 to 0.75 gallons per acre

Triploid grass carp – The Aquatic Plant Management Council is committed to maintenance stocking of triploid grass carp in the Santee Cooper Lakes to provide long-term control of hydrilla. A maintenance stocking plan approved in 1999 provided for stocking a small number of grass carp to control hydrilla while encouraging the expansion of a diverse, native aquatic plant community.

The plan was first implemented in 2007 following a year of substantial increases in hydrilla and overall aquatic plant populations system-wide. The maintenance stocking plan called for increasing the grass carp population to the level at which hydrilla was last under control, which appeared to be in 2005, and maintaining that level in subsequent years. Drought conditions resulted in a decrease in lake levels to near historic lows in early 2008, so no grass carp were stocked that year. However, supplemental stocking was resumed in 2009 bringing the estimated total grass carp population to 12,074. Year end surveys in 2009 indicated another substantial increase in hydrilla regrowth (800 acres) in Lake Marion and Moultrie.

Concerned about the rate of hydrilla spread in the past three years using the current maintenance stocking plan, DNR and Santee Cooper biologists reviewed approaches in other lakes. Recent experience gained in several North Carolina lakes indicates that a maintenance stocking rate of one fish for every eight surface acres appears to keep hydrilla regrowth suppressed following initial control. If applied to Lakes Marion and Moultrie, this rate would amount to about 20,000 grass carp for both lakes combined. This target stocking rate is higher than calculated by the original stocking plan developed in 1999 but it reflects research and experience not available at that time.

Based on this new information, the Aquatic Plant Management Council, with recommendations from DNR and Santee Cooper staff, is revising the maintenance stocking plan to maintain a grass carp population of one fish per eight total surface acres (160,000 acres). This equates to 20,000 grass carp system-wide. Establishing this level will require stocking approximately 12,000 fish in 2010. Fish will be released in carefully selected locations based on the presence of hydrilla. In order to compensate for an estimated 32% annual mortality, 6,400 grass carp will be stocked each subsequent year in order to maintain the target population of 20,000.

Lake Marion and Lake Moultrie will be carefully monitored for additional increases in hydrilla acreage. Herbicide treatments will be used to provide temporary control until results from grass carp feeding become apparent. Changes to the maintenance stocking strategy will be considered if survey results and regrowth warrant.

Method of application of control agents

Aquathol K, chelated copper, Sonar - subsurface application by airboat or surface application by helicopter.

Reward - (water hyacinth) spray on surface of foliage using handgun from airboat or by helicopter with appropriate surfactant ;(submersed plants) subsurface application.

Renovate 3, Glyphosate, Habitat, Clearcast - spray on surface of foliage with appropriate surfactant.

Triploid grass carp – Using standard techniques to minimize loss, stock sterile grass carp in areas of the lake with the greatest hydrilla growth.

Timing and sequence of control application

Herbicide applications - All herbicide applications to be applied when plants are actively growing. Water hyacinth treatments should be initiated in early spring when plant growth begins and continued regularly during the year as needed.

Triploid grass carp to be released as soon as possible in the spring of 2010 (March-May).
RESULTS FROM GRASS CARP MAY NOT BE EVIDENT FOR TWO OR MORE YEARS.

Other control application specifications

Treatment of the control area is to be conducted in a manner that will not significantly degrade water quality. This may require that only a portion of the control area be treated at any one time.

Hydrilla, Water hyacinth and Crested Floating Heart treatments should be considered a high priority to minimize spread to other areas of the lake system. Treatments should be conducted wherever the plants occur and access by boat is feasible. Areas inaccessible by boat or large acreages will be treated aerially. Frequent treatments in these areas will be necessary to meet management objectives.

If available, all sterile grass carp will be a minimum of 12 inches in length. Sterile grass carp shipments for Lake Marion will be certified by the SCDNR for sterility and checked for size and condition prior to stocking in the lake.

Entity to apply control agents

Herbicide application - S.C. Public Service Authority and/or commercial applicator.

Triploid Grass Carp - S.C. Public Service Authority and/or a commercial supplier with supervision by the SCDNR.

Estimated cost of control operations

\$595,000.00

Note: The budgeted amount is based on aquatic plant coverage and treatment needs from previous years. Actual expenditures will depend on the extent of noxious aquatic plant growth in 2010

Potential sources of funding

S.C. Public Service Authority cost share balance above \$40,000

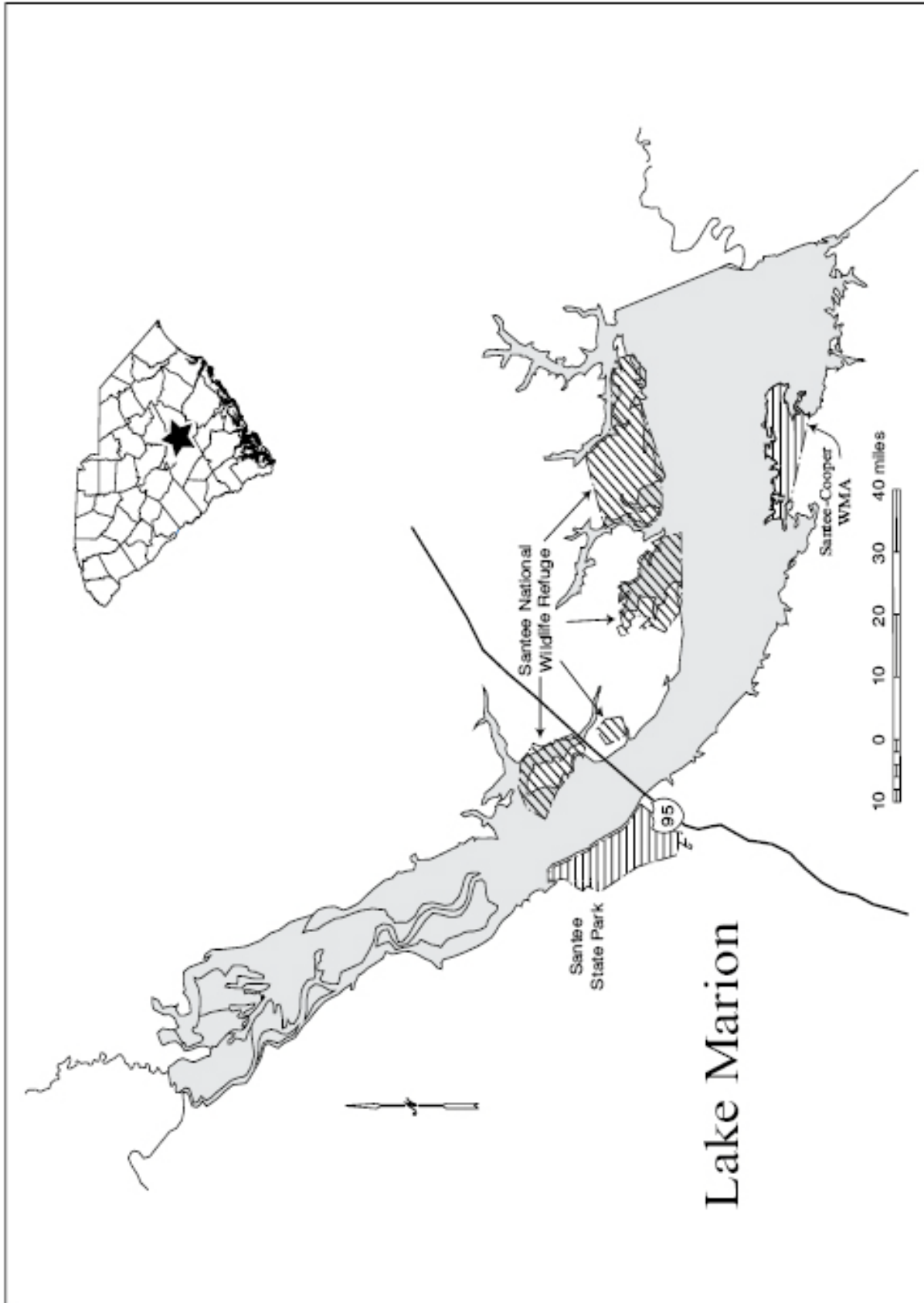
U.S. Army Corps of Engineers 0%

S.C. Department of Natural Resources 50% (up to \$40,000 cost share per waterbody)

(Percentage of match subject to change based on availability of Federal and State funding.)

Long term management strategy

- a) Support the management goals established by the DNR and Santee Cooper (Appendix E) which attempts to achieve a diverse assemblage of native aquatic vegetation in 10% of the total surface area of the lake and to effectively control non-native invasive species.
- b) Manage the distribution and abundance of nuisance aquatic plant populations at levels that minimize adverse impacts to water use activities and the environment through the use of federal and state approved control methods.
- c) A long-term integrated management strategy has been implemented to control hydrilla. Triploid grass carp have been stocked to control hydrilla growth lake-wide and approved aquatic herbicides are used to control localized growth in priority use areas. Future plans include annual maintenance stocking of grass carp to maintain the population at a level that is sufficient to maintain control of hydrilla but to minimize impacts on desirable native plant populations.
- d) Maintain or enhance native aquatic plant populations at levels beneficial to water use, water quality, and fish and wildlife populations through selective control of nuisance plant populations where feasible, introduction of native plant species where appropriate, and public education of the benefits of aquatic vegetation in general.
- e) Seek to prevent further introduction and distribution of problem species through public education, posting signs at boat ramps, regular surveys of the water body, and enforcement of existing laws and regulations.
- f) Periodically revise the management strategy and specific control sites as new environmental data, management agents and techniques, and public use patterns become available.



Lake Moultrie (Berkeley County)

Problem plant species

Hydrilla, Slender naiad, Watermilfoil, Water willow, Water primrose, Alligatorweed, Fanwort, Water hyacinth, Crested Floating Heart, Giant Cutgrass

Management objectives

Foster a diverse aquatic plant community through selective treatment of nuisance aquatic vegetation (to avoid adverse impacts to existing non-invasive plant species) and the introduction of desirable native plant species.

Manage hydrilla growth throughout the main lake and subimpoundments to minimize its spread within the lake, help prevent its spread to adjacent public waters, and minimize adverse impacts to electric power generation, agricultural irrigation withdrawals, and public use and access.

Reduce water hyacinth and Crested Floating Heart populations throughout the lake to enhance boating, fishing, hunting, public access and prevent spread to other areas of the lake.

Reduce giant cutgrass populations throughout the lake to enhance wildlife habitat and hunting opportunities.

Reduce other nuisance aquatic vegetation in priority use areas, such as electric power generation facilities, public and commercial access sites (boat ramps, piers, swimming areas, marinas) and residential shoreline areas.

Selected control method

Problem Species	Control Agents
Hydrilla	Aquathol K, Sonar, Triploid grass carp, Chelated Copper*
Water hyacinth	Reward, Renovate 3
Fanwort, slender naiad, watermilfoil	Aquathol K, Sonar, Reward, Renovate 3
Water primrose, alligatorweed, giant cutgrass	Glyphosate, Habitat, Renovate 3
Crested Floating Heart	Aquathol K, Clearcast / Glyphosate

* May be toxic to fish at recommended treatment rates; however, precautions will be implemented to minimize the risk of fish kills.

Area to which control is to be applied

Hydrilla, fanwort, watermilfoil - Approximately 300 acres in priority areas such as electric power generation facilities, public and commercial access sites (boat ramps, piers, swimming areas, marinas) and residential shoreline areas and sub-impoundments. If conditions warrant, release triploid grass carp in close proximity to areas of the lake with the greatest hydrilla growth and use herbicide applications to provide immediate short-term control of localized growth in those areas.

Giant cutgrass, water primrose, alligatorweed - Approximately 100 acres along shoreline areas throughout the lake.

Sub -Impoundments - Stoney Bay Impoundment - The general management strategy is to transition from hydrilla dominant plant communities to ones dominated by native plant species, which are beneficial to wildlife, by use of aquatic herbicides. Specific control methods for the sub-impoundments will be determined cooperatively between Santee Cooper and SCD-NR staffs which are consistent with both groups' interests for control of invasive plant species such as hydrilla while promoting vegetation beneficial to wildlife and waterfowl through other habitat enhancement projects.

Rate of control agents to be applied

Aquathol K 5 up to 10 gallons per acre (dependent on water depth)

Reward - 0.50 gallon per acre for floating plants; two gallons per acre for submersed plants

Renovate 3 - 0.50 to 0.75 gallons per acre for emergent species, per label for submersed plants.

Habitat - 0.25 to 0.75 gallons per acre

Sonar AS - 0.075 to 0.15 ppm in treatment area

Chelated copper - up to 1 ppm Glyphosate- up to 1.25 gallons per acre.

Sonar Q, Sonar PR - up to 40 ppb (approx 10 pounds/acre) Clearcast - 0.25 to 0.75 gallons per acre

Other approved aquatic herbicides - as per label instructions.

Triploid grass carp – The Aquatic Plant Management Council is committed to maintenance stocking of triploid grass carp in the Santee Cooper Lakes to provide long-term control of hydrilla. A maintenance stocking plan approved in 1999 provided for stocking a small number of grass carp to control hydrilla while encouraging the expansion of a diverse, native aquatic plant community.

The plan was first implemented in 2007 following a year of substantial increases in hydrilla and overall aquatic plant populations system-wide. The maintenance stocking plan called for increasing the grass carp population to the level at which hydrilla was last under control, which appeared to be in 2005, and maintaining that level in subsequent years. Drought conditions resulted in a decrease in lake levels to near historic lows in early 2008, so no grass carp were stocked that year. However, supplemental stocking was resumed in 2009 bringing the estimated total grass carp population to 12,074. Year end surveys in 2009 indicated another substantial increase in hydrilla regrowth (800 acres) in Lake Marion and Moultrie.

Concerned about the rate of hydrilla spread in the past three years using the current maintenance stocking plan, DNR and Santee Cooper biologists reviewed approaches in other lakes. Recent experience gained in several North Carolina lakes indicates that a maintenance stocking rate of one fish for every eight surface acres appears to keep hydrilla regrowth suppressed following initial control. If applied to Lakes Marion and Moultrie, this rate would amount to about 20,000 grass carp for both lakes combined. This target stocking rate is higher than calculated by the original stocking plan developed in 1999 but it reflects research and experience not available at that time.

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Lake Marion and Lake Moultrie will be carefully monitored for additional increases in hydrilla acreage. Herbicide treatments will be used to provide temporary control until results from grass carp feeding become apparent. Changes to the maintenance stocking strategy will be considered if survey results and regrowth warrant.

Method of application of control agents

Aquathol K, chelated copper, Sonar, - subsurface application by airboat or surface application by helicopter.

Reward - (water hyacinth) spray on surface of foliage using handgun from airboat or by helicopter with appropriate surfactant; (submersed plants) subsurface application.

Renovate 3, Glyphosate, Habitat, Clearcast - spray on surface of foliage with appropriate surfactant.

Triplod grass carp – Using standard techniques to minimize loss, stock sterile grass carp in areas of the lake with the greatest hydrilla growth.

Timing and sequence of control application

All herbicides to be applied when plants are actively growing. If needed, aerial treatment of hydrilla adjacent to the Rediversion Canal entrance should be performed as early as possible to prevent excessive plant growth and avoid impacts to the St. Stephen Hydropower Plant.

Triplod grass carp – If conditions warrant, triplod grass carp to be released as soon as possible.

Other control application specifications

Herbicide used only upon approval by the S.C. Department of Health and Environmental Control.

Treatment of the control area is to be conducted in a manner that will not significantly degrade water quality. This may require that only a portion of the control area be treated at any one time.

Treatment of lake, especially near the Rediversion Canal, should be coordinated with hydropower production to avoid excessive flows and maximize herbicide contact time.

If available, all sterile grass carp will be a minimum of 12 inches in length. Sterile grass carp shipments for Lake Moultrie will be certified by the SCDNR for sterility and checked for size and condition prior to stocking in the lake.

Entity to apply control agent

Herbicide application - S.C. Public Service Authority and/or commercial applicator.

Triploid Grass Carp - S.C. Public Service Authority and/or a commercial supplier with supervision by the SCDNR.

Estimated cost of control operations

\$135,000

Note: The budgeted amount is based on aquatic plant coverage and treatment needs from previous years. Actual expenditures will depend on the extent of noxious aquatic plant growth in 2010

Potential sources of funding

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U.S. Army Corps of Engineers 0%

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