US Army Corps
of Engineers ®
Wilmington District

Finding of No Significant Impact (FONSI)

Establishment of *Cyrtobagous salviniae* for Biological Control of *Salvinia molesta* in Richardson and Buffkin Ponds

Columbus County

North Carolina

The U.S. Army Corps of Engineers, Wilmington District (Corps) has adopted the environmental analyses presented by U.S. Department of Agriculture (USDA) in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended. The USDA assessed the effects of the proposed action in the Environmental Assessment, Field Release of the Salvinia Weevil, *Cyrtobagous salviniae* Calder and Sands (Curculionidae: Coleoptera) for Control of Giant Salvinia, *Salvinia molesta* Mitchell (Hydropteridales: Salviniaceae), dated February 2002 (Attachment 1).

As District Commander, it is my duty in the role of responsible Federal official to review and evaluate, in light of public interest, the stated views of other interested agencies and concerned public, the environmental effects of this action.

My evaluation and findings are as follows:

1. PROJECTION DESCRIPTION

Richardson and Buffkin Ponds, both located in Columbus County, North Carolina (Figure 1), are infested with giant salvinia (*Salvinia molesta*), which is an invasive aquatic macrophyte native to Brazil (Figure 2). The Corps requested assistance from the U.S. Army Engineer Research and Development Center (ERDC) regarding giant salvinia management at the two ponds utilizing the salvinia weevil (*Cyrtobagous salviniae*) biological control agent (Figure 3). Researchers at the ERDC Environmental Laboratory, Lewisville, Texas have been developing salvinia weevil mass-rearing, field release, and field density monitoring techniques since 2008.

Under the proposed action, ERDC will conduct applied, field-based research regarding the biological control of giant salvinia utilizing the salvinia weevil within the two ponds. The purpose of the proposed action is to establish salvinia weevils for present and future

management of giant Salvinia at the ponds. This will be accomplished with the following four tasks conducted over the next two years: 1) rearing of salvinia weevils, 2) on-site release and establishment of salvinia weevils, 3) post-release monitoring of salvinia weevil and giant salvinia density, and 4) monitoring and detection of salvinia weevil overwintering success.

Task 1 – Rear salvinia weevils.

Salvinia weevils (Brazil ecotype) will be reared by ERDC at the Lewisville Aquatic Ecosystem Research Facility (LAERF) in Lewisville, Texas in culture boxes contained within greenhouses. As the overall health and reproductive ability of the salvinia weevil is directly tied to the quality of its food source, each culture box will be closely monitored to assure that giant salvinia and the salvinia weevils are provided optimum growing conditions. This will include maintaining optimal pH, conductivity, nitrogen, and iron levels in the water and excluding generalist herbivores from the cultures.

Every 4-6 weeks salvinia weevil densities will be estimated per culture box, in adult and larval salvinia weevils per m^2 of giant Salvinia, by use of an extraction technique (i.e., Berlese funnels). When weevil densities reach approximately 300 adult and 300 larval salvinia weevils per m^2 of giant salvinia, field releases are possible.

Task 2 – Conduct salvinia weevil releases.

During early spring, adult salvinia weevils experience exponential growth rates due to high rates of reproductive activities (i.e., mating and egg laying). For this reason, it is imperative that salvinia weevils be released onto waterbodies as soon as possible following observance of live giant salvinia and water temperatures of at least 17ºC (63ºF), which is the low temperature limit for salvinia weevil reproduction and larval survival. Additionally, early season releases provide a maximum timeframe for weevil acclimation and establishment prior to the onset of low temperature extremes during the following winter. A single 2021 release event, possibly at multiple locations, will be conducted late in the season, during August or September. During late summer, sites typically experience peak warm temperatures which can cause a decline in salvinia weevil reproduction and subsequent establishment. This is not an optimal release time and could inhibit salvinia weevil establishment during 2021 and the ability to properly measure overwintering success during the winter of 2021-2022. During the second and third growing seasons (2022 and 2023), every effort will be made to ensure early season weevil releases which will greatly increase the potential for rapid salvinia weevil establishment at field sites.

Releases will be made by collection of salvinia weevil infested giant salvinia from rearing cultures at LAERF. Infested plant material will be packaged in coolers and shipped overnight to release sites. The infested plant material will be placed in the identified release sites allowing free mixing with existing giant salvinia.

Two different deployment techniques will be used for salvinia weevil releases; waterbody at-large and contained. Floating containment booms will easily identify weevil release locations and will initially inhibit at-large salvinia weevil distribution. By containing the salvinia weevils, the booms will aid in accurate data collection regarding salvinia weevil initial survival, establishment, and oerwinter survival rates. The containment booms will enclose a circular area of $19m^2$ (diameter of 4.9m) and

approximately 3 booms will be deployed within each pond. Salvinia weevils will also be released to the sites at-large in an attempt to accomplish widespread establishment. Post release, the at-large weevils will be much more difficult to detect and accurately monitor until populations have sufficiently increased. Each containment boom will be stocked with approximately 750-1000 adult weevils and any associated larvae present in the infested plant material. Dependent upon the success of rearing cultures and availability of salvinia weevils, approximately 5,000 to 10,000 salvinia weevils will be released at-large to each pond. More precise and accurate weevil release quantities will be recorded at the time of harvest and release.

During 2021, a single salvinia weevil release will be conducted during August or September. In 2022 and 2023, it is estimated that one to three consecutive weevil releases will be conducted during May through July of each year.

Task 3 – Post-release monitoring of salvinia weevil and giant salvinia population densities.

Sites will be sampled every six (6) weeks, year-round, for salvinia weevil and giant salvinia population densities.

Task 3a. Salvinia weevil density.

- Giant salvinia will be collected from the waterbodies at-large and from within each containment boom. Samples will be placed into gallon-sized plastic bags, returned to the LAERF, weighed, and placed into a Berlese funnel for 48 hours for adult and larval weevil extraction into 70% ethanol for preservation. Adult and larval salvinia weevils per kg (fresh weight giant salvinia) will be quantified by sorting and identification through a dissecting microscope.

Task 3b. Giant salvinia surface coverage and biomass.

- Measurements of giant salvinia percent surface coverage will be coupled with biomass. Giant salvinia has at least three growth forms of various size and weight. In terms of invasive status and impacts to native flora and fauna, 100% surface coverage of primary giant salvinia (the smallest growth form) is vastly different than 100% coverage of tertiary giant salvinia (the largest growth form). For this reason, collective monitoring of both surface coverage and biomass helps to explain overall trends. Furthermore, it is common for salvinia weevil feeding to result in continued 100% surface coverage of giant salvinia with a shift from large, tertiary plants to small, primary plants.

  The Daubenmire cover class method, which separates “cover” into six classes based on the ratio of plant/open water surface area occupation, will be used to estimate plant surface coverage at multiple sites within the waterbody at-large and individually for each boom. Each Daubenmire reading will be accompanied by a single salvinia biomass sample. Biomass samples will be collected from within a quadrat (1/25m^2) and will be returned to the lab for drying in a forced air oven at 55ºC for 48 hours to obtain giant salvinia dry weights per m^2.

Task 4 – Monitoring and Detection of Salvinia Weevil Overwintering.

To determine salvinia weevil overwintering success, salvinia weevil densities immediately before, during, and immediately after winter will be analyzed and coupled with water temperature readings. Low temperature extremes will be correlated to

changes in salvinia weevil population density and analysis will detect trends of weevil population stability or decline during winter. Water temperature loggers will be placed within each boom and in various other at-large locations.

To date, giant salvinia biocontrol efforts have only been applied at field sites within the southern United States, specifically in Texas and Louisiana. Success rates have varied and are dependent upon overwintering success of salvinia weevils. The proposed action will be the first attempt by ERDC to release and establish salvinia weevils within the southeastern United States.

The proposed action will directly address the following goal of the Civil Works Strategic Plan 2014-2018, “Restore, protect, and manage aquatic ecosystems to benefit the Nation”. Results from this project will be used to increase knowledge of the efficacy of giant salvinia biocontrol efforts in regions outside the southern United States and will be used to increase efficacy of salvinia biocontrol efforts.

2. COORDINATION

The Corps has coordinated the proposed action with The North Carolina Department of Environmental Quality (NCDEQ), North Carolina State University, local government officials, and local landowners. The proposed action will supplement, but be conducted independently of, existing NCDEQ giant salvinia control efforts; however, the NCDEQ will provide watercraft with which to conduct the proposed action. To date, the NCDEQ have conducted herbicidal treatment of ~75 infested acres at Richardson Pond. All coordination to date has resulted in support for the proposed action and for the greater goal of general giant Salvinia control efforts at Richardson and Buffkin Ponds.

3. ENVIRONMENTAL EFFECTS AND IMPACTS

The proposed action will be in compliance with all environmental laws and executive orders, and environmental impacts to protected resources will be minimized to the maximum extent practicable.

4. DETERMINATION

Based on information presented in the referenced 2002 USDA EA, I have determined that the proposed action does not constitute a major Federal action significantly affecting the quality of the human environment. Therefore, the action does not require the preparation of a detailed statement under Section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.). My determination was made considering the following factors discussed in the EA to which this document is attached:

a. The proposed action would have no effect on threatened or endangered species in the project area or vicinity including the northern long-eared bat, red-cockaded woodpecker, wood stork, American alligator, or Cooley’s meadowrue.

b. No significant cumulative or secondary impacts would result from implementation of the proposed action.

c. The proposed action would not significantly impact cultural resources.

d. The proposed action would result in no significant impacts to air or water quality.

e. The proposed action would result in no significant adverse impact to fish and wildlife resources.

f. The proposed action will not cause any environmental health risks or safety risks that may disproportionately affect children and complies with Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks."

g. The proposed action will not cause any disproportionately high and adverse human health or environmental effects on minority populations and low-income populations and complies with Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations."

5. FINDINGS AND CONCLUSIONS

The proposed action to implement the biological control of giant salvinia utilizing the salvinia weevil within Richardson and Buffkin Ponds would result in no significant environmental impacts.

18 Aug 21
Date

Benjamin A. Bennett
Colonel, U.S. Army
District Commander

Figure 1. Giant Salvinia Biocontrol Project Area.

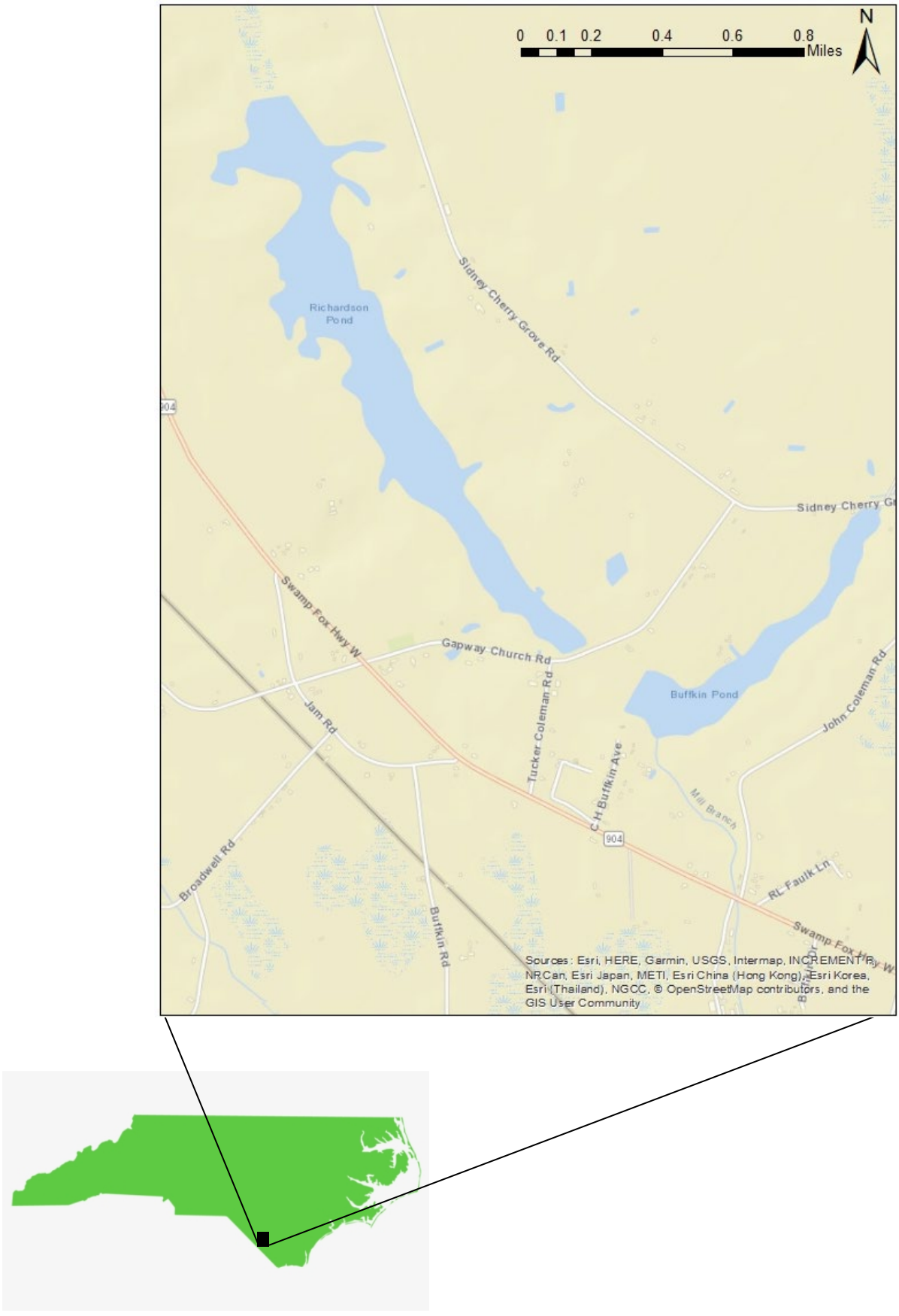

Figure 2. Giant Salvinia Example (at Richardson Pond, Columbus County, North Carolina).

Figure 3. Salvinia Weevil Examples (photo credit: Louisiana State University College of Agriculture)

Attachment 1

Field Release of the Salvinia Weevil, *Cyrtobagous salviniae* Calder and Sands (Curculionidae: Coleoptera) for Control of Giant Salvinia, *Salvinia molesta* Mitchell (Hydropteridales: Salviniaceae)

United States Department of Agriculture

December 2002

Field Release of the Salvinia Weevil, *Cyrtobagous salviniae* Calder and Sands (Curculionidae: Coleoptera) for Control of Giant Salvinia, *Salvinia molesta* Mitchell (Hydropteridales: Salviniaceae).

Environmental Assessment

December 2002

Agency Contact:
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Proposed Action:	The United States Department of Agriculture, Animal and Plant Health Inspection Service is proposing to issue a permit for the release of the South American weevil, *Cyrtobagous salviniae* Calder & Sands. The insect would be used by the applicant for the biological control of the aquatic fern giant salvinia, *Salvinia molesta* Mitchell.
Type of Statement:	Environmental Assessment
For Further Information:	Tracy A. Horner, Ph.D.

1. Purpose and Need for Action

1.1 The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS) is proposing to issue a permit for additional releases of the South American weevil, *Cyrtobagous salviniae* Calder & Sands. The insect would be used by the applicant for the biological control of the aquatic fern giant salvinia, *Salvinia molesta* Mitchell.

In September 2001, the USDA, APHIS prepared an Environmental Assessment (EA): *Demonstration Project: Giant Salvinia - Toledo Bend Reservoir and Surrounding Areas in Louisiana and Eastern Texas* (USDA, APHIS 2001). The APHIS EA and the associated Finding of No Significant Impact (FONSI) are being incorporated into this EA by reference. The APHIS EA and FONSI were prepared to assess the possible environmental impacts of an integrated approach to eradicate and prevent the spread of giant salvinia in Louisiana and eastern Texas. The alternatives analyzed in the APHIS EA were: eradication using an integrated approach including herbicides, mechanical, biological and regulatory control, biological control without herbicide application and no action. The method of integrated control selected by APHIS permitted the flexibility necessary for applying different methods based on site specific conditions. As a result of the FONSI, permits for environmental release of *C. salviniae* were issued by APHIS in September 2001 and the organism was released into the limited area of the Toledo Bend Reservoir of Texas and Louisiana. However, APHIS has received permit applications for additional releases of *C. salviniae* into other areas of the continental United States that are infested with giant salvinia, beyond the area considered in the APHIS EA.

Before a permit can be issued for release of *C. salviniae* into other areas of the United States that are infested with giant salvinia, APHIS needs to analyze the potential effects of widespread release of this agent. If approved, it is expected that releases of *C. salviniae* will be used as part of integrated control programs throughout infested areas of the United States.

1.2 *Salvinia molesta* is a free-floating aquatic fern. In its native range in southeastern Brazil, giant salvinia is a component of the floating and emergent plant communities, supports a variety of natural enemies (Forno and Bourne 1984) and normally does not form the extensive mats prevalent in its exotic range. Salvinia was first reported outside of cultivation in the United States during 1995 at a pond in southeastern South Carolina (Johnson 1995). It was eradicated before spread occurred but then in May 1998 it was found in Houston, Texas. Findings followed at other sites in Texas and in Louisiana during 1998. During 1999 it was found in Alabama, Arizona, California, Florida, Georgia, Hawaii, Mississippi, and Oklahoma (Jacono *et al.* 2000; USGS web site http://nas.er.usgs.gov/ferns). It is readily available for purchase in the United States, particularly through the World Wide Web.

Negative effects of this weed include the following:

- *Disrupts recreational activities.* Boating and fishing are prevented by dense mats formed by the weed
- *Results in negative effects on agriculture.* Agricultural interests are affected by clogged

irrigation intakes and pumps, and rice and crawfish yields are reduced significantly from competition from salvinia.

- *Creates mosquito habitat.* Mats of salvinia provide ideal habitat for *Mansonia* spp. and other mosquitoes.
- *Results in negative effects on the ecosystem.* Plants and animals that need open water to gain sunlight, oxygen and space for sustenance and growth or for alighting, fishing, nest building or mating are displaced.
- *Decreases water quality.* Salvinia reduces the concentration of nutrients and oxygen, and raises carbon dioxide and hydrogen sulfide concentrations of water.

The primary habitats subject to invasion by giant salvinia include quiet waters of lakes, ponds, oxbows, ditches, slowly flowing streams and rivers, backwater swamps, marshes and rice fields. The potential range of giant salvinia includes the Atlantic coastal plain from southeastern Virginia to south Florida, west across the Gulf coast states to southern Arizona and central California. It is somewhat more tolerant of environmental extremes than water hyacinth (*Eichornia crassipes*) and perhaps may extend further north. This includes most regions with USDA Plant Hardiness Zones 8, 9 and 10 and into Zone 7b. Giant salvinia has successfully overwintered in coastal North Carolina at a latitude of 34.4 degrees north (USDA Zone 8) and in Texas at 33 degrees north (USDA Zone 7b) where top-growth died during the winter, but plants appeared the following summer.

Giant salvinia is spread within and between aquatic systems mainly by man, accidentally when equipment or boats are moved, deliberately as a pond, aquarium or water-garden plant and as a biological weapon (Gewertz 1983). It is carried on animals when they move from infested water bodies (Forno and Smith 1999). Dispersal within a water body or catchment is by wind and water currents (Room and Julien 1995). Currents and floods wash mats away and growth is best in still or slowly moving water.

The applicant's purpose for releasing the non-indigenous insect *C. salviniae* is to reduce the severity and extent of giant salvinia in the United States. *C. salviniae* is a weevil native to Brazil, Bolivia and Paraguay (Wibmer and O'Brien 1986). Larvae of *C. salviniae* tunnel within the rhizomes of giant salvinia causing them to disintegrate. They also tunnel in the leaf buds and adults eat leaves and leaf buds, thus suppressing growth and vegetative propagation of this sterile weed. This insect has successfully controlled giant salvinia in 12 countries over 3 continents.

Weevils in the genus *Cyrtobagous* were first recorded from the United States in Florida at the Archbold Biological Station (Highlands County) in 1962 (Kissinger 1966). It is assumed that these weevils were accidentally introduced from South America because of the lack of any earlier U.S. records and the adventive status of its host plant, *Salvinia minima.* Kissinger (1966) considered the Florida weevils to be *C. singularis* but this was before *C. salviniae* was recognized as a separate species. Calder and Sands (1985) later classified the Florida specimens as *C. salviniae,* but noted that the *C. salviniae* from *S. minima* in Florida were significantly smaller than those from *S. molesta* in Brazil. Recent DNA assessments found 10 base pairs that were different between the two populations out of more than 560 base pairs sequenced (Goolsby

et al. 2000). Whether these differences imply separate species status is under investigation. However, the Florida and the Brazilian 'strains' are treated separately and only the Brazilian strain is considered in this environmental assessment.

1.3 APHIS must decide between the following alternatives:

A. To deny the permit application (no action)
B. To issue the permit as submitted
C. To issue the permit with management constraints or mitigation measures.

1.4 Issues arising from the field release of *C. salviniae* are:

A. Will *C. salviniae* attack non-target plants within and outside the area infested with giant salvinia?
B. Will *C. salviniae* affect any federally listed threatened or endangered species?

1.5 This environmental assessment (EA) was prepared by APHIS in compliance with the National Environmental Policy Act (NEPA) (42 USC 43421 *et seq.*) as described in the implementing regulations adopted by the Council on Environmental Quality (40 CFR 1500-1509), by USDA (7 CFR 1b) and by APHIS (7 CFR 372).

2. Alternatives Including the Proposed Action

2.1 This chapter will explain the alternatives available to APHIS. Although APHIS' alternatives are limited to a decision whether to issue a permit for the release of *C. salviniae*, other methods available for control of giant salvinia are also described. Although APHIS is not in a position to decide whether these other methods are used, their use may be affected by APHIS' decision whether or not a permit is issued for extended environmental release of *C. salviniae*. These are methods currently being used to control giant salvinia by public and private concerns and are presented to provide information to the reader.

2.2 Description of APHIS' alternatives.

2.2.1 Alternative 1 - No Action: Under this alternative, APHIS would not issue additional permits for the expanded release of *C. salviniae* into any States in the continental United States where giant salvinia is introduced. Further release of the insect would not take place.

2.2.2 Alternative 2 - Issue the Permit: Under this alternative, APHIS would issue permits for the field release of *C. salviniae* into any mainland U.S. State invaded by giant salvinia. This permit would contain no special provisions or requirements concerning release procedures or mitigating measures.

2.2.3 Alternative 3 - Issue the Permit with Specific Management Constraints and Mitigating Measures: Under this alternative, APHIS would issue permits for the field release of *C. salviniae* into any mainland U.S. State invaded by giant salvinia. However, the permit would

contain special provisions or requirements concerning release procedures or mitigating measures.

2.3 The following methods are presently being used to control giant salvinia. These controls will continue under the "No Action" alternative but may continue even if permits are issued for expanded releases of *C. salviniae*.

Other alternatives for giant salvinia control (including biological control) were analyzed in the APHIS EA mentioned previously (USDA, APHIS 2001). In February 2000, the U.S. Fish and Wildlife Service (USFWS), Division of Refuges prepared an EA: *Environmental Assessment for Control of the Aquatic Weed, Giant Salvinia* (*Salvinia molesta*) *on Four National Wildlife Refuges on the Lower Colorado River* (*Arizona/California*) (USFWS 2000). Also, in February 2000, the Bureau of Land Management (BLM), Yuma Field Office, prepared an EA: *Integrated Pest Management of Salvinia molesta in the Lower Colorado River* (BLM 2000). The BLM and USFWS EAs and associated FONSIs are being incorporated into this EA by reference. These EAs analyzed alternatives for giant salvinia control on the lower Colorado River. All EAs, including the APHIS EA mentioned previously, selected an integrated management alternative utilizing multiple control methods. A summary of the alternatives described in the three EAs is provided below.

2.3.1 Chemical control: The herbicides used include a diquat dibromide formulation labeled for use on *Salvinia* species, Reward®, and another herbicide labeled for use on aquatic weeds, fluridone (Sonar™). Adjuvants (surfactant/penetrant/spreader) such as Thoroughbred™ AQUA-KING, Kinetic or Cide-kick are used to increase the effectiveness of the herbicides. The herbicides and adjuvants are applied using a hand gun sprayer or booms from airboats or outboard motor-driven boats.

2.3.2 Mechanical control: These methods include hand-removal of plants, machine removal, and blocking the movement plants in or out of specific areas with the use of floating booms.

2.3.3 Regulatory control: Certain States have regulations in place allow that allow them to control outbreaks, seize giant salvinia plants, issue stop sale orders to nurseries and other places that sell giant salvinia plants, issue warnings to property owners requiring them to take action concerning infestations in privately-owned areas, and establish quarantines. Federal regulatory controls include interstate quarantines and national survey activities. In addition, State cooperators have projects to educate the public so that they will recognize giant salvinia and, when they detect it, have the appropriate information to notify the responsible authority(ies). Also, State cooperators conduct boat ramp inspections, post descriptive notices, and inform boat owners and operators of the need to be aware of the potential for the plant to spread.

2.3.4. Biological Control: Permits for environmental release of *C. salviniae* were issued by APHIS in September 2001 and releases have occurred in the Toledo Bend Reservoir area of Texas and Louisiana. It is still too early to determine the impact of the released biocontrol agent

on giant salvinia populations in this area.

2.4 Summary of Consequences

Table 1. Summary of Consequences

Consequences	No Action	Issue Permit	Issue Permit with conditions
Effects on non-target organisms	Use of non-selective mechanical control and herbicides would cause harm to native plants.	None expected	None expected
Effects on threatened and endangered species	Would expose T&E species to the effects of herbicides and disturbance of critical habitat from mechanical controls.	None expected	None expected

3. Affected Environment

3.1 *Taxonomically Related Plants*

The family Salviniaceae includes only one genus, *Salvinia*. The genus *Salvinia* is composed of 10 species which occur naturally in South America, Africa, and Asia. There are no native members of the Salviniaceae in the United States. However, two other families are taxonomically related to the Salviniaceae: the Azollaceae and Marsileaceae. These plant families contain species native to the United States.

The Azollaceae consists of the single genus *Azolla*. Three species of *Azolla, Azolla caroliniana* Willdenow, *Azolla mexicana* C. Presl, and *Azolla filiculoides* Lam. are native to North America (Lumpkin 1993). The range of *A. mexicana* extends from northern South America to British Columbia, Wisconsin and Illinois. *Azolla filiculoides* ranges from Alaska to Guatemala, and occurs in South America, Europe, Hawaii, and Australia. *Azolla caroliniana* occurs from Florida to Texas, New Mexico, and Oklahoma, north to North Carolina and Oregon and Alaska, the West Indies and Mexico to Patagonia in southern Argentina.

The Marsileaceae includes two North American genera, *Marsilea* and *Pilularia*. Six species of *Marsilea* are in the North American flora (Johnson 1993). They are, *Marsilea quadrifolia* Linnaeus, *Marsilea ancylopoda* A. Braun, *Marsilea oligospora* Gooding, *Marsilea mollis* B. L. Robinson and Fernald, *Marsilea macropoda* Engelmann, and *Marsilea vestita* Hooker and

Greville. According to Johnson (1993) their distributions are as follows: *M. ancylopoda* – Florida, Mexico, West Indies, Central and South America; *M. oligospora* – California, Idaho, Montana, Nevada, Oregon, Utah, Washington, Wyoming; *M. mollis* – Arizona, Texas, Mexico, South America; *M. macropoda* – Alabama, Louisiana, Texas, Mexico; *M. vestita* – Alberta, British Columbia, Saskatchewan, Arizona, Arkansas, California, Colorado, Idaho, Iowa, Kansas, Louisiana, Minnesota, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, Wyoming, Mexico, Peru. *Pilularia americana* A. Braun (American pillwort) is the only North American member of the genus *Pilularia*. The recorded distribution of *P. americana* is as follows (Johnson 1993): Alabama, Arkansas, California, Georgia, Kansas, Missouri, Nebraska, North Carolina, Oklahoma, Oregon, South Carolina, Tennessee; Mexico in Baja California.

3.1.1. *Evidence of host specificity:* Releases of *C. salviniae,* collected from *S. molesta* in southeastern Brazil, were made in Australia beginning in 1980, where it now controls the weed in most tropical and subtropical areas. It has since been released in 15 countries and controls the weed in at least 12 of them (Table 2). In Cote D'Ivoire, insufficient time has lapsed for evaluation purposes after relatively recent releases on nitrogen-poor salvinia (M. Julien, personal observations).

Table 2. The status of releases of *Cyrtobagous salviniae* Calder and Sands for each country and the date of initial release. The information is modified from Julien and Griffiths (1998)

Country	Initial Release	Status
Australia	1980	Control in tropical and subtropical areas Some control in temperate areas
Cote D'Ivoire	1998	Established and spreading
Fiji	1991	Successful control
Ghana	1996	Control
India	1983	Control at Bangalore and Kerala
Indonesia	1990s	Established on Java. Impact unknown
Kenya	1990	Control except where affected by herbicide
Malaysia	1989	Control where released. Needs redistribution
Namibia	1984	Good control
Papua New Guinea	1982	Good control
Philippines	1989	Established on Panay. Impact unknown
Republic of South Africa	1985	Successful control within 2 years
Sri Lanka	1986	Successful control
Zambia	1990	Excellent control
Zimbabwe	1992	Good control within 2 years

A total of 53 plant species from 33 families were tested using choice and no-choice methods by Forno *et al*. (1983) and by M. Hill (unpublished data) (Appendix 1). In both studies, development occurred only on *S. molesta*. In host specificity tests conducted by M. Hill, there was slight feeding on *S. minima.* Aside from *S. minima*, there was no feeding or development on any plant species, with two exceptions: *Pistia stratiotes* (water lettuce) and *Ipomoea batatas*

(sweet potato). In the case of *P. stratiotes*, adults did feed on the plant but no development took place. Dray *et al*. (1993) surveyed the arthropod fauna of *P. stratiotes* in 61 water bodies in Florida and never recovered *C. salviniae* from the plant. Water lettuce is often found growing in close association with *S. minima* which supports large populations of *C. salviniae* (Tipping, unpublished data). Similar surveys in Chaco Province, Argentina by Poi de Neiff (1983) did not record *C. salvinia* on *P. stratiotes*. In addition, Forno *et al*. (1983) never found *C. salviniae* attacking *P. stratiotes* in Brazil despite the frequent close association of different Salvinia species. The feeding that occurred in these tests may have been an artifact of the laboratory environment.

In the other case with *I. batatas*, a single feeding scar was recorded on each test plant of sweet potato, but further no-choice testing found no feeding and no survival of adults after 7 days. Additional no-choice tests with *P. stratiotes* and *Oryza sativa* yielded no feeding or reproduction by *C. salviniae*.

3.1.2 Endangered and threatened species are a special concern because they are protected by the Endangered Species Act. However, there are no threatened and endangered species in the plant family Salviniaceae.

3.2 No minority, low income populations, or children should be negatively impacted due to the proposed action. Potential reductions in herbicide usage to control giant salvinia may even be beneficial to human populations.

4. Environmental Consequences

4.1 This chapter will analyze the potential environmental consequences of each alternative on the resources described in Chapter 3.

4.2 Effects of Alternative 1 - No Action

4.2.1 Mechanical control is the least effective approach for giant salvinia control. The mobility of free-floating plants, rapid growth, and large biomass production combine to frustrate most mechanical control attempts. Physical removal of the plants require constant vigilance and repeated efforts and is not sustainable in larger water bodies. Chopping and shredding the plants will actually increase the risk of spread by creating many more smaller plants and fragments, many of which may still be viable. Booms may contain smaller infestations but are susceptible to breakage as the combined force of plant biomass and air and water currents act on them. They also require regular maintenance to clear out the debris and plant material they trap. Herbicides have limitations because they impact non-target plants, some salvinia infestations are not easily located or even accessible, and direct costs can be high (from $85 [Reward®] to $350 [Sonar®] per acre). There are strict requirements for their use around potable water intakes and reentry periods for cattle with all the herbicides except the copper compounds. Use of the non-selective herbicides available for control of giant salvinia will likely cause temporary declines in emergent, floating and submersed macrophytes, phytoplankton, and aquatic invertebrates in

treated areas.

4.2.2 Effects on Threatened and Endangered Species: Herbicides must be used carefully to prevent adverse effects to threatened and endangered species. The U.S. Fish and Wildlife Service has recommended that fluridone be prohibited from use in any stream that contains listed aquatic species.

4.3 Effects of Alternative 2 - Issue Permit

4.3.1 Several lines of evidence indicate that *C. salviniae* is highly host-specific and will not have direct negative impacts on native plant species:

Laboratory host-specificity tests:
A total of 53 plant species from 33 plant families were tested using choice and no choice methods. Some feeding occurred on *Salvinia minima*, *Pistia stratiodes* and a single feeding scar occurred on *Ipomoea batatas*. Additional no-choice testing of *P. stratiodes* and *I. batatas* resulted in no feeding or reproduction by *C. salviniae.* Insect development occurred only on *S. molesta.*

Field observations:
Post-release observations in many countries have indicated that *C. salviniae* does not damage non-target plants. In particular, surveys in Argentina and Brazil have never found *C. salviniae* attacking *P. stratiodes* despite frequent close association of this plant with *Salvinia* species.

Native relatives:
In the U.S., there are no native species in the same family as *S. molesta* and only a few species in the two closest groups, Marsileaceae and Azollaceae. Of plants tested in these families, including *Azolla*, *Marsilea* and *Salvinia* spp., only *S. minima* was fed upon by weevils, but no reproduction occurred on this plant species. *S. minima* is not native to the U.S. although its range includes western and southern Mexico.

4.3.2 *C. salviniae* is specific to *Salvinia* spp. and there are no threatened or endangered species in the Salviniaceae. The petition prepared by Dr. Ted Center and Dr. Phil Tipping for the Technical Advisory Group for Biological Control Agents of Weeds (TAG) (Tipping and Center 2001) was submitted to the U.S. Fish and Wildlife Service (FWS), Arlington, VA, in compliance with the Endangered Species Act of 1973. On May 16, 2002, the FWS issued a letter concurring with APHIS' determination that releases of *C. salviniae* are "not likely to adversely affect" threatened and endangered species or designated critical habitat.

4.4 Effects of Alternative 3 - Issue the Permit with Specific Management Constraints and Mitigating Measures

4.4.1 No specific management constraints or mitigating measures have been recommended for this species. Therefore, under this alternative, impacts on non-target

organisms would be identical to those described in 4.3.1.

4.4.2 No specific management constraints or mitigating measures have been recommended for this species. Therefore, under this alternative, impacts on threatened and endangered organisms would be identical to those described in 4.3.2.

4.5 No disproportionate effects are expected to impact low income or minority populations or pose undue risks for children.

4.6 An unavoidable effect of the proposed action would be the lack of complete control of the target pest. Should the proposed action be unsuccessful, the present chemical, mechanical, regulatory and biological control activities would continue at current levels.

4.7 Once a biological control agent such as *C. salviniae* is released into the environment and it becomes established, it could move from the target plant to non-target plants and itself become a pest. If a host shift does take place, the resulting effects could result in environmental impacts not easily reversed. Biological control agents such as *C. salviniae* generally spread without the agency of man. In principle therefore, release at even one site must be considered equivalent to release over the entire area in which potential host plants occur and in which the climate is suitable for reproduction and survival.

5. List of Preparers

This environmental assessment was prepared by Dr. Philip W. Tipping, Research Entomologist, and Dr. Ted D. Center, Research Leader, USDA-ARS, Invasive Plant Research Laboratory, Ft. Lauderdale, FL, and Dr. Tracy Horner, Entomologist, USDA-APHIS-PPQ, Riverdale, MD.

6. List of Agencies Consulted

The U.S. Fish and Wildlife Service was consulted under Section 7 of the Endangered Species Act of 1973.

The Technical Advisory Group for the Biological Control Agents of Weeds (TAG) reviewed a petition submitted from the applicant (Tipping and Center 2001) and recommended the release of *C. salviniae* on September 24, 2001. TAG members that reviewed the release petition included representatives from the U.S. Army Corps of Engineers, Environmental Protection Agency, USDA-ARS, USDA-Forest Service, National Plant Board, Bureau of Reclamation, and the Weed Science Society of America.

7. List of Agencies Consulted

This document was reviewed by Dr. Michael Firko, Asst. Director, Plant Health Programs, and Dr. Robert Flanders, Pest Permit Evaluations Branch Chief, USDA-APHIS-PPQ, Riverdale, MD.

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Appendix 1. List of plants tested experimentally for *Cyrtobagous salviniae* host specificity (Forno *et al.*1983, M. Hill, unpublished data).

Category 1. Species in the Same Genus as the Target Weed

Family	Scientific Name	Common Name	Researcher
Salviniaceae	*Salvinia minima* Baker	Common salvinia	M. Hill
	Salvinia hastata		

Category 2. Species in Other Families in the Same Order (Division)

Family	Scientific Name	Common Name	Researcher
Adiantaceae	*Adiantum hispidulum*	Arrow head	W. I. Forno
Azollaceae	*Azolla pinnata* R. Br.	Mosquito fern	
	Azolla pinnata africana R. Br.		M. Hill
	Azolla caroliniana Willdenow		
	Azolla filiculoides Lam.		
Dennstaedtiaceae	*Pteridium esculentum*	Bracken fern	W. Forno
Marsileaceae	*Marsilea drummondii* A. Braun	Nardoo	
	Marsilea vestita Hooker and Geville		M. Hill
Schizaeacea	*Schizae dichotoma* (L.) Sm.	Comb fern	W. Forno
Thelypteridaceae	*Christella dentata*	Binung	

Category 3. Species in Other Orders

Monocotyledons

Family	Scientific Name	Common Name	Researcher
Alismataceae	*Sagittaria graminea* Michx	Arrow head	W. Forno
Amaryllidaceae	*Allium cepa* L.	Onion	
Araceae	*Pistia stratiotes* L.	Water lettuce	
Bromeliaceae	*Ananas comosus* (L.) Merr.	Pineapple	
Gramineae	*Zea mays* L.	Maize	
	Orzya sativa L.	Rice (3 varieties)	
	Saccharum officinarum L.	Sugar-cane	
Liliaceae	*Asparagus officinalis* L.	Asparagus	
Musaceae	*Musa x paradisiaca* L.	Banana	
Ponterderiaceae	*Eichhornia crassipes* (Mart.) Solms-Laubach	Water hyacinth	
Potamogetonaceae	*Potamogeton tricarinatus*	Floating pondweed	

		F. Muel & A. Benn.	
Typhaceae	*Typha orientalis* Presl	Bullrush	
Zingiberaceae	*Zingiber officinale* Roscoe	Ginger	
Dicotyledons			
Caricaceae	*Carica papaya* L.	Papaya	W. Forno
Chenopodiaceae	*Beta vulgaris* L.	Beetroot	
	Spinacia oleracea L.	Spinach	
Compositae	*Lactuca sativa* L.	Lettuce	
Convolvulaceae	*Ipomoea batatas* (L.) Lam.	Sweet potato	
	Ipomoea aquatica Forssk.	Potato vine	
Curcurbitaceae	*Cucurbita maxima* Naudin	Pumpkin	
Cruciferae	*Nasturtium officinale* R. Br.	Water cress	
	Brassica oleracea var. *botrytis* L.	Cauliflower	
Papilionaceae	*Medicago sativa* L.	Lucerne	
	Trifolium subterraneum L.	Sub-clover	
Malvaceae	*Gossypium hirsutum* L.	Cotton	
Menyathaceae	*Nymphoides indica* (L.) Kuntze		
Myrtaceae	*Eucalyptus tereticornis* Sm.	Forest red gum	
	Eucalyptus maculata	Spotted gum	
Nymphaeaceae	*Nymphaea gigantea* Hook..	Purple water lily	
Onagraceae	*Ludwigia peploides* (Kunth) Raven	Water primrose	
Polygonaceae	*Polygonum lapathifolium*	Pale knotweed	
	Polygonum hydropiper	Water pepper	
	Polygonum sp.	Smartweed	
	Rumex brownii	Swamp dock	
	Rumex crispus L.	Curled dock	
Rosaceae	*Fragaria x ananassa* (Weston) Lois	Strawberry	
Rutaceae	*Citrus sinensis* L.	Orange	
	Citrus limon (L.) Burm.f.	Lemon	
	Citrus reticulata Blanco	Mandarin	
Solanaceae	*Lycopersicon esculentum* Miller	Tomato	

Decision and Finding of No Significant Impact
for
Field Release of *Cyrtobagous salviniae* (Curculionidae: Coleoptera) for Biological Control of Giant Salvinia (*Salvinia molesta*)
Environmental Assessment
December 2002

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), is proposing to issue a permit for the widespread field release of a nonindigenous insect (*Cyrtobagous salviniae*). The insect would be used for the biological control of giant salvinia (Sa*lvinia molesta*) in the continental United States.

The alternatives available to APHIS are No Action, Issue the Permit, and Issue the Permit with Management Constraints or Mitigating Measures. Because of the action being proposed by APHIS, the Issue the Permit and the Issue the Permit with Management Constraints or Mitigating Measures alternatives will result in the release of the biological control agent into the environment. APHIS has therefore analyzed the potential effects of the release of the agent into the environment. The No Action alternative, as described in the environmental assessment (EA), would result in the continued use at the current level of chemical, mechanical, regulatory and biological control methods for the management of giant salvinia. These control methods described are not alternatives for decisions to be made by APHIS, but are presently being used to control giant salvinia in the United States and may continue regardless of issuance of a permit for widespread field release of *C. salviniae*.

I have decided to issue the permit for the field release of *C. salviniae* without management constraints or mitigating measures. The reasons for my decision are:

- This biological control agent is sufficiently host specific and poses little, if any, threat to the biological resources of the United States
- This species will not disproportionately affect minority or low- income populations, nor will it disproportionately affect children or result in any environmental health risks or safety risks to children.
- *C. salviniae* poses no threat to the health of humans or wild or domestic animals.
- *C. salviniae* is not likely to adversely affect endangered or threatened species or their habitat.

- While there is not total assurance that the release of *C. salviniae* into the environment will be reversible, there is no evidence that this organism will cause any adverse environmental effects.

Based on the analysis found in the EA, I find that issuance of permits for the widespread field release of *C. salviniae* without management constraints or mitigating measures will not have a significant impact on the quality of the human environment.

/s/

December 12, 2002

Dr. Michael J. Firko
Assistant Director
APHIS Plant Health Programs
Plant Protection and Quarantine

Date