DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
10117 PRINCESS PALM AVENUE, SUITE 120
TAMPA, FLORIDA 33610

April 25, 2012

REPLY TO ATTENTION OF

Tampa Permits Section
SAJ-2011-00551 (IP-TEH)

Ms. Michele Baker
Pasco County Board of County Commissioners
7530 Little Road, Suite 320
New Port Richey, Florida 34654

Mr. John Post, Jr.
Florida Department of Transportation
Florida's Turnpike Enterprise
Post Office Box 613069
Ocoee, Florida 34761

Dear Ms. Baker and Mr. Post:

This is in reference to your permit application requesting Department of the Army (DA) authorization to impact waters of the United States in association with a project known as "Ridge Road Extension" (SAJ-2011-00551 (IP-TEH)). By letter dated March 8, 2012, the U.S. Army Corps of Engineers (Corps) requested that you provide a wildlife survey plan for the proposed project. In consultation with the U.S. Fish and Wildlife Service (USFWS) and the Florida Fish and Wildlife Conservation Commission (FFWCC), the Corps has reviewed the wildlife survey plan dated April 5, 2012.

The proposed wildlife survey plan lacks maps identifying the areas to be surveyed for each species. The maps for each species must include habitat types and transects (and playback stations in the case of scrub jays). An overall map of habitat types within the proposed project footprint must be provided. Without this critical information, we are unable to complete a meaningful review of the plan. We also request the following species-specific information be included in a revised plan:

<u>Wood stork</u>

a. Specify the level of survey effort per each helicopter flight[1] (e.g. number of passes, hours spent, etc.)

b. Specify appropriate constraints on weather conditions under which the helicopter flights will be conducted.

c. Revise the plan to state that if a colony is observed, the nest location will be verified on the ground and the location recorded.

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[1] Helicopter surveys alone will not be sufficient to address potential wood stork foraging habitat. Although not required as part of the wildlife survey plan, you will ultimately be required to complete the foraging habitat assessment procedure in accordance with the 2008 USFWS Wood Stork Key for Central and North Peninsular Florida.

Florida scrub-jay

a. Much of the habitat for Florida scrub-jays within the Serenova Tract is a sub-optimal fragmented mosaic of patchy habitat. Recent research suggests that in such landscapes, scrub-jay dispersal distances are much longer on average than in contiguous, optimal habitat. Based on this information, the Corps has determined that the 0.5-mile survey radius listed in the 2007 USFWS survey protocol (and proposed in your survey plan) for this species is inadequate. Both the USFWS and the FFWCC support a 3.5 km survey radius for this project. Consistent with our February 28, 2008 letter, the survey plan must be revised to include areas within 3.5 km of the project footprint. The project footprint includes the proposed right-of-way and ponds.

b. The 2007 USFWS protocol requires that the following habitat types be surveyed, if present: xeric oak scrub; scrubby pine flatwoods; scrubby coastal strand; sand pine scrub; pine-mesic oak; xeric oak; sand live oak; improved, unimproved, and woodland pastures; citrus groves; rangeland; pine flatwoods; longleaf pine xeric oak; sand pine; sand pine plantations; forest regeneration areas; sand other than beaches; disturbed rural land in transition without positive indicators of intended activity; and disturbed burned areas. Provide a survey map clearly indicating the location of these habitat types within the 3.5 km survey radius as well as the proposed playback stations. Indicate which of the listed habitat types are not present within the 3.5 km survey radius.

c. Provide details regarding the current suitability of scrub-jay habitat within the 3.5 km survey radius, including the status of the controlled burn regime conducted by the Southwest Florida Water Management District within the Serenova Tract.

Eastern Indigo Snake

a. Closer review of the 1998 Wildlife and Habitat Evaluation Report revealed that the proposed project will impact greater than 25 acres of xeric habitat. The January 25, 2010 Eastern Indigo Snake Programmatic Effect Determination Key (Enclosure 1) results in the following progression: A > B > C > D > "may affect". To determine if formal consultation is required, the Corps requests that you proceed with your plan to survey for this species in accordance with the Survey Protocol for the Eastern Indigo Snake in North and Central Florida, dated September 2011 (Enclosure 2).

Striped Newt

a. Specify that sampling will not be limited to ephemeral waters within preferred longleaf pine sandhill habitat and will include ephemeral waters in sub-optimal habitats.

b. Each ephemeral water must be identified and assigned a ranking to indicate the quality of habitat. Sampling must include the highest quality habitats, along with a random, stratified sample of sub-optimal habitats, sufficient to detect the species if present.

c. The survey map for this species must show all available ephemeral waters, the assigned habitat rank, and indicate which will be surveyed.

Plant surveys (Brooksville bellflower, Cooley's water willow, Britton's bear-grass)

a. Specify how each species will be identified.

b. Describe and identify optimal and sub-optimal habitat within the survey area. Assign each habitat a ranking to indicate the quality of habitat. Sampling must include the highest quality habitats, along with a random, stratified sample of sub-optimal habitats, sufficient to detect the species if present.

c. The survey map for each species must show all optimal and sub-optimal habitat within the survey area, the assigned rank, which will be surveyed, and approximate transect locations.

The Corps understands that habitat surveys of the project area were conducted in 1997-1998 to determine the potential presence of species based on habitat conditions, followed by wildlife surveys to determine which species were present. A report was provided to this office on July 5, 2005, updating the information in the 1998 Wildlife and Habitat Evaluation Report. Given the amount of time that has passed, coupled with potential changes in habitat conditions due to management activities on the Serenova Tract, the Corps requests that this document be updated and submitted along with the final survey report. This update should address, but not be limited to, potential habitat and presence of the Florida pine snake, Sherman's fox squirrel, Florida mouse, little blue heron, tri-colored heron, white ibis, southeastern American kestrel, limpkin, Florida sandhill crane, Florida burrowing owl, Florida short-tailed snake, gopher tortoise, Suwannee cooter, and gopher frog. An assessment should be made in terms of the potential for high, moderate, low, or confirmed occurrence of these species. The assessment should be performed based on the presence of a suitable amount, type, and quality of appropriate habitat types and field observations made during the planned wildlife surveys and other project related work as well as the scientific literature and available resource databases.

In a meeting on March 23, 2012, the Corps inquired as to whether you had resolved access issues that would enable survey efforts within Phase II of the project, east of the Suncoast Parkway. At that time, you indicated you would be contacting the landowners. As survey efforts within all project phases, including Phase II, must be complete prior to a permit decision, we again request the status of your access to these areas. Please also provide an estimated survey schedule, by species and phase, to ensure the timely completion of our review. Any delay in surveys on Phase II may render previously completed surveys on Phase I invalid, depending on the length of time that has passed, changes in habitat conditions, and developments in scientific research.

Please provide a revised wildlife survey plan, addressing the above-listed items. This plan will be reviewed by the Corps in consultation with the USFWS and FFWCC. As the results of the wildlife surveys are needed to assess the potential effects on protected species, to comply with the ESA this information must be provided prior to a permit decision. The wildlife survey plan must be approved by the Corps prior to commencement of survey efforts. We request you provide the revised wildlife survey plan no later than May 25, 2012. If no response is received, we will assume you have no further interest in obtaining a DA permit and the application will be withdrawn.

The contents of this letter pertain solely to wildlife surveys and do not reflect our ongoing review of other aspects of your application. This letter should not be interpreted as acceptance or approval of any aspect of the proposed application. The Corps is currently reviewing your

application and the comments received in response to the November 28, 2011 public notice. Upon completion of this review, you will be notified of any outstanding information needed to finalize the evaluation of your application.

Should you have any questions or comments regarding this letter, please contact Tracy Hurst of my staff at the letterhead address, by phone at 813-769-7063, or by electronic mail at Tracy.E.Hurst@usace.army.mil.

Sincerely,

Charles A. Schnepel
Chief, Tampa Permits Section

Enclosures:
1. 1/25/10 Eastern Indigo Snake Programmatic Effect Determination Key
2. 9/11 Survey Protocol for the Eastern Indigo Snake in North and Central Florida

cc (w/encls):

Ms. Jennifer Derby
Wetlands and Marine Regulatory Section
U.S. Environmental Protection Agency
61 Forsyth St.
Atlanta, GA 30303-8960

Mr. Terry Gilbert
Florida Fish and Wildlife Conservation Commission
27 West Point Drive
Crawfordville, FL 32327

Dr. Heath Rauschenberger
U.S. Fish and Wildlife Service
7915 Baymeadows Way, Suite 200
Jacksonville, Florida 32256-7517

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

January 25, 2010

David S. Hobbie
Chief, Regulatory Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Service Federal Activity Code: 41420-2009-FA-0642
Service Consultation Code: 41420-2009-I-0467
41910-2010-I-0045
Subject: North and South Florida Ecological Services Field Offices Programmatic Concurrence for Use of Original Eastern Indigo Snake Key(s) Until Further Notice

Dear Mr. Hobbie:

The U.S. Fish and Wildlife Service's (Service) South and North Florida Ecological Services Field Offices (FO), through consultation with the U.S. Army Corps of Engineers Jacksonville District (Corps), propose revision to both Programmatic concurrence letters/keys for the federally threatened Eastern Indigo Snake (*Drymarchon corais couperi*), (indigo snake), and now provide one key for both FO's. The original programmatic key was issued by the South Florida FO on November 9, 2007. The North Florida FO issued a revised version of the original key on September 18, 2008. Both keys were similar in content, but reflected differences in geographic work areas between the two Field Offices. The enclosed key satisfies each office's responsibilities under the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C.1531 *et seq.*).

Footnote number 3 in the original keys indicated "A member of the excavation team should be authorized for Incidental Take during excavation through either a section 10(a)(1)(A) permit issued by the Service or an incidental take permit issued by the Florida Fish and Wildlife Conservation Commission (FWC)." We have removed this reference to a Service issued Section 10(a)(1)(A) permit, as one is not necessary for this activity. We also referenced the FWC's revised April 2009 Gopher Tortoise Permitting Guidelines with a link to their website for updated excavation guidance, and have provided a website link to our Standard Protection Measures. All other conditions and criteria apply.

We believe the implementation of the attached key achieves our mutual goal for all users to make consistent effect determinations regarding this species. The use of this key for review of projects

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located in all referenced counties in our respective geographic work areas leads the Service to concur with the Corps' determination of "may affect, not likely to adversely affect" (MANLAA) for the Eastern indigo snake. The biological rationale for the determinations is contained within the referenced documents and is submitted in accordance with section 7 of the Act.

Should circumstances change or new information become available regarding the eastern indigo snake or implementation of the key, the determinations may be reconsidered as deemed necessary.

Thank you for your continued cooperation in the effort to conserve fish and wildlife resources. Any questions or comments should be directed to either Allen Webb (Vero Beach) at 772-562-3909, extension 246, or Jay Herrington (Jacksonville) at 904-731-3326.

Sincerely,

Paul Souza
Field Supervisor
South Florida Ecological Services Office

David L. Hankla
Field Supervisor
North Florida Ecological Services Office

Enclosure

cc: electronic only
FWC, Tallahassee, Florida (Dr. Elsa Haubold)
Service, Jacksonville, Florida (Jay Herrington)
Service, Vero Beach, Florida (Sandra Sneckenberger)

Eastern Indigo Snake Programmatic Effect Determination Key

Scope of the key

This key should be used only in the review of permit applications for effects determinations within the North and South Florida Ecological Services Field Offices Geographic Areas of Responsibility (GAR), and not for other listed species or for aquatic resources such as Essential Fish Habitat (EFH). Counties within the **North** Florida GAR include Alachua, Baker, Bradford, Brevard, Citrus, Clay, Columbia, Dixie, Duval, Flagler, Gilchrist, Hamilton, Hernando, Hillsborough, Lafayette, Lake, Levy, Madison, Manatee, Marion, Nassau, Orange, Pasco, Pinellas, Putnam, St. Johns, Seminole, Sumter, Suwannee, Taylor, Union, and Volusia.

Counties in the **South** Florida GAR include Broward, Charlotte, Collier, De Soto, Glades, Hardee, Hendry, Highlands, Lee, Indian River, Martin, Miami-Dade, Monroe, Okeechobee, Osceola, Palm Beach, Polk, Sarasota, St. Lucie.

Habitat

Over most of its range, the eastern indigo snake frequents several habitat types, including pine flatwoods, scrubby flatwoods, high pine, dry prairie, tropical hardwood hammocks, edges of freshwater marshes, agricultural fields, coastal dunes, and human-altered habitats (Service 1999). Eastern indigo snakes appear to need a mosaic of habitats to complete their life cycle. Wherever the eastern indigo snake occurs in xeric habitats, it is closely associated with the gopher tortoise *(Gopherus polyphemus),* the burrows of which provide shelter from winter cold and summer desiccation (Speake et al. 1978; Layne and Steiner 1996). Interspersion of tortoise-inhabited uplands and wetlands improves habitat quality for this species (Landers and Speake 1980; Auffenberg and Franz 1982).

In south Florida, agricultural sites, such as sugar cane fields, created in former wetland areas are occupied by eastern indigo snakes (Enge pers. comm. 2007). Formerly, indigo snakes would have only occupied higher elevation sites within the wetlands. The introduction of agriculture and its associated canal systems has resulted in an increase in rodents and other species of snakes that are prey for eastern indigo snakes. The result is that indigos occur at higher densities in these areas than they did historically.

Even though thermal stress may not be a limiting factor throughout the year in south Florida, indigo snakes still seek and use underground refugia. On the sandy central ridge of central Florida, eastern indigos use gopher tortoise burrows more (62 percent) than other underground refugia (Layne and Steiner 1996). Other underground refugia used include armadillo (*Dasypus novemcinctus*) burrows near citrus groves, cotton rat (*Sigmodon hispidus*) burrows, and land crab (*Cardisoma guanhumi*) burrows in coastal areas (Service 2006). Natural ground holes, hollows at the base of trees or shrubs, ground litter, trash piles, and crevices of rock-lined ditch walls are also used (Layne and Steiner 1996). These refugia are used most frequently where tortoise burrows are not available, principally in low-lying areas off the central and coastal ridges. In extreme south Florida (the Everglades and Florida Keys), indigo snakes are found in tropical

hardwood hammocks, pine rocklands, freshwater marshes, abandoned agricultural land, coastal prairie, mangrove swamps, and human-altered habitats (Steiner et al. 1983). It is suspected that they prefer hammocks and pine forests, because most observations occur in these habitats disproportionately to their presence in the landscape (Steiner et al. 1983). Hammocks may be important breeding areas as juveniles are typically found there. The eastern indigo snake is a snake-eater so the presence of other snake species may be a good indicator of habitat quality.

Conservation Measures

The Service routinely concurs with the Corps' "not likely to adversely affect" (NLAA) determination for individual project effects to the eastern indigo snake when assurances are given that our *Standard Protection Measures for the Eastern Indigo Snake* (Service 2004) located at: http://www.fws.gov/northflorida/IndigoSnakes/indigo-snakes will be used during project site preparation and project construction. There is no designated critical habitat for the eastern indigo snake.

In an effort to reduce correspondence in effect determinations and responses, the Service is providing an Eastern Indigo Snake Effect Determination Key, similar in utility to the West Indian Manatee Effect Determination Key and the Wood Stork Effect Determination Keys presently being utilized by the Corps. If the use of this key results in a Corps' determination of "no effect" for a particular project, the Service supports this determination. If the use of this Key results in a determination of NLAA, the Service concurs with this determination and no additional correspondence will be necessary[1]. This key is subject to revisitation as the Corps and Service deem necessary.

A. Project is not located in open water or salt marsh.....*go to* B

   Project is located solely in open water or salt marsh.....*"no effect"*

B. Permit will be conditioned for use of the Service's *Standard Protection Measures For The Eastern Indigo Snake* during site preparation and project construction.....*go to* C

   Permit will not be conditioned as above for the eastern indigo snake, or it is not known whether an applicant intends to use these measures and consultation with the Service is requested[2] .....*"may affect"*

C. There are gopher tortoise burrows, holes, cavities, or other refugia where a snake could be buried or trapped and injured during project activities .....*go to* D

   There are no gopher tortoise burrows, holes, cavities, or other refugia where a snake could be buried or trapped and injured during project activities .....*"NLAA"*

D. The project will impact less than 25 acres of xeric habitat supporting less than 25 active and inactive gopher tortoise burrows.....*go to* E

The project will impact more than 25 acres of xeric habitat or more than 25 active and inactive gopher tortoise burrows and consultation with the Service is requested[2]..... *"may affect"*

E. Any permit will be conditioned such that all gopher tortoise burrows, active or inactive, will be evacuated prior to site manipulation in the vicinity of the burrow[3]. If an indigo snake is encountered, the snake must be allowed to vacate the area prior to additional site manipulation in the vicinity. Any permit will also be conditioned such that holes, cavities, and snake refugia other than gopher tortoise burrows will be inspected each morning before planned site manipulation of a particular area, and, if occupied by an indigo snake, no work will commence until the snake has vacated the vicinity of proposed work..... *"NLAA"*

Permit will not be conditioned as outlined above and consultation with the Service is requested[2] ..... *"may affect"*

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[1]With an outcome of "no effect" or "NLAA" as outlined in this key, the requirements of section 7 of the Act are fulfilled for the eastern indigo snake and no further action is required.

[2]Consultation may be concluded informally or formally depending on project impacts.

[3] If burrow excavation is utilized, it should be performed by experienced personnel. The method used should minimize the potential for injury of an indigo snake. Applicants should follow the excavation guidance provided within the Florida Fish and Wildlife Conservation Commission's revised April 2009 Gopher Tortoise Permitting Guidelines located at **http://myfwc.com/License/Permits_ProtectedWildlife.htm#gophertortoise**. A member of the excavation team should be authorized for Incidental Take during excavation through an incidental take permit issued by the Florida Fish and Wildlife Conservation Commission.

Survey Protocol for the Eastern Indigo Snake, *Drymarchon couperi*,

in North and Central Florida

September 2011

Photo: FWS

Purpose and Scope

The purpose of this document is to provide a tool to improve the review of permit applications and proposed land clearing activities for potential effects on the federally-threatened eastern indigo snake (indigo snake), in accordance with Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 et seq.). The tool is applicable to the U.S. Fish and Wildlife Service (Service) North Florida Ecological Services Field Office (NFESFO) geographic area of responsibility, which includes the following counties: Alachua, Baker, Bradford, Brevard, Citrus, Clay, Columbia, Dixie, Duval, Flagler, Gilchrist, Hamilton, Hernando, Hillsborough, Lafayette, Lake, Levy, Madison, Manatee, Marion, Nassau, Orange, Pasco, Pinellas, Putnam, St. Johns, Seminole, Sumter, Suwannee, Taylor, Union, and Volusia.

The tool is a visual encounter survey protocol (Protocol) that is to be conducted by project proponents or their designees for determining the presence of indigo snakes at a proposed project site. The results of the Protocol will be used by Federal and non-Federal entities in evaluating permit applications and proposed activities for compliance with the ESA. The Protocol is primarily designed to be used by the U.S. Army Corps of Engineers in conjunction with their Eastern Indigo Snake Programmatic Effect Determination Key. However, the NFESFO encourages the use of the Protocol by other project proponents, and Federal and non-Federal permitting entities in situations where habitats that may support indigo snakes will be impacted by development activities. For projects that encompass vast acreage such as Developments of Regional Impact, military installations, and large restoration projects, we recommend contacting our office in advance to discuss the best approach for implementation of this Protocol in order to achieve the intended purpose and objective.

This Protocol does NOT authorize the handling or collection of indigo snakes. Therefore, the Service does not intend to issue Section 10 (a)(1) (A) scientific enhancement and collecting permits for the capture, handling, or relocating of indigo snakes in conjunction with the implementation of this Protocol.

This Protocol explains visual encounter survey methodologies that include pedestrian transect surveys and inspection of under and above ground refugia commonly used by indigo snakes. It also provides some regulatory guidance when eastern indigo snakes are discovered. Further discussion of these methodologies is located under **Survey Protocol** heading below.

An eastern indigo snake survey conducted according to this Protocol is an attempt to determine presence of the species within the impact area(s) of a proposed project site. Confirmation of eastern indigo snake(s)' presence during the project's planning stage provides project proponents an early opportunity to develop minimization and/or compensation measures and consult with the Service. Failure to detect any eastern indigo snakes does not confirm their absence. However, this protocol provides a method for surveying eastern indigo snakes in a manner which does not include handling, trapping, or potentially injuring the snakes.

We offer this Protocol as a measure to help us obtain necessary information to make informed regulatory decisions relative to the recovery and management of this federally-threatened species. It is the intent of the NFESFO to recommend this protocol until such time that better survey methodologies are available for project proponents. Please note that **Appendix A** contains **Frequently Asked Questions (FAQ'S)** for further assistance.

Natural History and Identification of the Eastern Indigo Snake

Description of the Species

The eastern indigo snake was historically known as the largest North American snake species until more recently when an 8.76 foot (267 cm) long bull snake (*Pituophis catenifer)* was discovered (Devitt et al 2007). The maximum total length recorded for an eastern indigo individual is 8.6 feet (262.9 cm), while most adult eastern indigo snakes average 5.0 – 7.0 feet (152 – 213 cm) (Conant and Collins 1998) in length. This stout-bodied serpent is uniformly iridescent bluish black above and uniformly slate blue below. Throughout much of its geographic distribution, the gular scales on the underside of the head found in the throat region and labial scales bordering the mouth opening are orange to coral-red; however, head and throat coloration can be variable. The head is generally indistinct from the neck. Scales are smooth and wide, and there are 17 scale rows at mid-body. Adult male eastern indigo snakes have weakly keeled scales on the median 3-5 dorsal scale rows (Conant and Collins 1998). Young eastern indigo snakes are 17-24 inches (43.2 – 61 cm) at hatching and resemble the adults in coloration (Conant and Collins 1998).

Similar Species

Within the NFESFO geographic area of responsibility, the southern black racer (*Coluber constrictor priapus*) is the only species with an overlapping geographic range that may be

mistaken for an eastern indigo snake. Within the geographic range of the eastern indigo snake all other plain black snakes have smooth scales, a divided anal plate or both. The black racer's scales are smooth and dull black, and the anal scale is divided. The black racer is a much more slender snake than the indigo, and often the chin and throat of the racer are creamy white in color. Young racers are strongly patterned with a mid-dorsal row of dark gray, brown or reddish brown blotches on a gray or bluish gray ground color. The patterns become less distinct as the individual matures (Wright and Wright 1957).

Figure 1. Eastern indigo snake (left photo) and a southern black racer (right photo) showing identification field marks. Throughout much of its range, eastern indigo snakes show coral or reddish brown lower mandible and throat. Black racers have a creamy or white lower mandible and throat. Areas around the eye are always dark in adult black racers.

Biology, Status and Trends

The broad distribution and large territory size of the eastern indigo snake complicate evaluation of its population status and trends. This species is difficult to locate in the field, even in areas where it is known to occur. Standard population survey and mark/recapture studies, population attributes such as sex ratio, age structure, reproductive variables, and mortality in the wild are not well known. However, a mark-recapture study conducted from 1998 through 2006 in southeastern Georgia (Stevenson et al. 2009) provided useful population information for this species that should encourage future research. In this study, 93 individual eastern indigo snakes were captured while surveying at gopher tortoise (*Gopherus polyphemus*) burrows, and 40 (43%) of these snakes recaptured. Nineteen males and 13 females exhibited overwintering site fidelity by returning to the same sandhills in successive years. Size data indicated males attain asymptotic size measured from Snout to Vent (SVL) = 1766 mm in 7.27 years; with females reaching asymptotic size (SVL = 1441 mm) in 5.22 years. Results indicate that more population monitoring is needed at other sites where this species may be reliably located by surveys at gopher tortoise burrows.

Several estimates of sex ratios and size at maturity are available from wild populations. Two studies of hatchlings/juveniles (Moulis 1976, Steiner et al. 1983) reported sex ratios not differing from 1 male: 1 female. However, sex ratios become more male biased in adult snakes. Stevenson et al. (2009) reported a ratio of 2.1 males: 1 female (63 males, 29 females), with no significant difference in recapture rates between sexes, in a study at Fort Stewart, Georgia. Maturity in wild

snakes has been estimated to be attained at 60 inches (1500 millimeters) total length (Speake et al. 1987, Layne and Steiner 1996).

Some information may be obtained from captive breeding populations. Speake et al. (1987) reported that two females, captive since birth, bred at 40 and 41 months of age. An average size clutch of 9.4 was reported using 20 females removed from the wild and laying eggs in the spring following their capture. Moulis (1976) reported a range of 4 to 12 eggs for captive females and estimated their sexual maturity to be reached at 3 to 4 years of age based on their rate of growth. Captive female eastern indigo snakes typically lay eggs every year. In a two-year study of a wild population, three of five females studied were gravid in both years (Bolt 2006). The maximum reported longevity for a captive eastern indigo snake of unknown sex was 25 years and 11 months (Snider and Bowler 1992).

Adult eastern indigo snakes have very large activity ranges and most estimates of home ranges vary from several hundred to several thousand acres (hectares). Studies on movements and estimates of home range size in peninsular Florida using radio telemetry indicate that home ranges for females vary from 4.75 ac (1.9 ha) to 375 ac (150 ha); male home ranges vary from 4.0 ac (1.6 ha) to 818 ac (327 ha) (Moler 1985b, Layne and Steiner 1996, Bolt 2006, Dodd and Barichivich 2007). Summer home ranges tend to be much larger than winter home ranges.

In a recent radio telemetry study in Georgia, Hyslop (2007) reported home range sizes of 87.5 to 8,885 ac (35 to 354 ha) for females and 350 to 3,825ac (~141 to 1,530 ha) for males. Most fall and winter locations of eastern indigo snakes were recorded at gopher tortoise burrows in Hyslop's study, with less reliance on these burrows in spring and summer.

Eastern indigo snakes can move considerable distances in short periods of time. Speake et al. (1978) reported that two snakes moved a maximum distance from release points of 2.2 miles (mi) (3.5 kilometers (km)) in 42 days and 2.4 mi (3.8 km) in 176 days. Moler (1985b) recorded long distance moves of 2,706 feet (ft) (820 meters) and 5,610 ft (1700 m) for snakes moving away from their wintering dens in mid to late March. Stevenson and Hyslop (2010) reported a linear distance of over 13.8 mi (22 km) in a two-year period between capture and recapture of a marked snake. Eastern indigo snakes exhibit a homing instinct and may return annually to previously used winter dens (Speake et al. 1978, Moler 1985b, Speake et al. 1987, Stevenson et al. 2003, Hyslop 2007).

There is some evidence of cannibalism, male territorial combat (ritualized fighting, often at or near gopher tortoise) burrows that contain adult females), and little overlap in the warm-season home ranges after snakes dispersed from upland sites where they over-wintered (Speake et al. 1987, Layne and Steiner 1996, Bolt 2006).

Habitat

Even though not commonly seen, eastern indigo snakes may be found throughout peninsular Florida in all terrestrial habitats and hydric hammocks which have not suffered high-density urban development (Moler 1985a, 1992). In south Florida, the eastern indigo snake is thought to be more widely distributed than in other parts of its range. Given their preference for upland

habitats, indigos are not commonly found in great numbers in the wetland complexes of the Everglades region (Duellman and Schwartz 1958, Steiner et al. 1983).

In the panhandle of Florida, eastern indigo snakes persist in low numbers (Enge 2007b, Gunzburger and Aresco 2007). In central and coastal Florida, they are found mainly on higher elevation sandy ridges where they use gopher tortoise burrows when available. On the sandy central ridge of south Florida, eastern indigo snakes use gopher tortoise burrows more (62 percent) than other underground refugia (Layne and Steiner 1996). In extreme southern Florida, indigos are typically found in pine flatwoods, pine rocklands, tropical hardwood hammocks, and in most other undeveloped areas (Kuntz 1977). Subterranean refugia used in these areas include burrows of armadillos (*Dasypus novemcinctus*), cotton rats (*Sigmodon hispidus*), and land crabs (*Cardisoma spp.*); burrows of unknown origin; natural ground holes; hollows at the base of trees or shrubs; ground litter; trash piles; and crevices of rock-lined ditch walls (Layne and Steiner 1996). Eastern indigo snakes also inhabit some agricultural lands (e.g., sugar cane fields and associated canal banks) (Layne and Steiner 1996).

History of Survey Methodologies Attempted for Eastern Indigo Snakes

It has been long recognized that the ability to survey for this species has been limited, thereby making the collection of population trend data more difficult than other species where survey methodologies have been well tested and established. At the Eastern Indigo Snake Conservation Summit held in 2001, herpetologists most familiar with the species decided that developing reliable survey methods was the most pressing research and monitoring need for the eastern indigo snake (U.S. Fish and Wildlife Service 2001).

Research in Brevard County, Florida initiated in 2002 involved a study to test the efficiency and applicability of three commonly-used herpetological survey techniques for detecting eastern indigo snakes (Smith and Dyer 2003). The three techniques tested were drift fence arrays with box and funnel traps, road cruising, and gopher tortoise burrow camera surveys. All techniques were used with radio telemetry to monitor the snakes in areas known to be inhabited by eastern indigo snakes. The results of the study indicated that none of the tested techniques could be relied on to easily or efficiently detect the species. Only three eastern indigo snakes were captured after 7,738 trap nights at the drift fence. No eastern indigo snakes were detected during road cruising surveys conducted along 926 mi (1,491 km) of occupied habitat. Lastly, the researchers concluded that using a camera to survey gopher tortoise burrows has shown limited success as a survey technique for indigo snakes. Gopher tortoise burrows comprised only a portion of potential known den sites in this study area of central Florida and no eastern indigo snakes were detected after using a camera to observe the interiors of 438 gopher tortoise burrows. However, results from this study alone is not enough to eliminate the potential for using a camera scope to search for indigo snakes in gopher tortoise burrows since collective information has indicated that indigo snakes have been located in gopher tortoise burrows through the use of camera scoping in certain circumstances.

Gopher tortoise burrows vary in length and depth and are usually determined by water table level. They are usually straight with only slight curves and may be as short as about 6 - 10 feet

long, but average around 30 feet with a record of approximately 50 ft., and range from around 3 - 20 feet deep (Ashton and Ashton 2008).

As such, some circumstances that may prevent effective camera scoping are either abandoned burrows that may be partially collapsed; or burrows with physical debris obstructions, or tortoises present close to the entrance that could obscure a clear view to the rest of the burrow; or when the length of the burrow simply exceeds the camera scope length to get an entire view. However, that being said, this method could be considered by the applicant as a supplementary procedure to further efforts towards finding indigo snakes.

In 2004, a study was initiated to test the feasibility of using a scent trail to lure eastern indigo snakes into traps. Scent trails are used to detect and follow prey; male snakes use scent trails to locate females for breeding purposes (Ford and Burghardt 1993, Greenlees et al. 2005, Smith et al. 2005). Since eastern indigo snakes are ophiophagous (they eat snakes), the idea that a bait solution could be made using a prey snake species was tested (Ford and Ford 2005). Initial lab trials with captive eastern indigo snakes were successful (Alessandrini 2005). As a result, field trials were initiated as well as research on the chemical composition of bait solutions most attractive as lures (Mason et al. 2007); however, the field trials were not successful as eastern indigo snakes generally showed an aversion to entering traps (Bolt and Weiss 2006).

Hysop et. al (2009) recommended a combination of burrow surveys (from mid-fall through March) and trapping especially in the late summer through fall, to most effectively monitor and detect eastern indigo snakes in the northern portion of the range of this species. Studies were conducted in southeastern Georgia from 2002 - 2004 to determine the effectiveness of two survey techniques in seven sandhills known to support this species. Eighteen indigo snakes were captured from December 2002 through March 2003 (14 person-hours per capture) during surveys of potential underground shelters, as searches were conducted near active/inactive and abandoned gopher tortoise burrows and other possible shelters. Six individuals were captured through trapping (141 trap days) using two box trap designs – one with a horizontal shelf added above each funnel trap entrance during the second year of the study. Trapping was most successful during early fall when surveys are often less effective compared to those conducted in late fall through early spring in Georgia. Based on these results, further experimentation with alternative trap designs and methods for detecting and surveying eastern indigo snakes is encouraged.

In 2006-2007 the Service initiated a study to use trained dogs to track and locate eastern indigo snakes in various habitat locations (Dziergowski pers. comm. 2010). This pilot study showed the specificity, accuracy, and potential for using canines to determine the presence of eastern indigo snakes. It demonstrated the ability of a canine to detect the scent of the eastern indigo snake under field conditions, as well as the detection of the trail of an eastern indigo snake that had previously been in the area and the ability to locate sheds and individual eastern indigo snakes in the field. This project demonstrated that utilizing a canine trained to detect the scent of an eastern indigo snake is a feasible and cost effective survey technique to locate individual eastern indigo snakes under field survey conditions. This method showed potential as an effective survey tool for determining presence of eastern indigo snakes and generated further research interest.

Subsequent to the initial pilot study, Stevenson et al. (2010) investigated the ability of trained detector dogs to find eastern indigo snakes and their shed skins in gopher tortoise habitat at two sites in Georgia and Florida. During training exercises, the dog found more than 90% of the hidden shed skins. For Phase I live snake trials, the dog was correct 81% of the time (44 of 54) for below-ground and 88% of the time (23 of 26) for above-ground trials. The dog was 100% successful finding all shed skins in 54 trials above and below ground. Based on these results, if a project proponent is able to acquire the services of a trained detector dog, we encourage the proponent to contact our office to discuss this option as an alternative to the protocol described in this document. It is possible that we could consider a single search of the entire site by a trained detector dog to be an acceptable alternative to the following protocol.

Survey Protocol

Visual encounter surveys are intended to locate eastern indigo snakes above ground and to identify refugia for subsequent inspection of the impact area. The impact area is defined as the project footprint or that part of the parcel to be built out that will no longer constitute eastern indigo snake habitat after the construction of the project. Underground refugia commonly used by this species include active or inactive burrows excavated by gopher tortoises or other species, ground holes, hollows at the base of trees and other similar formations. Above ground refugia includes thick shrub formations, stumps, the base of thick palmetto (*Serenoa repens* or *Sabal etonia*) ground litter, brush piles, trash piles, and abandoned structures, and crevices of rock-lined ditch walls and other similar refugia.

Survey Period

Timing for transect surveys and inspection of refugia should coincide with the increased likelihood of finding eastern indigo snakes in or near refugia, and while the snake's home range is reduced in winter months. In Florida, eastern indigo snakes will generally concentrate their activities near refugia during the cooler months; however we also recognize the differences in temperature regimes within the State. Therefore, we recommend conducting surveys for eastern indigo snakes **from October 1 through April 30** . If cold weather prevails outside of these dates, please contact the NFESFO for the potential to work outside of the designated time window.

Methodology

The Protocol's methodology consists of three steps:

1. Transect surveys (visual encounter surveys to locate snakes and identify above-ground and underground refugia in the impact area).
2. Inspection of above-ground refugia.
3. Inspection of underground refugia.

The surveyor should always carry a camera to first photo-document any snake sightings, and use a Global Positioning System (GPS) unit to document the location using the latitude/ longitude

coordinate system and record and submit the beginning and end points for transects. If a GPS unit is not available, the location should be marked with rebar, wooden stake or flagging tape so that relocation with a GPS unit to record the location at a later date is possible. In addition, a notebook entry with location and site characteristics should be utilized. Locating eastern indigo snakes involves walking along transects previously established on a map or graphic representation to scale of the project parcel. These transects should be appropriately spaced to ensure that all areas inside of the impact area are inspected as described below.

Transect Surveys

Transect surveys are to be conducted along established transects when the prevailing weather conditions allow for effective surveys. A minimum of five (5) survey days with a minimum of two (2) "high quality" weather days is most effective. A high quality weather day is a warm day preceded by several cool or cold days. A high quality weather day increases the likelihood of encountering an eastern indigo snake above ground. Survey dates do not have to be conducted on consecutive days and can be conducted by one or multiple surveyors depending on the size of the impact area. The optimal temperature range for conducting pedestrian surveys is 60º F – 70º F (15.55 C – 21.11 C) (Georgia Department of Transportation, 2004). Within this range of temperatures eastern indigo snakes will most likely be thermoregulating above ground. **Please note:** A survey day is the amount of time required to review the entire impact area once. Therefore, the entire impact area needs to be reviewed a minimum of 5 times which may actually result in more than 5 survey days for larger impact areas. **Should any eastern indigo snakes be located after the completion of at least one survey day; then the surveyor may discontinue the survey for the remaining days of the recommended five (5) days since presence has been established.**

Surveys are to be conducted during the part of the day when the snakes are likely to emerge from their refugia. On sunny days this can be from 0900–1600, with the optimal search period being from 1030–1500. (Georgia Department of Transportation, 2004). This time period allows for sufficient time for the warming of air and surface temperatures that may induce activity in the snakes. Overcast days may require longer periods to achieve acceptable temperatures.

When weather conditions are appropriate, surveyors should walk the previously established transects through the project's impact area. The recommended approach is to systematically search the entire impact zone by traveling parallel transects spaced appropriately for the habitat conditions (i.e., the length may be consistent or vary with the shape of the site, but the width should allow a reasonable level of detection of burrows or other eastern indigo snake refugia). The search can be conducted by one or more observers. Transect edges should be marked with flagging to ensure complete coverage.

In open habitat such as mowed pasture or natural sandhill, transects should be spaced no more than 10 meters (33 feet) apart. In thicker habitat, such as flatwoods and scrub, transects should be spaced as close as five meters (16 feet) apart. Patches of extremely thick habitat, such as saw palmetto or blackberry patches, should be searched more intensely, with spacing at approximately one meter (three feet) or less. Surveyors should look for eastern indigo snakes moving or resting on the surface, noting any signs of tracks, scat, or shed skin, and provide

photographs to assist with identification, along with the coordinates of the location where these signs were discovered, date, time, habitat conditions, and nearest know potential refugia included with the Final Survey Report. Surveyors should closely investigate the ground around saw palmetto clumps, downed trees, and other types of cover for shed skins. Eastern indigo snakes shed their skins every 30-45 days (Moler 1992), and these shed skins may persist for many weeks.

All potential eastern indigo snake refugia should be flagged and numbered, using GPS to record the location of eastern indigo snake refugia in the surveyed area. The refugium shall be identified as to type, e.g. gopher tortoise burrow, armadillo burrow, and stump hole. This will assist field work during the period of inspection of the refugia. Survey results should be submitted to NFESFO at the end of the visual encounter surveys even if no eastern indigo snake refugia are identified.

Inspection of Above Ground Refugia

Caution should be applied when placing hands, heads, or feet on the ground near the entrance to gopher tortoise burrows as eastern diamondback rattlesnakes (*Crotalus adamanteus*) are frequent commensals in the burrows and may be provoked by excavation or inspection disturbances. Pigmy rattlesnakes (*Sistrurus miliarius*), fire ants (*Solenopsis invicta*) and black widow spiders (*Latrodectus mactans*) may also be present and pose a threat to the unwary surveyor (GDOT 2004).

Previously identified above ground refugia on the project impact area of the parcel should be inspected **in a non-destructive manner.** Above ground refugia include shrubs, ground litter, brush piles, trash piles, abandoned structures, rock piles, stumps, and other similar formations likely to serve as eastern indigo snake refugia. Inspection of above ground refugia includes inspecting ground litter, trash piles, and around ground cover such as plywood boards or sheet metal to locate eastern indigo snakes in hiding. After inspections, refugia should be restored to a condition similar to as found. Note: if a snake is observed do NOT place objects on top of snake.

Inspection of Underground Refugia

For this Protocol, the inspection of underground refugia involves the visual inspection of gopher tortoise burrows, burrows excavated by other species, and other holes in the ground. Scoping a burrow or refugia with a camera may be beneficial, but camera scoping does not always detect eastern indigo snakes. In addition, the scoping of gopher tortoise burrows requires authorization from the state of Florida.

At each potential refugium, intensive searches will be conducted within a 10-meter (33 feet) radius. Any animal sign, e.g. tracks, scat, or shed skin, in the immediate area of a 10-meter (33 feet) radius of the refugium should be noted. Surveyors should closely investigate the ground around saw palmetto clumps, downed trees, and other types of cover for shed skins. The entrance to the gopher tortoise burrow should be examined for snake tracks. A flashlight, or a small mirror to direct sunlight, may be employed to examine the first few feet of the burrow where a snake may be resting (GDOT 2004).

Reporting

The surveyor(s) and their supervisor should sign and date the completed Final Survey Report and data sheets provided in **Appendix B** and submit it to the Service with the following statement included: "I have read and understand the survey protocol for the eastern indigo snake. This report represents a true, accurate and representative description of the results obtained after following this Protocol." The Service will consider the results of the survey protocol to be valid for two (2) years from the date of completion, unless the habitat has been significantly modified.

After reviewing the Final Survey Report with attached data sheets and other relevant information, the Service will determine if incidental take is likely to occur, and may recommend commensurate conservation measures through informal or formal consultation, or Section 10 permit coordination procedures as appropriate. The Service will provide the action agency or applicant with a letter or biological opinion concluding the consultation.

Eastern Indigo Snake Survey Protocol and Gopher Tortoise Relocation

If project proponents are required by the state of Florida's Fish and Wildlife Conservation Commission (FWC) to get a Gopher Tortoise Conservation Permit, then the eastern indigo snake survey protocol may be conducted at the time when 100% of the area is surveyed for gopher tortoises, as long as the seasonal window of the snake Protocol is followed. Therefore, the timing of the indigo snake surveys shall be determined by the project proponent to coincide with other agencies permitting authorizations. For details on FWC's Gopher Tortoise Permitting Guidelines - June 2011 version go to http://myfwc.com/license/wildlife/gopher-tortoise-permits/

If an indigo snake is observed during the excavation and/or relocation of gopher tortoises then activities should cease and the NFESFO should be contacted within 3 working days to initiate or reinitiate consultation.

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Appendix A

Eastern Indigo Snake Survey Protocol FAQ's

What is the purpose of the protocol?
Section 7 of the Endangered Species Act (ESA) requires that Federal agencies consult with the USFWS on proposed activities that may affect eastern indigo snakes. The purpose of this Protocol is to detect eastern indigo snakes (indigos) on project sites, focusing on areas that will be impacted by development activities.

Who is supposed to use the protocol?
The Protocol is designed for use by the U.S. Army Corps of Engineers Regulatory Division (Corps) in conjunction with their Eastern Indigo Snake Programmatic Effect Determination Key (exhibit attachment) when a "May Affect" determination is reached. For projects that do not fall under the Corps' jurisidiction, project proponents may contact the USFWS North Florida Field Office (NFFO) to determine if a survey should be conducted.

Where (geographic area) does the protocol apply?
The protocol is to be applied in the USFWS North Florida Field Office's area of responsibility. The list of counties can be viewed at: http://www.fws.gov/northflorida/Area1.htm. If a proposed project is outside of NFFO's area, then the proponent should contact the local USFWS office.

What happens if indigo snakes are detected?
Positive survey results means that the site is occupied and the NFFO will determine if "incidental take" is reasonably certain to occur and subsequently write a biological opinion that will include measures to minimize "take".

What happens if indigo snakes are NOT detected?
Failing to detect indigos does not mean they are not utilizing the site at some point in time. However, the USFWS must be reasonably certain that a site is occupied and that "take" is reasonably certain to occur in order to initiate formal consultation and provide incidental take. Therefore, a negative survey would result in a 'may affect, not likely to adversely affect' conclusion issued to the action agency provided the project proponent agrees to implement the current, standard eastern indigo snake protection measures.

What happens if indigo snakes were not detected during the survey but were later detected after work began?
The ESA consultation process has a reinitiation process that allows project proponents and the USFWS to discuss any new information relevant to species impacts and resolve any issues.

What if the project is very large in scale or multi-phased?
For large projects (DRI's, military, restoration projects and etc.), we recommend contacting our office in advance to discuss the best survey approach to achieve the intended objective.

When should the protocol be conducted?
Transect surveys are to be conducted from **October 1 – April 30**, for a minimum of **five (5) survey days** which do not have to be consecutive, with a minimum of **2** "high quality" weather days. The optimal temperature range **is 60º F – 70º F (15.55 C – 21.11 C**) for finding indigo snakes. If cold weather prevails outside of these dates, please contact the NFESFO for the potential to work outside of the designated time window.

If an indigo snake is detected on the first day, can the survey be discontinued?
If an indigo snake is detected after the completion of **at least one survey day**; then the surveyor may discontinue the survey for the remaining days of the recommended five (5) days since presence has been established.

If an eastern indigo snake is identified within the project impact area and Section 7 formal consultation is initiated, what would be required in terms of minimization and conservation measures?
The minimization and conservation measures will be determined on a case-by-case basis. Measures that may be considered by the Service include: (1) those measures provided for other state and federally-listed species affected by the project as requested by other permitting agencies that may benefit eastern indigo snakes; (2) land management activities (burning and etc.); (3) restoration and enhancement activities, and (4) species relocation under specific circumstances. Factors to be considered in evaluating these options include total impact acreage loss, adjacent land use, location of roads and highways, proximity to protected and public lands and other known indigo snake sightings.

If shed skins or photographs are taken, how can they be identified as that of an indigo snake?
Positive identification of indigo snakes shed skins or photographs may be obtained by contacting Candace Martino (Candace_Martino@fws.gov; 904-731-3142)

Appendix B

Eastern Indigo Survey Data Sheet

Project Name:

Name of Surveyor(s):

Sworn Affidavit: I have read and understand the USFWS Eastern Indigo Snake Survey Protocol. These results represent true, accurate, and representative information resulting from the survey activities on this project site.
Signature of Surveyor(s) Supervisor:

Project Lat/Long:

Survey area (acres):

No. of Transects:

Survey Type (circle): Pedestrian Refugia Both

Habitat Description (circle): pine flatwoods sandhills mixed/oak scrub pasture/grass Other:

Day of Survey (1-5)	Date (mm/dd/yyyy)	Start Time (24 hr)	Start Temp. (F)	End Time (24 hr)	End Temp. (F)
Day 1					
Day 2					
Day 3					
Day 4					
Day 5					

Day of Survey (1-5)	Indigo Snake sighting/sign	Lat/Long	Other Animal sightings
Day 1			
Day 2			
Day 3			
Day 4			
Day 5			
Notes: (Indicate here and use back)			

Notes (cont.)