

BIOLOGICAL OPINION

on the Effects of Habitat Restoration Practices
by the U.S. Fish and Wildlife Service
on the Northern Population of the Bog Turtle

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Region 5 – Ecological Services

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INTRODUCTION

This document represents the U.S. Fish and Wildlife Service's (Service) programmatic biological opinion on the effects of its bog turtle habitat restoration program over a 5-year period. The projects considered in this opinion are those funded or conducted by the Service in the northern range of the bog turtle (*Clemmys (Glyptemys) muhlenbergii*) as well as those for which "take" is permitted by the Service via a Recovery Permit [10(a)(1)(A) permit]. This biological opinion is issued in accordance with Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.). (ESA)

During previous consultations regarding bog turtle habitat restoration projects, the Service recognized that many of the issues encountered were very similar from project to project. Consequently, the Service determined that a programmatic approach to the consultation process was appropriate and that completion of a programmatic consultation would streamline and expedite consultation on individual actions carried out by the Service. To ensure the risks associated with habitat restoration were minimized, the Service developed programmatic conservation measures that were incorporated into habitat restoration projects.

This programmatic consultation involves a two-tiered approach, with Tier 1 consisting of the programmatic consultation on the overall agency program and Tier 2 involving streamlined consultations on individual actions carried out under the habitat restoration program. This programmatic biological opinion serves as the Tier 1 consultation, evaluating the Service's habitat restoration program for a 5-year period, beginning with the issuance of this opinion. Individual habitat restoration projects or actions will undergo individual (Tier 2) consultation with the Service's Endangered Species Program to ensure consistency with recovery objectives and the programmatic conservation measures outlined in this opinion. Individual projects or activities that cannot be designed or carried out to conform to the protective programmatic conservation measures and projects that will exceed the anticipated effects or level of take described within this programmatic biological opinion will require a separate effects analysis and may require a project-specific biological opinion.

CONSULTATION HISTORY

On March 10, 2006, the Service issued a programmatic biological opinion regarding bog turtle habitat restoration practices to be authorized, funded, or carried out by the Service from 2006 to 2010. This biological opinion was subsequently extended through 2011.

In preparation for the new biological opinion, the Service evaluated data from several Service programs, including Endangered Species, Partners for Fish and Wildlife, Refuges, Coastal, and Wildlife and Sport Fish Restoration to determine the degree to which the previous programmatic biological opinion was implemented. Eighty-three bog turtle sites in 5 states have benefited from restoration practices that were funded or carried out, in whole or in part, by the Service under the previous programmatic biological opinion (Table 1). The Service had estimated that restoration practices would occur at 20 to 40 sites annually, totaling 100 to 200 sites over the 5-year period covered by the biological opinion. The number of sites restored during the term of the previous programmatic biological opinion (83) was substantially lower than our estimates.

Table 1. Number of bog turtle sites subject to various restoration practices (2006-2010).

HABITAT RESTORATION PRACTICE	CT	DE	MA	MD	NJ	NY	PA	Total	% of Sites Where Practice was Implemented
Maintenance Grazing	0	0	0	6	14	0	8	28	34%
Restoration Grazing	0	0	0	5	0	0	0	5	6%
Fence Installation	0	0	0	7	10	1	8	26	31%
Herbicide Application	0	2	0	12	29	1	14	58	70%
Vegetation Cutting/Removal (LIGHT equipment)	0	2	0	8	28	1	19	58	70%
Vegetation Cutting/Removal (HEAVY equipment)	0	0	0	1	8	1	15	25	30%
Total Number of Sites Restored	0	2	0	15	45	1	20	83	

Most bog turtle sites were subject to more than one type of habitat restoration practice. For example, fence installation typically occurred to facilitate maintenance grazing or restoration grazing, and herbicide application typically occurred with some type of vegetation cutting.

The programmatic biological opinion estimated bog turtles may be killed, injured, or harassed during site restoration activities, particularly those activities where heavy equipment was used in the wetland. The opinion also noted that incidental take would be very difficult to detect due to the small, cryptic, and secretive nature of the bog turtle. While monitoring was reported to have occurred at 58 of the 83 restoration sites (70%), a monitoring report was prepared for only three sites. Therefore, there is no record of the type of monitoring (e.g., restoration effectiveness, habitat impacts, incidental take monitoring) or monitoring results for most restoration efforts carried out at bog turtle sites.

“Treatment documentation” includes site-specific monitoring of the effectiveness of habitat restoration as well as the effects of habitat restoration on bog turtles and their habitat. It is one of the conservation measures that the Service committed to implement for herbicide treatment, cutting and removal of woody vegetation, and restoration grazing. The lack of reporting makes it difficult to document beneficial or adverse effects on bog turtles or their habitat as they relate to various restoration practices. However, a failure to monitor and report on the effects of habitat

treatment is not expected to have caused incidental take levels to exceed those estimated in the biological opinion, provided all other conservation measures to reduce the likelihood of take were implemented.

To date, incidental take has been documented and reported at only one bog turtle site – a single dead bog turtle was found where heavy equipment had been used during restoration activities in an occupied wetland. Incidental take in the form of undetected bog turtle death, injury, or harassment due to habitat restoration activities has probably exceeded one turtle, but we have no reason to believe it would have exceeded the levels estimated in the previous programmatic biological opinion because the number of habitat restoration projects was substantially less than originally estimated.

In preparation for the new biological opinion, the Service solicited input from biologists in various Service programs to determine whether restoration practices from the previous biological opinion should be revised and whether new restoration practices should be included. The Service also assembled a consultation team with representatives from the following Service program areas: Endangered Species, Partners for Fish and Wildlife, Environmental Contaminants, Coastal, and Wildlife and Sport Fish Restoration. Based on Service input and consultation team discussions, the following practices were considered for potential revision or inclusion in this biological opinion.

- Prescribed fire – This practice was already included in the previous biological opinion as a practice that is “not likely to adversely affect” bog turtles when carried out between November 1 and March 31. No changes to this practice have been proposed because 1) this practice appears to be marginally effective in controlling invasive woody vegetation and 2) the risk of conducting burns outside this seasonal window outweighs the potential benefits to bog turtles.
- Hydrological restoration of wetlands – This may benefit bog turtles by restoring hydrology (surface flow patterns, soil saturation) to affected areas of the wetland, and thereby expanding available, high-quality habitat. It would typically involve practices such as ditch plugging, breaking up tile drains, removal or dewatering of dams, and similar practices. Many of these practices would involve the use of heavy equipment in bog turtle sites, which poses a substantial risk of take. Consequently, the risk versus the benefits of this type of restoration must be carefully weighed. Because site-specific conditions will dictate site-specific design and restoration approaches, it would be very difficult to develop a programmatic project description, define programmatic conservation measures, and conduct a programmatic effects analysis. Therefore, these practices will not be included in this programmatic biological opinion, as their direct and indirect effects are best addressed through project-specific intra-Service consultations.
- Road removal – There are several instances where existing roads are known to bisect bog turtle wetlands, influencing wetland hydrology and posing a risk of mortality due to vehicular traffic. Road removal has the potential to restore former hydrological flows and reduce the risk of road-related fatalities to bog turtles. However, this is an infrequent restoration practice and another instance where site-specific conditions will dictate a site-

specific restoration approach and site-specific conservation measures. Therefore, this type of practice will not be included in the programmatic biological opinion, as its effects are best addressed through project-specific intra-Service consultations.

- Boulder placement – It was suggested that boulders be placed in wetlands to provide potential hibernacula for bog turtles. However, there is no indication that hibernacula are a limiting resource for bog turtles or that boulders would provide high-quality habitat if hibernacula were, in fact, a limiting resource. As this has not been identified as a threat, there is no need to carry out habitat restoration practices to attempt to alleviate it.
- Berm and dam construction – It was suggested that berms or dams be constructed to increase water levels in bog turtle wetlands. This practice has not been included in this programmatic biological opinion because 1) it is not clear that this practice would quickly or effectively control invasive native or exotic plant species and 2) the risks of this practice (e.g., bog turtle death, nest destruction, loss of suitable habitat) far outweigh the speculative benefits.
- Beaver control – It was suggested that beaver control measures be included in the programmatic biological opinion, as there are a few sites where beavers have partially flooded bog turtle habitat. Where bog turtle habitat is fragmented and isolated, the negative effects of flooding by beaver may need to be addressed. However, as this is not an issue at most bog turtle sites, we have not attempted to analyze the effects of beaver control measures at a programmatic level. When beaver control at a site is contemplated, it should undergo a project-specific, intra-Service consultation to evaluate the direct and indirect effects of such control.
- Use of triclopyr in a basal bark formulation (e.g., Pathfinder® II) to control woody vegetation – This is included in the new programmatic biological opinion due to its effectiveness and efficiency of application, especially when compared to more labor-intensive practices, such as cut-stump and hack-and-squirt herbicide application methods.
- Use of imazapyr wherever glyphosate use is allowed – It was suggested that the use of imazapyr be allowed for all target plant species and all herbicide application methods. This recommendation has not been adopted because unlike glyphosate, imazapyr has high mobility and long persistence in the environment, and it does not bind readily to soils. Consequently, it can remain active for several months, increasing the risk of bog turtle exposure and non-target plant impacts. Therefore, imazapyr's use is limited to the injection application method and to re-treatment of dense Phragmites and cattail stands.
- Restoration grazing by cattle – It was suggested that cattle be used for the purpose of restoration grazing. The previous biological opinion considered restoration grazing by goats and sheep at grazing densities that exceed “light to moderate grazing” densities; however, it did not consider the use of cattle at the higher densities. As the potential adverse effects associated with higher grazing densities (soil erosion, degradation of native vegetation, trampling of bog turtles and nests), may be magnified by the use of heavy grazers such as cattle, this biological opinion does not contemplate the use of cattle

at restoration grazing densities. However, it should be noted that cattle grazing at “light to moderate grazing” levels may result in both the restoration and maintenance of bog turtle habitat, while ensuring the grazing density is compatible with bog turtle conservation. It should also be noted that restoration grazing is typically for the purpose of woody vegetation control, which can be effectively accomplished with goats (which browse) rather than cattle (which graze).

- Mowing of herbaceous vegetation with low ground pressure equipment – The previous programmatic biological opinion considered the effects of cutting and removal of woody vegetation using heavy equipment and light equipment. However, it did not consider the mowing of herbaceous vegetation with low ground pressure equipment. As mowing is a practice that is used to maintain wetland habitats in an open-canopy condition and is also compatible with the conservation of bog turtles when done appropriately, it has been added to the biological opinion.
- Bog turtle management – It was suggested that bog turtle management practices (e.g., installation of nest protectors, trapping of predators) be included in the programmatic biological opinion. However, these types of activities are outside the scope of this opinion, which focuses on habitat restoration and maintenance activities; therefore, they have not been included.

BIOLOGICAL OPINION

This biological opinion is based on the proposed implementation of bog turtle habitat restoration projects by the Service using the methods detailed in this opinion to restore or maintain habitat, while minimizing the risk of take. Supporting information for this opinion includes the *Bog Turtle (Northern Population) Recovery Plan* and other information available in Service files. A complete administrative record of this consultation is on file at the Service’s Pennsylvania Field Office.

Description of the Proposed Action

The northern population of the bog turtle (*Clemmys (Glyptemys) muhlenbergii*) faces three primary threats 1) habitat loss, degradation, and fragmentation due to development; 2) habitat degradation due to succession and invasive exotic plant species; and 3) illegal collection. This opinion addresses the Services’ role in implementing, permitting, or funding the implementation of, habitat restoration or maintenance activities to counter the threat of habitat succession and invasive exotic plant species. The recovery plan for the northern population of the bog turtle identifies controlling succession and invasive exotic plants (task 6.3.1) as a priority 1 recovery action (Service 2001). Methods of control vary depending upon the target plant species and may include chemical control (herbicides), biological control (e.g., introduction of insects, grazers), burning, and mechanical or manual removal.

Habitat restoration and maintenance methods are discussed in detail under *Proposed Practices and Their Effects*. The Service has committed to funding, authorizing and implementing habitat

restoration and maintenance practices consistent with the specific methods and measures detailed in this biological opinion. Any projects that do not meet these descriptions are beyond the scope of this opinion; those projects will, therefore, be subject to further intra-Service consultation.

In the northern range of the bog turtle, the Service proposes to fund or implement bog turtle habitat restoration and maintenance practices over the next 5 years (Table 2). Restoration and maintenance projects are often carried out by the Service in cooperation with one of more partners, which may include landowners, land managers, state wildlife agencies, and non-government organizations. The Service funds the implementation of habitat restoration and maintenance projects through various grant programs, including Section 6 and State Wildlife Grants.

This opinion also considers the implementation of habitat restoration and maintenance projects that are authorized by the Service through the issuance of section 10(a)(1)(A) permits under the ESA. These Recovery Permits authorize limited levels of take for activities that are expected to have an overall beneficial effect on the species and contribute to its recovery. The expansion of the biological opinion to cover permitted activities will allow private landowners, conservation organizations, and others to carry out bog turtle habitat restoration and maintenance activities that are consistent with this biological opinion, in coordination with the Service. This biological opinion fulfills the intra-Service consultation necessary for those recovery permits.

Table 2. Anticipated number of bog turtle sites subject to habitat restoration practices (2012-2016)

Action	Estimated Number of Bog Turtle Sites Affected Annually	Estimated Number of Bog Turtle Sites Affected Cumulatively
SERVICE funding or SERVICE implementation of habitat restoration	30	150
SERVICE authorization of take during habitat restoration via Recovery Permits	30	150
TOTAL	60	300

Action Area

The action area affected directly and indirectly by bog turtle habitat restoration projects employing practices considered in this biological opinion includes wetlands in the seven-state northern range of the bog turtle. These states include: Connecticut, Delaware, Maryland, Massachusetts, New Jersey, New York, and Pennsylvania. Wetlands subject to restoration will vary in size, but all are undergoing invasion by woody and/or invasive herbaceous vegetation. The action area also includes upland areas immediately adjacent to these wetlands.

Status of the Species and Aspects of the Rangewide Environmental Baseline Pertinent to Habitat Restoration Activities

The northern population of the bog turtle, which occurs in seven states ranging from Massachusetts to Maryland, was added to the list of threatened species in 1997. Primary threats to the bog turtle are loss, fragmentation, and degradation of its fragile, early successional wet-meadow habitat and collection for the wildlife trade (SERVICE 1997). Critical habitat has not been designated for this species because identifying site locations could serve to facilitate and exacerbate illegal collection of bog turtles.

Bog turtles are semi-aquatic and active from April to mid-October in the northern part of their range. They hibernate from October to April, often just below the upper surface of frozen mud or ice (Chase *et al.* 1989, Feaga 2010, Pittman and Dorcas 2009). Their varied diet consists of slugs, beetles, lepidopteran larvae, caddisfly larvae, snails, nematodes, millipedes, fleshy pondweed seeds, sedge seeds, carrion, and green frog tadpoles (Barton and Price 1955, Nemuras 1967, Zappalorti 1997). Bog turtles usually occur in small, discrete populations occupying suitable habitat dispersed along a watershed (Buhlmann *et al.* 1997, Collins 1990).

Bog turtles typically inhabit shallow spring-fed fens, sphagnum bogs, swamps, marshy meadows, and pastures with soft muddy areas. These emergent wetlands are usually a mosaic of shallow water and soft mud, low grasses and sedges, and interspersed wet and dry pockets. Spring seeps often form a network of small rivulets in the wetland. The open canopy of these wetlands provides sunlight for basking and nesting and is essential for continued use by bog turtles. Roots of interspersed trees and shrubs within this saturated area provide structure for hibernacula. Bog turtle habitats are sustained primarily by groundwater, although surface water also contributes to wetland maintenance. Bog turtles depend upon relatively stable, year-round supplies of clean groundwater to support their food base, brumation (hibernation) and aestivation areas, and their nesting habitat. The shallow water and deep “mucky” soils (see Glossary) are crucial bog turtle habitat components. Soft substrates and water levels just above or below the surface protect bog turtles against freezing and overheating (Feaga 2010, Pittman and Dorcas 2009,) as well as from predators (Carter *et al.* 1999). Multiple authors have reported on bog turtle hibernation periods and site characteristics throughout its range (Chase *et al.* 1989, Ernst *et al.* 1989, Feaga 2010, Pittman and Dorcas 2009, Whitlock 2002). They found turtles hibernating in spring-fed rivulets under soft mud below shrub and tree roots, sedge clumps, and mats of emergent vegetation, in muskrat and small mammal burrows, and along ditch and stream edges. Bog turtles have frequently been observed in communal hibernacula, sometimes with other turtle species (S. Smith *in litt.* 2000, A. Whitlock, pers. comm).

Female bog turtles in the northern population reach sexual maturity between 6 and 11 years of age (Ernst 1977, Whitlock 2002). Mating occurs and females deposit from two to six white eggs (average 3.5) in sphagnum moss or sedge tussocks in May and June (Ernst 1994, Whitlock 2002). The eggs hatch after an incubation period of 48 to 103 days (Zappalorti *et al. in litt.* 1997, Whitlock 2002), and the young emerge in August to mid-September (Arndt 1977, Zappalorti *et al., in litt.* 1997, Whitlock 2002). Infertile eggs are common (Zappalorti *et al.* 1997, Whitlock 2002), and not all females produce clutches annually (Whitlock 2002). There is no evidence to suggest that multiple clutches are deposited in a single season.

Bog turtles inhabit sub-climax seral wetland stages and are dependent on riparian systems that are unfragmented and sufficiently dynamic to allow the natural creation of meadows and open habitat to compensate for the closing over of habitats caused by ecological succession. Succession of many wetlands from open-canopy fens to closed-canopy red maple (*Acer rubrum*) swamps contributes to the loss of bog turtle habitat. Spread of exotic invasive vegetation, including common reed (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*), multiflora rose (*Rosa multiflora*), and reed canary grass (*Phalaris arundinacea*), also degrades bog turtle habitat in many locations. Soil disturbance and roads often provide avenues for the introduction or spread of invasive native and exotic plants.

Based upon documented losses of bog turtles and their habitat, the northern population has declined by at least 50 percent, with most of the documented decline occurring over the past 30 years. Significant declines are likely to have occurred prior to this due to the filling and draining of wetlands.

As of 2011, bog turtles have been documented at approximately 545 individual sites (based on records within the past 30 years and not including road finds with no associated habitat), ranging in quality from good to poor, within the northern range (Table 1, Whitlock *in litt.* 2011). These represent individual wetlands where the species has been confirmed. These sites or occurrences are not equivalent to the “population analysis sites” (PAS)² or sub-populations referred to in the bog turtle recovery plan. In some cases, sites are close enough together to allow turtle movement between wetlands; therefore, the clustering of multiple sites or occurrences into sub-populations (PAS) would better reflect the species’ status. However, due to widespread wetland habitat fragmentation throughout the bog turtle’s range, many sites consist of only one small, marginally viable, extant occurrence, often isolated from other such occurrences and under threat of development (SERVICE 2000, p. 5).

Habitat loss, degradation, and fragmentation and illegal collecting for the pet trade are the primary threats to the species. Direct habitat loss or degradation has occurred from the draining, ditching, dredging, or filling of suitable sites for agricultural use, development, and pond or reservoir construction. The proximity of many remaining bog turtles to roadways and population centers exposes these populations to increased predation, road kills, pollution, and establishment of invasive native or exotic plant species which pose a significant indirect threat to the species. The eggs and young bog turtles are particularly vulnerable to predators such as rodents, mink, raccoons, opossum, skunks, fox, snapping turtles, water snakes, and larger birds. Populations of many of these predators are elevated in areas of high human activity.

¹ The term “occurrence” refers to bog turtles associated with a specific location or site, typically a specific discrete wetland. One or more occurrences may make up a Population Analysis Site (PAS). Occurrences are grouped to form a PAS based on specific criteria (see Footnote 2).

² The term “Population Analysis Site” (or “PAS”) refers to a wetland or group of wetlands supporting bog turtles, as defined by Klemens’ 1993 Standardized Bog Turtle Site-quality Analysis (see Appendix C in the Bog Turtle Recovery Plan). Individual wetlands occupied by bog turtles are clustered or grouped into a PAS if they are part of the same wetland system/drainage basin and there are no major impediments to turtle movements between the wetlands.

The bog turtle is also vulnerable to local extirpation and range-wide reduction due to the small size and isolation of many populations, delayed sexual maturity, low juvenile recruitment, low mobility, and small home range (Arndt 1977, Chase *et al.* 1989). Population modeling and sensitivity analysis show that the viability of turtle populations is far more dependent on adult survivorship than hatchling survivorship. Many species models show that the added loss of even one adult at a site may compromise the survival of that population (Whitlock 2002). In addition, the isolation of populations limits gene flow which could result in inbreeding depression. Furthermore, isolation and habitat fragmentation prevent the re-colonization of existing habitat where populations have declined or disappeared as well as the expansion and colonization of newly created habitat (62 FR 59620). Regional simulation models indicate that complexes of bog turtle populations comprising greater than or equal to 4 inter-connected populations of greater than or equal to 20 individuals may persist for greater than or equal to 100 years if core habitat is conserved (Shoemaker 2011).

Multi-year, mark-recapture studies have been conducted at only a few sites range-wide. Fewer than 35 of 545 sites have estimates of more than 30 individuals, and fewer than 10 of these sites have reports of more than 100 individuals. Further, based on the repeated finding of only old individuals at some sites and the degraded condition of existing habitat at many locations, many sites are thought to support small numbers of turtles – probably between 10 and 20. Considering the species’ low reproductive potential and small sub-population numbers, it is critical to protect mature adults and attempt to boost nesting success to prevent further population declines.

Table 1. Bog Turtle Occurrences in the Northern Range

State	Counties of Occurrence	Number of Extant Occurrences
Connecticut	1	4
Delaware	1	8
Maryland	4	83
Massachusetts	1	3
New Jersey	10	182
New York	8	72
Pennsylvania	15	193
TOTAL	40	545

In an effort to address the threats posed by habitat succession and invasive species, habitat restoration activities have been undertaken throughout the northern range of the bog turtle. A state-by-state summary of recent habitat restoration activities is presented below (Whitlock *in litt.* 2011).

Delaware – All of Delaware’s sites are threatened by invasive species and/or natural succession. Two wetlands have active management occurring. One landowner conducts regular mowing to control multiflora rose, and uses herbicides to manage other invasive species on the perimeter of the site. Efforts to obtain management agreements with other landowners are in progress.

Connecticut – Three Connecticut sites are dominated by early successional and invasive species. Purple loosestrife, common reed, multiflora rose, cattails and red maple are the primary concerns at these locations. No locations have received recent vegetation management treatments.

Maryland – Of 112 Maryland bog turtle wetlands assessed for invasive species from 1993 to 2004, 29 wetlands had 51 to 75 percent invasive species cover, while invasive species cover at 17 wetlands was greater than 75 percent. Habitat restoration activities have been conducted at 26 Maryland bog turtle wetlands totaling more than 150 acres since 1997. Thirteen extant bog turtle sites have received recent active management for invasive control.

Massachusetts – The three Massachusetts sites have undergone limited treatment for invasive and successional species during the past several years. The Nature Conservancy (TNC) has actively managed two sites for the last 15 years while a third site has been grazed and burned by the landowner. Invasive species cover was at 50 to 75 percent with red maple, *Phragmites* and reed canary grass being the predominant threats.

New Jersey – Of the 182 occupied bog turtle wetlands in New Jersey, 48 have some degree of habitat degradation caused by succession, invasive species, or a combination of both. Habitat conditions at most (77 percent) of the extant bog turtle sites have not been assessed. The 72 PAS that New Jersey identified as viable (SERVICE 2001) have been the focus of their long-term bog turtle restoration conservation strategy, which includes habitat management and restoration, developing cooperative relationships with private landowners, and acquiring sites threatened by secondary impacts. Through this program, habitat management has been carried out at 27 percent (49 of 182) of their extant bog turtle occurrences.

The New Jersey Endangered and Nongame Species Program with support from USDA initiated habitat restoration activities at several degraded sites. Woody vegetation (red maple, alder, poison sumac) has been managed at some of the sites using the hack and squirt technique with Rodeo® or the cut stem technique. One hundred percent elimination occurred for all targeted species within 1 to 2 applications (1 to 2 years).

From 1998 to 2004, 685,414 *Galerucella* spp. beetles were released at 36 bog turtle sites to control purple loosestrife over time. These beetles weaken and kill purple loosestrife plants, reducing loosestrife cover in wetlands. Recovery of beetles the following year after release constitutes successful establishment of the beetle and has been made at all 36 sites.

Twenty active grazing projects are underway targeting *Phragmites*, reed canary grass, purple loosestrife, multiflora rose, and woody vegetation. Grazing has eliminated roughly 85 percent of *Phragmites*, purple loosestrife, and multiflora rose over 3 years. The remainder of *Phragmites* has been controlled using the snip and drip technique (applying Rodeo® to the cut shoot). Reed canary grass has been grazed to a low height; it is nearly impossible to eliminate (Zarate, pers. comm., 2005).

New York – Of approximately 72 known extant bog turtle sites, generally all have some degree of habitat degradation through either succession or invasive species encroachment. Habitat restoration projects have been initiated at least 23 sites. Vegetation control techniques include

Galerucella spp. beetle release, manual vegetation removal, herbicide application, tree girdling, and grazing using cows, goats, and/or sheep. Vegetation monitoring has occurred at almost all sites involving Natural Resources Conservation Service (NRCS), and bog turtle habitat use is being studied pre- and post-restoration using radio-telemetry at a sample of restoration sites.

In southeastern New York, major progress has been made in the last several years in engaging with private landowners to restore bog turtle habitat. Eighteen restoration projects are underway at known bog turtle sites, and an additional six projects are underway at sites that are part of wetland complexes with known populations. Most of these projects are occurring on privately owned lands, and private landowners have generally responded very positively to the initiative. These projects have been organized and funded by a broad working group of conservation partners, including NRCS, the Service, Environmental Defense Fund, TNC, New York Natural Heritage Program, and New York Department of Environmental Conservation. These efforts have laid the groundwork for further recovery progress. Many of the restoration projects were funded through the NRCS Wetlands Reserve Program, and NRCS is planning to work with conservation partners to convert projects from 10-year landowner agreements to permanent conservation easements.

Pennsylvania –Management at 19 of the 193 extant bog turtle sites in Pennsylvania has been reported. Succession is known to occur to some degree at 74 sites, but like New Jersey, most of Pennsylvania's sites (approximately 65 percent) have not been assessed. Many bog turtle sites in Pennsylvania have been degraded by red maple, reed canary grass, and *Phragmites*. Purple loosestrife and multiflora rose also pose a threat to bog turtle habitat, but to a lesser degree at this time. Over the past few decades, it appears that the elimination of grazing on an increasingly suburban landscape has allowed invasive plants and woody vegetation to overtake the open, emergent wetlands favored by bog turtles. The Service's Partners for Fish and Wildlife Program has installed fencing at three bog turtle sites, facilitating the introduction of grazing and restoration of habitat. Woody vegetation control using mechanical or chemical treatment has occurred at several sites, opening up the canopy and restoring emergent wetland conditions suitable for bog turtles. Habitat restoration projects have also been undertaken by various conservation partners, including the Berks County Conservancy, TNC, Environmental Defense Fund, the Commonwealth of Pennsylvania, and private consultants.

Practices Not Likely To Adversely Affect Bog Turtles

During previous informal consultations (e.g., intra-Service consultations between the Service's Endangered Species and Partners for Fish and Wildlife Programs), the following habitat restoration and maintenance practices have been determined not likely to adversely affect bog turtles and have been excluded from the formal consultation process. These practices have been and will continue to be implemented to restore and maintain bog turtle habitat, and their effects are expected to be wholly beneficial. If information becomes available indicating that any of these practices may have an adverse effect on bog turtles, consultation on the practice(s) will be initiated.

Project proposals that involve only these specific habitat management practices do not require any additional intra-Service consultation so long as no activities beyond those described here are

undertaken in the wetland. However, to ensure recovery actions benefitting the bog turtle are effectively planned, implemented, monitored, and tracked, actions indicated in **bold** below will be coordinated with the Service's Endangered Species Program in the State where the activity will occur. This will be done on a project-by-project basis.

- ✓ Installation of fencing in upland areas for the purpose of introducing “light to moderate grazing” (see *Glossary*) in bog turtle habitat.
- ✓ Hand-installation of fencing in wetlands at any time of year to facilitate “light to moderate grazing” (see *Glossary*). Prior to hand installation, a “bog turtle specialist” (see *Glossary*) or “monitoring biologist” (see *Glossary*) will search the wetland work areas (e.g., surface and substrate where the fence posts will be placed) to ensure bog turtles are not present. No vehicles will be used in the wetland.
- ✓ Installation of interior, partition fencing or movement of such fencing within wetlands at any time of year. Interior, temporary fencing is supported by small-diameter (not to exceed 1 inch in diameter), hand-placed poles (e.g., 1-inch diameter fiberglass rods).
- ✓ Prescribed burning in wetlands between November 1 and March 31. Some of the dead emergent vegetation in mucky areas of the wetland will remain unburned to provide cover for bog turtles when they emerge in the spring.
- ✓ Introduction of biological control beetles (i.e., *Galerucella californiensis* and *G. pusilla*) in wetlands to control purple loosestrife (*Lythrum salicaria*).
- ✓ Introduction of biological control weevils (i.e., *Rhinoncomimus latipes*) in wetlands to control mile-a-minute weed (*Persicaria perfoliata*) (formerly *Polygonum perfoliatum*).
- ✓ Application of glyphosate, triclopyr, or imazapyr (following label directions) in uplands adjacent to wetlands occupied by the bog turtle. This refers specifically to the application of these herbicides to control invasive plant species problematic to the bog turtle (e.g., multiflora rose, mile-a-minute weed), provided there is no application of herbicide in the wetland.
- ✓ Girdling of woody vegetation in wetlands. Approximately 10 to 20 percent of the tree and shrub cover in “mucky areas” (see *Glossary*) of the wetland will be retained (i.e., not treated), especially alder, red maple, and poison sumac located in or near seeps, springs, rivulets, and mucky areas.
- ✓ Cutting and/or removal of woody vegetation less than or equal to 3 inches in diameter at breast height (d.b.h.) between October 1 and March 31 using light equipment (e.g., chainsaw, ax – see *Glossary*). No vehicles will be used in the wetland.

Note: Cutting done outside this window, cutting of larger d.b.h. vegetation, and cutting that is followed by herbicide application are practices that may affect bog turtles.

Therefore, these practices, along with conservation measures to minimize take, are included in this biological opinion under Cutting and Removal of Woody Vegetation.

- ✓ Cutting of herbaceous vegetation between October 1 and March 31 using light equipment (e.g., hand-held weed trimmer). Vegetation will be cut to a height of at least 8 inches to ensure adequate cover. No vehicles will be used in the wetland.
- ✓ “Light to moderate grazing” (= habitat maintenance grazing) within wetlands. In the final listing rule for the bog turtle, the Service recognized the beneficial effect of grazing in controlling succession and maintaining bog turtle habitat. While grazing could potentially result in the death or injury of bog turtles due to trampling, the risk of take was considered very low and the benefits of grazing were determined to significantly outweigh this risk of take. Therefore, the Service determined that “light to moderate livestock grazing that prevents or minimizes the encroachment of invasive native and exotic plant species” is an activity that will not result in a violation of section 9 of the ESA (*Federal Register*, Vol. 62, No. 213, p. 59621).

For the purpose of this opinion, “light to moderate grazing” is defined as grazing using a stocking density of less than 0.75 animal units per acre of “grassland” within the fenced enclosure. “Grassland” is defined as open, grassy areas such as areas with emergent wetland vegetation (e.g., sedges, rushes); upland pasture grasses (e.g., fescue, timothy); or invasive, exotic plants (e.g., *Phragmites*, reed canary grass). This stocking density is equivalent to one dairy cow per 2 acres, four sheep per acre, or five goats per acre of grassland within the fenced enclosure. See Appendix B for an animal unit equivalents guide. Grazers have access to both upland and wetland areas, and large grazers (see *Glossary*) are excluded from known nesting areas during the bog turtle nesting season (June 1 to September 30).

Although there have been documented cases of cattle stepping on and killing or injuring bog turtles (Feaga 2010, Herman 2005), the risk of this happening is very small when the density of large grazers (e.g., cattle, horses) is low and when those grazers also have access to upland areas. Under these conditions, grazers are not in the wetland continuously, and when they are present in the wetland, they are there at a low density. In addition, large grazers (see *Glossary*) will be excluded from known nesting areas during the nesting season (June 1 to September 30), further minimizing the risk to turtles and their nests. When grazing is carried out in the manner described above, grazing is considered a beneficial activity and the risk of take is considered to be low.

Proposed Practices and Their Effects

The following practices are proposed to restore or maintain bog turtle habitat to further the recovery of the species. These practices are expected to have a beneficial effect, but due to the use of heavy equipment or herbicides, there is also the potential for adverse effects³.

³ In the past, some project-specific analyses have determined that practices similar to those described here were not likely to adversely affect bog turtles because all the potential direct and indirect effects were beneficial, discountable, and/or insignificant. As a result, no incidental take monitoring was conducted. Although it is likely

To minimize the risk of take, each habitat restoration/maintenance practice includes conservation measures. Conservation measures represent actions pledged in the project description that the action agency or the applicant will implement to reduce potential adverse effects. The beneficial effects of conservation measures are taken into consideration in the Service's conclusion of jeopardy or non-jeopardy to the listed species and in the analysis of incidental take.

The intent of each of the practices listed below is to restore or maintain bog turtle habitat. Therefore, each practice represents a conservation activity consistent with the habitat restoration and maintenance task in the bog turtle recovery plan (task 6.4). In addition, practice-specific conservation measures have been incorporated into the project description for each of the proposed practices. These measures are designed specifically to avoid and minimize impacts of the proposed action on the bog turtle. The Service has analyzed the effects of the proposed practices based on the assumption that all conservation measures will be implemented. Implementation of the conservation measures will minimize the risk of take, ensuring the beneficial effects of habitat restoration will outweigh the risks of undertaking these activities. The specified duties of the bog turtle specialist and the monitoring biologist are especially important to assuring the effective implementation of the conservation measures and consistency of projects with all aspects of this opinion.

Because the habitat restoration and maintenance practices discussed in this opinion have received little or no monitoring, the effects of these practices on both the bog turtle and its habitat will be evaluated as projects are completed. This opinion considers the effects of implementing the following practices over a 5-year time period, from 2012 to 2016, after which the practices and their effects will be re-evaluated to determine whether they continue to be consistent with this opinion and the recovery needs of the species.

1. Installation of Fencing to Facilitate Grazing

Project Description – To facilitate the introduction and/or management of grazers, fencing will be installed to provide an appropriate amount of pasture. Both upland and wetland areas will be made available to grazers. Fence posts will typically be installed with a fence post pounder attached to a tracked or wheeled vehicle, such as a skid steer. Use of this equipment allows posts to be quickly and efficiently driven deep into the substrate, below the frost line to ensure the posts remain in place. To install fencing, low ground pressure equipment will be used (less than or equal to 3.1 psi) to minimize soil disturbance and compaction. Vehicles will typically make a single pass over the route of the fence alignment when installing fencing. Also, fencing will be installed only for the purpose of facilitating “light to moderate grazing” (= maintenance grazing, see *Glossary*) or restoration grazing (see Practice #5 in this opinion).

Conservation Measures – To minimize the risk of take, the following conservation measures will be implemented in wetlands occupied by bog turtles.

that these practices would similarly be found not likely to adversely affect bog turtles in many future project-specific analyses, in the interest of expediting future restoration projects, the Service has elected to presume that the potential for adverse effects warrants formal analysis, formulation of a biological opinion, and an incidental take statement.

1. *Site reconnaissance* – A bog turtle specialist (see *Glossary*) will conduct an on-site evaluation to identify threats and potential threats to bog turtles and their habitat and determine appropriate measures to eliminate or minimize those threats. The monitoring biologist, landowner, and individuals who will be conducting habitat restoration or management activities should be present for this on-site evaluation or should plan on participating in a subsequent site visit with the specialist to discuss the feasibility of carrying out the recommended restoration or management practice(s), as well as to discuss the implementation of practice-specific conservation measures at the site-specific level.

The bog turtle specialist will carry out the roles detailed in the *Glossary*, including, but not limited to, the identification of appropriate restoration practices, mapping of nesting and hibernating areas, and identification of treatment areas.

2. *Site restoration/management plan* – After the site has been field-viewed by a bog turtle specialist to determine which restoration or management activities are necessary and appropriate, a detailed project description, project location map, and site map will be prepared. The project location map will identify the project's location on a U.S. Geological Survey topographic map. The site map will identify the property boundaries, wetland boundaries, known nesting and hibernating areas, and the proposed fence alignment in the wetland and upland. The project narrative will include information about the type and density of proposed grazers, the acreage of wetland and acreage of upland to be fenced, and short- and long-term grazing objectives. This information will be submitted to the Service's Endangered Species program in the state where the work will be conducted (Appendix C) for a project-specific Tier 2 consultation.
3. *Stocking density* – The Service will install, fund, or permit the installation of fencing only to facilitate "light to moderate grazing" (= habitat maintenance grazing, see *Glossary*) or habitat restoration grazing done in accordance with this biological opinion or future amendments to this document. The Service will make landowners, grant recipients, and permit holders aware of the need to remain within these stocking densities to avoid unauthorized incidental take. These notifications will be done via landowner agreements, grant contracts or agreements, or Recovery Permits. They will also be made aware of the need to exclude large grazers (see *Glossary*) from known nesting areas during the nesting season (see Conservation Measure 9). Known nesting areas are areas where bog turtle nests have been found.
4. *Monitoring biologist* (see *Glossary* for a complete description of responsibilities)
 - Prior to fence installation, a monitoring biologist (see *Glossary*) will walk through the wetland to identify "mucky areas" (see *Glossary*), particularly along the proposed fence alignment. The monitoring biologist will work with the project proponent and landowner to avoid or minimize encroachments into mucky areas when laying out the fence alignment.

- During fence installation, the monitoring biologist will ensure that sensitive areas, including known nesting and hibernating areas are avoided.
 - The monitoring biologist will help to identify the most appropriate travel routes (see *Glossary*) for heavy equipment within the wetland. These travel routes will avoid mucky areas and known nesting and hibernating areas.
 - A monitoring biologist will be present on site the first day restoration activities are undertaken to brief workers on the conservation measures and ensure that sensitive areas are avoided. In addition, the monitoring biologist will conduct site inspections periodically during restoration to ensure that the conservation measures are being implemented appropriately.
5. *Spill avoidance* – To reduce the risk of spills within the wetland, vehicles and heavy machinery will be serviced in upland areas. When it is necessary to fuel light equipment (chainsaws, hand-held power augers, etc.) in the wetland, absorbent pads will be used to catch and contain any spills.
 6. *Siting posts* – Wherever possible, fence posts will be installed in upland areas. Where this is not feasible (e.g., where it is necessary to install fencing within the wetland due to the location of property boundaries), fence posts will be installed in non-mucky areas within the wetland whenever possible. When it is necessary to install fence posts in mucky areas (see *Glossary*), small-diameter, hand-set posts (e.g., fiberglass rods) will be used whenever possible.
 7. *Installing fencing using heavy equipment (see Glossary)*
 - When it is necessary to install fencing or fence posts in wetlands using heavy equipment, only low ground pressure equipment will be used (less than or equal to 3.1 PSI), and installation will occur between November 1 and March 31
 - Heavy equipment will use pre-determined travel routes when working in the wetland. Travel routes will avoid mucky areas and known nesting and hibernating areas.
 8. *Installing fencing by hand*. When fencing will be installed in the wetland by hand (i.e., using light equipment such as hand-operated augers), installation may occur at any time of year. In cases where fencing is installed in uplands or where a monitoring biologist inspects work areas in wetlands, the hand-installation of fencing is an activity that is not likely to adversely affect bog turtles.
 9. *Known nesting areas*. Fencing will be installed to exclude large grazers (see *Glossary*) from known bog turtle nesting areas during the nesting season (June 1 to September 30). In most cases, this will be done by the landowner using temporary, partition fencing.

10. *Known hibernacula.* Where there are known hibernacula, the bog turtle specialist and monitoring biologist will ensure the fence line and heavy equipment travel routes are at least 50 feet from these hibernacula.
11. *Landowner Guidance.* At sites where the Service has installed, funded, or authorized (permitted) the installation of fencing to facilitate grazing, the Service will provide technical assistance to landowners on appropriate grazing densities, grazing methods, and desired wetland habitat conditions. This will typically require one or more site visits to assess the effect that grazers are having on wetland vegetation and soils, with adjustments being made as necessary to achieve desired habitat conditions for bog turtles. To avoid unauthorized take of bog turtles, landowners will be advised to avoid placing salt licks, livestock feeders, and livestock watering devices in or within 50 feet of wetlands occupied by bog turtles.
12. *Treatment Documentation.* Areas that have been fenced to facilitate grazing will be inspected to determine the effectiveness of grazing in restoring or maintaining bog turtle habitat. A monitoring report (see Appendix E for template) will include the acreage fenced (wetland and upland acres tallied separately), the number and type of grazers, the density of grazers, and the observed condition of the bog turtle's habitat. This report will be submitted by December 31 of the year following fencing installation. This information will assist the Service in 1) identifying the risks, benefits, and effectiveness of various habitat restoration practices; 2) tracking recovery implementation; and 3) determining if changes to this opinion are necessary to further the recovery of the bog turtle.

Effects of the Action – Fencing allows landowners to manage the location and numbers of grazers. Fences required to manage grazers must cross wetlands containing bog turtles in a variety of circumstances, such as where the entire wetland is larger than the restoration area, where wetlands cross property boundaries, or where fencing is necessary to keep grazing animals from entering another part of the wetland (e.g., riparian buffer, forested wetland, and bog turtle nesting area).

Indirect beneficial effects include maintenance of intermediate stages of native plant succession that support optimal densities of bog turtles. The bog turtle recovery plan (p. 13) indicates that grazing by domestic livestock in bog turtle wetlands has “either replaced grazing by native herbivores or replaced one of the other historical factors (e.g., beaver, fire) that would have acted to maintain the wetlands in an early successional stage.” Grazers are able to maintain wetlands in an emergent condition by grazing on competing invasive vegetation and breaking up the root system of invasive species, such as reed canary grass. This maintains open areas within the wetland for nesting, basking, and escape cover. Improvements in bog turtle habitat conditions following introduction of grazers at several New Jersey sites is described by Tesauro (2001). The risk of take is extremely low when grazing is done in accordance with the “light to moderate grazing” guidelines. During bog turtle surveys in North Carolina, where many sites are actively grazed over the past 30 years, Herman (2005) reported that he had found or seen over 1500 bog turtles of which fewer than 10 were definitely injured by livestock. Two were killed and the others had old healed-over injuries that he assumed were caused by trampling. Based on his

field surveys, the observed death and injury rate was 0.67 percent of the located turtles. Feaga (2010) reported a dead bog turtle in a pasture, apparently flipped and trodden by livestock. The actual rate may be slightly higher because dead turtles would not be expected to persist in the wetland due to scavengers. Nevertheless, the benefits of maintaining or restoring high-quality habitat outweigh the low risk of taking bog turtles. Adherence to the grazing guidelines will ensure that the risk of take is minimized to acceptable levels.

The installation of fencing to support grazing poses a direct risk of injury or death to turtles, but the conservation measures listed above will substantially reduce that risk. In most cases, at least part of the fencing will be installed in uplands, avoiding any impacts to bog turtles. When it is necessary to install fencing in wetlands using heavy equipment (see *Glossary*), it will be installed between November 1 and March 31, when bog turtles are hibernating (brumating) or concentrated near their hibernation areas. These are areas of the wetland having soft saturated soils and/or subsurface tunnels, along with appropriate hydrological conditions (springs, seeps, subsurface flow) to prevent the turtles from freezing. Although the locations of these hibernacula will not usually be known prior to project implementation, the risk of take will be minimized by reducing equipment encroachments into areas of the wetland that are potentially suitable for hibernation (i.e., mucky areas) and by using low ground pressure equipment within wetlands.

Driving equipment through the wetland to install fencing is safer when turtles are hibernating, because during this period turtles are concentrated in the areas of the wetland where vehicle use is least likely to occur. In addition, the vehicle installing the fencing is expected to make a single pass through any mucky areas along the fence alignment. A single pass with low ground pressure equipment reduces the risk of killing or injuring bog turtles by minimizing both the size and severity of the encroachment footprint within sensitive habitat.

Despite implementation of these conservation measures, there remains some risk of take. In situations where it is necessary to install fence posts in mucky areas, it is possible that a post(s) will hit and kill or injure one or more hibernating turtles. When heavy equipment is driven through mucky areas, hibernating turtles could be crushed (killed), injured, or displaced from their hibernacula, placing them at an increased risk of death. This could also occur if vehicles break through the snow/ice cover over mucky areas supporting hibernating turtles. Despite the use of low ground pressure equipment, bog turtles sometimes hibernate as shallow as 2 inches from the surface, placing them at risk of being crushed, embedded within, or displaced from their hibernating location when the equipment passes over them. Feaga (2010) documented hibernation depths of 5 to 55 cm below the surface. If a hibernating turtle is displaced from its hibernaculum due to fence post installation or vehicle use in mucky areas, the turtle may avoid immediate death/injury but have to re-position itself in an appropriate hibernating location. If it has been forced to the surface, a combination of cold temperatures and slow body metabolism may prevent it from successfully locating an appropriate hibernating spot, leading to death. The installation of fencing by hand also poses some (albeit low) risk if a monitoring biologist is not present to inspect the project area for turtles prior to work activities. When fencing is installed by hand during the bog turtle active season (approximately April to mid-October), turtles may be present anywhere in the wetland. Bog turtles could be killed or injured, or their nests could be damaged as fencing materials are transported to work areas or as posts are

installed. However, the risk of hand installation is quite small considering the size of the disturbance area relative to the wetland.

Conclusion – Careful implementation of the conservation measures is expected to substantially reduce the risk of take when installing fencing in wetlands occupied by the bog turtle. When the small risk of injuring or killing a bog turtle during installation of fencing is balanced against the benefits of grazing to maintain wetland conditions that favor bog turtles or reverse the effects of invasive vegetation, it is clear that this activity will produce a net benefit to the bog turtle and is not likely to jeopardize its continued existence. No critical habitat has been designated for the bog turtle; therefore, none will be affected.

Take Estimate – It is anticipated that, on average, up to 1 bog turtle will be killed or injured for every 10 sites fenced, where heavy equipment is used within the wetland.

2. Herbicide Application

Project Description – In some situations, the application of glyphosate (*e.g.*, Rodeo®), imazapyr (*e.g.*, Habitat®), or triclopyr (*e.g.*, Pathfinder® II) will be carried out to control invasive native and exotic plant species that are degrading the quality of the bog turtle's wetland habitat.

This opinion is limited to certain herbicides, application methods, and target vegetation:

- Use of imazapyr to control woody vegetation using the injection application method. Target woody vegetation includes, but is not limited to, red maple, alder, poison sumac, and multiflora rose.
- Use of imazapyr as a re-treatment for Phragmites and cattail using the spray application method. Glyphosate will be used for the 1st year treatment of Phragmites and cattail, while the 2nd year of treatment will include either glyphosate or imazapyr (e.g., Habitat®).
- Use of triclopyr to control woody vegetation using the basal bark application method. Target woody vegetation includes, but is not limited to, red maple, alder, poison sumac, and multiflora rose.
- Use of glyphosate to control Phragmites, purple loosestrife, cattail, red maple, alder, poison sumac, multiflora rose, Japanese stiltgrass, and mile-a-minute weed using various methods, including foliar application, injection method, hack-and-squirt, and cut-stump or cut-stem application.⁴

Over time, some of these invasive exotic plant species form dense, monotypic stands. Unabated encroachment and growth of woody vegetation accelerates succession and makes the wetland drier. As a result, valuable nesting and basking habitat is lost and escape cover is reduced. Over time, this is expected to reduce the size of the bog turtle population by reducing reproduction, recruitment, and survival.

Specific methods of glyphosate, imazapyr, and triclopyr application in wetlands occupied by bog turtles are proposed, as detailed below. The application methods are consistent with those discussed in TNC's *Weed Control Methods Handbook: Tools & Techniques for Use in Natural Areas* (Tu et al. 2001)⁵ and *Safe Herbicide Handling in Natural Areas: A Guide for Land Stewards and Volunteer Stewards* (Hillmer and Liedtke 2003)⁶. Further details about these methods and their applicability can be found in Chapter 5 and on pages 5-13 of the subject publications, respectively.

This opinion does **not** assess the use of other herbicides, other application methods (*i.e.*, that are not described below, such as soil application of herbicide), use of the described methods on target plant species that are not listed, or use of these methods outside the specified treatment periods. In addition, the use of wheeled or tracked equipment in wetlands is not covered by this project description (with the exception of large-scale *Phragmites* and cattail control, as discussed below) but may be assessed in a future amendment to this biological opinion or in a project-specific consultation.

⁴ Reed canary grass may be considered a target species in a revision to this programmatic biological opinion after studies are conducted on the effects and effectiveness of reed canary grass control using glyphosate.

⁵ <http://www.invasive.org/gist/handbook.html>

⁶ <http://www.invasive.org/gist/products/library/herbsafe.pdf>

Herbicide Treatment Methods

➤ **Injection (glyphosate or imazapyr)**

- This method involves the injection of pellets of glyphosate or imazapyr directly into the trunks of woody vegetation.
- Treatment period – In accordance with EPA-approved label instructions
- Application tool – an E-Z-Ject® Lance (or equivalent)
- Injection of pellets containing imazapyr will be limited to stem diameters exceeding 2 inches to minimize the risk of herbicide leaching from roots into the surrounding soil.
- Herbicide is delivered directly to woody stems, avoiding any herbicide spillage in the wetland. Little or no migration of herbicide from the root system to wetland soils is anticipated.
- Target plants – red maple, alder, poison sumac, multiflora rose, and other trees and shrubs in need of treatment

➤ **Basal Bark Application (triclopyr)**

- This method involves the application of the ester formulation of triclopyr (*e.g.*, Pathfinder® II) to woody plants with stems less than 6 inches in basal diameter (see “Low Volume Basal Bark Treatment” on the Pathfinder® II Specimen Label).
- Treatment period – To minimize potential adverse effects on bog turtles, this herbicide will be applied only from November 1 to March 31, when bog turtle are hibernating.
- Herbicide is applied with a backpack sprayer using low pressure and a solid cone or flat nozzle. The herbicide is sprayed on the lowermost 12 to 15 inches of woody stems, including the root collar zone. Herbicide will not be applied when snow cover prevents spraying to the ground line.
- Woody stems will not be saturated to the point that runoff into the soil occurs.
- Herbicide will not be applied to open water or water present in wetlands.
- Care will be taken to reduce the risk of herbicide contacting adjacent non-target vegetation, as this may kill beneficial vegetation and introduce herbicide into the surrounding soil.

➤ **Hack and Squirt (also Frill, Drill and Fill) (glyphosate)**

- The trunk of the tree is cut using a sharp object (*e.g.*, knife, saw, ax) or holes are made in the trunk with a power drill or other device. Glyphosate is then immediately applied to the cut using a backpack sprayer, squirt bottle, or syringe. A Hypo-Hatchet® Tree Injector can also be used.
- Treatment period – In accordance with EPA-approved label instructions for glyphosate application.
- Herbicide is delivered directly to cuts in woody stems; however, some spillage of herbicide may occur (from the sprayer, bottle), and herbicide may run down the treated stems into wetland soils.
- To minimize the risk of herbicide spillage, open containers of herbicide will not be used in the wetland (*e.g.*, an open container and paint brush).
- Target plants – red maple, alder, poison sumac, multiflora rose, and other trees and shrubs in need of treatment

➤ **Cut Stump (or Cut Stem) (glyphosate)**

- The tree or shrub is cut within 6 inches of the ground, exposing a horizontal treatment surface. Glyphosate is immediately applied to the cut surface(s) using a spray bottle or wick applicator. If vegetation has been cut previously (outside the glyphosate application period), height of the initial cutting should be adjusted to allow for subsequent re-cutting.
- Treatment period – In accordance with EPA-approved label instructions for glyphosate application. Note that other time-of-year restrictions apply to the cutting and removal of woody vegetation greater than 3" d.b.h. (see Practice #3 – Cutting and Removal of Woody Vegetation).
- A variation of this method is the “snip and drip” technique, which is used to treat *Phragmites*. This involves cutting the stem and then dripping glyphosate onto the cut stem. This is usually done in late summer/early fall.
- Glyphosate will be applied using a device that minimizes the risk of spillage (*e.g.*, via a hand-held spray bottle rather than a paint brush and open container of herbicide).
- Glyphosate is delivered directly to the horizontal surface of cut stems. Herbicide should be applied sufficient to coat the cut surface, but not so much that it runs down the stem into the soil.
- Target plants – red maple, alder, poison sumac, *Phragmites*, multiflora rose, and other trees and shrubs in need of treatment.

➤ **Wick Application (glyphosate)**

- This is a foliar application method, intended to deliver herbicide to the intact leaves or stem of the target plant.
- Treatment period - during the growing season, usually when plants are close to flowering
- Glyphosate is applied directly to the leaves and/or stem via the “glove application” method (see *Glossary*) or by using a “paint stick” or “stain stick” with a contained reservoir to hold the herbicide (see Tu *et al.* 2001). To reduce the risk of spills, herbicide will not be applied using an open container of herbicide.
- Because the herbicide is wicked directly onto the target plant, the risk of herbicide being spilled onto non-target plants or wetland soils is greatly reduced.
- Target plants – *Phragmites*, purple loosestrife, cattail, mile-a-minute weed (*Persicaria perfoliata*), Japanese stiltgrass (*Microstegium vimineum*), alder, or re-sprouts of woody vegetation (*e.g.*, red maple, alder).

➤ **Low-Pressure Spray and Low-Pressure Spot Spray (glyphosate)**

- These are foliar application methods, intended to deliver herbicide to the leaves and/or stems of target plants. Spot spray refers to the spraying of individual plants, around which non-target plants occur. Care is taken to spray just the target plant, so that damage to adjacent, non-target plants is minimized. In contrast, spray applications are intended to treat dense stands of the target plant species, within which few or no non-target plants occur. Spraying will be done only when the target plant species occurs at a high enough density to minimize the risk of effects to non-target plants.
- Treatment periods – September for *Phragmites*; around the time of flowering for purple loosestrife (July/August); July-September for multiflora rose and woody re-sprouts; September for cattail. Later dates (post-July) are preferred whenever feasible to reduce potential impacts to nests.
- Glyphosate is sprayed onto the leaves or stem via spray bottle, backpack sprayer, or modified low volume hydraulic applicator with hand-held directed spray equipment with a spray pressure not to exceed 60 pounds per square inch. A wand will be used to ensure that herbicide reaches the tops of tall plants. High pressure sprayers will not be used, as this would increase the risk of herbicide drift. Herbicide drift from the sprayer can kill or damage desirable non-target plants and end up in wetland soils.

- Target plants⁷ – multiflora rose, *Phragmites*, purple loosestrife, cattail, mile-a-minute weed, Japanese stiltgrass, alder, and re-sprouts of woody vegetation (e.g., red maple).
- **High-Pressure Spray Control of *Phragmites* or Cattail Stands (glyphosate/imazapyr)**
 - This is a foliar application method, intended to deliver herbicide to the leaves and stems of target plants. The high-pressure spray application is intended to treat dense stands of *Phragmites* or cattail within which few or no non-target plants occur. High-pressure spraying will be done only when *Phragmites* or cattail occurs at a high enough density to minimize the risk of effects to non-target plants. These high-density stands of *Phragmites* and cattail are typically devoid of any other herbaceous vegetation, evidenced by large expanses of bare soil or target species thatch within the proposed treatment area.
 - Treatment period – herbicide application in September⁸
 - Glyphosate is sprayed onto the plants using hand-directed spray equipment, with a spray pressure not to exceed 400 pounds per square inch. At 400 PSI, the sprayer will distribute herbicide as far as 50 feet from the nozzle. To ensure the herbicide reaches the top leaves of the *Phragmites* plants, the spray equipment and operator are typically positioned on top of a low-ground pressure (less than or equal to 2.0 PSI) vehicle (e.g., Marsh Master), which is driven through and adjacent to the wetland in parallel transects to access all parts of the *Phragmites* stand. High pressure sprayers will be used only to treat large stands of *Phragmites* or cattail, where herbicide application with hand-held sprayers is not practical.
 - Treatment sequence – Glyphosate is applied to the *Phragmites* or cattail stand in September using a high-pressure sprayer. Between November 1 and March 31, the *Phragmites* or cattail stand may be mown (see Practice #4 – Mowing of Herbaceous Vegetation). The following September, the remaining *Phragmites* or cattail plants are spot sprayed or sprayed with either glyphosate or imazapyr using low-pressure spray equipment if the remaining target plants are sparsely distributed. However, if the first treatment resulted in poor control and left a dense, live stand of the target plants, the re-treatment will typically be done with high-pressure spray equipment using either glyphosate or imazapyr.
 - Target plant – *Phragmites*, cattail

Regardless of the application method used, glyphosate and imazapyr will be applied in a dilution appropriate for the method of application. When carrying out a foliar application of glyphosate or imazapyr, the surfactant LI-700® may be used in accordance with the EPA-approved label instructions to improve efficacy of the herbicide and potentially reduce or eliminate the need for

⁷ Reed canary grass may be considered a target species in a revision to this programmatic biological opinion, after studies are conducted on the effects and effectiveness of reed canary grass control using glyphosate.

⁸ This is typically followed by mowing of the treated *Phragmites* stand between November 1 and March 31. See Practice #4 – Mowing.

re-treatment. However, a surfactant is not necessary when using the cut stump, hack and squirt, or injection method. In addition, certain herbicides (e.g., imazapyr pellets, triclopyr as Pathfinder® II) will be used only in formulations that are pre-mixed, so dilution is not necessary, and the addition of a surfactant is not necessary.

Conservation Measures – To minimize the risk of take, the following conservation measures will be implemented in wetlands occupied by bog turtles.

1. *Site reconnaissance* – A bog turtle specialist (see *Glossary*) will conduct an on-site evaluation to identify threats and potential threats to bog turtles and their habitat and determine appropriate measures to eliminate or minimize those threats. The monitoring biologist, landowner, and individuals who will be conducting habitat restoration or management activities should be present for this on-site evaluation, or should plan on participating in a subsequent site visit with the specialist to discuss the feasibility of carrying out the recommended restoration or management practice(s), as well as to discuss the implementation of practice-specific conservation measures at the site-specific level.

The bog turtle specialist will carry out the roles detailed in the *Glossary*, including the identification of appropriate restoration practices, identification and mapping of nesting and hibernating areas, and identification and mapping of treatment areas. When possible, telemetry or early season surveys will be conducted to identify particular patches of woody vegetation serving as hibernacula. Such areas will not be subject to woody vegetation control. If possible, surveys will also be conducted to identify nesting areas.

2. *Site restoration/management plan* – After the site has been field-viewed by a bog turtle specialist (see *Glossary*), a detailed project description, project location map, and site map will be prepared. The project location map will identify the project's location on a USGS topographic map. The site map will identify the property boundaries, wetland boundaries, known nesting and hibernating areas, and proposed treatment areas by target plant species. The project narrative will include detailed information about the proposed treatment for each target plant species, including herbicide and surfactant type and concentration, application method, timing of treatment, and size of area to be treated. This information will be submitted to the Service's Endangered Species program in the state where the work will be conducted (Appendix C) for a project-specific consultation.
3. *Monitoring biologist* – A monitoring biologist (see *Glossary* for a complete description of responsibilities) will be present on site the first day restoration activities are undertaken to brief workers on the conservation measures and ensure that sensitive areas (i.e., areas to remain untreated) are avoided. All treatment areas will be clearly identified. In addition, the monitoring biologist will conduct daily site inspections during restoration to ensure the conservation measures are being implemented appropriately.
4. *Licensed applicator* – A licensed applicator will be present on site at all times when herbicide is being applied.

5. *Spill avoidance* – To reduce the risk of spills within the wetland, the filling and emptying of herbicide containers (*e.g.*, spray bottles, backpack sprayers) will occur in upland areas. All applicators will have available a spill kit with absorbent pads. In addition, all equipment, hoses, tanks and clamps will be inspected in the uplands prior to spraying each treatment day.
6. *Treatment area limits*
 - No more than 50 percent of the wetland will be treated in any 1-year period. Refer also to treatment area limitations under *Implementation of Multiple Restoration Practices*.
 - When controlling woody vegetation with herbicides, approximately 10 to 20 percent of the native tree and shrub cover in “mucky areas” (see *Glossary*) of the wetland will be retained (*i.e.*, not treated), especially alder, red maple, and poison sumac located in or near seeps, springs, rivulets, and mucky areas. Scattered pockets of shrubs will be retained in mucky areas within the emergent portion of the wetland. In addition, 10 to 20 percent of the tree cover will be retained within the forested parts of the wetland, typically in mucky areas. These areas will be clearly identified to avoid treatment.
7. *Surfactant* – When it is necessary to use a surfactant to increase the efficacy of glyphosate or imazapyr, the surfactant LI-700® will be used in accordance with the EPA-approved label instructions.
8. *Known nesting areas* – Herbicide will not be applied within known nesting areas between June 1 and September 30, and workers and equipment will not traverse through known nesting areas during this period.
9. *Known hibernating areas* – Herbicide will not be applied to woody vegetation within documented hibernating areas.
10. *Consideration of other control mechanisms* – Herbicide application will not be carried out when another mechanism is controlling or likely to effectively control the target species (*e.g.*, when multiflora rose in a wetland has already been infected by rose rosette disease or when grazing is effectively controlling the target species).
11. *Cattail treatment* – Cattail will be controlled with herbicides only when this species has become a dominant plant species in the wetland (*i.e.*, it has attained over 50 percent cover in the emergent portion of the wetland). At least 10 percent of the cattail cover will remain untreated, particularly within mucky parts of the wetland, as the *elimination* of cattail is not a treatment objective. Cattail is considered an important component of bog turtle habitat. Bog turtles have been documented to select cattail patches, presumably for their shade and the relatively high-density slug populations that are often found on the lower stems of the plants. Therefore, in most cases, cattail is not considered a target species for control efforts. When it does appear that cattail cover within a wetland is increasing, it may be a sign that sediment and/or nutrient inputs have increased, giving

this species a competitive advantage (Scott Smith, Maryland DNR, personal communication). If this is the case, these input sources should be addressed. If it has been determined that measures should be implemented to control cattail, the preferred treatment method is grazing. Cattle preferentially graze cattail and reduce cattail cover by breaking up the roots with their hooves. When grazing cannot be used, patches of cattail may be treated using glyphosate as a last resort control measure.

12. *Spray application* – to reduce impacts to non-target plant species, glyphosate will be sprayed only where there is a dense stand of the target plant species. Herbicide will be applied when wind speed at treatment height is less than or equal to 5 miles per hour to reduce the risk of drift. Low-pressure sprayers will not exceed 60 PSI and high-pressure sprayers will not exceed 400 PSI.
13. *Heavy equipment use* – Low ground pressure equipment (less than or equal to 2.0 PSI) will be used to apply glyphosate or imazapyr to large, dense stands of *Phragmites* or cattail. Where feasible, spraying will occur from the adjacent upland. Encroachments into the wetland will be minimized, and travel routes to/from the *Phragmites* or cattail stand will avoid sensitive bog turtle habitats, including mucky areas with native herbaceous vegetation, known nesting areas, and known hibernating areas.
14. *Re-establishment of native herbaceous vegetation* – Large treatment areas (i.e., greater than or equal to 1 acre or greater than or equal to 25 percent of the wetland) will be monitored to ensure that native herbaceous vegetation is re-establishing in the treatment area. For treatments in late summer or early fall, monitoring will take place the following spring (no later than May). For treatments in the spring, monitoring will take place 1 to 2 months following the treatment. If the treatment area is devoid of vegetation, native herbaceous vegetation or a non-invasive annual cover will be planted.
15. *Treatment documentation*
 - Areas that have been treated with herbicide will be inspected the following growing season to determine the effectiveness of the treatment method and document the re-establishment of vegetative growth (target and non-target) in the treatment area.
 - By December 31 of the year following treatment, a report will be submitted to the Service's Endangered Species program in the state where the work was conducted (Appendix C) documenting the following for each target plant species treated: name of the target plant species, area (in acres) treated, treatment method and timing, herbicide and surfactant concentration used, effectiveness of the treatment (percent kill), any observed effects on non-target plants, and any observed effects on bog turtles or their use of habitat. A map showing the wetland and treated areas within the wetland will be submitted with this report.
 - This information will assist the Service in 1) identifying the risks, benefits and effectiveness of various habitat restoration practices; 2) tracking recovery

implementation; and 3) determining if changes to this opinion are necessary to further the recovery of the bog turtle.

Effects of the Action – Although herbicide application has been conducted at several bog turtle sites using various application methods, no incidental take monitoring has occurred. Monitoring, when conducted, has been focused on inspections of the treated target plants to determine whether or not further treatment would be necessary. Therefore, the Service's effects analysis below is based on available information about herbicide and surfactant toxicity and bog turtle habitat use.

Imazapyr is part of the imidazolinone chemical class, and is a systemic, non-selective, pre- and post-emergent herbicide used for the control of a broad range of terrestrial and aquatic weeds. Imazapyr is applied either as an acid or as the isopropylamine salt. The mode of toxic action of imazapyr in plants as an amino acid synthesis inhibitor has been well described. Imazapyr is absorbed quickly through plant tissue and can be taken up by roots. It inhibits the enzymatic production of the amino acids valine, leucine, and isoleucine. Plant death is usually slow and can take up to several weeks. Imazapyr does not bind readily to soil, and it has high mobility and a relatively long soil half-life (1 to 5 months). Due to these characteristics, it can damage or kill non-target vegetation.

Imazapyr has relatively low toxicity to birds, mammals, fish, and invertebrates, but it is considered an eye and skin irritant. In tests, rats rapidly excreted imazapyr through feces and urine, and no residues accumulated in liver kidney or muscle. It has not been found to cause mutations, birth defects, or cancer in birds or mammals.

Triclopyr, part of the pyridine herbicide family, is a selective systemic herbicide used to control woody and herbaceous broadleaf plants along rights-of-ways, and in forests, grasslands, and parklands. Triclopyr controls target weeds by mimicking the plant hormone auxin, causing uncontrolled plant growth. There are two basic formulations of triclopyr - a triethylamine salt (TEA: Garlon 3A®) and a butoxyethyl ester (TBEE: Pathfinder II®). Triclopyr is regarded as only slightly toxic to birds and mammals. The salt form, Garlon 3A®, can cause severe eye damage to both humans and wildlife. Triclopyr formulations can be highly toxic to fish and aquatic invertebrates. The extent to which the toxic effects are reduced by degradation is poorly understood.

Glyphosate is a broad-spectrum systemic herbicide that kills plants by interfering with amino acid synthesis and enzyme production. It is water soluble, but is strongly adsorbed to soil particles, making it relatively non-mobile in the environment and unlikely to be taken up by the roots of non-target plants once it has entered the soil. It is broken down by microbial action, but due to its strong adsorption to soil, its average soil half-life is approximately 2 months (Tu *et al.* 2001). Glyphosate is of relatively low toxicity to birds, mammals, and fish but was not tested on reptiles or amphibians prior to EPA registration (EPA 1993).

A **surfactant** is often used to increase the efficacy of glyphosate. At this time, the Service's Region 5 Environmental Contaminants Program recommends the use of LI-700®, which the Service has rated as "practically nontoxic" to aquatic organisms. Supporting documentation is

provided in “*Acute Toxicity of Various Nonionic Surfactants/Spreaders Used with Glyphosate Products and Toxicity of Formulated Glyphosate Products*” prepared by Elaine Snyder-Conn, National Pest Management Coordinator for the Regional Pest Managers Meeting, Ellsworth ME August 26, 2002, and in Monheit *et al.* (2004), Solomon and Thompson (2003), and Syracuse Environmental Research Associates (1997). Despite approvals for aquatic use and extensive available data, the possibility of adverse effects (especially sub-lethal effects) cannot be completely discounted.

The toxicity of imazapyr and triclopyr has been examined in only a limited number of species, as required within the framework of the regulatory registration process. The tests were conducted under conditions that do not represent populations of free-ranging, non-target organisms. Moreover, tests typically consider only the toxicity of the active ingredients imazapyr and triclopyr, found in Habitat® and Pathfinder II®, respectively. The commercial formulations contain proprietary and undisclosed “inert” ingredients that may include emulsifiers, surfactants, and oils that are not considered in this opinion. Notwithstanding these limitations, the information that is available suggests a relatively low risk of adverse effects on bog turtles from limited exposure (i.e., aerosol drift, dermal contact with contaminated runoff) to properly applied, pre-mixed products containing imazapyr or triclopyr as the active ingredient. Potential effects on amphibians, fish, and invertebrates could occur from direct and indirect toxic action of TBEE. Toxic effects on worms, snails and slugs would be of particular relevance to bog turtle food supply.

There is some available information indicating that direct exposure to glyphosate and LI-700® may adversely affect bog turtles. This includes a laboratory study by Sparling (2005), which indicates that direct exposure of eggs may cause adverse effects. He suggests that exposing reared slider (*Trachemys scripta elegans*) embryos to treatment solutions containing a glyphosate + surfactant mixture may affect post-hatching survival. Sparling investigated the effects of direct exposure of embryos to herbicide mixtures by dipping turtle eggs into solutions containing different concentrations of Glypro® (0, 1.2, 3.5, 10.6, 31.7, or 95 percent) and a set concentration (3percent) of the surfactant LI-700®. Effects were then quantified by measuring the time taken by individual hatchlings to right themselves after being turned over. Hatchlings exposed to the mixture containing 95 percent Glypro® were “less capable of righting themselves and showed less progress in gaining strength and agility post hatch than those at other treatments” (Sparling 2005). Additionally, hatchlings exposed to Glypro® at lower concentrations showed “subtle differences in behavior...compared to controls in that there were substantially fewer animals that righted themselves within 30 seconds.” Results also suggest that the surfactant LI-700 may have a genotoxicity effect (Sparling 2005).

The risk of incidental take due to herbicide or surfactant exposure is considered very small because 1) most treatment methods result in delivery of herbicide directly to the target plant, resulting in little risk of soil, bog turtle, or nest exposure; 2) implementation of the conservation measures will substantially reduce the risk of embryo exposure; 3) exposure of adults will be minimal because they are not likely to occur in high densities in the areas to be treated (e.g., forested areas, thick shrubby vegetation, or thick monotypic stands of invasive herbaceous vegetation); and 4) when used according to label directions, glyphosate, triclopyr, imazapyr, and LI-700® appear to have a low risk of toxicity effects. Careful adherence to the label directions

when using these herbicides and full implementation of the conservation measures will substantially reduce the potential for adverse sub-lethal effects on bog turtles by reducing the risk of exposure to glyphosate, triclopyr, imazapyr, and LI-700®.

Herbicide application is an effective means of controlling invasive plant species that degrade bog turtle habitat – and in situations where it is not possible to use grazers to control invasive species, herbicide application may be the only effective means of control. Surfactants increase the efficacy of glyphosate and imazapyr; greater habitat improvement is realized more quickly and the need for re-treatment is minimized. For example, a glyphosate/LI-700® mixture was used to treat large quantities of multiflora rose adjacent to five bog turtle wetlands in Maryland during the summers of 2002 and 2003. Based on transect surveys, mortality of multiflora rose during the growing season following treatment was nearly 100 percent (Schultz 2004). Due to its thorny arching stems, it is very difficult to control multiflora rose using hand-held equipment. In addition, removal of multiflora rose by other methods, including cutting or pulling by tracked or wheeled vehicles could result in a higher risk of habitat damage and incidental take than herbicide application, especially if the rose occurs in mucky areas.

Spray applications of glyphosate and imazapyr pose a threat to non-target plant species due to chemical drift. If applicators are not careful, herbicide drift could kill native herbaceous vegetation used by bog turtles for nesting, basking, foraging, and cover, potentially resulting in harm. The risk of impacting desirable native vegetation will be minimized by spot-treating the target plant species or ensuring spray applications are limited to dense stands of the target plant species.

With all of the herbicide treatment methods, there is a risk of trampling bog turtle nests, particularly when the treatment is carried out in the emergent part of the wetland by a large crew of applicators between mid-May and mid-September. In addition, with the high-pressure spray application of glyphosate to control *Phragmites* and cattail there is a risk of crushing bog turtles or their nests through the use of heavy equipment. There is also a risk of spilling or applying herbicide onto wetland soils and onto bog turtle nests, directly or indirectly exposing bog turtles and turtle embryos to herbicide. The risks of crushing and herbicide exposure have been reduced by avoiding herbicide application in known nesting areas during the nesting season, by limiting the amount of the wetland that can be treated at one time, and by limiting use of heavy equipment to dense *Phragmites* and cattail stands, where nesting is not likely to occur and where adult bog turtle densities are expected to be very low.

There is also a risk of exposing brumating turtles to herbicide (glyphosate, triclopyr, and imazapyr), especially when concentrated herbicide is delivered to the stems of woody or herbaceous plants in late summer, fall, or winter. Although woody vegetation within known hibernating areas will not be treated (see conservation measures), in most cases the locations of hibernacula will not be known prior to treatment. During basal bark application of triclopyr, some of the herbicide spray is likely to miss the woody stems and land on nearby soils. Herbicide (glyphosate, triclopyr, imazapyr) is also likely to leach from the roots of treated woody and herbaceous plants into the soil, exposing turtles to herbicide when they brumate among the root systems. During this period, herbicide breakdown will be slow due to cold temperatures and turtles will remain among the roots for a prolonged period of time. However, direct exposure to

glyphosate is likely to be limited due to its tendency to bind to soil. The potential for triclopyr exposure is also low. While it does not readily bind to soil, it has limited leaching potential because it is broken down rapidly by light and microbes and has a half-life of about 24 hours. The risk of imazapyr exposure is greatest as it does not bind tightly with soils. Unlike glyphosate and triclopyr, it is highly mobile and has a relatively long soil half-life, ranging from 1 to 5 months. To reduce the risk of exposing bog turtles to imazapyr, its application has been limited to the injection method (for woody vegetation) and spray control of large *Phragmites* and cattail stands.

Although the purpose of herbicide treatment is to elicit beneficial changes in the wetland's vegetative cover types, the treatment may result in short-term adverse effects on bog turtles, particularly if key areas (*e.g.*, hibernacula) or large areas of the wetland are treated at one time. Although the woody vegetation associated with known hibernating areas will not be treated, in most cases the location of hibernacula will not be known. Changes to a hibernating area may make that area less desirable or potentially less suitable, prompting turtles to seek another area for hibernation. In addition, spray application of glyphosate in a large treatment area may leave that area devoid of vegetation for a period of time. Until the area re-vegetates, turtles must either seek food and shelter in an untreated area of the wetland or risk staying in the treatment area. Turtles that stay in the treatment area may face an increased risk of predation, decreased food supply, and less than optimal conditions for regulating body temperature. In most cases, the on-site seed bank and vegetative community will probably be sufficient to ensure that treated areas re-vegetate rapidly. However, there may be situations in which the treatment area is devoid of vegetation for many months or re-vegetates with invasive plants. The conservation measures seek to minimize these risks by limiting the treatment area to no more than 50 percent of the wetland, by limiting the spray application method to dense stands of invasive plants, and by providing for the replanting of herbaceous vegetation.

Conclusion – In light of the benefits of habitat restoration and the low risk of adverse effects on bog turtles, the Service concludes that use of glyphosate, imazapyr, and triclopyr – either alone or in conjunction with LI-700®, as appropriate – are likely to have a long-term beneficial effect on bog turtle populations and, therefore, are not likely to jeopardize the continued existence of the bog turtle. No critical habitat has been designated for the bog turtle; therefore, none will be affected.

Take Estimate – While the Service acknowledges there may be some risk of take due to the direct or indirect effects of the herbicide and/or surfactant, the risk is likely to be very small. While no death, injury, or reproductive impairment is currently anticipated due to herbicide or surfactant exposure, any observations indicating that glyphosate, imazapyr, triclopyr, or LI-700® may have caused take of bog turtles or impaired their reproductive success must be promptly reported to the Service Office of Law Enforcement and the Service's Endangered Species program in the state where the work was conducted (Appendix C).

It is anticipated that, on average, up to 1 bog turtle will be harmed (killed or injured) for every 10 sites subject to herbicide application. Death or injury could result from a variety of direct or indirect effects associated with herbicide application, including trampling of nests, crushing of bog turtles or their nests due to use of heavy equipment (when treating *Phragmites* or cattail),

increased predation risk due to loss of vegetative cover, reduced suitability of hibernating areas, or reduced food supply or thermoregulatory cover due to a temporary loss of vegetation. This risk of take is highest when 1) a large crew carries out herbicide application throughout a significant portion of the wetland, 2) unknown hibernating areas are treated, 3) unknown nesting areas are treated, 4) large areas of the emergent part of the wetland are treated and fail to quickly re-vegetate, or 5) heavy equipment is used within the wetland to apply herbicide.

3. Cutting and Removal of Woody Vegetation

Project Description – To control woody vegetation in wetlands, either hand-held equipment (e.g., chainsaw, ax, saw) will be used and the wetland will be entered on foot or heavy equipment such as a rubber-tracked skid steer with a rotary cutter or tree shear attachment will be driven into the wetland and used. In some cases, both types of equipment may be used. The rotary cutter can cut woody vegetation up to 3 inches in diameter, while the tree shear can cut trees up to 16 inches d.b.h.

This biological opinion evaluates the effects of the cutting and removal of woody vegetation at times of the year when bog turtles are least vulnerable to the potential direct and indirect adverse effects of this activity. As both light and heavy equipment may be used in bog turtle wetlands, the effects of each are considered.

This opinion is limited to the following types of woody vegetation control:

Equipment Type	Vegetation Size	Cutting Period	Effect Determination ⁹
Light	≤ 3" dbh	Oct 1 to March 31	NLAA ¹⁰
	≤ 3" dbh	April 1 to Sept 30	LAA
	> 3" dbh	Nov 1 to March 31	LAA
Heavy (≤ 3.1 psi ground pressure)	All sizes	Nov 1 to March 31	LAA

The extent of woody vegetation control will vary based on site conditions. At some sites, woody vegetation is just beginning to encroach into the wetland, so the control of this vegetation will affect only a small portion of the wetland and control could be done with light equipment (e.g., chainsaw). In other cases, woody vegetation has overtaken the wetland, resulting in almost full canopy closure. Control measures at those sites may affect the entire wetland over a period of a few years.

Woody vegetation control will occur primarily in mucky areas of the wetland, since these are the areas that already have the hydrology and soils necessary for essential functions, such as nesting, hibernation, and predator escape. Although the mucky area of the wetland may be relatively small in comparison to the wetland as a whole, restoration efforts within this most critical area will have the greatest conservation benefit. Because restoration work is targeted toward the most sensitive and preferentially used habitat areas (i.e., mucky areas), conservation measures are included to reduce the risk of take. One of the most important of these conservation measures is the prohibition on the use of heavy equipment in mucky areas to reduce the risk of crushing bog turtles.

Conservation Measures – To minimize the risk of take, the following conservation measures will be implemented in wetlands occupied by bog turtles.

1. *Site reconnaissance* – A bog turtle specialist (see *Glossary*) will conduct an on-site evaluation to identify threats and potential threats to bog turtles and their habitat, and determine appropriate measures to eliminate or minimize those threats. The monitoring biologist, landowner, and individuals who will be conducting habitat restoration or management activities should be present for this on-site evaluation or should plan on participating in a subsequent site visit with the specialist to discuss the feasibility of carrying out the recommended restoration or management practice(s), as well as to discuss the implementation of practice-specific conservation measures at the site-specific level.

⁹ LAA = likely to adversely affect and considered in this biological opinion. NLAA = not likely to adversely affect.

¹⁰ The Service has determined that the cutting and removal of woody vegetation less than or equal to 3 inches d.b.h. using light equipment between October 1 and March 31 is not likely to adversely affect bog turtles (see *Practices Not Likely to Adversely Affect Bog Turtles*).

The bog turtle specialist will carry out the roles detailed in the *Glossary*, including the identification of appropriate restoration practices, identification and mapping of nesting and hibernating areas, and identification and mapping of treatment areas. When possible, telemetry or early season surveys will be conducted to identify particular patches of woody vegetation serving as hibernacula. Such areas will not be subject to woody vegetation control. If possible, surveys will also be conducted to identify nesting areas.

2. *Alternatives Analysis* – Where it has been determined that woody vegetation is reducing the quality or quantity of bog turtle habitat, there will be a consideration of alternatives to control the woody vegetation. Such alternatives include 1) cutting and removal, 2) herbicide treatment of standing vegetation (*e.g.*, injection, basal bark application), and 3) restoration grazing. The method that best meets the biological objectives of increasing bog turtle reproduction and survival should be selected. The potential risks associated with herbicide application and restoration grazing will typically be substantially less than those associated with the operation of heavy equipment in occupied bog turtle habitat. For example, where the landowner does not object to standing, dead woody vegetation, it is typically quicker and safer to control woody vegetation via herbicide injection or basal bark application than to cut the woody vegetation with heavy equipment and follow-up with a cut-stump application of herbicide. If woody vegetation is cut and not treated with herbicide, the subsequent re-sprouting is likely to reduce bog turtle habitat quality.
3. *Site restoration/management plan* – After the site has been field-viewed by a bog turtle specialist (see *Glossary*), a detailed project description, project location map, and site map will be prepared. The project location map will identify the project's location on a USGS topographic map. The site map will identify the property boundaries, wetland boundaries, known nesting and hibernating areas, "mucky areas" (regardless of vegetative cover type), and proposed treatment areas. The project narrative will include detailed information about the proposed treatment, including timing and duration of treatment, treatment method(s) (*e.g.*, type of equipment to be used), and size of area to be treated. This information will be submitted to the Service's Endangered Species program in the state where the work will be conducted (Appendix C) for a project-specific consultation.
4. *Monitoring biologist* (see *Glossary* for a complete description of responsibilities)
 - Prior to carrying out woody vegetation control, a monitoring biologist will walk through the wetland to identify "mucky areas" (see *Glossary*).
 - The monitoring biologist will help to identify the most appropriate travel routes (see *Glossary*) for heavy equipment within the wetland. These travel routes will avoid mucky areas, known nesting and hibernating areas, and areas of woody vegetation to be retained.
 - A briefing will occur the day before or morning of the work, during which direct lines of authority will be established and the project will be discussed in detail. A

carefully planned command hierarchy needs to be established and communicated clearly to all involved, particularly if operators and others are being drawn from different offices and/or agencies. The hierarchy should be based first and foremost on knowledge of bog turtle habitat and avoidance of take.

- A monitoring biologist will be present on site the first day restoration activities are undertaken to brief workers on the conservation measures, and ensure that sensitive areas (e.g., nesting areas, hibernating areas, mucky areas) and areas of woody vegetation to be retained are avoided.
 - When the project entails cutting and removal of woody vegetation less than 3 inches d.b.h. using light equipment between April 1 and September 30, pre-project orientation by the monitoring biologist will include the need for workers to avoid walking on hummocks and identification of routes to avoid when dragging woody debris. The monitoring biologist will conduct periodic inspections on a frequency appropriate to habitat conditions, likely bog turtle activity, experience of the crew, and project scope and duration.
 - In addition to the operator, each piece of heavy equipment (see *Glossary*) will have an assigned biologist familiar with bog turtle habitat (i.e., monitoring biologist). This attendant will precede the equipment into work areas. An appropriate signaling system should be adopted or two-way radio headphones should be used to establish communication links between operators and biologist attendants. The attendant will stay with the equipment the entire time it is in use in the wetland to ensure equipment does not enter restricted areas (i.e., known nesting and hibernating areas, mucky areas, areas of woody vegetation to be retained). The attendant's decisions on entering/not entering areas must supersede the operator's opinions, regardless of rank or agency affiliation.
 - If heavy equipment enters mucky areas or known nesting or hibernating habitat, the monitoring biologist will survey these areas for signs of adverse effects, including dead or injured bog turtles and damage to habitat. Impacts will be documented in writing.
5. *Treatment area* – No more than 50 percent of the wetland will be subject to woody vegetation cutting and removal in any 1-year period. Refer also to treatment area limitations under Implementation of Multiple Restoration Practices.
 6. *Retention of woody vegetation* – Approximately 10 to 20 percent of the native tree and shrub cover in “mucky areas” (see *Glossary*) in both the emergent and forested parts of the wetland will be retained (i.e., not treated), especially alder, red maple, and poison sumac located in or near seeps, springs, rivulets, and mucky areas. These areas will be clearly mapped and marked or flagged to avoid treatment.
 7. *Spill avoidance* – To reduce the risk of spills within the wetland, vehicles and heavy machinery will be serviced in upland areas. When it is necessary to fuel light

equipment (chainsaws, hand-held power augers, etc.) in the wetland, absorbent pads will be used to catch and contain any spills.

8. *Use of light equipment (see Glossary)*

- Treatment of woody vegetation less than or equal to 3 inches d.b.h. can occur any time of year, but if it occurs between April 1 and September 30, there is a risk of take. If cutting occurs between April 1 and September 30, a monitoring biologist will brief workers on measures to reduce the likelihood of take (*e.g.*, avoid walking on hummocks, avoid dragging woody debris through nesting areas).
- Treatment of woody vegetation greater than 3 inches d.b.h. will only occur between November 1 and March 31.

9. *Use of heavy equipment (see Glossary)*

- When it is necessary to control woody vegetation in wetlands using heavy equipment, only low ground pressure equipment will be used (less than or equal to 3.1 PSI), and work will occur between November 1 and March 31.
- Heavy equipment will use pre-determined travel routes and will not be used in or driven through known nesting areas or known hibernating areas.
- Heavy equipment will not be used in or driven through mucky areas of the wetland, except when it is necessary to cross a narrow, mucky channel or rivulet to reach non-mucky parts of the wetland.

10. *Woody debris*

- Woody debris will not be dragged through known nesting areas.
- Whenever possible, woody vegetation greater than or equal to 4 inches d.b.h. will be felled into adjacent uplands or into non-mucky areas of the wetland.
- Woody vegetation greater than or equal to 4 inches d.b.h will not be dragged through mucky areas of the wetland, unless there is sufficient frozen ground or snow/ice cover to prevent disturbance to wetland soils. Rather, the vegetation will be left in place, or cut into pieces small enough to remove by hand and then processed or placed in an upland area. If the monitoring biologist determines that large-diameter woody debris would result in adverse hydrological changes to the wetland (*e.g.*, by blocking water flow), or would be so abundant that it would impede bog turtle movement, the woody debris will be removed to avoid or minimize this effect.
- To avoid displacement of hibernating turtles and potential destruction of hibernacula, woody vegetation will not be pulled out by its roots in mucky areas.

11. *Treatment documentation*

- Areas that have been treated will be inspected the following growing season to determine the effectiveness of the treatment method.
- By December 31 of the year following treatment, a report will be submitted to the Service's Endangered Species program in the state where the work is conducted (Appendix C) documenting the following: name(s) of the target plant species, area (in acres) treated, treatment method, effectiveness of the treatment, any observed effects on non-target plants, any observed effects on wetland soils or hydrology (*e.g.*, rutting, channelization), and any observed effects on bog turtles or their use of habitat. A map showing the wetland and treated areas within the wetland will be submitted with this report. See Appendix E for a report template.
- This information will assist the Service in 1) identifying the risks, benefits, and effectiveness of various habitat restoration practices; 2) tracking recovery implementation; and 3) determining if changes to this opinion are necessary to further the recovery of the bog turtle.

Effects – Bog turtles are long-lived and may persist for many years at sites that have reverted to wooded swamps. Unfortunately, their ability to successfully nest in such habitat is compromised, and the populations at such sites will eventually perish if recruitment does not occur. Mechanical removal of woody vegetation will open up areas of the wetland to increased solar exposure, allowing native herbaceous vegetation to become re-established. This will increase the amount of emergent habitat available for successful bog turtle nesting and basking.

The use of heavy equipment in wetlands occupied by bog turtles poses a direct risk of injury or death to turtles. For example, one bog turtle was killed during habitat restoration activities at a site in Maryland, and it is possible that others were killed or injured but not located. Heavy equipment was used in the subject wetland to remove multiflora rose and install fencing. During a follow-up survey, one crushed bog turtle was found in a tire track near a spring area that was probably used for hibernation (Constantino 2005, Smith 2005). The muck in this area was 3 to 5 inches deep and underlain by rock. The documented mortality occurred because equipment operators entered flagged (restricted areas). In this and other situations where heavy equipment has been used, it has become apparent that it is almost impossible for equipment operators to look for sensitive habitats in the wetland while also operating the heavy equipment (Constantino 2006, Smith 2005). We are not aware of incidental take monitoring occurring at other sites where restoration activities have been carried out.

The conservation measures listed above will substantially reduce the risk of take. When it is necessary to cut large woody vegetation or use heavy equipment in wetlands, only low ground pressure equipment will be used (less than or equal to 3.1 PSI) and all work will be done between November 1 and March 31, when bog turtles are hibernating or concentrated near their hibernation areas. Although the locations of these hibernacula will not usually be known prior to project implementation, the risk of take will be minimized by restricting vehicle use in areas of the wetland that are potentially suitable for hibernation (*i.e.*, mucky areas). If vehicles were used

in mucky areas of the wetland, it is likely that take would be substantially higher due to the need for multiple passes through these areas to position and re-position the vehicle to cut and remove trees or shrubs. In mucky areas of the wetland, the control of woody vegetation via herbicide injection (e.g., via an E-Z-Ject® Lance) or basal bark application (e.g., Pathfinder II) will typically be the most labor-efficient and cost-efficient control method, considering the prohibition on the use of heavy equipment in these sensitive areas.

Despite implementation of these conservation measures, there remains some risk of take. In situations where it is necessary to cut trees in mucky areas, it is possible that a tree will fall on a hibernaculum – killing, injuring, or displacing one or more turtles. If a hibernating turtle is displaced from its hibernaculum due to the felling of a tree or inadvertent vehicle use in mucky areas, the turtle may avoid immediate death/injury but have to reposition itself in an appropriate hibernating location. If it has been forced to the surface, a combination of cold temperatures and slow body metabolism may prevent it from successfully locating an appropriate hibernating spot, leading to death.

It is likely that some mucky areas will not be identified during site reconnaissance and that heavy equipment will occasionally be driven through mucky areas during restoration activities. If tracked or wheeled vehicles are driven through mucky areas – accidentally, intentionally, or because the mucky areas were not carefully delineated prior to project implementation – hibernating turtles could be crushed (killed), injured, or displaced from their hibernacula placing them at an increased risk of death.

Cutting and removal of material less than 3 inches d.b.h. between April 1 and September 30 also poses a risk of disturbance to mating turtles and disturbance, injury, or death of nests and hatchlings. Guidance from the monitoring biologist and avoidance of hummocks will substantially reduce, but will not completely remove, this risk.

Indirect effects may result from woody vegetation control, particularly if a large number of trees are felled in the wetland and left in place. These trees may impede bog turtle movement in the wetland, resulting in harm or harassment. Use of an experienced monitoring biologist to assess and minimize this risk, and use of herbicide application in mucky areas for woody vegetation control will reduce the risk of indirect effects.

Indirect effects may also result from changes to hibernating areas. Although the woody vegetation associated with known hibernating areas will not be treated, in most cases the location of hibernacula will not be known. Changes to a hibernating area may make that area less desirable or potentially less suitable, prompting turtles to seek another area for hibernation. Although implementation of the conservation measures will reduce these risks, bog turtles may be harassed or harmed when a large part of the wetland is subject to woody vegetation control or when undocumented hibernating areas are treated.

Conclusion – In light of the benefits of habitat restoration and the implementation of conservation measures to minimize potential adverse effects, the Service concludes that the cutting and removal of woody vegetation is not likely to jeopardize the continued existence of the bog turtle. No critical habitat has been designated for the bog turtle; therefore, none will be affected.

Take Estimate – The Service estimates that up to two bog turtles may be killed or injured per site at sites subject to the most extensive mechanical control of woody vegetation within mucky areas (i.e., control within greater than or equal to 25 percent of the mucky area within the wetland), but the extent of take is likely to average less than one turtle killed or injured at most sites. At sites subject to less extensive control of woody vegetation between November 1 and March 31, up to one bog turtle will be killed or injured for every ten sites treated. Cutting and removal of vegetation using light equipment between April 1 and September 30 may result in killing up to 1 bog turtle and loss of up to 2 nests for every 10 sites treated.

4. Mowing of Herbaceous Vegetation

Project Description –To control invasive, exotic herbaceous vegetation in wetlands and reduce the potential for colonization and growth of woody vegetation, some bog turtle wetlands will be periodically mown. To reduce the risk of rutting wetland soils, damaging beneficial wetland vegetation, crushing or injuring bog turtles, and destroying nests, mowing will be done between November 1 and March 31 using low ground pressure, heavy equipment (less than or equal to 2.0 PSI)¹¹.

This opinion is limited to certain types of mowing activities:

- Habitat Restoration Mowing – Use of low ground pressure equipment (less than or equal to 2.0 PSI) between November 1 and March 31 to cut *Phragmites* and cattail. Effective control of *Phragmites* often requires the cutting of standing, dead stems so that re-growth of native herbaceous vegetation is readily accessible to sunlight and unaffected *Phragmites* plants are readily accessible to a second application of herbicide. This activity involves a single mowing event in the first year of treatment, rather than periodic mowing events. Mowing equipment would be used primarily within the *Phragmites* or cattail stand.
- Habitat Maintenance Mowing – Use of low ground pressure equipment (less than or equal to 2.0 PSI) between November 1 and March 31 to cut herbaceous vegetation and small-diameter woody vegetation (less than or equal to 2.0 inches in diameter) to reduce the colonization and growth of woody vegetation. This maintenance activity is carried out by various entities (e.g., utility companies, highway departments, county road maintenance crews, private landowners) to reduce woody vegetation encroachment in fields and road and utility line rights-of-way. As a result, it has kept some bog turtle wetlands (or portions thereof) in an open canopy condition. Mowing equipment would either be used in the entire wetland or only the parts of the wetland that occur within the targeted treatment area (e.g., utility line right-of-way). Mowing frequency will not exceed once every 3 years, which gives bog turtle sites at least three full growing seasons of no disturbance (e.g., if a site were mown in March of 2010, it would not be mown again until March of 2013).

¹¹ In some cases, the cutting of herbaceous vegetation is not expected to result in adverse effects. See “Practices Not Likely to Adversely Affect Bog Turtles” on pages 12-13 of this Opinion.

Conservation Measures – To minimize the risk of take, the following conservation measures will be implemented in wetlands occupied by bog turtles.

1. *Site reconnaissance* – A bog turtle specialist (see *Glossary*) will conduct an on-site evaluation to identify threats and potential threats to bog turtles and their habitat, and determine appropriate measures to eliminate or minimize those threats. The monitoring biologist, landowner, and individuals who will be conducting habitat restoration or management activities should be present for this on-site evaluation or should plan on participating in a subsequent site visit with the specialist to discuss the feasibility of carrying out the recommended restoration or management practice(s), as well as to discuss the implementation of practice-specific conservation measures at the site-specific level.

The bog turtle specialist will carry out the roles detailed in the *Glossary*, including the identification of appropriate restoration/management practices, identification of nesting and hibernating areas, and identification and mapping of treatment areas. When possible, telemetry or early season surveys will be conducted to identify particular patches of woody vegetation serving as hibernacula. Such areas will not be subject to mowing. If possible, surveys will also be conducted to identify nesting areas.

2. *Site restoration/management plan* – After the site has been field-viewed by a bog turtle specialist (see *Glossary*), a detailed project description, project location map, and site map will be prepared. The project location map will identify the project's location on a USGS topographic map. The site map will identify the property boundaries, wetland boundaries, known nesting and hibernating areas, and proposed treatment areas. The project narrative will include detailed information about the proposed treatment, including timing and frequency of treatment, treatment method(s) (e.g., type of equipment to be used), size of area to be treated, and conservation measures. This information will be submitted to the Fish and Wildlife Service's Endangered Species program in the state where the work will be conducted (Appendix C) for a project-specific consultation.

3. *Monitoring biologist* (see *Glossary* for a complete description of responsibilities)

A monitoring biologist will be present on site when mowing occurs to brief workers on the conservation measures and ensure that sensitive areas are avoided.

4. *Seasonal restriction* – Mowing will occur only from November 1 to March 31, when bog turtles are hibernating. Within this seasonal window, mowing will occur only when the daytime air temperature is less than 50°F.
5. *Mowing equipment* – Only low ground pressure equipment will be used for mowing. This equipment must exert no more than 2.0 psi of ground pressure.¹²

¹² Mowing equipment has more stringent ground pressure requirements (i.e., lower PSI) than equipment used for the cutting and removal of woody vegetation because mowing equipment may be used throughout the emergent parts of the wetland, where the risk of exposing bog turtles and their nests to the equipment is greatest.

6. *Treatment area, mowing height, and mowing frequency*

Habitat Restoration Mowing – Mowing will only occur within the *Phragmites* or cattail stand. Mower height will be at least 5 inches. Mowing will occur once, following the initial herbicide treatment of the *Phragmites* or cattail stand.

Habitat Maintenance Mowing – When mowing is being done for habitat maintenance, up to 100 percent of the wetland may be mown, with the exception of woody areas to be retained. Mower height will be at least 8 inches to ensure there is adequate vegetative cover for bog turtles, to minimize the risk of damaging nests and hummocks, and to reduce the risk of harming bog turtles that may be active during warm spells during the hibernation period. Mowing will occur at intervals greater than or equal to once every 3 years.

7. *Disturbance Minimization* – Mowing equipment will make a single pass over each area to be mowed, as multiple passes over the same area would increase the risk of soil disturbance, vegetation damage, and bog turtle mortality.
8. *Retention of woody vegetation* – Approximately 10 to 20 percent of the native tree and shrub cover in “mucky areas” (see *Glossary*) in both the emergent and forested parts of the wetland will be retained (i.e., not treated), especially alder, red maple, and poison sumac located in or near seeps, springs, rivulets, and mucky areas. If there is already woody vegetation in mucky areas of the wetland outside the area proposed for mowing (e.g., outside the road or utility line right-of-way), this measure does not apply.
9. *Spill avoidance* – To reduce the risk of spills within the wetland, equipment will be serviced and fueled in upland areas.
10. *Treatment documentation*

By June 1, a report will be submitted to the Service’s Endangered Species program in the state where the work was conducted (Appendix C) documenting which bog turtle sites were mown. The report will include the following for each site that was mown during the previous seasonal window (November 1 to March 31): bog turtle site (site number or identifier), site location, entity responsible for mowing, date when mowing occurred, mowing height, type and ground pressure (PSI) of equipment that was used, type of mower that was used, any observed adverse effects on wetland soils or hydrology (e.g., rutting, channelization), and any observed effects on bog turtles or their use of habitat. A map showing the wetland location will be submitted with this report.

This information will assist the Service in 1) identifying the risks, benefits, and effectiveness of various habitat restoration practices; 2) tracking recovery implementation; and 3) determining if changes to this opinion are necessary to further the recovery of the bog turtle.

Effects – The mowing of herbaceous wetland vegetation is typically considered a habitat maintenance practice rather than a restoration practice, as it keeps woody vegetation from

becoming dominant and displacing desirable herbaceous vegetation. An exception to this would be the mowing of *Phragmites* or an extensive cattail stand to restore a degraded part of a wetland to more desirable and diverse, native herbaceous vegetation. Several bog turtle sites currently have areas of suitable, open-canopy habitat because they have been regularly mown to prevent the encroachment of woody vegetation or remove hay. While mowing was not typically conducted for the benefit of bog turtles, the species did incidentally benefit nonetheless. This incidental benefit was similar to the benefits from light to moderate grazing by livestock, which also functioned to maintain wetlands in an open-canopy condition.

Because mowing may occur throughout the wetland – including sensitive and preferentially used habitat areas (i.e., mucky areas) – conservation measures are included to reduce the risk of take. Some of the most important conservation measures include a seasonal restriction on mowing and the use of low ground pressure equipment, both of which are intended to reduce the risk of crushing bog turtles, destroying their nests, and damaging native herbaceous vegetation.

Portions of several known bog turtle sites have been subject to mowing over the past several years. The maintenance of bog turtle habitat in an open-canopy condition contributes to increased reproduction and recruitment by maintaining emergent habitat for successful bog turtle nesting and basking. Mowing is an effective tool to accomplish this and is expected to have a beneficial effect by increasing or maintaining the quality and quantity of open-emergent wetland habitat.

However, the use of heavy equipment in wetlands occupied by bog turtles poses a direct risk of injury or death to turtles. Studies have shown that wood turtles suffer high rates of mortality from agricultural activities (Jones 2009, Saumure *et al.* 2007). In response to these studies, Erb and Jones (2011) conducted experiments to evaluate the risk of turtle mortality associated with the style of mower, mower blade height, and tractor tires. Provided mower height was set well above the turtles, they found that most of the risk of turtle death or injury was associated with the tires, as the weight of the mowing equipment was concentrated on the ground at those contact points.

The risk to bog turtles has been substantially reduced by mowing with low ground pressure equipment (less than or equal to 2.0 PSI), and restricting all mowing to the period when bog turtles are hibernating. These conservation measures were developed following the Service's evaluation of the effects of low ground pressure equipment (Schrading *in litt.* 2011). The Service conducted a field test to evaluate the risk of injury to bog turtles. In that test, a turtle shell and a hard-boiled egg were placed at five different depths (16 inches, 12 inches, 6 inches, 2 inches, and ground surface), after which a Marsh Master 2 (MM-2, 1.3 PSI) with mower attachment was driven over the shell and egg. After each test, the shell and egg were examined for signs of damage. No damage to the turtle shell was observed at any depth; however, during the surface test the turtle shell was pushed into the wetland soil so that the top of the shell was even with the surrounding surface. There was no damage to the hard-boiled egg, except for the surface test which resulted in the egg shell cracking in several locations.

The MM-2 test suggests the risk of bog turtle death or injury is low, unless bog turtles are on the substrate surface when the equipment passes over them. To reduce the risk of take, equipment

will be used only in the wetland between November 1 and March 31, when the daytime air temperature is below 50° F. During this period, bog turtles are likely to be hibernating beneath the surface and turtle eggs from the previous season would have hatched. However, if bog turtles are on the substrate surface due to mild weather conditions or hibernating at shallow depths within mucky soils, low ground pressure equipment would be expected to push turtles into the substrate. While the pressure and treads/tracks of the equipment may not be sufficient to crack the turtle's shell, it may damage the surface of the shell or injure soft body parts (e.g., legs, head). As the allowable ground pressure (less than or equal to 2.0 PSI) is almost twice that of the test equipment (1.3 PSI), the risk of take is somewhat greater than the field test suggests. Nevertheless, the risk of take has been greatly reduced by a combination of low ground pressure equipment, seasonal restriction, and temperature restriction.

The risk of take is further reduced by constraints on disturbance intensity and frequency. With all mowing, the mower is expected to make a single pass over the area to be mown, rather than repeated passes over the same area. In *Phragmites* and cattail control areas, mowing will occur only once within the *Phragmites* or cattail stand, with minimal heavy equipment encroachment into non-target areas for wetland ingress or egress. In wetlands that are routinely maintained in an open herbaceous condition by mowing, the mowing disturbance will occur at a frequency of no more than once every 3 years. When mowing affects all or most of the wetland, a significant portion of the bog turtle population will be hibernating under the mown area; however, we would expect most of the turtles to hibernate at depths where they are not adversely affected by low ground pressure equipment. With respect to *Phragmites* and cattail control areas and wetlands within rights-of-way, we would expect some of the turtles to be hibernating in emergent, scrub-shrub, or forested areas outside the treatment area.

Conclusion – In light of the benefits of habitat restoration and maintenance and the implementation of conservation measures to minimize potential adverse effects, the Service concludes that the mowing of herbaceous vegetation is not likely to jeopardize the continued existence of the bog turtle. No critical habitat has been designated for the bog turtle; therefore, none will be affected.

Take Estimate – The Service estimates that up to 1 bog turtle may be killed or injured for every 10 bog turtle wetlands that are mown in their entirety, and that up to 1 bog turtle may be killed or injured for every 20 bog turtle wetlands that are partially mown.

5. Restoration Grazing

Project Description – For the purposes of this opinion, this method of habitat management is limited to the use of goats or sheep on sites (or fenced sub-portions of a site) where exotic invasive species or woody successional species (e.g., red maple, alder) constitute more than 50 percent cover. This would typically include portions of the wetland dominated by *Phragmites* or dense scrub-shrub areas. A stocking density of 0.75 animal unit per acre of open grassy habitat works equally well for habitat maintenance enclosures and habitat restoration enclosures, because it is the design of the enclosures that will determine the amount of grazing pressure in a wetland, not the density (Tesauro 2006). For restoration grazing, the enclosure should include the targeted degraded wetland area plus an adjoining upland area approximately 10 percent of the

size of the targeted wetland. The intent of this grazing method is to restore highly degraded wetland habitat, rather than maintain already suitable wetland habitat. Tesauro (2006) presents a more detailed discussion of restoration grazing, including methods to calculate stocking density. See also Appendix B for an animal unit equivalents guide.

Conservation Measures – To minimize the risk of take, the following conservation measures will be implemented when restoration grazing is implemented.

1. *Site reconnaissance* – A bog turtle specialist (see *Glossary*) will conduct an on-site evaluation to identify threats and potential threats to bog turtles and their habitat and determine appropriate measures to eliminate or minimize those threats. The monitoring biologist, landowner, and individuals who will be conducting habitat restoration or management activities should be present for this on-site evaluation or should plan on participating in a subsequent site visit with the specialist to discuss the feasibility of carrying out the recommended restoration or management practice(s), as well as to discuss the implementation of practice-specific conservation measures at the site-specific level.

The bog turtle specialist will carry out the roles detailed in the *Glossary*, including the identification of appropriate restoration practices, mapping of nesting and hibernating areas, and identification of treatment areas. When possible, telemetry or early season surveys will be conducted to identify particular patches of woody vegetation serving as hibernacula. Such areas will not be subject to woody vegetation control. If possible, surveys will also be conducted to identify nesting areas.

2. *Site restoration/management plan* – After the site has been field-viewed by a bog turtle specialist (see *Glossary*) to determine which restoration activities are necessary and appropriate, a detailed project description, project location map, and site map will be prepared. The project location map will identify the project's location on a USGS topographic map. The site map will identify the property boundaries, wetland boundaries, known and potentially suitable nesting habitat, hibernating areas, treatment areas, and the fence location (in the wetland and upland). The project narrative will include information about the type and density of grazers, anticipated grazing duration, the acreage of wetland and acreage of upland to be grazed, target plant species, and short- and long-term grazing objectives. This information will be submitted to the Service's Endangered Species program in the state where the work will be conducted (Appendix C) for a project-specific consultation.
3. *Fencing installation* – Fencing will be installed in accordance with Practice 1 of this opinion (see Installation of Fencing to Facilitate Grazing), and grazers will have access to both upland and wetland habitat.
4. *Grazing density and duration* – A stocking density of 0.75 animal unit per acre of fenced enclosure will be used; however, up to 1.0 animal unit per acre may be used for goats when addressing the invasion of woody vegetation. This equates to 5 to 10 mature sheep or goats per acre. The grazing period will not exceed 5 consecutive months. This

treatment may occur over 1 to 5 years, but will not exceed 5 consecutive years. Goats will not be pastured at 1 animal unit per acre for more than 3 years (Tesauro 2006).

5. *Known and potentially suitable nesting areas* - Prior to conducting restoration grazing, known and potentially suitable nesting areas will be identified and fenced to exclude restoration grazing. These are typically areas with native emergent vegetation (*e.g.*, sedges, rushes) and little or no shading from woody vegetation or tall invasive herbaceous plants. Grazers will be excluded from these areas because restoration grazing is not an appropriate practice within high quality habitat. As restoration grazing proceeds into its second or third year, treated areas of the wetland may become suitable for nesting (*i.e.*, look like potentially suitable nesting areas). However, restoration grazing may continue in these areas (for up to 5 years total) in order to achieve effective control of the target plant species. Grazers may have access to potentially suitable nesting areas at maintenance grazing densities (*i.e.* less than 0.75 animal unit per acre).
6. *Site monitoring* – Experienced staff who have successfully done prescribed grazing and who have a good understanding of bog turtle ecology will monitor the grazing project. They will survey the vegetation in the fenced area at least once a week while the goats or sheep are grazing to ensure that adverse effects on native herbaceous vegetation are minimized. They will also determine if the grazing pressure needs to be increased or decreased, although it will not be increased beyond 1.0 animal unit per acre. Any indications of imminent denuding of hummocks or denuding of moss cover down to substrate should result in prompt removal of grazers, as this is a sign of detrimental overgrazing.
7. *Treatment documentation* – Areas that have been treated using this restoration practice will be inspected during the growing season, after removal of high stocking densities, to determine the effectiveness of the treatment method. By December 31 of each treatment year, a monitoring report (see Appendix E for report template) will be submitted to the Service's Endangered Species program in the state where the work was conducted (Appendix C) documenting the following for each site treated: Name(s) of the target plant species, area (in acres) treated, type of grazer(s) used and stocking density, extent of treatment (*e.g.*, 2 months each year for 2 consecutive years), effectiveness of the treatment (percent control), any observed adverse or beneficial effects on non-target vegetation, and any observed effects on bog turtles or their use of habitat. A map showing the wetland and treated areas within the wetland, along with before and after photos, will be submitted with this report. This information will assist the Service in: 1) Identifying the risks, benefits, and effectiveness of various habitat restoration practices; 2) tracking recovery implementation; and 3) determining if changes to this opinion are necessary to further the recovery of the bog turtle.

Effects – Goats are browsers whose food preferences target species, especially woody vegetation and *Phragmites* that degrade bog turtle habitat. Heavy grazing of *Phragmites* has been demonstrated to deplete the plants' reserves and slow its regeneration, promoting the re-establishment and maintenance of suitable native wetland vegetation (Tesauro 2001). Goats

control shrubby vegetation by eating the accessible leaves and small branches and stripping the bark.

Except under duress, goats are unlikely to overgraze herbaceous vegetation preferred by bog turtles. Any instances of degradation of vegetation preferred by bog turtles will be temporary and rapidly offset by the re-growth of herbaceous vegetation when goat numbers are reduced. An exception to this is overgrazing of moss hummocks. When goats denude moss hummocks to substrate, it takes years for the moss to recover (Alison Whitlock, Service, personal communication). This may affect bog turtles by reducing high quality nesting areas within the wetland.

Goats are too small to damage wetland soils or crush bog turtles, which are likely to be absent or at very low densities on such highly degraded sites, particularly in the areas of these sites that would be subject to goat grazing. Further, because goat grazing will typically occur in areas dominated by woody vegetation, no damage to nests or eggs is anticipated.

In contrast to goats, sheep tend to crop herbaceous vegetation off close to the ground. The sheep densities contemplated for restoration grazing may result in short-term degradation of herbaceous vegetation and some trampling and exposure of soils. Because both sheep and bog turtles would likely be using the open, emergent portions of the wetland, bog turtles may be harassed or harmed by this practice if individual turtles are displaced from their home ranges or if foraging, basking, or nesting areas are trampled or degraded. However, should this occur, the effects would be offset by a reduction in stocking density or complete removal of sheep following restoration grazing, allowing native herbaceous vegetation to recover.

Because it may be necessary to use goats or sheep for restoration grazing over several seasons, emergent wetland vegetation favored by bog turtles for nesting, foraging, basking, or cover may show signs of overgrazing. The vegetation may be very short, and some exposed wetland soils may be evident. As a result, bog turtles and any nests in the grazed area may be exposed to an increased risk of predation. In addition, nests may experience decreased hatching due to egg desiccation resulting from increased solar exposure. However, the long-term beneficial effects are expected to outweigh the short-term effects on the vegetation and any temporary effects on turtles using the habitat. Take in the form of harassment or harm may result, but native vegetation is expected to quickly recover after the goat/sheep stocking densities are reduced, and the status of individual bog turtle sub-populations is expected to improve due to the restoration of native emergent vegetation.

Conclusion – Restoration grazing on highly degraded sites is not likely to jeopardize the continued existence of the northern population of the bog turtle. No critical habitat has been designated for the bog turtle; therefore, none will be affected.

Take Estimate – Restoration grazing by goats or sheep on degraded sites could temporarily cause further degradation of preferred plant species that might slightly reduce the survival rates or reproductive rates of any turtles persisting on the site. Since such injury would be difficult to detect, a noticeable reduction of native herbaceous vegetation by goats or sheep on a degraded

but occupied bog turtle site will be presumed to indicate injury to or harassment of one or more turtles.

The risk of take is lowest where goats are used to treat an enclosed area of scrub-shrub vegetation and highest where sheep are used to treat a large area of emergent wetland supporting bog turtles. It is anticipated that harassment will occur at up to 25 percent of the sites grazed by goats and up to 75 percent of the sites grazed by sheep. Multiple turtles may experience short-term harassment due to restoration grazing, particularly at sites grazed by sheep. The Service estimates that restoration grazing within emergent wetland habitat will result in the loss of up to 1 nest for every 10 sites grazed, and the death or injury of up to 1 bog turtle for every 20 sites grazed.

6. Implementation of Multiple Restoration Practices

Project Description – At many sites, it is necessary to implement multiple practices over a period of 1 to a few years to control invasive plants and restore bog turtle habitat. For example, prior to the introduction of grazing, it may be necessary to cut woody vegetation, treat woody vegetation with herbicide, and/or install fencing. Where grazing is not possible, it may be necessary to control woody and herbaceous vegetation via both cutting and herbicide application.

Because bog turtle habitat often suffers from the effects of multiple invasive plant species, restoration plans will be designed by a bog turtle specialist (see *Glossary*), in cooperation with the landowner, monitoring biologist, and person(s) who will be carrying out the restoration plan.

Conservation Measures – To minimize the risk of take, the following conservation measures will be implemented in wetlands occupied by bog turtles when multiple restoration practices are proposed.

1. *Site reconnaissance* – A bog turtle specialist (see *Glossary*) will conduct an on-site evaluation to identify threats and potential threats to bog turtles and their habitat and determine appropriate measures to eliminate or minimize those threats. The monitoring biologist, landowner, and individuals who will be conducting habitat restoration or management activities should be present for this on-site evaluation or should plan on participating in a subsequent site visit with the specialist to discuss the feasibility of carrying out the recommended restoration or management practices, as well as to discuss the implementation of practice-specific conservation measures at the site-specific level.

The bog turtle specialist will carry out the roles detailed in the *Glossary*, including the identification of appropriate restoration practices, mapping of known nesting and hibernating areas, and identification and mapping of treatment areas. When possible, telemetry or early season surveys will be conducted to identify particular patches of woody vegetation serving as hibernacula. Such areas will not be subject to woody vegetation control. If possible, surveys will also be conducted to identify nesting areas.

2. *Practice-specific conservation measures* – All practice-specific conservation measures will be implemented. These conservation measures are detailed above, under each restoration practice.
3. *Total treatment area* – No more than 50 percent of the wetland will be subject to all combined habitat restoration practices in any 1-year period. This limit on overall treatment area does not apply to mowing, restoration grazing, the installation of fencing to facilitate grazing, or to the practices “not likely to adversely affect” bog turtles, as described above in this document.

Cumulative Effects

At 50 CFR 402.02, “cumulative effects” are defined as those effects of future state or private activities, not including Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

The action area associated with individual habitat restoration projects may be subject to state and private activities that are reasonably certain to occur (i.e., cumulative effects). Reasonably foreseeable activities that may occur in uplands adjacent to bog turtle habitat include, but are not limited to, residential and commercial development, road construction and maintenance, construction and maintenance of utility infrastructure (e.g., pipelines, powerlines, water and sewer lines, telecommunications), resource extraction (e.g., oil and gas, water, minerals), and agricultural practices. Even though these activities occur in uplands, they have the potential to negatively affect various aspects of the bog turtle’s habitat, such as wetland water quality, wetland hydrology, and wetland plant species composition (e.g., prevalence of invasive plants, rate of vegetative succession). In addition, such activities will isolate bog turtle populations by altering or fragmenting travel corridors. Some of these activities will also contribute to an increased risk of bog turtle mortality (e.g., road kills, death/injury during dispersal through hostile upland environments, nest predation due to an increase in the prevalence of predators that thrive near human developments).

Reasonably foreseeable non-Federal activities that are likely to occur in bog turtle habitat include livestock grazing, mowing, and vegetation management in pipeline and power line rights-of-way¹³. These activities are expected to have a beneficial effect on bog turtle habitat, unless they are carried out in a manner that destroys or degrades the native wetland vegetation that bog turtles rely upon. Each of these activities also carries a risk of take in the form of death or injury to bog turtles or their nests (e.g., from crushing by large grazers or heavy mowing equipment).

In cases where upland activities cause or contribute to conditions favorable to invasive exotic plants or increased rates of succession, habitat restoration activities will, in part, offset some cumulative effects. However, the habitat restoration activities described in this opinion are not

¹³ Where these activities are covered under a Recovery Permit, they are considered effects of the action rather than cumulative effects.

expected to address the root causes of the problem, such as changes in surface water patterns, changes in the rates and locations of groundwater infiltration and recharge, reductions in spring flows due to groundwater withdrawals, and reductions in wetland quality due to increased chemical and sediment inputs. Climate change could further alter hydrologic conditions through erratic weather patterns, either drying or flooding the turtle's habitat.

The Service activities evaluated in this document are not anticipated to cause adverse effects that are synergistic with the cumulative effects mentioned above. The Service has determined, therefore, that for the purposes of completing the jeopardy analysis and conclusion, activities in this document can be effectively analyzed independent of future state and private activities.

Summary Conclusion

After reviewing the current status of the bog turtle, the environmental baseline for the action area, and the effects of the types of restoration activities proposed, it is the Service's biological opinion that implementation of the described habitat restoration activities is not likely to jeopardize the continued existence of the northern population of the bog turtle. No critical habitat has been designated for this species; therefore, none will be affected.

The Service has based this determination on the relatively few bog turtles that are likely to be killed or injured during the implementation of habitat restoration activities. The loss of a small number of turtles will be more than offset by the beneficial effects of habitat restoration over the long term. Habitat restoration and maintenance projects are expected to restore degraded bog turtle habitat or maintain that habitat in a condition appropriate for the turtle. These activities will increase the amount of high quality emergent vegetation necessary for bog turtle nesting, basking, and escape cover. The restoration of nesting habitat is likely to improve nesting success, leading to a gradual increase in the population at a site, provided other factors (*e.g.*, predation, poaching, road kills) do not offset these increases in reproductive output. Although beneficial effects, such as increased reproductive success, are expected, at this time the beneficial effect cannot be quantified.

If implemented at numerous sites within the northern range, the proposed habitat restoration and maintenance practices may help reverse (or at least slow) the decline of the northern population of the bog turtle and increase the likelihood of recovery from its threatened status. Provided there is full implementation of the practice-specific conservation measures, the proposed actions are not likely to appreciably reduce the likelihood of the survival or recovery of the northern population of the bog turtle. Based on a review of the current status of the species, the Service concludes that the proposed restoration and maintenance practices are likely to result in net beneficial effects at both the site and population level.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA, as amended, and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to

include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering.

In accordance with the regulations governing section 7 consultation (50 CFR part 402), the Service is charged with issuing a biological opinion indicating whether or not the proposed action is likely to jeopardize the continued existence of listed species. In those cases where the Service concludes that an action (or the implementation of any reasonable and prudent alternatives) and the resultant incidental take of listed species will not violate section 7(a)(2) of the ESA, the Service provides an "incidental take statement" with the biological opinion. The incidental take statement exempts the take anticipated as a result of the action.

Because incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity, this Incidental Take Statement is valid only upon receipt of appropriate authorizations and permits from Federal, state and local permitting authorities. For activities that are not funded or carried out by the Service, a Recovery Permit may be necessary. Permits or authorizations for herbicide application, tree removal, or fence installation in wetlands may also be necessary. Permitting requirements vary by state and local governing authority; therefore, project proponents should determine what authorizations may be needed before beginning work.

Under the terms of section 7(b)(4) and section 7(o)(2) of the ESA, taking that is incidental to and not intended as part of the agency action is not considered to be a prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary and must be undertaken by the Service so that they become binding conditions of any restoration project implemented, funded, or authorized for the exemption in section 7(o)(2) to apply. The Service has a continuing duty to regulate the activity covered by this incidental take statement. If the Service 1) fails to assume and implement the terms and conditions or 2) fails to require the applicant or grant or contract recipient to adhere to the terms and conditions of the incidental take statement, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Service must report the progress of the action and its impacts on the species as specified in the Incidental Take Statement [50 CFR 402.14(i)(3)].

Amount or Extent of Take

Incidental take of bog turtles is expected to be in the form of killing, injuring, harming or harassing during habitat restoration activities. The actual level of incidental take will be difficult to detect or quantify for the following reasons: 1) bog turtles are small and cryptic; 2) bog turtles are likely to exhibit predator-evasive behaviors (*e.g.*, burying themselves in the substrate during restoration activities) making them difficult to locate; and 3) finding dead or injured specimens is unlikely due to the nature of activities proposed.

Based on the practice-specific effects analyses, the Service anticipates that incidental take will not exceed the following:

- Fence installation – Death or injury of up to 1 bog turtle for every 10 sites fenced where heavy equipment (i.e., tracked or wheeled vehicles) is used in the wetland.
- Herbicide Application – Death or injury of up to 1 bog turtle for every 10 sites subject to herbicide application. The risk of take is highest when 1) a large crew carries out herbicide application throughout a significant portion of a wetland, 2) unknown hibernating areas are treated, 3) unknown nesting areas are treated, 4) large areas of the emergent part of the wetland are sprayed with herbicide and fail to quickly re-vegetate, or 5) heavy equipment is used within the wetland to apply herbicide to control *Phragmites* or cattail.
- Cutting and Removal of Woody Vegetation – Death or injury of up to two bog turtles per site at sites subject to the most extensive control of large woody vegetation within mucky areas (i.e., control within greater than or equal to 25 percent of the mucky area within the wetland), particularly when using heavy equipment. At sites subject to less extensive control of woody vegetation, death or injury of up to 1 bog turtle for every 10 sites subject to woody vegetation control between November 1 and March 31. Death of up to 1 bog turtle and loss of up to 2 nests for every 10 sites where material less than 3 inches d.b.h. is cut and removed between April 1 and September 30.
- Mowing – Up to 1 bog turtle may be killed or injured for every 10 bog turtle wetlands that are mown in their entirety and up to 1 bog turtle may be killed or injured for every 20 bog turtle wetlands that are partially mown.
- Restoration Grazing – Where restoration grazing occurs within emergent wetlands, loss of up to 1 nest for every 10 sites subject to restoration grazing, and the death or injury of up to 1 bog turtle for every 20 sites subject to restoration grazing. Harassment at up to 25 percent of the sites grazed by goats and up to 75 percent of the sites grazed by sheep.

When multiple restoration practices are proposed at a site, the Service does not expect an increase in take over the practice-specific take estimates because the total treatment area will be limited, and most of the practices present a fairly low risk of take when the conservation measures are implemented.

The Service estimates that it will fund or implement habitat restoration and maintenance practices at up to 30 occupied bog turtle sites per year within the northern range of the species. Based on the practice-specific effects analyses, the Service estimates that these activities will result in the death or injury of up to 3 bog turtles per year. At many sites, short-term harassment of bog turtles may also occur while the restoration activities are being undertaken. Over the 5-year period covered by this opinion (i.e., 2012 to 2016), habitat restoration practices may occur at an estimated 150 bog turtle sites resulting in the death or injury of up to 15 bog turtles.

The Service anticipates it will authorize take due to the implementation of habitat restoration and maintenance practices at up to 30 occupied bog turtle sites per year within the northern range of the species. This take authorization is expected to occur via the issuance of section 10(a)(1)(A) Recovery Permits. Based on the practice-specific effects analyses, the Service estimates that these activities will result in the death or injury of up to three bog turtles per year. At many sites, short-term harassment of bog turtles may also occur while the restoration activities are being undertaken. Over the 5-year period covered by this opinion (i.e., 2012 to 2016), habitat restoration and maintenance practices may occur at an estimated 150 bog turtle sites resulting in the death or injury of up to 15 bog turtles.

This level of incidental take is not expected to result in adverse population-level effects at either individual sites or within the northern range of the species. The Service anticipates that the beneficial effects of habitat restoration will substantially exceed the adverse effects.

Effect of the Take

In the accompanying biological opinion, the Service determined that this level of expected take is not likely to result in jeopardy to the bog turtle.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize and monitor take of the bog turtle.

1. Restore and maintain bog turtle habitat in a manner that reduces the risk of take and minimizes the risk of adverse impacts to bog turtle habitat.
2. Consult with the Service's Endangered Species Program on bog turtle habitat restoration and maintenance projects.
3. Monitor and report take.
4. Monitor project effects and treatment effectiveness.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Service must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. Conservation Measures

Due to the bog turtle's low reproductive potential and small population size, loss of adult turtles and their nests must be avoided whenever possible. Therefore, fully implement the practice-specific conservation measures detailed in this biological opinion during the design and implementation of bog turtle habitat restoration and maintenance projects. Failure to implement these measures could cause take that results in significant population-level effects, calling into question the beneficial effects of restoration activities at a site.

2. Project Review – Tier 2 Consultations¹⁴

Consult with the Service's Endangered Species program¹⁵ on bog turtle habitat restoration and maintenance projects. The project-specific consultations will focus on 1) site-specific threats to the bog turtle and its habitat, 2) the most appropriate habitat restoration or maintenance method(s) to counteract the identified threats; 3) the integration of project-specific conservation measures at the site level; and 4) consistency of the project with the scope and effects analyzed in this programmatic opinion.

- a. Provide the Service's Endangered Species Program with a hard copy and electronic copy of the Site Restoration/Management Plan. Plan contents are detailed for each habitat restoration practice (see Conservation Measures). In addition, practice-specific checklists are included in Appendix D of this opinion to assist the Service (and Service applicants, and grant and contract recipients) in incorporating the practice-specific conservation measures and maintaining an administrative record.
- b. If the proposed restoration or maintenance practice(s) 1) are appropriate for the site(s) under consideration, 2) are consistent with those identified and analyzed in this opinion, and 3) have adverse effects that do not exceed those disclosed in this opinion, the project will be considered to be in compliance with this opinion, and the Service's section 7(a)(2) consultation requirements for that project will be satisfied. If the proposed restoration or maintenance practices are not appropriate for the site(s), the Service's Endangered Species Program will provide guidance on appropriate practices compatible with the site and species.
- c. If the proposed project was not considered in this opinion (*e.g.*, use of herbicides not specifically covered by this opinion, alteration of wetland hydrology, etc.) or if the project is expected to have effects not considered in this opinion, the project will undergo further consultation, pursuant to section 7(a)(2) of the ESA.

¹⁴ Although we have provided a programmatic biological opinion to the Service for the implementation of certain bog turtle habitat restoration and maintenance practices, we will review, as they are developed, site-specific projects that "may affect" this species. During those consultations, the Service's Endangered Species Program will provide other Service programs with technical assistance and determine if any effects will occur as a result of a site-specific project in a manner, or to an extent, not evaluated or previously disclosed and discussed in this programmatic BO. The Service considers this site-specific project review and analysis to be "Tier 2" of the consultation process, with the programmatic consultation (and resulting opinion) constituting the "Tier 1" consultation.

¹⁵ In the state where the work is proposed (see Appendix C).

3. Take Reporting

Upon finding a dead or injured turtle that has been, or is likely to have been, killed or injured by habitat restoration practices at a site, the project proponent will immediately contact the Service's Endangered Species program in the state where the work was conducted (Appendix C). If the turtle was likely killed or injured by the use of heavy equipment (*e.g.*, tracked or wheeled vehicles), use of the vehicles will be discontinued until a site investigation by a Service endangered species biologist takes place. The conditions leading to the death or injury of the turtle(s) will be documented to assist the Service in designing future projects and to ensure that the assumptions and effects detailed in this opinion are correct.

Care must be taken in handling dead or injured bog turtles that are found in the project area to preserve biological material in the best possible state. In conjunction with the preservation of any dead specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead specimens does not imply enforcement proceedings pursuant to the ESA. The reporting of dead specimens is required to enable the Service to determine if take is reached or exceeded and to ensure that the conservation measures and terms and conditions are appropriate and effective. Upon locating a dead, injured, or sick bog turtle, notification must be made within 24 hours to:

- U.S. Fish and Wildlife Service – Office of Law Enforcement, 300 Westgate Center Drive, Hadley, Massachusetts 01035-9589 (telephone: 413-253-8343); and
- The Service's Endangered Species program in the state where the restoration work was conducted (Appendix C).

4. Treatment Effects and Effectiveness

Provide a report (hard copy and electronic copy) to the Service's Endangered Species Program, documenting the treatment effects and effectiveness for each project, as detailed under Treatment Documentation for each restoration practice (see Conservation Measures). See Appendix E for a report template.

5. Tracking of Take and Recovery Implementation

The Endangered Species Program will track recovery implementation and take, using a standardized template or database. The following information will be tracked for each site: bog turtle site (site identifier or number), site location (state, county), restoration or maintenance practice(s) implemented, year implemented, acres restored or maintained, Service action (funding, implementation, or permitting), amount of take, and follow-up treatment monitoring (date).

Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of threatened and endangered species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. Work with landowners, the general public, and other agencies to promote education and information about the bog turtle and its conservation.
2. Work with NRCS to further NRCS programs (*e.g.*, Wetland Reserve Program) to conserve and protect wetlands occupied by bog turtles, as well the surrounding upland buffers.
3. Determine the short- and long-term effects and effectiveness of spray applications of glyphosate on reed canary grass, including the rate and diversity of vegetation re-establishment.
4. Track the implementation of habitat restoration projects that are "not likely to adversely affect" bog turtles.
5. To determine the effect of restoration activities on bog turtles, conduct pre- and post-restoration telemetry studies to document habitat areas used for nesting, hibernating, and foraging. In addition, determine nesting success pre- and post-restoration.

In order for the Service's Endangered Species Program to be kept informed of actions benefitting listed species or their habitats, we request notification of the implementation of any conservation recommendations so that we can track progress in meeting recovery goals and objectives.

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the request. As provided in 50 C.F.R. §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the actions has been retained (or is authorized by law) and if 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; or 3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Acting

Assistant Regional Director

7/23/12

Date

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Appendix A – Glossary of Terms

Bog turtle specialist – a biologist knowledgeable about bog turtle life history, habitat requirements, habitat preferences, threats to the species and its habitat, threat mitigation, and the basics of habitat restoration practices. This person is someone skilled in the identification and characterization of bog turtle habitat and capable of identifying potentially suitable nesting habitat and hibernating areas within wetlands occupied by bog turtles. This would typically be a Service endangered species biologist, a state non-game biologist, a recognized qualified bog turtle surveyor, or other approved biologist with the knowledge and skills outlined above. A list of bog turtle specialists is available from the Service. Additions to that list will be reviewed by the Service’s Endangered Species program.

The roles of the bog turtle specialist include:

- Identifying threats and potential threats to bog turtles and their habitat
- Identifying appropriate measures to alleviate site-specific threats to bog turtles and their habitat
- Identifying, mapping, and marking (as appropriate) known or potential nesting and hibernating habitat
- Identifying, mapping, and marking (as appropriate) areas that will be subject to, or excluded from, habitat restoration activities
- Determining the appropriate scale and type of habitat restoration and habitat management activities, typically in coordination with the landowner, monitoring biologist, and individuals who will be implementing those activities

Glove application – application of glyphosate to a plant using a cotton glove saturated with the herbicide. The person applying herbicide wears chemical resistant nitrile or latex gloves on both hands covered by a fleecy, cotton glove on one of the hands. The target plant is held by the hand with the cotton glove and herbicide is sprayed into that hand (trying not to hit non-target plants). Then the cotton glove is wicked up the top one-third of the plant.

Heavy equipment – tracked or wheeled vehicles

Large grazers – cattle, horses, and other similar-sized animals

Light equipment – equipment that is hand carried (e.g., chainsaw, hatchet, or E-Z-Ject® Lance)

Light to moderate grazing – Also referred to as “habitat maintenance grazing” or “maintenance grazing.” This type of grazing is done to maintain bog turtle habitat in a primarily emergent vegetative condition, with minimal presence of invasive herbaceous plants. A stocking density of less than 0.75 animal units per acre of “grassland” is used within the fenced enclosure. “Grassland” is defined as open, grassy areas such as areas with emergent wetland vegetation (e.g., sedges, rushes); upland pasture grasses (e.g., fescue, timothy); or invasive, exotic plants (e.g., *Phragmites*, reed canary grass). This stocking density is equivalent to one dairy cow per 2 acres, four mature sheep per acre, or five mature goats per acre of grassland within the fenced enclosure. See Appendix B for an animal unit equivalents guide. Grazers have access to both

upland and wetland areas, and large grazers are excluded from known nesting areas during the bog turtle nesting season (June 1 to September 30).

Maintenance grazing – see “light to moderate grazing”

Monitoring biologist – a biologist who 1) is knowledgeable about and skilled in the implementation of practice-specific conservation measures, 2) can accurately identify sensitive areas (*e.g.*, mucky areas, springs) where restoration practices are restricted, and 3) is capable of overseeing individuals carrying out restoration practices in a manner that ensures conservation measures are implemented. While carrying out the responsibilities of a monitoring biologist, this individual has oversight responsibilities for the implementation of practice-specific conservation measures, and therefore, will not concurrently be carrying out those restoration activities.

The roles of the monitoring biologist include:

- Identifying and delineating “mucky areas” within bog turtle wetlands
- Working with the bog turtle specialist to identify travel routes for equipment within the wetland
- Coordinating with the bog turtle specialist to understand the location and constraints associated with nesting and hibernating areas
- Briefing project personnel on the appropriate implementation of practice-specific conservation measures
- Monitoring the implementation of practice-specific conservation measures to ensure those measures are fully implemented
- Documenting compliance or non-compliance with practice-specific conservation measures

Mucky areas – areas of the wetland having soft, saturated substrates at least 4 inches deep. These areas are usually identified using a wooden probe (*e.g.*, broom or tool handle).

Non-mucky areas – areas of the wetland lacking soft, saturated substrates or having soft, saturated substrates that can be probed only to a depth of less than 4 inches.

Restoration grazing - The intent of this grazing method is to restore highly degraded wetland habitat, rather than maintain already suitable wetland habitat. This method of habitat management is limited to the use of goats or sheep on sites (or fenced sub-portions of a site) where exotic invasive species or woody successional species (*e.g.*, red maple, alder) constitute more than 50 percent cover. A stocking density of 0.75 animal unit per acre of fenced enclosure is used; however, up to 1.0 animal unit per acre may be used for goats when addressing the invasion of woody vegetation. This equates to 5 to 10 mature sheep or goats per acre. The grazing period will not exceed 5 consecutive months. This treatment may occur over 1 to 5 years, but will not exceed 5 consecutive years.

Small grazers – sheep and goats

Travel route – a path used repeatedly by heavy equipment to access the project site.

Wetland – refers to the entire wetland, not just the best bog turtle habitat within the wetland

Wetlands occupied by bog turtles – any wetland where bog turtles have been confirmed at any time within the past 50 years.

Appendix B – Animal Unit Equivalents¹

Kind of livestock	Animal-unit equivalent²
Cow, young dairy (heifer, 1-2 yrs)	1.0
Cow, mature dairy (3+ yrs)	1.5
Bull, mature	1.5-1.9
Cattle, mature beef (1-2 yrs)	1.0
Horse, mature draught	2.0
Horse, mature saddle	1.25
Sheep, mature	0.20
Lamb, 1 year old	0.15
Goat, mature	0.17
Kid, 1 year old	0.10

¹ Table compiled from various sources, including: Maryland Department of Agriculture, 1999 (http://www.mda.state.md.us/resource_conservation/nutrient_management/manual/animal_unit_equivalencies.php);

Delaware Department of Agriculture, 2000

(http://www.state.de.us/deptagri/nutrients/newsltr/feb_00.shtml); USDA, 2003, Table 6-5 of the National Resource Conservation Service's National Range and Pasture Handbook, Rev. 1.

² One Animal Unit is equivalent to the forage consumption of a 1000-pound grazer.

Appendix C – SERVICE Contacts

STATE	U.S. FISH AND WILDLIFE SERVICE ECOLOGICAL SERVICES FIELD OFFICE
Connecticut & Massachusetts	U.S. Fish and Wildlife Service New England Field Office 22 Bridge Street, Unit #1 Concord, NH 03301
Delaware & Maryland	U.S. Fish and Wildlife Service Chesapeake Bay Field Office 177 Admiral Cochrane Drive Annapolis, MD 21401
New Jersey	U.S. Fish and Wildlife Service New Jersey Field Office 927 North Main Street, Bldg. D-1 Pleasantville, NJ 08232
New York	U.S. Fish and Wildlife Service 3817 Luker Road Cortland, NY 13045
Pennsylvania	U.S. Fish and Wildlife Service Pennsylvania Field Office 315 South Allen Street, Suite 322 State College, PA 16801

Appendix D – Restoration Practice Checklists

**BOG TURTLE HABITAT MAINTENANCE AND RESTORATION
ACTIVITIES THAT ARE “NOT LIKELY TO ADVERSELY AFFECT”**

- ✓ Installation of fencing in upland areas to facilitate “light to moderate grazing”
- ✓ Hand-installation of fencing in wetlands at any time of year to facilitate “light to moderate grazing”. Prior to hand installation, a “bog turtle specialist” or “monitoring biologist” will search the wetland work areas (*e.g.*, surface and substrate where the fence posts will be placed, access routes through the wetland) to ensure that bog turtles are not present. No vehicles will be used in the wetland.
- ✓ Installation of interior, partition fencing or movement of such fencing within wetlands at any time of year. Interior, temporary fencing is supported by small-diameter (not to exceed one inch in diameter), hand-placed poles (*e.g.*, 1-inch diameter fiberglass rods).
- ✓ Prescribed burning in wetlands between November 1 and March 31. Some of the dead emergent vegetation in mucky areas of the wetland will remain unburned to provide cover for bog turtles when they emerge in the spring.
- ✓ Introduction of biological control beetles (*i.e.*, *Galerucella californiensis* and *G. pusilla*) in wetlands to control purple loosestrife (*Lythrum salicaria*). Introduction of biological control weevils (*i.e.*, *Rhinoncomimus latipes*) in wetlands to control mile-a-minute weed (*Persicaria perfoliata*) (formerly *Polygonum perfoliatum*).
- ✓ Application of glyphosate, triclopyr or imazapyr (following label directions) in uplands adjacent wetlands occupied by the bog turtle. This refers specifically to the application of herbicide to control invasive plant species problematic to the bog turtle (*e.g.*, multiflora rose, mile-a-minute weed), provided there is no application of herbicide in the wetland.
- ✓ Girdling of woody vegetation in or adjacent to wetlands. At least 10-20% of the tree and shrub cover in “mucky areas” of the wetland will be retained (*i.e.*, not treated), especially alder, red maple and poison sumac located in or near seeps, springs, rivulets and mucky areas. These areas will be clearly marked or flagged to avoid treatment.
- ✓ Cutting and/or removal of woody vegetation ≤ 3 inches d.b.h. between October 1 and March 31 using light equipment (*e.g.*, chainsaw, ax). No vehicles will be used in the wetland.
- ✓ Cutting of herbaceous vegetation between October 1 and March 31 using light equipment. Vegetation is cut to a height of at least 8 inches to ensure adequate cover. No vehicles will be used in the wetland.
- ✓ “Light to moderate grazing” (= habitat maintenance grazing) within wetlands. This is defined as grazing using a stocking density of < 0.75 animal unit per acre of “grassland” within the fenced enclosure. “Grassland” is defined as open, grassy areas such as areas with emergent wetland vegetation (*e.g.*, sedges, rushes); upland pasture grasses (*e.g.*, fescue, timothy); or invasive, exotic plants (*e.g.*, *Phragmites*, reed canary grass). This stocking density is equivalent to 1 dairy cow per 2 acres, 3 to 4 sheep per acre, or 4 to 5 goats per acre of grassland within the fenced enclosure (depending on animal size). See animal unit equivalents guide. Grazers have access to both upland and wetland areas, and large grazers are excluded from known nesting areas during the bog turtle nesting season (June 1 to September 30).

FENCING INSTALLATION TO FACILITE GRAZING – CONSERVATION MEASURE CHECKLIST

- A “bog turtle specialist” has conducted an on-site evaluation and determined that grazing is a necessary and appropriate habitat restoration/maintenance practice for the site.
- Fencing will only be installed to facilitate “light to moderate grazing”¹⁶ or “restoration grazing”.
- Landowner has been advised in writing of appropriate grazing densities, the need to keep large grazers out of known nesting areas from June 1 to Sept 30, and the need to avoid placing salt or mineral licks, livestock feeders and livestock watering devices in or within 50 feet of wetlands.
- A monitoring biologist will be on-site and ensure conservation measures are implemented.
- Mucky areas, and known nesting and hibernating areas have been identified.
- When it is necessary to use heavy equipment in wetlands 1) only low ground pressure equipment will be used (≤ 3.1 psi), 2) work will occur between Nov. 1 and March 31, 3) known nesting and known hibernating areas will be avoided, 4) mucky areas will be avoided to the maximum extent practicable, and 5) heavy equipment will use pre-determined travel routes that avoid mucky areas, and known nesting and hibernating areas.
- Whenever possible, fence posts will be installed in upland areas. Where this is not feasible, fence posts will be installed in non-mucky areas within the wetland whenever possible. When it is necessary to install fence posts in mucky areas, small-diameter, hand-set posts will be used whenever possible.
- The fence alignment will minimize impacts on mucky areas, avoid known hibernating areas (plus a 50-foot buffer), and allow for the exclusion of large grazers from known nesting areas.
- Vehicles and heavy machinery will be serviced in uplands.
- Absorbent pads will be used under light equipment when it is refueled in wetlands.
- Fencing will be installed to exclude large grazers from known nesting areas during the nesting season (June 1 to Sept. 30). (This can be done using partition fencing.)
- A site restoration/management plan has been prepared (see Conservation Measures for plan content). This information will be retained in SERVICE project files and submitted to the Service’s Endangered Species Program (in the state where the project is conducted) for review and project-specific consultation.

¹⁶ “Light to moderate grazing” (= habitat maintenance grazing) is defined as grazing using a stocking density of < 0.75 animal unit per acre of “grassland” within the fenced enclosure. “Grassland” is defined as open, grassy areas such as areas with emergent wetland vegetation (*e.g.*, sedges, rushes); upland pasture grasses (*e.g.*, fescue, timothy); or invasive, exotic plants (*e.g.*, *Phragmites*, reed canary grass). This stocking density is equivalent to 1 dairy cow per 2 acres, 3 to 4 sheep per acre, or 4 to 5 goats per acre of grassland within the fenced enclosure (depending on animal size). See animal unit equivalents guide. Grazers have access to both upland and wetland areas, and large grazers are excluded from known nesting areas during the bog turtle nesting season (June 1 to September 30).

- A monitoring report has been sent to the SERVICE Endangered Species Program (see report template).

HERBICIDE APPLICATION – CONSERVATION MEASURE CHECKLIST

- A “bog turtle specialist” has conducted an on-site evaluation and determined that herbicide application is a necessary and appropriate habitat restoration practice for the site.
- Herbicide application will not be carried out when another mechanism is controlling or likely to effectively control the target plant species.
- A monitoring biologist will be on-site and ensure conservation measures are implemented.
- No more than 50% of the wetland will be treated in any 1-year period.
- Herbicide will not be applied within known nesting areas between June 1 and September 30, nor will workers traverse through known nesting areas during this period.
- Herbicide will not be applied to woody vegetation within known hibernating areas.
- At least 10-20% of the native tree and shrub cover in “mucky areas” of the wetland will be retained (i.e., not treated), especially alder, red maple and poison sumac located in or near seeps, springs, rivulets and mucky areas. Scattered pockets of shrubs will be retained in mucky areas within the emergent portion of the wetland. In addition, at least 10-20% of the tree cover will be retained within forested parts of the wetland, typically in mucky areas. These areas will be clearly marked to avoid treatment.
- Cattail will only be controlled with herbicides when it has become the dominant plant species in the wetland (i.e., > 50% cover in the emergent portion of the wetland). At least 10% of the cattail cover will remain untreated, particularly within mucky parts of the wetland.
- When it is necessary to use a surfactant to increase herbicide efficacy, the surfactant LI-700® will be used in accordance with the EPA-approved label instructions.
- A licensed applicator will be present on site at all times when herbicide is being applied.
- To reduce the risk of spills within the wetland, the filling and emptying of herbicide containers (e.g., spray bottles, backpack sprayers) will occur in upland areas. All applicators will have available a spill kit with absorbent pads. In addition, all equipment, hoses, tanks and clamps will be inspected in the uplands prior to spraying each treatment day.
- Open containers of herbicide will not be used in the wetland.
- To reduce impacts to non-target plants, herbicide will only be sprayed where there is a dense stand of the target plants. Herbicide will be applied when wind speed at treatment height is ≤ 5 m.p.h. to reduce the risk of drift.
- The following herbicides and herbicide application method(s) will be used:

- Imazapyr to control woody vegetation using the injection method (e.g., EZ-Ject Lance). Use of the herbicide imazapyr will be limited to the control of woody vegetation >2” diameter.
- Imazapyr as a re-treatment for Phragmites or cattail using a low-pressure / high-pressure (circle one) spray application in September.
- Triclopyr (e.g., Pathfinder® II) to control woody vegetation using the basal bark application method between November 1 and March 31.
- Glyphosate – check the application method(s) below
 - Injection** – Glyphosate pellets will be injected into the stems of woody vegetation using an EZ-Ject Lance (or similar device)
 - Hack and Squirt** – Glyphosate will be directly applied to cuts or holes in woody vegetation using a backpack sprayer, squirt bottle, or syringe. A Hypo-Hatchet® Tree Injector may also be used.
 - Cut stump or Cut stem** – Glyphosate will be directly applied to the cut stump or stem of woody or herbaceous vegetation using a device that minimizes the risk of herbicide spills (e.g., spray bottle, wick applicator).
 - Wick application** – During the growing season, glyphosate will be applied directly to the leaves or stems of *Phragmites*, purple loosestrife, cattail, mile-a-minute weed, Japanese stiltgrass, alder, or re-sprouts of woody vegetation (e.g., red maple, alder) via the “glove application” method or by using a “paint stick” or “stain stick” with a contained reservoir to hold the herbicide.
 - Low pressure spray or spot spray** – Glyphosate will be sprayed on the leaves or stems of multiflora rose, *Phragmites*, purple loosestrife, cattail, mile-a-minute weed, Japanese stiltgrass, alder, or re-sprouts of woody vegetation via a backpack sprayer, squirt bottle, or modified low volume hydraulic applicator. The spray pressure will not exceed 60 PSI. A wand will be used to ensure herbicide reaches the tops of tall plants. High pressure sprayers will not be used, as this will increase the risk of herbicide drift. Treatment periods: September for *Phragmites*; around the time of flowering for purple loosestrife (July/August); July-September for multiflora rose and woody re-sprouts; September for cattail. Later dates (post-July) are preferred whenever feasible to reduce potential impacts to nests.
 - High-pressure spray control of *Phragmites*** – Glyphosate will be sprayed on large, dense stands of *Phragmites* in September, using spray equipment whose pressure does not exceed 400 PSI. Re-treatment the following season will include glyphosate or imazapyr application using a high-pressure sprayer, low-pressure sprayer or spot spraying.
 - Low ground pressure equipment (psi ≤ 2.0) will be used in the wetland and serve as a platform for personnel and spray equipment. OR
 - No heavy equipment will be used in the wetland
 - High-pressure spray control of cattail** – Glyphosate will be sprayed on large, dense stands of cattail in September, using spray equipment whose pressure does not exceed 400 PSI. Re-

treatment the following season will include glyphosate or imazapyr application using a high-pressure sprayer, low-pressure sprayer or spot spraying.

- Low ground pressure equipment (psi \leq 2.0) will be used in the wetland and serve as a platform for personnel and spray equipment. OR
- No heavy equipment will be used in the wetland
- Monitoring biologist will be present on site the first day restoration activities are undertaken to brief workers on the conservation measures, and ensure that sensitive areas (i.e., areas to remain untreated) are avoided. All treatment areas will be clearly identified.
- Monitoring biologist will conduct daily site inspections during restoration to ensure the conservation measures are being implemented appropriately.
- Large areas (i.e., \geq 1 acre or \geq 25% of the wetland) that have been sprayed with herbicide will be monitored to ensure native herbaceous vegetation is re-establishing. For late summer/early fall treatments, monitoring will occur the following spring (by May). For spring treatments, monitoring will occur 1-2 months after treatment. If the treatment area is devoid of vegetation, native herbaceous vegetation or a non-invasive annual cover will be planted.
- A site restoration/management plan has been prepared. This information will be retained in SERVICE project files and submitted to the Service's Endangered Species Program (in the state where the project is conducted) for review and project-specific consultation. The plan includes a project description, project location map, and site map, reflecting the above conservation measures. The site map identifies property boundaries, wetland boundaries, known nesting and hibernating areas, and proposed treatment areas by target plant species. The project narrative includes detailed information about the proposed treatment for each target plant species, including herbicide and surfactant type and concentration, application method, timing of treatment, and size of area to be treated.
- Treatment areas will be inspected the following growing season to determine treatment effectiveness and document re-establishment of vegetative growth (target and non-target).
- A monitoring report has been provided to the Service's Endangered Species Program (in the state where the project was conducted) by December 31 of the year following treatment. The report (see template) will document the following: name(s) of the target plant species, area (in acres) treated, treatment method and timing, herbicide and surfactant concentration used, effectiveness of the treatment (% kill), any observed effects on non-target plants, and any observed effects on bog turtles or their use of habitat. A map showing the wetland and treated areas within the wetland will be submitted with this report.

CUTTING AND REMOVAL OF WOODY VEGETATION – CONSERVATION MEASURE CHECKLIST

- A “bog turtle specialist” has conducted an on-site evaluation and determined that cutting of woody vegetation is a necessary and appropriate habitat restoration practice for the site. Alternatives to the cutting of woody vegetation have been carefully considered.
- A monitoring biologist will be on-site and ensure conservation measures are implemented.
- Known nesting and hibernating areas have been identified and mapped, as well as areas of woody vegetation to be retained. As appropriate, these areas will be marked or flagged.
- Monitoring biologist has identified travel routes for heavy equipment to avoid mucky areas, known nesting and hibernating areas, and areas of woody vegetation to be retained.
- The monitoring biologists will conduct a briefing immediately prior to work, during which direct lines of authority will be established and the project discussed in detail. A carefully planned command hierarchy will be established and communicated clearly to all involved, particularly when operators and partners are from different offices and/or agencies. The hierarchy should be based on knowledge of bog turtle habitat and avoidance of take.
- Monitoring biologist will be present on the first day of restoration activities to brief workers on conservation measures, and ensure that sensitive areas (nesting and hibernating areas, mucky areas) and areas of woody vegetation to be retained are identified and avoided.
- If heavy equipment enters mucky areas or known nesting or hibernating areas, the monitoring biologist will survey these areas for signs of adverse effects, including dead or injured bog turtles, and damage to habitat.
- In addition to the operator, each piece of heavy equipment will have an assigned biologist (i.e., monitoring biologist) familiar with bog turtle habitat. This attendant will precede the equipment into work areas. An appropriate signaling system will be adopted or 2-way radio headphones used to establish communication links between operators and biologist attendants. The attendant will stay with the equipment the entire time it is in use in the wetland to ensure equipment does not enter restricted areas (i.e., known nesting and hibernating areas, mucky areas, areas of woody vegetation to be retained). The attendant’s decisions on entering/not entering areas will supersede the operator’s opinions, regardless of rank or agency affiliation.
- No more than 50% of the wetland will be treated in any 1-year period.
- At least 10-20% of the native tree and shrub cover in “mucky areas” in both the emergent and forested parts of the wetland will be retained (i.e., not treated), especially alder, red maple and poison sumac located in or near seeps, springs, rivulets and mucky areas. These areas will be clearly marked to avoid treatment.
- Vehicles and heavy machinery will be serviced in uplands.
- Absorbent pads will be used under light equipment when it is refueled in wetlands.

- Use of light equipment (see *Glossary*)
 - Treatment of woody vegetation ≤ 3 " d.b.h. can occur any time of year, but if it occurs between April 1 and Sept. 30, there is a risk of take. If cutting occurs between April 1 and Sept. 30, a monitoring biologist will brief workers on measures to reduce the likelihood of take (e.g., avoid walking on hummocks, avoid dragging woody debris through nesting areas).
 - Treatment of woody vegetation > 3 " d.b.h. will only occur between Nov. 1 and March 31.
- Use of heavy equipment
 - Only low ground pressure equipment will be used (≤ 3.1 psi), and work will occur between November 1 and March 31.
 - Heavy equipment will not be used in or driven through known nesting or hibernating areas.
 - Heavy equipment will not be used in or driven through mucky areas, except when it is necessary to cross a narrow, mucky channel or rivulet.
 - Heavy equipment will use pre-determined travel routes when working in the wetland. Travel routes will avoid mucky areas and known nesting and hibernating areas.
- Woody debris
 - Woody debris will not be dragged through known nesting areas.
 - Whenever possible, woody vegetation ≥ 4 inches d.b.h will be felled into adjacent uplands or into non-mucky areas of the wetland.
 - Woody vegetation ≥ 4 inches d.b.h will not be dragged through mucky areas of the wetland, unless there is sufficient frozen ground or snow/ice cover to prevent disturbance to wetland soils. Rather, the vegetation will be left in place, or cut into pieces small enough to remove by hand and then processed or placed in an upland area. If the monitoring biologist determines that large-diameter woody debris would result in adverse hydrological changes to the wetland (e.g., by blocking water flow), or would be so abundant that it would impede bog turtle movement, the woody debris will be removed to avoid or minimize this effect.
 - Woody vegetation will not be pulled out by its roots in mucky areas.
- A site restoration/management plan has been prepared. This plan will be retained in SERVICE project files and submitted to the Service's Endangered Species Program (in the state where the project is conducted) for review and project-specific consultation. The plan will include a project description, project location map, and site map, reflecting the above conservation measures. The site map identifies property boundaries, wetland boundaries, known nesting and hibernating areas, "mucky" areas, and proposed treatment areas. The project narrative includes detailed information about the proposed treatment, including timing and duration of treatment, treatment method(s), and size of area to be treated.

- Treatment areas will be inspected the following growing season to determine treatment effectiveness.

- A treatment documentation report has been provided to the Service's Endangered Species Program (in the state where the project was conducted) by December 31 of the year following treatment. The report will document the following: name(s) of the target plant species, area (in acres) treated, treatment method, effectiveness of the treatment, any observed effects on non-target plants, and any observed effects on wetland soils or hydrology (e.g. rutting, channelization), and any observed effects on bog turtles or their use of habitat. A map showing the wetland and treated areas within the wetland will be submitted with this report.

MOWING OF HERBACEOUS VEGETATION – CONSERVATION MEASURE CHECKLIST

- A “bog turtle specialist” has conducted an on-site evaluation and determined that mowing is a necessary and appropriate habitat maintenance/restoration practice for the site.
- Low ground pressure equipment will be used (not to exceed 2.0 psi).
- Mowing will occur between Nov. 1 and March 31, when the daytime air temperature is less than 50° F.
- Mowing will be done for (check one):
 - Phragmites* or cattail control (habitat restoration) – Mowing will only occur within the *Phragmites* or cattail stand. Mower height will be at least 5 inches. Mowing will occur once, following the initial herbicide treatment of the *Phragmites* or cattail stand.
 - Habitat maintenance mowing – Up to 100% of the wetland will be mown, with the exception of woody areas to be retained. Mower height will be at least 8 inches. Mowing will occur at intervals greater than or equal to once every 3 years.
- A monitoring biologist will be present on site when mowing occurs to brief workers on the conservation measures, and ensure that sensitive areas are avoided.
- Mowing equipment will make a single pass over each area to be mowed.
- Approximately 10-20% of the native tree and shrub cover in “mucky areas” (see *Glossary*) in both the emergent and forested parts of the wetland will be retained (i.e., not treated), especially alder, red maple and poison sumac located in or near seeps, springs, rivulets and mucky areas. If there is already woody vegetation in mucky areas of the wetland outside the area proposed for mowing (e.g., outside the road or utility line ROW), this measure does not apply.
- Equipment will be serviced and fueled in upland areas.
- A site management plan has been developed and submitted to the Service’s Endangered Species Program (in the state where the project will occur) for review and approval. The plan includes a project description, description of heavy equipment (type, psi), description of mower, project location map, site map, bog turtle site number (or other identifier), and incorporates the above conservation measures. The site map will identify property boundaries, wetland boundaries, known nesting and hibernating areas, and proposed treatment areas.
- A monitoring report will be provided to the Service’s Endangered Species Program (in the state where the project was conducted) by June 1. The report will include the following for each site that was mown during the previous seasonal window (November 1 to March 31): bog turtle site (site number or identifier), site location, entity responsible for mowing, date when mowing occurred, mowing height, type and ground pressure (psi) of equipment that was used, type of mower, any observed adverse effects on wetland soils or hydrology (e.g., rutting, channelization),

and any observed effects on bog turtles or their use of habitat. A map showing the wetland location will be submitted with this report. See report template.

RESTORATION GRAZING – CONSERVATION MEASURE CHECKLIST

- A “bog turtle specialist” has conducted an on-site evaluation and determined that restoration grazing is a necessary and appropriate habitat restoration practice for the site.
- Fencing will be installed in accordance with Practice #1 in the BO.
- Grazers will have access to both upland and wetland areas.
- A stocking density of 0.75 animal unit/acre of fenced enclosure will be used; however, up to 1.0 animal unit/acre may be used when controlling invasive woody vegetation with goats. This equates to 5-10 sheep or goats per acre.
- The grazing period will not exceed 5 consecutive months.
- The treatment will occur over 1-5 years, but will not exceed 5 consecutive years. Goats will not be pastured at 1.0 animal unit/acre for more than 3 years.
- Known and potentially suitable nesting areas will be identified and excluded from restoration grazing. These are typically areas of native emergent vegetation and little or no shading from woody vegetation or tall invasive herbaceous plants. Grazers may have access to potentially suitable nesting areas at maintenance grazing densities (i.e., < 0.75 animal unit/acre).
- Experienced staff who have successfully managed prescribed grazing and who have a good understanding of bog turtle ecology will monitor the grazing project. Vegetation in the fenced area will be monitored at least once/week during grazing to ensure adverse effects on native herbaceous vegetation are minimized. They will also determine if the grazing pressure needs to be increased or decreased, although it will not be increased beyond 1.0 animal unit/acre.
- A site restoration/management plan has been prepared. This plan will be retained in SERVICE project files and submitted to the Service’s Endangered Species Program (in the state where the project is conducted) for review and project-specific consultation. The plan will include a project description, project location map, and site map, reflecting the above conservation measures. The site map identifies property boundaries, wetland boundaries, known and potentially suitable nesting habitat, hibernating areas, treatment areas and the fence location in the wetland and upland. The project narrative includes information about the type and density of grazers, anticipated grazing duration, the acreage of wetland and acreage of upland to be grazed, target plant species, and short- and long-term grazing objectives.
- A treatment documentation report has been provided to the Service’s Endangered Species Program (in the state where the project was conducted) by December 31 of the year following treatment. Areas that have been restoration-grazed will be inspected during the growing season, after removal of high stocking densities, to determine treatment effectiveness. The report will document the following for each treated site: name(s) of the target plant species, area (in acres) treated, type of grazer(s) used and stocking density, extent of treatment (e.g., 2 months each year for 2 consecutive years), effectiveness of the treatment (% control), any observed adverse or beneficial effects on non-target vegetation, and any observed effects on bog turtles or their use of habitat. A map

showing the wetland and treated areas within the wetland will be submitted with this report, along with before and after photos.

ANIMAL UNIT EQUIVALENTS¹

Kind of livestock	Animal-unit equivalent²
Cow, young dairy (heifer, 1-2 yrs)	1.0
Cow, mature dairy (3+ yrs)	1.5
Bull, mature	1.5-1.9
Cattle, mature beef (1-2 yrs)	1.0
Horse, mature draught	2.0
Horse, mature saddle	1.25
Sheep, mature	0.20
Lamb, 1 year old	0.15
Goat, mature	0.17
Kid, 1 year old	0.10

¹ Table compiled from various sources, including: Maryland Department of Agriculture, 1999 (http://www.mda.state.md.us/resource_conservation/nutrient_management/manual/animal_unit_equivalencies.php); Delaware Department of Agriculture, 2000 (http://www.state.de.us/deptagri/nutrients/newsltr/feb_00.shtml); USDA, 2003, Table 6-5 of the National Resource Conservation Service's National Range and Pasture Handbook, Rev. 1.

² One Animal Unit is equivalent to the forage consumption of a 1000-pound grazer.

ADMINISTRATIVE RECORD CHECKLIST

- Map showing site location
- Name and contact info for bog turtle specialist who assessed the site and participated in habitat restoration or maintenance plan preparation
- Name and contact info for monitoring biologist
- Names and affiliations of people participating in the project
- Site description (current conditions)
- Threat assessment (type, location and magnitude of threats)
- Project objective and description – describe how threats will be alleviated to meet the desired biological outcome (*e.g.*, increased nesting success). Detail the type, scope, timing and duration of management/restoration method(s).
- Site restoration/management plan
- Restoration/Maintenance Practice Checklist(s)
- Landowner contact information
- Landowner agreement
- Section 7 documentation
- Treatment documentation (monitoring) report

Appendix E – Monitoring Report Template

BOG TURTLE HABITAT MANAGEMENT – MONITORING REPORT

(include additional pages for notes and/or photos, as needed)

Bog Turtle Site: _____ Location: _____

Date: _____ Biologist(s): _____

Habitat management practice(s) implemented at site:

"light to moderate grazing" (maintenance grazing) restoration grazing mowing

fence installation herbicide use cutting/removal woody vegetation

other _____

Grazing & Fencing

Year fence installed: _____ Year grazing began: _____ Currently grazed: Yes No

Type of grazers: _____

Grazing schedule: _____

grazers: _____ # acres fenced: _____ Density (animals/acre fenced): _____

Describe any grazing issues or degradation of vegetation/soils, and remedial actions needed (e.g., grazing density too high/too low, grazers concentrating in a certain area of wetland):

Describe condition of bog turtle habitat: _____

Bog turtle fatalities/injury observed at site? Yes No

If yes, describe _____

Is landowner/manager aware of and willing to remedy identified problems (see above)?

Yes No

Explain _____

Cutting/Removal of Woody Vegetation

Month/Year cutting occurred: _____ Acres cut: _____

Entity that cut site: _____

Type(s) of light equipment used: _____

Make/model of heavy equipment used: _____

Ground pressure of heavy equipment used in wetland (psi): _____

Herbicide applied to cut vegetation? Yes No If yes, complete Herbicide section.

Describe any degradation of vegetation/soils due to treatment (e.g., ruts, erosion, damage to non-target vegetation):

Describe degree of treatment effectiveness: _____

Is retreatment or a different treatment needed? Yes No

If so, explain _____

Describe condition of bog turtle habitat: _____

Bog turtle fatalities/injury observed at site? Yes No

If yes, describe _____

Herbicide Treatment

Month/Year herbicide applied: _____ Acres treated: _____
Entity who applied herbicide: _____
Herbicide name: _____ Concentration: _____
Surfactant used? Yes No Surfactant: _____
Application method(s): _____
Targeted vegetation: _____
Any damage to non-target vegetation? Yes No
If yes, describe _____

Describe degree of treatment effectiveness: _____

Is retreatment or a different treatment needed? Yes No
If so, explain _____

Bog turtle fatalities/injury observed at site? Yes No
If yes, describe _____

Mowing

Date mown: _____ When was site last mown prior to this (month/year)? _____
Entity who mowed site: _____
Make/model of heavy equipment: _____ Ground pressure (psi): _____
Type of mower: _____ Mowing height: _____
Purpose of mowing: *Phragmites* or cattail control Routine vegetation maintenance
Is the mown area on a utility line ROW? Yes No Company _____
Describe any degradation of vegetation or soils due to mowing (e.g., ruts), and actions that will be taken to remedy the situation: _____

Bog turtle fatalities/injury observed at site? Yes No
If yes, describe _____

Other Management

Type of management: _____
Month/Year of management: _____ Acres treated: _____
Entity that carried out management: _____
Targeted vegetation: _____
Any damage to non-target vegetation? Yes No
If yes, describe _____

Describe degree of treatment effectiveness: _____

Is retreatment or a different treatment needed? Yes No
If so, explain _____

Bog turtle fatalities/injury observed at site? Yes No
If yes, describe _____