

EXHIBIT D

SPECIES SURVEYS AND HABITAT ASSESSMENTS

- USFWS Official Species List
- 2018-2019 Survey for Protected Amphibians/Reptiles on the Twin Pines Site, Charlton County, Georgia – Altamaha Environmental Consulting
- Results of Eastern Indigo Snake Surveys on the Twin Pines Site, Charlton County, Georgia: Year 2 – Altamaha Environmental Consulting
- 2019 Survey for Rare, Threatened and Endangered Plants, Twin Pines Mining Block 1, Charlton County, Georgia – Terra-Ignea Enterprises, LLC
- Threatened & Endangered Species Habitat Assessment Report, Approximately 53.095-acre Chip Mill Property, Saint George, Charlton County, Georgia – TTL, Inc.



United States Department of the Interior

FISH AND WILDLIFE SERVICE
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In Reply Refer To:

February 28, 2020

Consultation Code: 04EG1000-2020-SLI-1378

Event Code: 04EG1000-2020-E-02535

Project Name: Saunders Demonstration Mine

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

This list identifies threatened, endangered, proposed and candidate species, as well as critical habitat, that may be affected by your proposed project. This list may change before your project is completed. Under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this list should be verified after 90 days. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation.

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*). Projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html).

Wind energy projects should follow the wind energy guidelines <http://www.fws.gov/windenergy/> for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts of communication towers on migratory birds can be found under the "Bird Hazards" tab at: www.fws.gov/migratorybirds.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Georgia Ecological Services Field Office

355 East Hancock Avenue

Room 320

Athens, GA 30601

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Project Summary

Consultation Code: 04EG1000-2020-SLI-1378

Event Code: 04EG1000-2020-E-02535

Project Name: Saunders Demonstration Mine

Project Type: MINING

Project Description: heavy mineral sand demonstration mining project

Project Location:

Approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/place/30.523742267443925N82.11752613020312W>



Counties: Charlton, GA

Endangered Species Act Species

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries¹, as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Red-cockaded Woodpecker <i>Picoides borealis</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7614	Endangered

Reptiles

NAME	STATUS
Eastern Indigo Snake <i>Drymarchon corais couperi</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/646	Threatened
Gopher Tortoise <i>Gopherus polyphemus</i> Population: eastern No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6994	Candidate

Amphibians

NAME	STATUS
Frosted Flatwoods Salamander <i>Ambystoma cingulatum</i> There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/4981	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.



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**2018-2019 Survey for Protected
Amphibians/Reptiles on the
Twin Pines Site, Charlton County, Georgia**

DIRK J. STEVENSON

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2018-2019 Survey for Protected Amphibians/Reptiles on the Twin Pines Tract, Charlton County, Georgia

Executive Summary

From November 2018 – April 2019, I conducted amphibian and reptile surveys on four tracts (Adirondack, Keystone, Loncala, TIAA) that are part of the Twin Pines Site, Charlton County, Georgia. These field surveys were species-specific, targeting 2 reptile species (eastern indigo snake, gopher tortoise) and 3 amphibians (frosted flatwood salamander, striped newt, gopher frog) which are federally listed and-or state listed.

Isolated depressional wetlands (i.e., cypress-gum ponds) on-site (n = 41) were reviewed to determine their habitat characteristics and potential suitability for the amphibian species, especially the frosted flatwoods salamander. Almost all wetlands were considered poor habitat due to historic/current disturbances from commercial forestry practices (to both wetlands and adjacent uplands). Twelve depressional wetlands were surveyed by dip-netting and minnow trapping during February-March 2019; no frosted flatwoods salamanders or striped newts were found.

Transect surveys for gopher tortoises identified 118 active/inactive tortoise burrows. Visual encounter surveys conducted at/near each of these gopher tortoise burrows during the winter months (conducted on 2-3 separate dates) did not document any evidence of eastern indigo snake presence on-site. Scoping gopher tortoise burrows in April 2019 with a gopher tortoise burrow camera revealed resident tortoises in 23 adult-sized burrows, 11 subadult-sized burrows, and in 1 juvenile-sized burrow; occupancy of another 4 active adult burrows, 11 active subadult burrows, and 2 active juvenile burrows could not be determined conclusively and these burrows may also contain tortoises.

The state-rare gopher frog was observed on-site (6 adult frogs were observed, all in tortoise burrows). Three “special concern” animal species tracked by Georgia Department of Natural Resources (redface topminnow, pine snake, black swampsnake) were documented on-site during the course of these surveys.

Below I summarize the results of my field surveys for federal-and-state-listed amphibians and reptiles on the Twin Pines Site. Aerial photos and topographic map figures of survey sites are shown in Figures 1 and 2, respectively.

FEDERALLY LISTED SPECIES

Frosted Flatwoods Salamander (*Ambystoma cingulatum*)

Background

The Frosted Flatwoods Salamander (*Ambystoma cingulatum*) is federally listed as Threatened and state listed by the Georgia Department of Natural Resources as Threatened. This salamander is endemic to mesic longleaf pine-wiregrass flatwoods and savannahs where it breeds in isolated, ephemeral depressional wetlands (Palis 1997; Jensen and Stevenson 2008). Optimal breeding habitats are kept open-canopied by occasional fire events and the basins of these wetlands are typically carpeted with graminaceous vegetation (Bishop and Haas 2005, Palis 1997; US FWS 1999). Adult salamanders spend over 90% of their lives in fire-maintained, mesic longleaf/slash pine-wiregrass flatwoods surrounding breeding sites (Palis and Means 2005). Late winter-early spring surveys for larvae are the most effective and efficient way to document the presence of this salamander (Bishop et al. 2006, Bevelhimer et al. 2008).

Since 2003, the frosted flatwoods salamander has been documented from only one site in Georgia—a breeding pond on Fort Stewart (Liberty County). There are no recent records (i.e., post-2000) for Charlton County, Georgia (John Jensen, Georgia Department of Natural Resources, pers. comm., 2019). The nearest (i.e., closest to the Twin Pines site) historic frosted flatwoods salamander records (with year date of most recent collection and distance from Twin Pines, in parenthesis) include: a) Chesser Island, on what is now the Okefenokee National Wildlife Refuge, Charlton County, Georgia (1922; ca. 17 km N of Twin Pines study area); b) a site in Duval County, Florida (1980; ca. 30 km SE of the study area); c) State Hwy. 177, SSE Waycross, Ware County, Georgia (1980; ca. 56 km N of the study area) (John Jensen, Georgia Department of Natural Resources, pers. comm., 2019; Kevin Enge, Florida Fish and Wildlife Conservation Commission, pers. comm., 2019).

Survey Methods

In December, 2018, I visited all wetlands on-site that could be considered potential breeding pond habitats for the frosted flatwoods salamander (i.e., isolated

depressional wetlands forested with pond cypress (*Taxodium ascendens*), black gum (*Nyssa biflora*), slash pine (*Pinus elliottii*), and myrtle-leaved holly (*Ilex myrtifolia*) (Figure 3). Earlier in 2018, these wetland systems had been delineated and mapped by TTL staff.

Each wetland ($n = 41$) was evaluated as to its potential suitability for frosted flatwoods salamander reproduction modeled after a ranking system developed by Palis (2002). Specifically, for each wetland I evaluated:

- 1) Pond Hydrology: Based on canopy-subcanopy species and other vegetation present in the wetland basin. For a site to be considered for surveys it had to be an ephemeral wetland that would possess an appropriate hydroperiod, during an average year, to allow frosted flatwoods salamander larval development.
- 2) Presence/Absence of Graminaceous Vegetation in Pond: Each pond was qualitatively scored 1, 2, or 3, as follows: 1 = Sites with abundant graminaceous vegetation (especially *Carex*, *Rhynchospora*, *Eriocaulon*, *Xyris*, and *Panicum* spp.) throughout the wetland basin; 2 = Sites with some, albeit patchy, graminaceous vegetation in basin; 3 = sites lacking, or nearly so, graminaceous vegetation.
- 3) Fire History of Pond: As above, each pond was qualitatively scored 1, 2, or 3, as follows: 1 = Sites with a regular history of fire management and/or fire events that have promoted the open-canopied and grassy conditions in the pond basin needed for salamander reproduction; 2 = Sites that are noticeably fire-suppressed, but have had some recent fire history; 3 = Sites that are severely fire-suppressed, shaded and impenetrably shrubby, and/or lacking ground cover.
- 4) Condition of Upland Habitats Surrounding Pond: As above each pond was scored a 1, 2, or 3, as follows: 1 = wetland sites surrounded by mesic, intact and fire-managed longleaf/slash pine–wiregrass flatwoods; 2 = wetland sites surrounded by planted pine habitats lacking intact ground cover layers (i.e., no wiregrass, indicating profound soil disturbance); 3 = surrounding uplands as # 2 above, significantly degraded and showing evidence of having recently been clearcut, site-prepped and bedded, and/or treated with herbicides as part of commercial forestry operations.

Wetland habitat ranks are shown in Table 1. None of the 41 ponds that I reviewed were surrounded by naturally-functioning, intact longleaf/slash pine–wiregrass flatwoods habitat and upland habitat conditions for all sites was scored a “3”. In fact, at all sites, upland habitats have been grossly degraded by silvicultural practices (bedding, ditching, fire suppression, etc.) and there are no areas of upland habitat remaining that are characterized by undisturbed soil and an intact, wiregrass-dominated groundcover.

Similarly, isolated wetlands on-site are also in poor condition due to bedding (historically, beds have been plowed into the ecotones and often into the basins of depressional wetlands on-site), ditching, historic fire suppression, and other disturbances. Although some ponds on-site possessed graminaceous vegetation in their basins, we suspect these wetlands had long been fire-suppressed (with a concomitant increase in canopy and shrub layer vegetation) before being burned by a catastrophic wildfire on 6 May 2017. As it passed through the basins of isolated depressions that most likely had been fire-suppressed for many years this fire event killed many of the larger slash pine, pond cypress, black gum and myrtle-leaved holly in these wetlands. Unusually thick mats of sphagnum moss are now present in many of these wetlands.

I selected 12 of the 41 ponds, including sites spread over the entire property (i.e., ponds on the Adirondack, Keystone, Loncala and TIAA tracts) as survey sites for frosted flatwoods salamanders (Figure 4). Some graminaceous vegetation is present in the basins of these wetlands (Figure 5). The wet winter of 2018–2019 included frequent rain events and filled these pond basins – providing appropriate hydroperiod conditions for salamander reproduction. I sampled each of these 12 wetlands for frosted flatwoods salamander larvae during February–March 2019 using dipnets and minnow traps (Figure 6). Some of the minnow traps deployed (during surveys conducted from 2/28 – 3/9/2019) were provided with glow-sticks, as doing so may enhance capture rates of ambystomatid salamander larvae (Bennett et al. 2012). However, *Ambystoma* larvae, including those of the frosted flatwoods salamander, are also commonly captured in minnow traps not provided with glow-sticks (Stevenson, unpubl. data).

Results and Discussion

The 12 survey ponds were sampled from 27 February– 9 March 2019. My surveys included 17.25 person-hours dip netting and 175 trap-nights. No frosted flatwoods salamander larvae were found. On these surveys I captured 2 species of salamanders, 6 species of anurans, 9 species of fishes, and 4 species of snakes (Tables 2 and 3). During the same period frosted flatwoods salamander larvae were found on Fort Stewart, Georgia, indicating the species bred at this site during the fall-winter of 2018-2019 (Chris Coppola, U.S. Fish and Wildlife Service, pers. comm., 2019).

The disappearance of the frosted flatwoods salamander from Chesser Island and Okefenokee National Wildlife refuge lands is most likely attributed to anthropogenic disturbances the region suffered prior to being acquired by the U.S. Fish and Wildlife Service (Jensen 1995). Large-scale declines and extirpations of frosted flatwoods salamanders have been attributed to habitat loss and degradation from commercial forestry practices (Means et al. 1996, Palis 1997). In fact, the impetus, in part, for the federal listing of the species in 1999 was widespread loss of habitat due to silviculture (US FWS 1999). It is probable that my inability to document frosted flatwoods salamanders – as well as two easily sampled frog species typical of pine flatwoods habitats, the southern chorus frog (*Pseudacris nigrita*) and ornate chorus frog (*Pseudacris ornata*) – on Twin Pines is due to their extirpation, historically, from habitat changes caused by forestry operations (Figure 7).

The uplands on the Twin Pines site – although in some areas underlain by hydric-to-mesic flatwoods soils that historically may have supported the specific pine savannah habitats required by frosted flatwoods salamanders– are, as detailed above, grossly degraded from commercial forestry operations that (based on a review of aerial photographs) date at least to the early 1970s (Figures 8 and 9). Today, these uplands no longer support intact ground vegetation (e.g., wiregrass, *Aristida stricta*) as is typical of habitat still occupied by this species.

Eastern Indigo Snake (*Drymarchon couperi*)

Background

The eastern indigo snake was federally listed as Threatened in 1978 and is state listed by the Georgia Department of Natural Resources as Threatened. The snake is generally, albeit locally, distributed in southeastern Georgia with several recent records (i.e., 2000-present) available for Trail Ridge, Charlton County, Georgia (Enge et al. 2013). An extant eastern indigo snake population occurs at the Okefenokee National Wildlife Refuge, Charlton County, Georgia, approx. 18 km N of the Twin Pines site (Stevenson 2010). Other indigo snake records located relatively close to the Twin Pines site (with year date of most recent collection and distance from Twin Pines, in parenthesis) include Cary State Forest, Nassau County, Florida (1965; 21 km E of Twin Pines) and Whitehouse Naval Outlying Field, Duval County, Florida (1996; 29 km SE of Twin Pines) (Enge et al. 2013; Kevin Enge, Florida Fish and Wildlife Conservation Commission, pers. comm., 2019).

I conducted surveys for eastern indigo snakes following methods described by Stevenson et al. (2003, 2009) and Bauder et al. (2017) that are effective for the species in the southern Georgia portion of its range. Specifically, I conducted visual encounter surveys for indigo snakes overwintering in gopher tortoise colonies. I surveyed for basking indigo snakes, and shed skins, at/near all active/inactive gopher tortoise burrows on-site ($n = 118$) on 2-3 dates during the cooler months (my surveys were conducted from 17 December 2018 to 19 March 2019). Maps of indigo snake survey areas and gopher tortoise burrow locations are provided (Figures 10 and 11).

On each indigo snake survey, each tortoise burrow was carefully examined for the presence of fresh snake tracks (if found, burrows with tracks are scoped with a gopher tortoise burrow camera in an effort to locate snakes resting deep inside the burrow). From 1-4 TTL biologists assisted me on these surveys.

No eastern indigo snakes or eastern indigo snake shed skins were found by my visual encounter surveys at the Twin Pines site, and no fresh snake tracks were located at burrows. A single pygmy rattlesnake (*Sistrurus miliarius*), the shed skin of an eastern coachwhip (*Coluber flagellum*) and two observations of gopher frogs (*Rana capito*) were observed during my surveys (Table 4).

In addition to the above visual encounter surveys, all active/inactive gopher tortoise burrows on-site were visited on 2-4 April 2019. As part of a tortoise survey, most subadult-and-adult-sized burrows were scoped with a tortoise burrow camera at this time (see Gopher Tortoise account below). No indigo snakes or shed skins were found during this effort.

The indigo snake is an extremely vagile species that often moves between upland and wetland habitats in search of food (Stevenson et al. 2010, Breininger et al. 2011). Individual snakes studied in southern Georgia had large home ranges, for some large males up to 3,500 acres in size (Hyslop et al. 2014). A lack of indigo snake observations during focused surveys doesn't demonstrate that the species is never present or transient on the Twin Pines site (even if the species doesn't winter on-site it is possible that snakes from adjacent tracts, if present that is, may occasionally visit the Twins Pines site to forage). However, there are no recent credible sightings known for the property (i.e., from TTL and other staff who have spent considerable field time on-site).

STATE-LISTED SPECIES

Gopher Tortoise (*Gopherus polyphemus*)

The gopher tortoise is a federal candidate for listing and is state-listed as Threatened by the Georgia Department of Natural Resources.

Gopher tortoise survey methods closely followed those recommended by Smith et al. (2009). From a review of soil maps and vegetation, combined with initial field reconnaissance, it became apparent that, on-site, gopher tortoise burrows were limited to habitats underlain by the soil type classified as Mandarin Fine Sand (MAA). Mandarin soils are fine to loamy sands and are somewhat poorly-drained; seasonally, the water table may be within 1.5-2 m of ground surface (we observed water ca. 1.5 - 2 m below ground surface in most burrows located at site Loncala-A during January, 2019). Mandarin is classified as a suitable soil, but not as a preferred soil, for the tortoise (U.S. Department of Agriculture Natural Resources Conservation Service, 2013).

To locate burrows, we walked line transects, with observers spaced ca. 5 m apart, through all areas of potential habitat. Except for eight burrows on the Adirondack tract that we first located in March 2019, we flagged and collected geospatial data for all active (i.e., intact burrows with fresh tortoise tracks) and inactive (i.e., intact burrows, but lacking fresh tracks) tortoise burrows on the Twin

Pines site during the summer-fall of 2018 (for a grand total of 118 active/inactive burrows) (Figures 10 and 11).

On the Twin Pines site, the sandy, well-drained environments that support gopher tortoises have historically been site-prepped and bedded and are now in planted pine, usually slash pine. Tortoises are not especially common or widespread on Twin Pines site, occurring only in 4-5 fairly small and discrete areas of sandy, open-canopied plantation habitat; individual tortoise colonies support ca. 10-15 adult tortoises, or less.

On 2-4 April 2019, we revisited the 118 burrows and (except for 17 burrows that were now abandoned) we measured each burrow with calipers (50 cm inside the burrow entrance); burrow width is related to tortoise carapace length and thus one can estimate the size of the tortoise occupying a particular burrow from its width (Martin and Layne 1987). We classified gopher tortoise burrow widths to size class as follows: juvenile burrows are 0-7.85 cm in width; subadult burrows 7.86- 25.7 cm wide; adult burrows are 25.8+ cm wide (these widths correspond to carapace lengths of 0-12 cm, 12.1-24 cm, and 24+ cm, respectively).

Also on 2-4 April, to obtain an accurate tortoise population estimate for the Twin Pines site we scoped gopher tortoise burrows using a burrow camera system (burrow camera built by Emmett Blankenship, Environmental Management Systems, Inc., Canton, GA) (Figure 12). (Note: 19 burrows that were less than 14 cm in burrow width were not scoped because of their small size; however, they were closely examined using a mirror or flashlight and in doing so we observed tortoises in 5 of these burrows; we scoped all remaining burrows).

With the burrow camera (or using flashlights/mirrors), we observed gopher tortoises in 23 adult-sized burrows, 11 subadult-sized burrows, and in 1 juvenile-sized burrow. For another 4 active adult-sized burrows, 11 active subadult-sized burrows, and 2 active juvenile burrows, we could not determine conclusively whether or not the burrow was in fact occupied by a tortoise.

Four adult gopher frogs and one Florida pinesnake were observed during these surveys. Tortoise survey data is provided in Table 5.

Striped Newt (*Notophthalmus perstriatus*)

Until recently the striped newt was considered a candidate for federal listing under the Endangered Species Act. In December 2018, the U.S. Fish and Wildlife Service determined that federal listing is not warranted at this time (US FWS 2018). The species is state listed as Threatened by the Georgia Department of Natural Resources. This amphibian is known to have declined and disappeared from portions of its historic range on Trail Ridge, near the Okefenokee Swamp National Wildlife Refuge, due to commercial forestry operations (Dodd and LaClaire 1993, Farmer et al. 2017). Since 1990, the striped newt has been found at a single site in Charlton County, Georgia, a pond on the Okefenokee NWR (located ca. 18 km N of Twin Pines); the newt was last found at this site in 1994 (Farmer et al. 2017).

My dipnet and minnow trap surveys of 12 isolated wetlands on-site did not document the striped newt. Naturally-functioning longleaf pine–wiregrass sandhills, the preferred habitat for transformed examples of this newt, are lacking on-site. Due to the profound habitat changes and perturbations from commercial forestry practices (see Frosted Flatwoods Salamander Account above) it is unlikely that the species persists on the Twin Pines site, if in fact it was ever present.

Gopher Frog (*Rana capito*)

The gopher frog, state-listed as Rare by the Georgia Department of Natural Resources, was documented on the Twin Pines site, including observations for the Adirondack, Keystone, and Loncala tracts (Figure 13). A total of six gopher frogs were observed, including three adults seen in gopher tortoise burrows during indigo snake surveys or gopher tortoise surveys and three adults observed in tortoise burrows while scoping burrows with the burrow camera. Two frogs were captured and voucher photographs were taken of these specimens. Dates and specific location information for these records are provided in Table 5.

Dipnet and minnow trap surveys of 12 isolated wetlands that I conducted on-site during February-March 2019 did not document egg masses or tadpoles of the gopher frog. On 23 April 2019, I visited two wetlands on the Loncala tract (30.57433°N, 82.11841° W and 30.57040°N, 82.12284° W) that were not among the 12 survey sites but that are located fairly close (within a quarter mile or less) of

three of our gopher frog sightings; both sites were in poor condition (e.g., choked with sphagnum, thick with bay trees) and no gopher frog tadpoles were found.

An isolated wetland I surveyed in March 2019 (A-04; 30.525379°N, 82.09925° W), dry when revisited on 23 April 2019, is a potential breeding pond for the gopher frog (Figure 3). A small cypress pond, converted in part into a borrow pit and located offsite and just south of the Keystone tract (30.51613°N, 82.11790°W), may be a breeding site used by gopher frogs.

OTHER STATE-LISTED AND SPECIAL CONCERN ANIMAL SPECIES

As a by-product of the herpetofaunal surveys I conducted on the Twin Pines site from November 2018–April 2019, a total of 38 species of amphibians and reptiles were observed on-site (comprised of 3 species of salamanders, 11 species of anurans, 3 species of turtles, 7 species of lizards, 13 species of snakes, and the American alligator) (Appendix 1). The state-listed (Threatened) southern hog-nosed snake (*Heterodon simus*), state-listed (Rare) mimic glass lizard (*Ophisaurus mimicus*) and state-listed (Unusual) Spotted Turtle (*Clemmys guttata*) were not found on-site and the extremely limited, if any, suitable habitat on-site for these taxa. There are no spotted turtle records close to the Twin Pines site (Stevenson et al. 2015).

The state-listed Bachman's sparrow (*Peucaea aestivalis*) was documented from one location on-site and from a second location just east of the site boundary. Three special concern animal species that are monitored by the Georgia Department of Natural Resources Biotics Division were found on site: redbreast blackminnow *Fundulus rubifrons*, Florida pine snake (*Pituophis melanoleucus*), and black swampsnake (*Liodytes pygaea*); locality data for these species is presented in Supplemental File 1.

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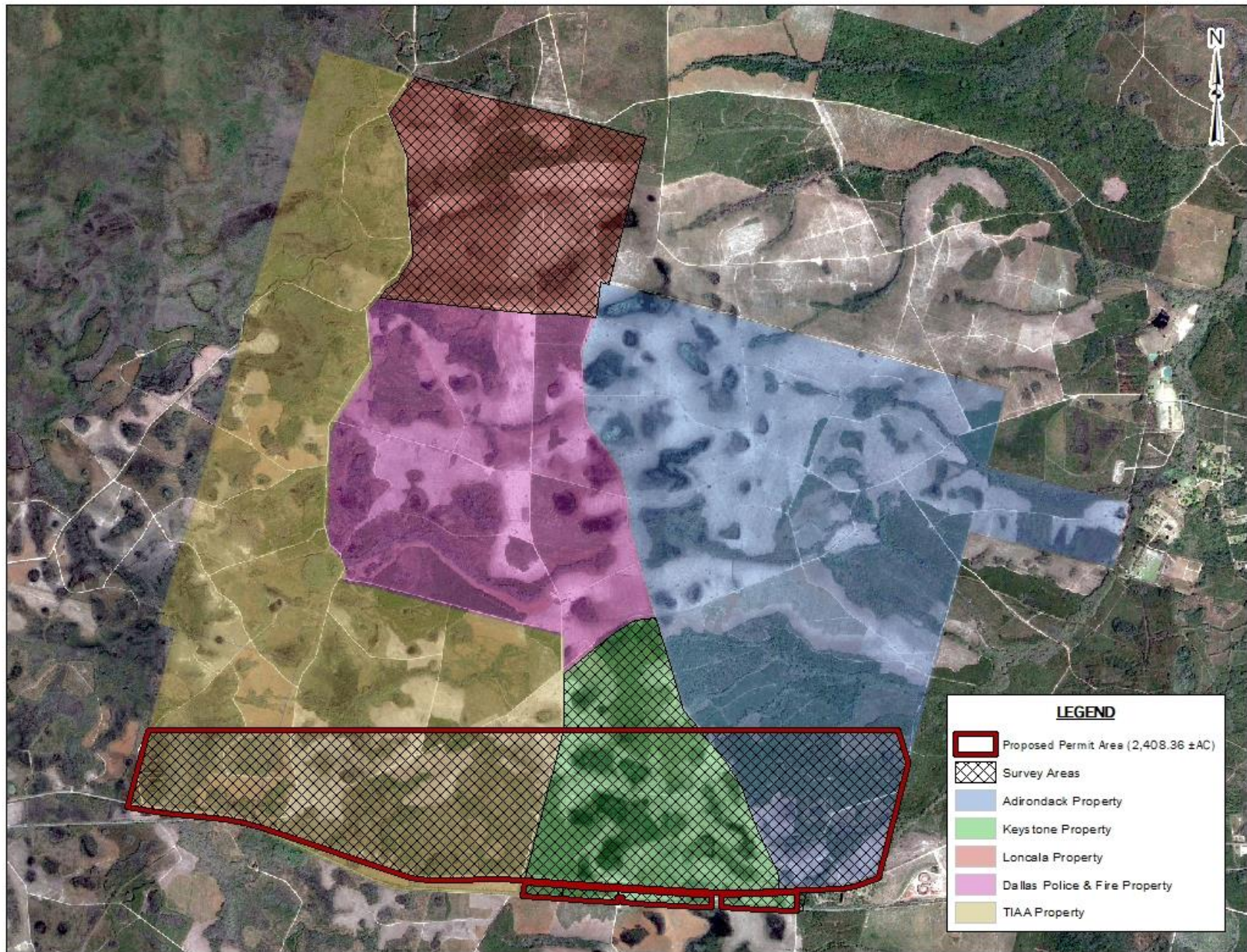


Figure 1. An aerial photograph of the Twin Pines site amphibian/reptile survey areas.

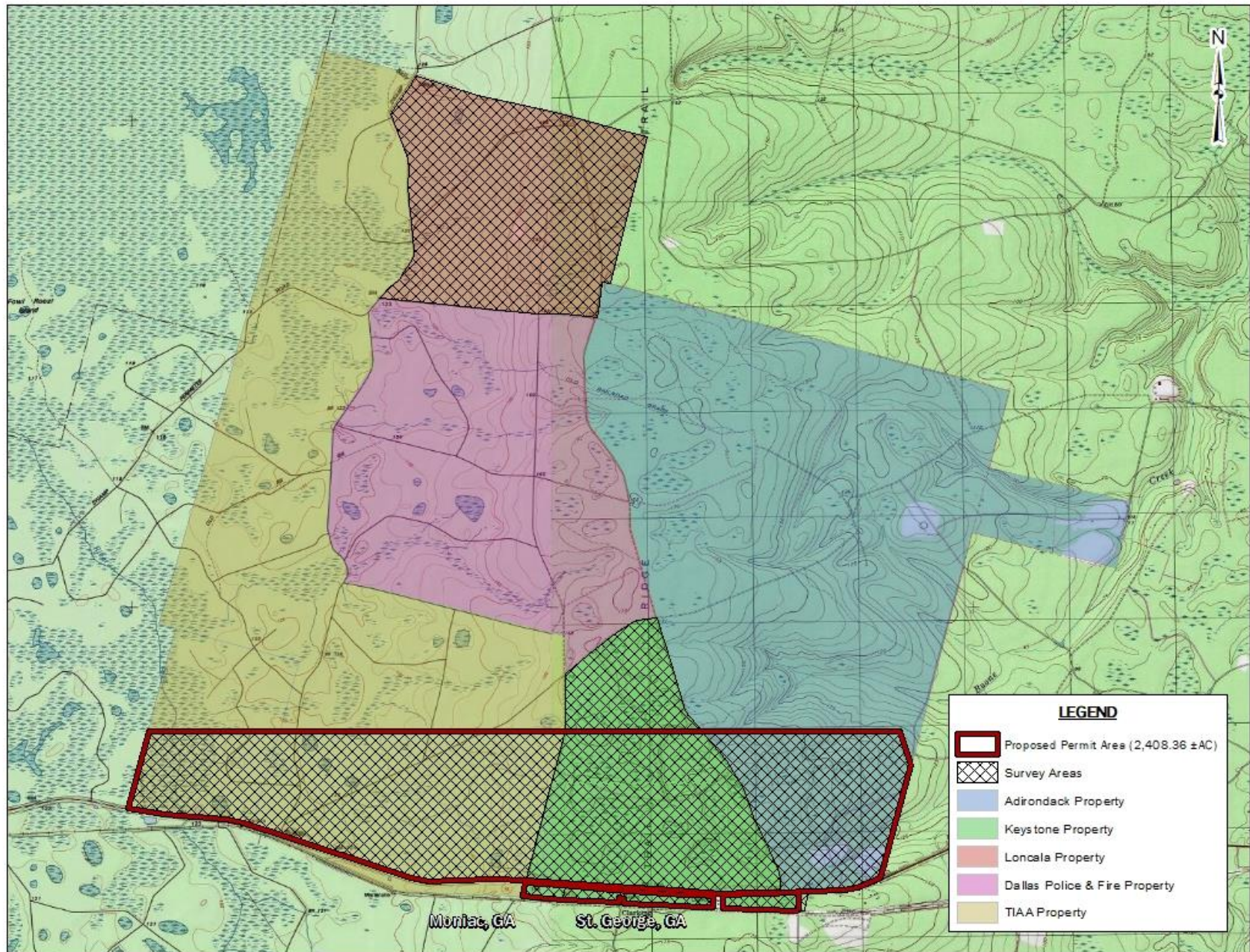


Figure 2. A USGS topographic map of the Twin Pines site amphibian/reptile survey areas.

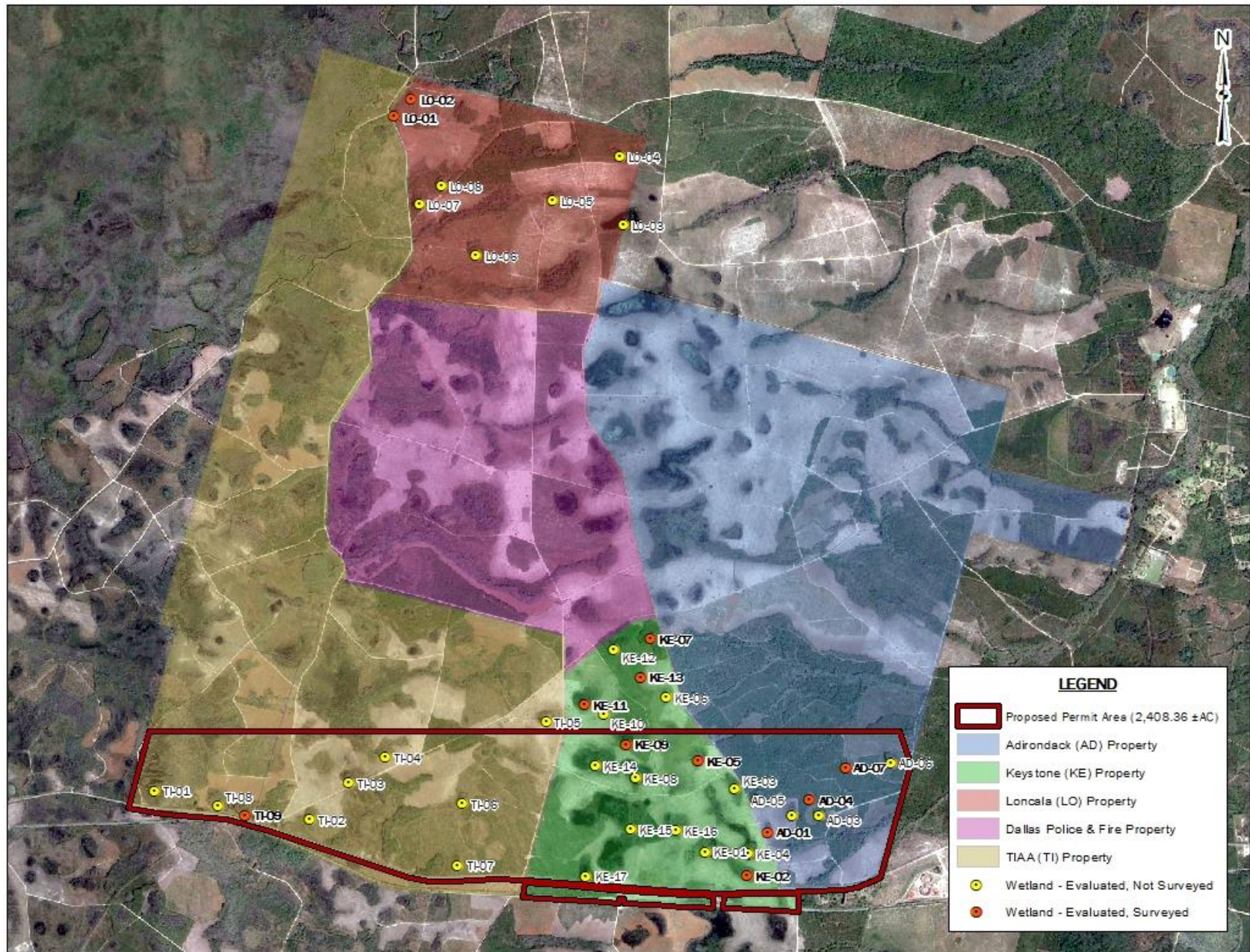


Figure 3. Locations of the 41 isolated depressional wetlands, including 12 survey sites, that were reviewed for the frosted flatwoods salamander, striped newt, and gopher frog.



Figure 4. Frosted flatwoods salamander survey site (Keystone-11). Note presence of graminaceous vegetation and fire-scarred pond cypress.



Figure 5. Frosted flatwoods salamander survey site (Loncala-01). Note scattered graminaceous vegetation and fire-killed trees in wetland.



Figure 6. Frosted flatwoods salamander survey site (Adirondack-04). Two minnow traps are visible in the foreground. A gopher frog was found in a gopher tortoise burrow ca. 2 km to the NE.



Figure 7. Wetland margin/pine upland ecotone of frosted flatwoods salamander survey site shown in Figure 1 (Keystone-11). Note parallel rows of beds extending into ectotone and standing water (result of soil compaction).



Figure 8. Pine upland habitat (part of a commercial slash pine plantation) adjacent to the frosted flatwoods salamander survey site shown in Figure 4 (Keystone-11). Note anthropogenic disturbance from parallel rows of deeply plowed beds (planted with slash pine) and the absence of a wiregrass-dominated ground cover.



Figure 9. Pine upland habitat adjacent to frosted flatwoods salamander survey site (Keystone-02). Pond can be seen in the background, Note incised ditch extending out from depressional wetland and the dominance of broomsedge in what is a recent clearcut and bedded landscape.

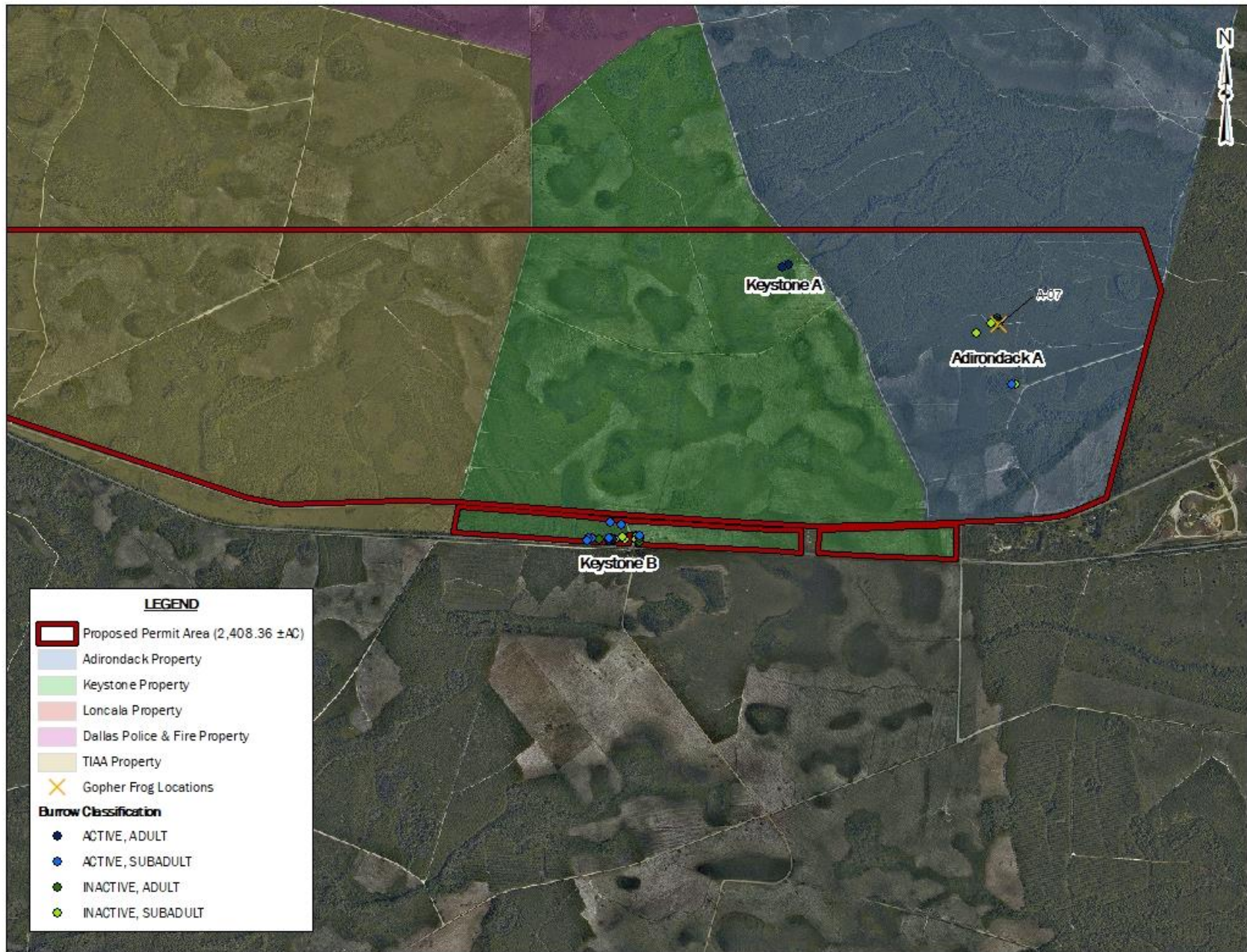


Figure 10. Locations of active/inactive gopher tortoise burrows and gopher frog observations on the Adirondack and Keystone tracts. The tortoise burrows shown on this map were surveyed on multiple dates for eastern indigo snakes.

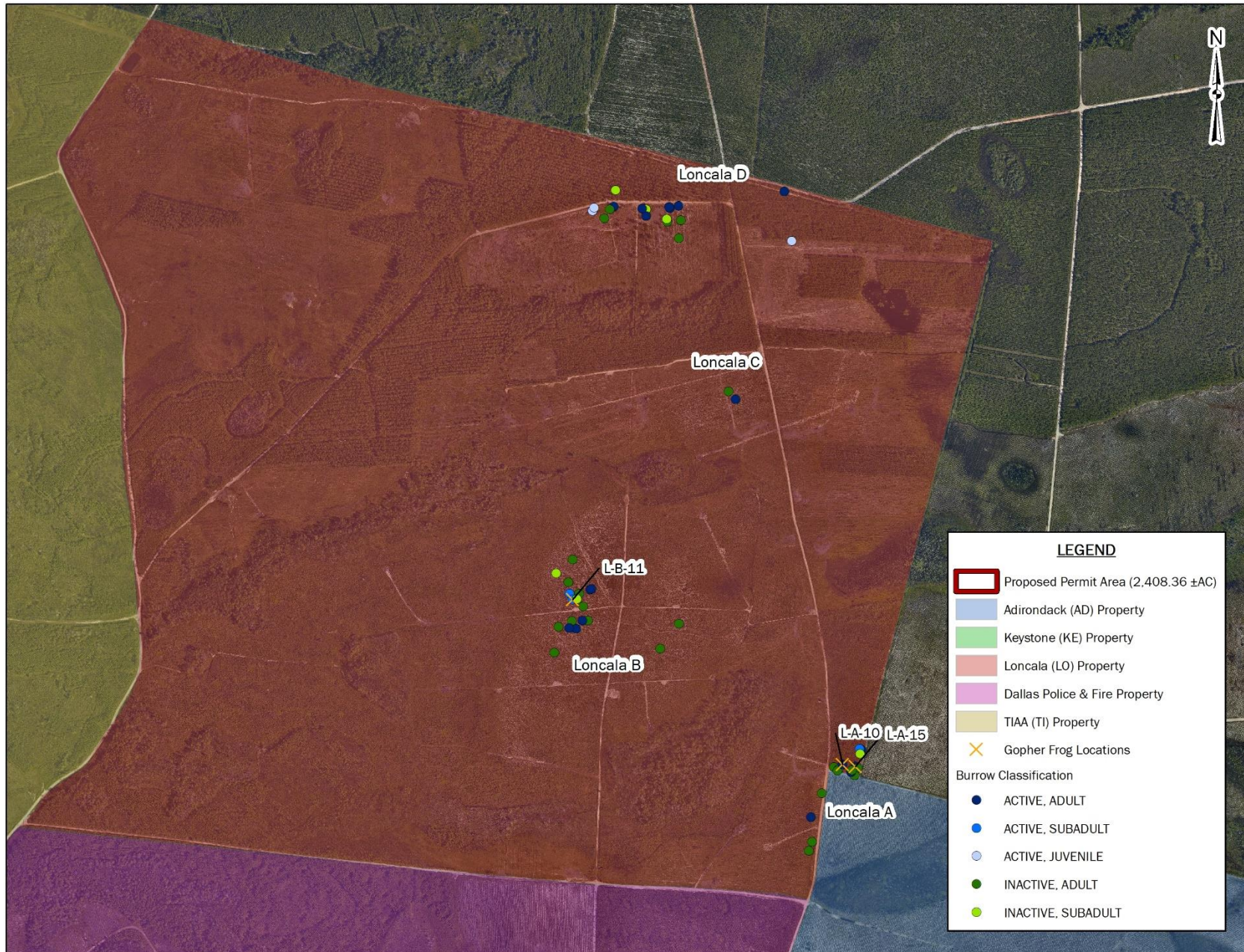


Figure 11. Locations of active/inactive gopher tortoise burrows and gopher frog observations on the Loncala tract. The tortoise burrows shown on this map were surveyed on multiple dates for eastern indigo snakes.



Figure 12. Using a burrow camera to examine the burrow of an adult gopher tortoise.



Figure 13. An adult gopher frog (*Rana capito*) found in a gopher tortoise burrow on the Twin Pines Site.

Tables

Table 1. Habitat Review of Isolated Wetlands on the Twin Pines Site, Charlton County, Georgia

(see text for explanation of ranking system)

Pond Code	Latitude	Longitude	Hydrology	Vegetation	Fire History	Intact Ground Cover?	Bedded?	Habitat Condition	Upland Habitat	Survey Site?
KEYSTONE										
KE-01	30.520979	82.109586	Suitable	3	2,3	No	Yes	3	2-year planted pine	No
KE-02	30.518907	82.105418	Suitable	3	2,3	No	Yes	3	2-year p. pine	Yes
KE-03	30.526381	82.106644	Suitable	3	2,3	No	Yes	3	2-year p. pine	No
KE-04	30.520788	82.105337	Suitable	3	2,3	No	Yes	3	2-year p. pine	No
KE-05	30.528737	82.110309	Suitable	2	2,3	No	Yes	3	2-year p. pine	Yes
KE-06	30.534172	82.113456	Suitable	2	2,3	No	Yes	3	2-year p. pine	No
KE-07	30.539235	82.114972	Suitable	2	2,3	No	Yes	3	planted pine	Yes
KE-08	30.527284	82.11642	Unsuitable	3	2,3	No	Yes	3	2-year p. pine	No
KE-09	30.53016	82.117364	Suitable	2	2,3	No	Yes	3	8-year p. pine	Yes
KE-10	30.532728	82.11965	Unsuitable	3	2,3	No	Yes	3	planted pine	No
KE-11	30.53357	82.121489	Suitable	2	2,3	No	Yes	3	2-year p. pine	Yes
KE-12	30.538326	82.118573	Suitable	2	2,3	No	Yes	3	8-year p. pine	No
KE-13	30.535922	82.11594	Suitable	2	2,3	No	Yes	3	8 year p. pine	Yes
KE-14	30.52835	82.120406	Suitable	2	2,3	No	Yes	3	2-year p. pine	No
KE-15	30.522925	82.116888	Suitable	3	2,3	No	Yes	3	2-year p. pine	No
KE-16	30.522785	82.112462	Suitable	3	2,3	No	Yes	3	2-year p. pine	No
KE-17	30.518872	82.121427	Unsuitable	3	2,3	No	Yes	3	2-year p. pine	No
LONCALA										
LO-01	30.583984	82.140291	Suitable	2	2,3	No	Yes	3	8-10-year p. pine	Yes
LO-02	30.585451	82.138633	Suitable	2	2,3	No	Yes	3	8-10 year p. pine	Yes
LO-03	30.574639	82.117651	Suitable	3	2,3	No	Yes	3	recent clearcut	No
LO-04	30.580485	82.118042	Unsuitable	3	3	No	Yes	3	recent clearcut	No
LO-05	30.576724	82.124697	Suitable	3	2,3	No	Yes	3	recent clearcut	No
LO-06	30.572041	82.132216	Unsuitable	3	2,3	No	Yes	3	ca. 8-10 p. pine	No
LO-07	30.576472	82.13783	Suitable	3	2,3	No	Yes	3	recent clearcut	No
LO-08	30.578002	82.135673	Suitable	3	2,3	No	Yes	3	recent clearcut	No

Table 1. Habitat Review of Isolated Wetlands on the Twin Pines Site, Charlton County, Georgia (Continued)

ADIROND										
AD-01	30.522642	82.103361	Suitable	2	2	No	Yes	3	2-year p. pine	Yes
AD-02	30.525445	82.104549	Unsuitable	3	3	No	Yes	3	2-year p. pine	No
AD-03	30.524073	82.098321	Unsuitable	3	3	No	Yes	3	12-year slash pine	No
AD-04	30.525379	82.099249	Suitable	2	3	No	Yes	3	12-yr slash pine	Yes
AD-05	30.524052	82.101006	Unsuitable	3	3	No	Yes	3	recent clearcut	No
AD-06	30.528595	82.091191	Unsuitable	3	3	No	Yes	3	10-year slash pine	No
AD-07	30.528172	82.095729	Suitable	2	3	No	Yes	3	8-15 year slash pine	Yes
TIAA										
TI-01	30.526199	82.164059	Unsuitable	2	2,3	No	Yes	3	clearcut	No
TI-02	30.523727	82.148684	Suitable	3	2,3	No	Yes	3	2-12 year slash pine	No
TI-03	30.526854	82.14479	Suitable	3	2,3	No	Yes	3	2-year slash pine	No
TI-04	30.52908	82.141195	Unsuitable	3	2,3	No	Yes	3	2-year slash pine	No
TI-05	30.532081	82.125323	Suitable	3	2,3	No	Yes	3	2-year slash pine	No
TI-06	30.525121	82.133605	Unsuitable	3	2,3	No	Yes	3	planted pine	No
TI-07	30.519821	82.134069	Unsuitable	3	2,3	No	Yes	3	planted pine	No
TI-08	30.524865	82.157784	Unsuitable	3	2,3	No	Yes	3	2-year slash pine	No
TI-09	30.524101	82.155082	Suitable	2	2,3	No	Yes	3	2-year slash pine	Yes

Table 2. Frosted Flatwoods Salamander Survey Data

Pond Code	Survey Dates	Personnel	Dipnet Hours	Trap-Nights	Vegetation Sampled ¹	Amphibians Observed ²
KEYSTONE						
KE-02	2/28-3/1/2019	ds, jk, ct	1.5	16	1	RSPH (L), AGRY (A), POCU (A), HFEM (A), EQUA (L)
KE-05	2/26-2/27/2019	ds, jk, ct	1.5	16	1, 2, 3, 4, 5, 6	RSPH (L), AGRY (A), EQUA (L)
KE-07	2/26-2/27/2019	ds, jk, ct	1.5	16	1, 2, 3, 4, 5, 6	RSPH (A, L), AGRY (A), POCU (A), RGRY (A)
KE-09	2/27-2/28/2019	ds, jk, ct	1.5	24	1, 4, 5, 6	RSPH (L)
KE-11	2/27-2/28/2019	ds, jk, ct	2	12	1, 2, 3, 4, 5, 6	RSPH (L), AGRY (A), EQUA (L), ATER (A), AQUE (A)
KE-13	2/27/2019	ds, jk, ct	1.5	0	5	RSPH (L), POCU (L)
LONCALA						
LO-01	2/28-3/1/2019	ds, jk, ct	1	12	1, 5	RSPH (L), HFEM (A)
LO-02	2/28-3/1/2019	ds, jk, ct	1	12	1	RSPH (L), EQUA (L)
ADIROND						
AD-01	3/7-3/8/2019	ds, jk, cs	1.5	12	2, 4, 5, 6	RSPH (E, L), AGRY (A), EQUA (L)
AD-04	3/7-3/8/2019	ds, jk, cs	1.5	12	2, 3, 4, 5, 6	POCU (L)
AD-07	3/7-3/8/2019	ds, jk, cs	1.25	14	1, 2, 4, 5	RSPH (A, L), EQUA (L)
TIAA						
TI-09	3/8-3/9/2019	ds, jk, cs	1.5	29	1	RSPH (L), HCIN (A), EQUA (L), SINT (A)

¹1=Carex; 2=Panicum; 3=Rhynchospora; 4=Eriocaulon; 5=Sphagnum; 6=Xyris

²E=Egg mass; L=Larva; A=Adult

AGRY (Acris gryllis); EQUA (Eurycea quadrigitata); HCIN (Hyla cinerea); HFEM (Hyla femoralis); POCU (Pseudacris ocularis); RGRY (Rana grylio); RSPH (Rana sphenoccephala); SINT (Siren intermedia); ATER (Anaxyrus terrestris); AQUE (Anaxyrus quercicus)

Table 3: Amphibians, Reptiles and Fishes Observed at Frosted Flatwoods Salamander Survey Sites

[illegible]

Table 3: Amphibians, Reptiles and Fishes Observed at Frosted Flatwoods Salamander Survey Sites (Continued)

banded sunfish (<i>Enneacanthus obesus</i>)	X	X	X		X	X		X	X
pygmy sunfish (<i>Elassoma</i> sp.)	X								X
mud sunfish (<i>Acantharcus pomotis</i>)									X

¹E = Eggs; L = Larvae; A = Adult, X=Species observed

Table 4. Eastern Indigo Snake Survey Data: Twin Pines Site, Charlton County, Georgia

Site	Survey #	Date	Time	Tortoise Burrows Surveyed	Weather	Results
ADIROND						
Adirondack	1	3/6-3/7/2019	1000-1600	8	sunny, clear 70 F	no indigo snakes found
Adirondack	2	3/19/2019	1550-1630	8	very cloudy, 62 F	no indigo snakes found
KEYSTONE						
Keystone A	1	12/17/2018	1140-1255	5	calm, partly cloudy, 57-60 F	no indigo snakes found, pigmy rattlesnake, burrow 01
Keystone A	2	1/18/2019	1030-1055	5	calm, mostly sunny, 64 F	no indigo snakes found
Keystone A	3	2/26/2019	1130-1200	5	cloudy, warm 68 F	no indigo snakes found
Keystone B	1	12/17/2018	1415-1636	40	calm, mostly cloudy, 61-64 F	no indigo snakes found, gopher frog, burrow 03; e. coachwhip shed, burrow 04
Keystone B	2	1/18/2019	1130-1340	40	calm, mostly sunny, 70 F	no indigo snakes found
Keystone B	3	2/26/2019	1500-1630	40	cloudy, warm 74 F	no indigo snakes found, gopher frog, burrow 02
LONCALA						
Loncala A	1	12/18/2018	1022-1142	22	calm, mostly sunny, 62-64 F	no indigo snakes found
Loncala A	2	1/17/2019	1500-1600	22	calm, sunny, 67 F	no indigo snakes found
Loncala A	3	2/26/2019	1230-1300	22	cloudy, warm 70 F	no indigo snakes found
Loncala B	1	12/18/2018	1216-1408	19	calm, mostly sunny, 67 F	no indigo snakes found
Loncala B	2	1/17/2019	1145-1420	19	calm, mostly sunny, 63 F	no indigo snakes found
Loncala B	3	2/26/2019	1310-1340	19	cloudy, warm 70 F	no indigo snakes found
Loncala C	1	12/18/2018	1452-1503	3	calm, mostly sunny, 68 F	no indigo snakes found
Loncala C	2	1/17/2019	1430-1450	3	calm, mostly sunny, 65 F	no indigo snakes found
Loncala C	3	2/26/2019	1345-1400	3	cloudy, warm 72 F	no indigo snakes found
Loncala D	1	2/26/2019	1405-1435	21	cloudy, warm 72 F	no indigo snakes found
Loncala D	2	3/19/2019	1430-1530	21	very cloudy, 62 F	no indigo snakes found

Table 5. Gopher Tortoise Survey Data, Twin Pines Site, Charlton Co., GA

Date	Site-No.	Latitude, Longitude	Activity Status Active/Inact/Ab ¹	Burrow Width (cm)	Size Class	Tortoise Observed (Yes/No/Undet.)	Commensal Species Observed
ADIRON							
4/3/2019	A-01	30.524019°N, 82.097257°W	INACTIVE	21	SUBADULT	No	
4/3/2019	A-02	30.524032°N, 82.097501°W	ACTIVE	25	SUBADULT	Yes	pine snake
4/3/2019	A-03	30.526448°N, 82.099388°W	INACTIVE	21	SUBADULT	Yes	
4/3/2019	A-04	30.527119°N, 82.098285°W	INACTIVE	31.5	ADULT	No	
4/3/2019	A-05	30.526959°N, 82.098139°W	ACTIVE	11.5	SUBADULT	Undet.	
4/3/2019	A-06	30.527028°N, 82.098256°W	ACTIVE	33	ADULT	Yes	
4/3/2019	A-07	30.526818°N, 82.098197°W	INACTIVE	27.5	ADULT	No	gopher frog
4/3/2019	A-08	30.526869°N, 82.098624°W	INACTIVE	11	SUBADULT	Undet.	
KEYSTONE							
4/3/2019	K-A-01	30.529655°N, 82.109575°W	ACTIVE	32.5	ADULT	No	
4/3/2019	K-A-02	30.529535°N, 82.109940°W	ACTIVE	35	ADULT	No	
4/3/2019	K-A-03	30.529522°N, 82.109943°W	ACTIVE	35.5	ADULT	Yes	
4/3/2019	K-A-04	30.529890°N, 82.109420°W	ABAN (INA)	N/A	ADULT	No	
4/3/2019	K-A-05	30.530050°N, 82.109950°W	ABAN (INA)	N/A	ADULT	No	
4/4/2019	K-B-01	30.516932°N, 82.117889°W	INACTIVE	30	ADULT	Yes	
4/4/2019	K-B-02	30.516924°N, 82.117859°W	ACTIVE	19.5	SUBADULT	No	
4/4/2019	K-B-03	30.516866°N, 82.117834°W	INACTIVE	9	SUBADULT	Undet.	
4/4/2019	K-B-04	30.516786°N, 82.117861°W	INACTIVE	9	SUBADULT	Undet.	
4/4/2019	K-B-05	30.516661°N, 82.117679°W	INACTIVE	26	ADULT	No	
4/4/2019	K-B-06	30.516624°N, 82.117662°W	ABAN (INA)	N/A	ADULT	No	
4/4/2019	K-B-07	30.516813°N, 82.117682°W	INACTIVE	26	ADULT	Yes	
4/4/2019	K-B-08	30.516937°N, 82.117685°W	ACTIVE	13	SUBADULT	Yes	
4/4/2019	K-B-09	30.516909°N, 82.117596°W	ABAN (INA)	N/A	JUVENILE	No	
4/4/2019	K-B-10	30.516693°N, 82.118407°W	ABAN (ACT)	N/A	JUVENILE	No	

Table 5. Gopher Tortoise Survey Data, Twin Pines Site, Charlton Co., GA

Date	Site-No.	Latitude, Longitude	Activity Status Active/Inact/Ab¹	Burrow Width (cm)	Size Class	Tortoise Observed (Yes/No/Undet.)	Commensal Species Observed
4/4/2019	K-B-11	30.516781°N, 82.118489°W	INACTIVE	22	SUBADULT	No	
4/4/2019	K-B-12	30.516715°N, 82.118419°W	ABAN (INA)	N/A	ADULT	No	
4/4/2019	K-B-13a	30.516781°N, 82.118489°W	INACTIVE	37	ADULT	Yes	
4/4/2019	K-B-13b	30.516781°N, 82.118489°W	INACTIVE	22	SUBADULT	No	
4/4/2019	K-B-14	30.516826°N, 82.118559°W	ABAN (INA)	N/A	JUVENILE	No	
4/4/2019	K-B-15	30.516849°N, 82.118558°W	INACTIVE	13.5	SUBADULT	Yes	
4/4/2019	K-B-16	30.516778°N, 82.118957°W	INACTIVE	24	SUBADULT	No	
4/4/2019	K-B-17	30.516835°N, 82.119183°W	ACTIVE	33	ADULT	Yes	
4/4/2019	K-B-18	30.516802°N, 82.119119°W	ABAN (INA)	N/A	SUBADULT	No	
4/4/2019	K-B-19	30.516786°N, 82.119124°W	ACTIVE	31	ADULT	No	
4/4/2019	K-B-20	30.516730°N, 82.119288°W	ACTIVE	30	ADULT	Yes	
4/4/2019	K-B-21	30.516800°N, 82.119323°W	ACTIVE	13	SUBADULT	Yes	
4/4/2019	K-B-22	30.516915°N, 82.119692°W	ABAN (INA)	N/A	ADULT	No	
4/4/2019	K-B-23	30.516750°N, 82.119825°W	INACTIVE	32	ADULT	No	
4/4/2019	K-B-24	30.516883°N, 82.119894°W	ABAN (INA)	N/A	SUBADULT	No	
4/4/2019	K-B-25	30.516813°N, 82.120248°W	ACTIVE	16.5	SUBADULT	Yes	
4/4/2019	K-B-26	30.516801°N, 82.120424°W	ACTIVE	12	SUBADULT	Yes	
4/4/2019	K-B-27	30.516832°N, 82.120449°W	ACTIVE	12	SUBADULT	Undet.	
4/4/2019	K-B-28	30.516722°N, 82.120482°W	ACTIVE	25.5	SUBADULT	Yes	
4/4/2019	K-B-35	30.517612°N, 82.119058°W	INACTIVE	12	SUBADULT	Undet.	
4/4/2019	K-B-36	30.517587°N, 82.119131°W	ABAN (INA)	N/A	JUVENILE	No	
4/4/2019	K-B-37	30.517568°N, 82.119173°W	ABAN (INA)	N/A	SUBADULT	No	
4/4/2019	K-B-38	30.517567°N, 82.119232°W	ACTIVE	12	SUBADULT	Undet.	
4/4/2019	K-B-39	30.517439°N, 82.118669°W	ACTIVE	12	SUBADULT	Undet.	
LONCALA							
4/2/2019	L-A-01	30.568645°N, 82.120398°W	ACTIVE	36	ADULT	Yes	

Table 5. Gopher Tortoise Survey Data, Twin Pines Site, Charlton Co., GA

Date	Site-No.	Latitude, Longitude	Activity Status Active/Inact/Ab¹	Burrow Width (cm)	Size Class	Tortoise Observed (Yes/No/Undet.)	Commensal Species Observed
4/2/2019	L-A-02	30.568065°N, 82.120363°W	INACTIVE	26	ADULT	No	
4/2/2019	L-A-03	30.567858°N, 82.120446°W	INACTIVE	35	ADULT	No	
4/2/2019	L-A-04	30.569200°N, 82.120101°W	INACTIVE	32	ADULT	No	
4/2/2019	L-A-05	30.569848°N, 82.119892°W	ABAN (INA)	N/A	JUVENILE	No	
4/2/2019	L-A-06	30.569819°N, 82.119773°W	INACTIVE	29.5	ADULT	No	
4/2/2019	L-A-07	30.569884°N, 82.119772°W	ACTIVE	11.2	SUBADULT	Undet.	
4/2/2019	L-A-08	30.569774°N, 82.119646°W	INACTIVE	29.6	ADULT	No	
4/2/2019	L-A-09	30.569731°N, 82.119676°W	INACTIVE	34	ADULT	No	
4/2/2019	L-A-10	30.569880°N, 82.119536°W	ACTIVE	40.2	ADULT	Yes	gopher frog
4/2/2019	L-A-11	30.570100°N, 82.119250°W	ABAN (INA)	N/A	ADULT	No	
4/2/2019	L-A-12	30.570215°N, 82.119014°W	ACTIVE	34.2	ADULT	Yes	
4/2/2019	L-A-13	30.570249°N, 82.119065°W	ACTIVE	13	SUBADULT	Undet.	
4/2/2019	L-A-14	30.570124°N, 82.119064°W	INACTIVE	22	SUBADULT	No	
4/2/2019	L-A-15	30.569835°N, 82.119189°W	ACTIVE	33	ADULT	Yes	gopher frog
4/2/2019	L-A-16	30.569792°N, 82.119152°W	INACTIVE	26.5	ADULT	No	
4/2/2019	L-A-17	30.569799°N, 82.119118°W	INACTIVE	29.7	ADULT	No	
4/2/2019	L-A-18	30.569621°N, 82.119207°W	INACTIVE	30.5	ADULT	No	
4/2/2019	L-A-19	30.569692°N, 82.119306°W	ACTIVE	34	ADULT	Yes	
4/2/2019	L-A-20	30.569696°N, 82.119308°W	ABAN (INA)	N/A	SUBADULT	No	
4/2/2019	L-A-21	30.569743°N, 82.119279°W	INACTIVE	29.2	ADULT	No	
4/2/2019	L-A-22	30.570552°N, 82.118916°W	ABAN (INA)	N/A	ADULT	No	
4/3/2019	L-B-01	30.573181°N, 82.123975°W	INACTIVE	31.5	ADULT	No	
4/3/2019	L-B-02	30.572592°N, 82.124486°W	INACTIVE	28	ADULT	No	
4/3/2019	L-B-03	30.574680°N, 82.126850°W	INACTIVE	33	ADULT	No	
4/3/2019	L-B-04	30.574364°N, 82.127295°W	INACTIVE	24	SUBADULT	No	
4/3/2019	L-B-05	30.574151°N, 82.126971°W	INACTIVE	33.5	ADULT	No	
4/3/2019	L-B-06	30.573883°N, 82.126677°W	INACTIVE	32	ADULT	No	

Table 5. Gopher Tortoise Survey Data, Twin Pines Site, Charlton Co., GA

Date	Site-No.	Latitude, Longitude	Activity Status Active/Inact/Ab¹	Burrow Width (cm)	Size Class	Tortoise Observed (Yes/No/Undet.)	Commensal Species Observed
4/3/2019	L-B-07	30.573982°N, 82.126377°W	ACTIVE	34.5	ADULT	Yes	gopher frog
4/3/2019	L-B-08	30.57400°N, 82.126340°W	ACTIVE	35	ADULT	No	
4/3/2019	L-B-09	30.573589°N, 82.126571°W	INACTIVE	37.5	ADULT	No	
4/3/2019	L-B-10	30.573884°N, 82.126939°W	ACTIVE	13	SUBADULT	Undet.	
4/3/2019	L-B-11	30.573746°N, 82.126855°W	ACTIVE	11	SUBADULT	Undet.	
4/3/2019	L-B-12	30.573251°N, 82.126441°W	INACTIVE	35	ADULT	No	
4/3/2019	L-B-13	30.573251°N, 82.126591°W	ACTIVE	35	ADULT	Yes	
4/3/2019	L-B-14	30.573063°N, 82.126757°W	ACTIVE	30.5	ADULT	Yes	
4/3/2019	L-B-15	30.573244°N, 82.126875°W	INACTIVE	29.5	ADULT	No	
4/3/2019	L-B-16	30.573112°N, 82.127239°W	INACTIVE	32	ADULT	No	
4/3/2019	L-B-17	30.572507°N, 82.127354°W	INACTIVE	33	ADULT	No	
4/3/2019	L-B-18	30.573081°N, 82.126946°W	ACTIVE	32	ADULT	Yes	
4/3/2019	L-B-19	30.573755°N, 82.126735°W	INACTIVE	15.5	SUBADULT	Undet.	
4/3/2019	L-C-01	30.579251°N, 82.121553°W	ABAN (INA)	N/A	JUVENILE	No	
4/3/2019	L-C-02	30.578621°N, 82.122628°W	INACTIVE	29	ADULT	No	
4/3/2019	L-C-03	30.578438°N, 82.122431°W	ACTIVE	38.5	ADULT	Yes	
4/2/2019	L-D-01	30.582978°N, 82.123975°W	ACTIVE	30	ADULT	Yes	
4/2/2019	L-D-02	30.582636°N, 82.123911°W	INACTIVE	28	ADULT	No	
4/2/2019	L-D-03	30.582222°N, 82.123969°W	INACTIVE	43	ADULT	No	
4/2/2019	L-D-04	30.582603°N, 82.124289°W	INACTIVE	28	ADULT	No	
4/2/2019	L-D-05	30.582669°N, 82.124294°W	INACTIVE	24	SUBADULT	No	
4/2/2019	L-D-06	30.582925°N, 82.124217°W	ACTIVE	32.5	ADULT	Yes	
4/2/2019	L-D-07	30.582953°N, 82.124230°W	ACTIVE	23	SUBADULT	Yes	
4/2/2019	L-D-08	30.582952°N, 82.124231°W	ACTIVE	29	ADULT	Yes	
4/2/2019	L-D-09	30.582893°N, 82.124861°W	INACTIVE	20	SUBADULT	Undet.	
4/2/2019	L-D-10	30.582738°N, 82.124859°W	ACTIVE	33.5	ADULT	Yes	
4/2/2019	L-D-11	30.582555°N, 82.124848°W	ACTIVE	14	SUBADULT	Yes	

Table 5. Gopher Tortoise Survey Data, Twin Pines Site, Charlton Co., GA

Date	Site-No.	Latitude, Longitude	Activity Status Active/Inact/Ab¹	Burrow Width (cm)	Size Class	Tortoise Observed (Yes/No/Undet.)	Commensal Species Observed
4/2/2019	L-D-12	30.582919°N, 82.124967°W	ACTIVE	31	ADULT	Yes	
4/2/2019	L-D-13	30.583345°N, 82.125689°W	INACTIVE	25	SUBADULT	Yes	
4/2/2019	L-D-14	30.582959°N, 82.125734°W	ACTIVE	35.5	ADULT	No	
4/2/2019	L-D-15	30.582895°N, 82.125845°W	INACTIVE	41.5	ADULT	No	
4/3/2019	L-D-16	30.582688°N, 82.125988°W	INACTIVE	32.5	ADULT	No	
4/3/2019	L-D-17	30.582864°N, 82.126309°W	INACTIVE	37.5	ADULT	Undet.	
4/3/2019	L-D-18	30.582864°N, 82.126309°W	ACTIVE	6	JUVENILE	Yes	
4/3/2019	L-D-19	30.582929°N, 82.126268°W	ACTIVE	6	JUVENILE	Undet.	
4/3/2019	L-D-20	30.582149°N, 82.120903°W	ACTIVE	7.5	JUVENILE	Undet.	
4/3/2019	L-D-21	30.583321°N, 82.121103°W	ACTIVE	43.5	ADULT	Yes	

¹ABA (ACT) and ABA (INA) indicate burrows that were abandoned when visited in April 2019 but had been classified as Active (ACT) or Inactive (INA) in November 2018.

Appendix 1: Amphibian/Reptile Species List for Twin Pines, Charlton County, Georgia
A= Adirondack, K = Keystone, L = Loncala, T = Tia Tract

Reptiles

American Alligator	<i>Alligator mississippiensis</i>	L, T
Gopher Tortoise	<i>Gopherus polyphemus</i>	A, K, L
Coastal Plain Cooter	<i>Pseudemys floridana</i>	L
Eastern Box Turtle	<i>Terrapene carolina</i>	A
Eastern Glass Lizard	<i>Ophisaurus ventralis</i>	T
Green Anole	<i>Anolis carolinensis</i>	A, K, L, T
Fence Lizard	<i>Sceloporus undulatus</i>	A, K
Southeastern Five-lined Skink	<i>Plestiodon inexpectatus</i>	K
Broadhead Skink	<i>Plestiodon laticeps</i>	K, L
Ground Skink	<i>Scincella lateralis</i>	K, L
Six-lined Racerunner	<i>Aspiloscelis sexlineata</i>	A, L
Eastern Garter Snake	<i>Thamnophis sirtalis</i>	K, L
Eastern Ribbon Snake	<i>Thamnophis sauritus</i>	A, K, T
Banded Watersnake	<i>Nerodia fasciata</i>	A, T
Black Swampsnake	<i>Liodytes pygaea</i>	L
Black Racer	<i>Coluber constrictor</i>	A, K, L, T
Eastern Coachwhip	<i>Coluber flagellum</i>	K
Rough Greensnake	<i>Opheodrys aestivus</i>	A, T
Florida Pine Snake	<i>Pituophis melanoleucus</i>	A, K
Corn Snake	<i>Pantherophis guttatus</i>	A, K
Scarlet Kingsnake	<i>Lampropeltis elapsoides</i>	K, L
Cottonmouth	<i>Agkistrodon piscivorous</i>	A, L, T
Pygmy Rattlesnake	<i>Sistrurus miliarius</i>	A, K, L, T
Timber Rattlesnake	<i>Crotalus horridus</i>	A

Amphibians

Dwarf Salamander	<i>Eurycea quadridigitata</i>	A, K, L, T
Lesser Siren	<i>Siren intermedia</i>	T
Two-toed Amphiuma	<i>Amphiuma means</i>	A
Southern Toad	<i>Anaxyrus terrestris</i>	A, K, L
Oak Toad	<i>Anaxyrus quercicus</i>	K, L
Southern Cricket Frog	<i>Acris gryllus</i>	A, K, L, T
Little Grass Frog	<i>Pseudacris ocularis</i>	A, K
Pinewoods Treefrog	<i>Hyla femoralis</i>	A, K, L, T
Green Treefrog	<i>Hyla cinerea</i>	K, T
Gopher Frog	<i>Rana capito</i>	A, K, L
Southern Leopard Frog	<i>Rana sphenoccephala</i>	A, K, L, T
Bronze Frog	<i>Rana clamitans</i>	K
Bullfrog	<i>Rana catesbeiana</i>	K
Pig Frog	<i>Rana grylio</i>	K, L



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Results of Eastern Indigo Snake Surveys on the Twin Pines Site, Charlton County, Georgia: Year 2

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Results of Eastern Indigo Snake Surveys on the Twin Pines Site, Charlton County, Georgia: Year 2

In November-December 2019, I again conducted eastern indigo snake (*Drymarchon couperi*) surveys on the Twin Pines Site, Charlton County, Georgia.

Similar to my first round of indigo snake surveys (conducted December, 2018 – March, 2019 [see Stevenson, 2019]), these surveys followed the field methods described by Stevenson et al. (2003) and Bauder et al. (2017). Specifically, I conducted visual encounter surveys for indigo snakes overwintering in gopher tortoise colonies. I surveyed for basking indigo snakes, and for indigo snake shed skins, at/near all active/inactive gopher tortoise burrows on-site ($n = 106$ burrows) on three dates from 19 November – 18 December 2019. Approximately two weeks separated each survey event for each respective site. Maps of indigo snake survey areas and gopher tortoise burrow locations are provided.

On each indigo snake survey, each tortoise burrow was carefully examined for the presence of fresh snake tracks (if found, burrows with tracks are scoped with a gopher tortoise burrow camera in an effort to locate snakes resting deep inside the burrow). From 1-4 TTL biologists assisted me on these surveys.

No eastern indigo snakes or eastern indigo snake shed skins were found by my visual encounter surveys at the Twin Pines site, and no fresh snake tracks were located at burrows. A single pygmy rattlesnake (*Sistrurus miliarius*) and the shed skin of a Florida pinesnake (*Pituophis melanoleucus*) were observed (Table 1). No gopher frogs (*Rana capito*) were observed during these surveys.

A lack of indigo snake observations during focused surveys doesn't demonstrate that the species is never present or transient on the Twin Pines site (even if the species doesn't winter on-site it is possible that snakes from adjacent tracts, if present that is, may occasionally visit the Twins Pines site to forage). However, there are no recent credible sightings known for the property (i.e., from TTL and other staff who have spent considerable field time on-site) and my dedicated surveys during two consecutive years failed to locate the species.

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Education, Experience, Integrity in Applied Ecology and Conservation

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2019 Survey for Rare, Threatened and Endangered Plants

**Twin Pines Mining Block 1
Charlton County, Georgia**

FINAL REPORT

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2019 Survey for Rare, Threatened and Endangered Plants

Executive Summary

From January 2019 – December 2019 I conducted surveys for rare plants on approximately 2,424 acres of land in Charlton County, GA proposed for heavy mineral sands mining by Twin Pines Minerals, LLC (U.S. Army Corps of Engineers permit application # SAS-2018-00554). These surveys targeted plants listed or proposed to be listed under the federal Endangered Species Act as threatened or endangered, as well as plants listed under the Wildflower Preservation Act of Georgia as unusual, rare, threatened or endangered, and plants that are tracked by the state of GA Department of Natural Resources (GA DNR, Wildlife Resources Division, Wildlife Conservation Section). Uplands and wetlands on site were degraded by former silvicultural activity so I concentrated survey efforts in areas where habitat was most likely to harbor rare species (e.g. graminaceous wetlands, open sphagnum bogs, bayheads containing hardwood species, uplands where planting beds were eroded to some degree, uplands consisting of gopher tortoise-appropriate soils and uplands with minimal midstory density).

I detected six plant species that are tracked by GA DNR (*Asclepius pedicillata*, *Asimina pygmaea*, *Fuirena scirpoidea*, *Quercus chapmanii*, *Rhexia nuttallii*, *Tillandsia bartramii*), two species that are listed under the GA Wildflower Preservation Act (*Sarracenia minor*, *Sarracenia psitticina*), and no species that are federally listed or proposed to be listed under the Endangered Species Act. Of these, three tracked species (*Asimina pygmaea*, *Fuirena scirpoidea*, *Rhexia nuttallii*) were numerous and widespread where appropriate habitat was present.

Introduction

In 2018 Twin Pines Minerals LLC and TTL inc. (agent) consulted with federal and state agencies (U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, Georgia Department of Natural Resources, and U.S. Environmental Protection Agency) as part of a preliminary planning process for a proposed 2,424 acre heavy mineral sands mining project on Trail Ridge east of Okefenokee National Wildlife Refuge in Charlton County, Georgia [U.S. Army Corps of Engineers permit application # SAS-2018-00554]. One outcome of the consultation was a request that threatened and endangered species surveys be conducted on the site prior to permit approvals. As an experienced botanist and ecologist with Terra-Ignea Enterprises LLC, I was subcontracted by TTL to conduct surveys for target plant species beginning January 2019 and concluding by December 2019.

Methods

U.S. Fish and Wildlife Service and Georgia Department of Natural Resources provided TTL with a list of target plant species with ranges overlapping the proposed mining tracts and for which habitat was likely to occur on the tracts. These included three candidate plant species proposed for listing under the Endangered Species Act (*Hartwrightia floridana*, *Coreopsis integrifolia*, *Balduina atropurpurea*). An additional 24 species of plants, either listed under the GA Wildflower Preservation Act or state-tracked, were added to the list by GA DNR botanists (Table 1), for a total of 27 target plant species that agencies requested be considered.

I assessed target plant species habitat availability and quality on the proposed mining area using satellite imagery, National Wetlands Inventory maps, topographic maps and soils maps followed by ground-truthing. Although the entire proposed project site has been severely impacted by prior silvicultural activity, I selected 450 acres of highest quality flatwoods available (uplands where planting beds were eroded to some degree, uplands consisting of gopher tortoise-appropriate soils and uplands with minimal midstory density, Figures 1-4) and surveyed all of that area despite habitat being marginal at best (pine planting beds up to 0.5 m high, obvious intensive prior herbicide treatment, severe 2017 wildfire effects and subsequent salvage logging, Figures 5-8). I walked on parallel transects that were approximately 50 m apart, with a TTL staff approximately 10 m to each side of me (three of us total), throughout the selected flatwoods

habitat during four separate survey periods to catch peak bloom time for all target plant species; survey periods were April 15-26, May 29-June 5, July 15-22 and October 7-14.

I identified 45 wetlands totaling approximately 472 acres for plant surveys using primarily satellite imagery. Three people (myself and two TTL staff) walked approximately 10 m apart around wetland ecotones to survey all 45 wetlands for target wetland plant species from April 15-26. Because many of the wetlands were in extremely degraded condition (mechanical site preparation for silviculture, planted with *Pinus elliotii*, disturbed by feral swine and severely impacted by wildfire as a result of long-term fire suppression, Figures 9-11), during the first survey I scored wetland characteristics (hydrology, fire, graminoids, midstory, canopy, surrounding upland) on a scale of 1-3, 1 being intact and 3 being severely degraded (Table 2). In subsequent survey periods, I only surveyed the 32 wetlands (329 acres) with a cumulative score < 12 and/or that had target species occurrences in the first survey. Subsequent survey periods for wetlands remaining in the survey were May 29-June 5, July 15-22 and October 7-14.

I recorded all plant locations using a Trimble R1 GNSS receiver with sub-meter accuracy and a Trimble Nomad 1050 handheld data collection device. If I could not identify species with 100% certainty in the field, I collected specimens and identified them with a dissecting microscope, using 'Flora of the Southern and Mid-Atlantic States' (Weakley 2015) as the authoritative reference.

I used geospatial software (ArcGIS) to map precise locations of all observed occurrences of target plant species (Figures 1-4) and summarized findings in an Excel database (Table 1). I shared all Excel database files, maps and GIS files with TTL staff.

Results

Within the proposed mining project boundary, as of August 2019, I documented a total of 1000 occurrences of target plants, with some of those occurrences representing single plants and some representing clusters of plants. I detected four target plant species that are tracked by GA DNR: *Asimina pygmaea*, *Fuirena scirpoidea*, *Quercus chapmanii* and *Tillandsia bartramii* (Table 1). Of these, *Asimina pygmaea* and *Fuirena scirpoidea* were abundant and widespread. I also encountered two additional species that are state-tracked that were not on the original target species list: *Asclepius pedicillata* and *Rhexia nuttallii* (Table 1), with *Rhexia nuttallii* being abundant and widespread. I documented two species that are listed and under the GA Wildflower Preservation Act: *Sarracenia minor* and *Sarracenia psitticina* (Table 1 and Figures 1-4). I failed to detect any plant species protected or proposed for protection under the federal Endangered Species Act. Because there were records of four other state-tracked species near to the proposed project site, I added them to the target species list: *Epidendrum magnolia*, *Platanthera chapmanii*, *Platanthera integra*, and *Platanthera nivea*. I did not observe any of those species within the proposed project area.

Although not exhaustive, I compiled a general list of plant species encountered on site as I opportunistically observed them (Table 3.) The list includes 104 species, mostly forbs that I was able to identify in the field or that I identified using a scope and 'Weakley's Flora.'

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Table 1. Target plant species 2019. # occurrences = documented on proposed mine site. Protection status: GA tracked = not listed; U.S. petitioned/under review = candidate species for protection under U.S. Endangered Species Act; GA unusual, threatened or rare = listed under GA Wildflower Preservation Act. Added by (entity who added the species to the target species list): JMK = J.M. Klaus Conservation Services/Terra-Ignea Enterprises; GA DNR = Georgia Department of Natural Resources; US FWS = U.S. Fish and Wildlife Service.

Scientific name	Common name	# occurrences	Protection status	Flower/fruit time	Added by
<i>Asclepias pedicellata</i>	Savannah Milkweed	9	GA tracked	July-August	JMK
<i>Asimina pygmaea</i>	Dwarf Pawpaw	413	GA tracked	April-July	GA DNR
<i>Balduina atropurpurea</i>	Purple honeycomb-head	0	U.S. petitioned/under review	August-November	US FWS
<i>Coreopsis integrifolia</i>	Floodplain tickseed	0	U.S. petitioned/under review	August-November	US FWS
<i>Ctenium floridanum</i>	Florida Orange-grass	0	GA tracked	June-October	GA DNR
<i>Epidendrum magnoliae</i>	Green-fly orchid	0	GA unusual	June-July	JMK
<i>Fuirena scirpoidea</i>	Southern Umbrella-sedge	206	GA tracked	July-November	GA DNR
<i>Galactia floridana</i>	Florida Milk-pea	0	GA tracked	June-September	GA DNR
<i>Gymnopogon chapmanianus</i>	Chapman's Skeleton Grass	0	GA tracked	August-November	GA DNR
<i>Hartwrightia floridana</i>	Hartwrightia	0	U.S. petitioned/under review	July-December	US FWS
<i>Justicia angusta</i>	Narrowleaf Water-willow	0	GA tracked	March-November	GA DNR
<i>Lachnocaulon beyrichianum</i>	Southern Bog-button	0	GA tracked	May-October	GA DNR
<i>Litsea aestivalis</i>	Pond Spice	0	GA rare	March-May	GA DNR
<i>Palafoxia integrifolia</i>	Palafoxia	0	GA tracked	August-November	GA DNR
<i>Peltandra sagittifolia</i>	Arrow Arum	0	GA tracked	July-September	GA DNR
<i>Piloblephis rigida</i>	Pennyroyal	0	GA tracked	January-December	GA DNR
<i>Platanthera chapmanii</i>	Chapman's fringed orchid	0	GA tracked	July-September	JMK
<i>Platanthera integra</i>	Yellow fringeless orchid	0	GA tracked	July-September	JMK
<i>Platanthera nivea</i>	Snowy orchid	0	GA tracked	June	JMK
<i>Pteroglossaspis ecristata</i>	Wild Coco	0	GA threatened	June-October	GA DNR
<i>Quercus chapmanii</i>	Chapman Oak	4	GA tracked	September-December	GA DNR
<i>Rhexia nuttallii</i>	Nuttall meadowbeauty	253	GA tracked	June	JMK
<i>Rhynchospora fernaldii</i>	Fernald's Beakrush	0	GA tracked	June-January	GA DNR
<i>Sarracenia minor</i> var. <i>minor</i>	Hooded Pitcherplant	78	GA unusual	April-June	GA DNR
<i>Sarracenia psittacina</i>	Parrot Pitcherplant	8	GA threatened	March-July	GA DNR
<i>Schoenolirion albiflorum</i>	White Sunnysbell	0	GA tracked	May-June	GA DNR
<i>Scutellaria arenicola</i>	Sandhill Skullcap	0	GA tracked	May-September	GA DNR
<i>Spiranthes floridana</i>	Florida Ladies-tresses	0	GA tracked	April-June	GA DNR
<i>Sporobolus teretifolius</i>	Wireleaf dropseed	0	GA tracked	July-October	GA DNR
<i>Stokesia laevis</i>	Stokes Aster	0	GA tracked	June-September	GA DNR
<i>Tephrosia chrysophylla</i>	Sprawling Goats Rue	0	GA tracked	April-November	GA DNR
<i>Tillandsia bartramii</i>	Bartram's Air-plant	29	GA tracked	June-September	GA DNR
<i>Verbesina heterophylla</i>	Diverse-leaf Crownbeard	0	GA tracked	April-July	GA DNR

Table 2. Scoring system for wetlands.

	1	2	3
Hydrology	Intact	Some degradation, easily restored	Severely degraded, restoration difficult
Fire	Frequent	Evidence of some past fire suppression	Evidence of severe fire suppression
Graminoids	Abundant	Some	Sparse or none
Midstory	Sparse	Patchy	Dense throughout basin
Canopy	< 50% closed	> 50% closed	Complete closure
Upland	Intact	Ditched & bedded, low groundcover quality	Severely degraded, low groundcover quality

Table 3. All plants identified during 2019 surveys (not an exhaustive plant list).

Scientific name	Scientific name	Scientific name	Scientific name	Scientific name
<i>Acer rubrum</i>	<i>Crotalaria maritima</i>	<i>Lachnanthes caroliniana</i>	<i>Polygala lutea</i>	<i>Scutellaria integrifolia</i>
<i>Aletris lutea</i>	<i>Cyrtilla racemosa</i>	<i>Lachnocaulon anceps</i>	<i>Polygala nana</i>	<i>Serenoa repens</i>
<i>Anchistia virginica</i>	<i>Eleocharis sp.</i>	<i>Leucothoe axillaris</i>	<i>Pteridium aquilinum</i>	<i>Seymeria cassoides</i>
<i>Andropogon virginicus</i>	<i>Erigeron philadelphicus</i>	<i>Liatris tenuifolia</i>	<i>Pterocaulon pycnostachyum</i>	<i>Smilax auriculata</i>
<i>Aristida spiciformis</i>	<i>Eryngium integrifolium</i>	<i>Lobelia glandulosa</i>	<i>Quercus chapmanii</i>	<i>Smilax bona-nox</i>
<i>Asclepius cinerea</i>	<i>Eupatorium capillifolium</i>	<i>Lyonia ferruginea</i>	<i>Quercus laurifolia</i>	<i>Smilax glauca</i>
<i>Asclepius connivens</i>	<i>Euthamia caroliniana</i>	<i>Lyonia fruticosa</i>	<i>Quercus myrtifolia</i>	<i>Smilax laurifolia</i>
<i>Asclepius pedicellata</i>	<i>Fuirena scirpoidea</i>	<i>Lyonia lucida</i>	<i>Quercus virginiana</i>	<i>Solidago sp.</i>
<i>Asimina incana</i>	<i>Galactia regularis</i>	<i>Magnolia virginica</i>	<i>Rhexia nuttallii</i>	<i>Sophronanthe hispida</i>
<i>Asimina pygmaea</i>	<i>Gelsemium sempervirens</i>	<i>Mikania scandens</i>	<i>Rhexia sp.</i>	<i>Stipulicida setacea</i>
<i>Baccharis halimifolia</i>	<i>Gordonia lasianthus</i>	<i>Myrica caroliniensis</i>	<i>Rhododenron canescens</i>	<i>Tephrosia spicata</i>
<i>Balduina angustifolia</i>	<i>Helenium vernale</i>	<i>Nyssa biflora</i>	<i>Rhododenron viscosum</i>	<i>Tillandsia bartramii</i>
<i>Balduina uniflora</i>	<i>Hypericum brachyphyllum</i>	<i>Onoclea sensibilis</i>	<i>Rhus copellinum</i>	<i>Trichostema sp.</i>
<i>Bejaria racemosa</i>	<i>Hypericum sp.</i>	<i>Panicum hemitomon</i>	<i>Rhynchospora latifolia</i>	<i>Trilisa odoratissima</i>
<i>Bidens mitis</i>	<i>Hypericum tetrapetalum</i>	<i>Persea palustris</i>	<i>Sabatia brachiata</i>	<i>Typha sp.</i>
<i>Calopogon pallidus</i>	<i>Hypoxis sp.</i>	<i>Physostegia virginiana</i>	<i>Sabatia dodecandra</i>	<i>Vaccinium arboreum</i>
<i>Carphephorus corymbosus</i>	<i>Ilex coriacea</i>	<i>Pinguicula cerulea</i>	<i>Sabatia macrophylla</i>	<i>Vaccinium myrsinites</i>
<i>Cleistesiosis divaricata</i>	<i>Ilex glabra</i>	<i>Pinus elliotii</i>	<i>Sagittaria sp.</i>	<i>Vaccinium stamineum</i>
<i>Clethra alnifolia</i>	<i>Iris virginica</i>	<i>Pinus palustris</i>	<i>Salix sp.</i>	<i>Vitis sp.</i>
<i>Cliftonia monophylla</i>	<i>Juncus polycephalos</i>	<i>Pluchea odorata</i>	<i>Sarracenia minor</i>	<i>Wisteria frutescens</i>
<i>Acer rubrum</i>	<i>Kalmia hirsuta</i>	<i>Polygala cruciata</i>	<i>Sarracenia psitticina</i>	



Figure 1. Twin Pines 2019 proposed mining project area with select flatwoods, wetlands and target plant locations. Degraded flatwoods areas were only surveyed opportunistically. Degraded wetlands are those that scored > 12 using the wetland scoring system (Table 2) and were not surveyed after the first survey period.

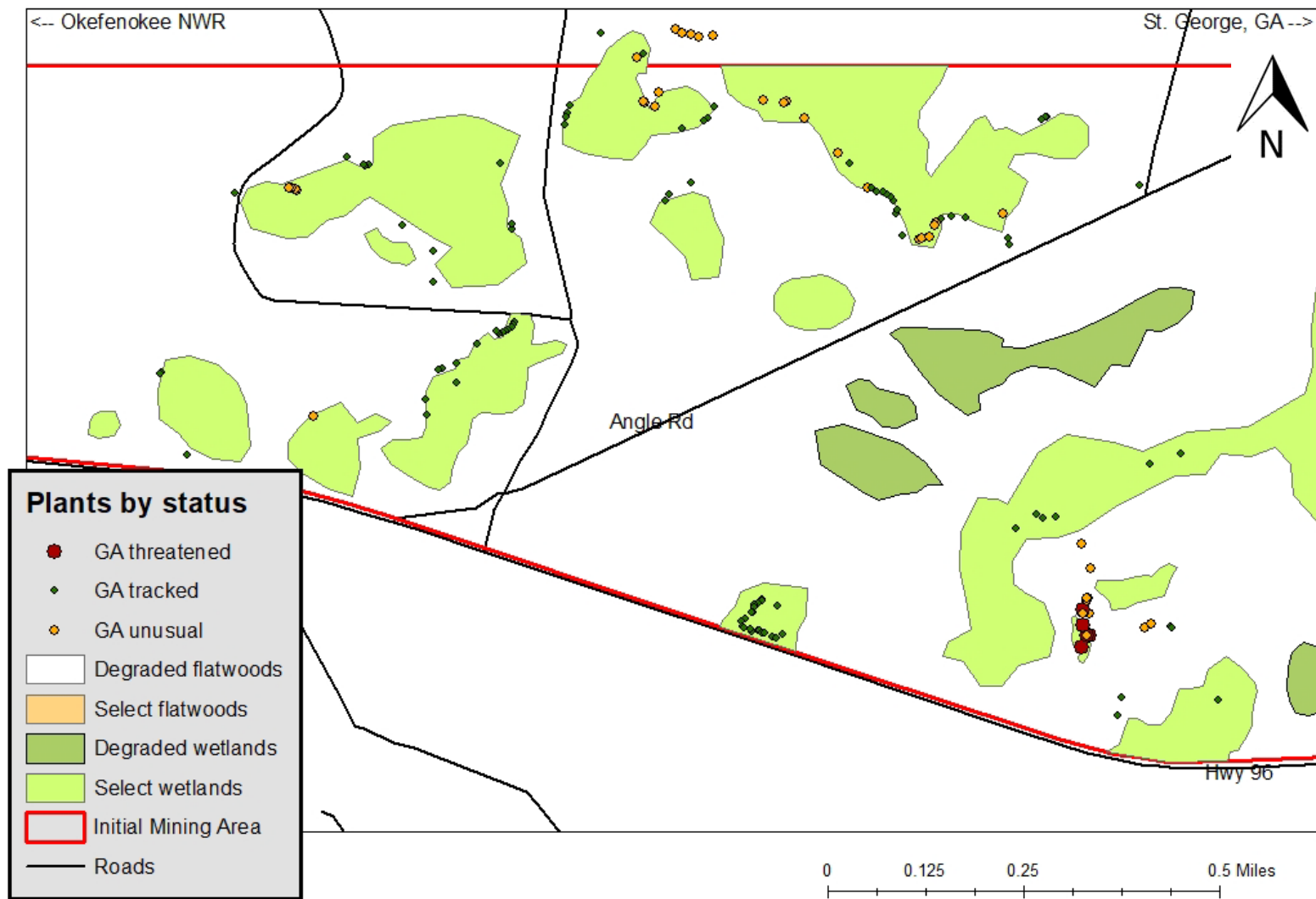


Figure 2. Twin Pines 2019 proposed mining project area, western section with select flatwoods, wetlands and target plant locations. Degraded flatwoods areas were only surveyed opportunistically. Degraded wetlands are those that scored > 12 using the wetland scoring system (Table 2) and were not surveyed after the first survey period.

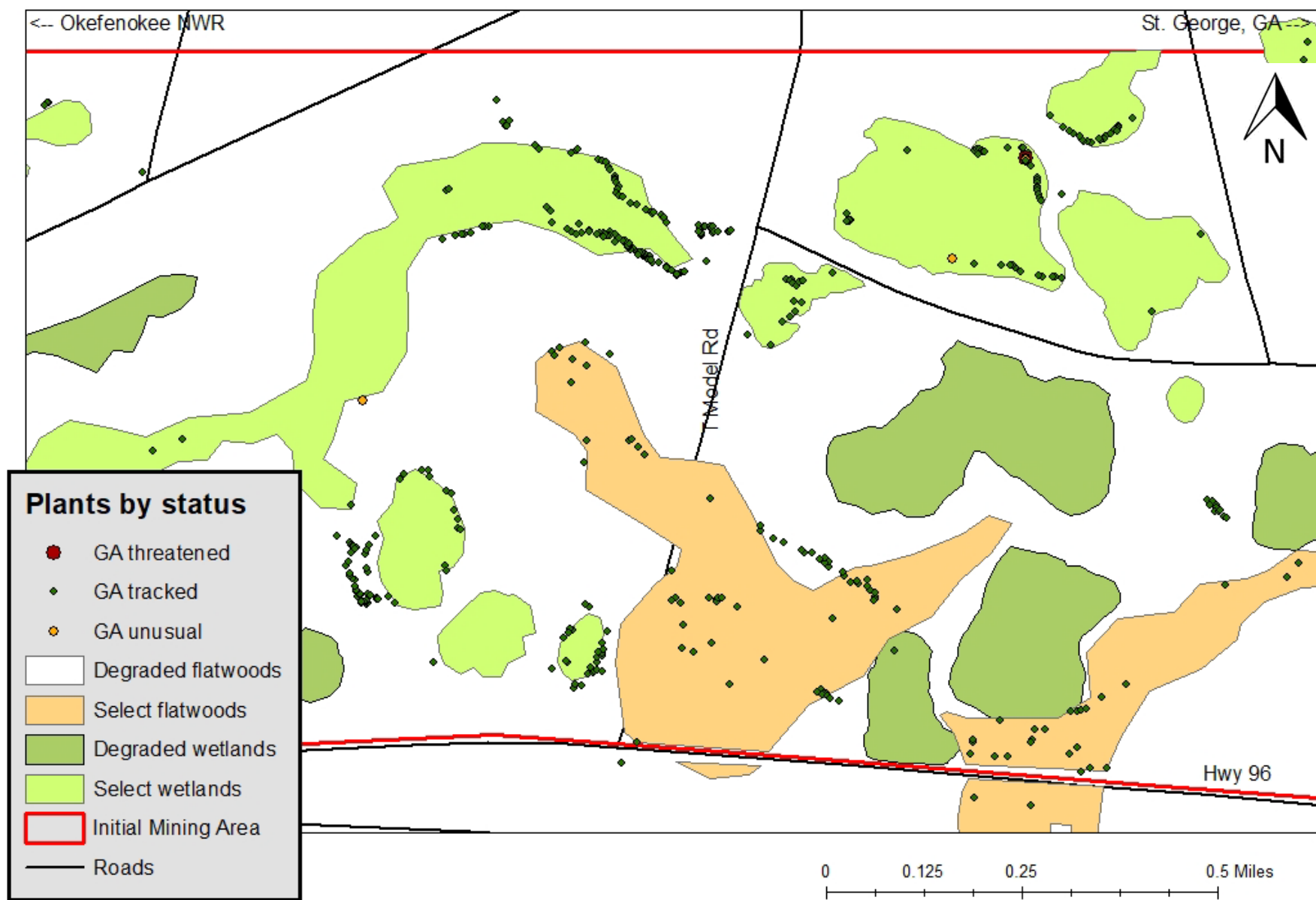


Figure 3. Twin Pines 2019 proposed mining project area central section with select flatwoods, wetlands and target plant locations. Degraded flatwoods areas were only surveyed opportunistically. Degraded wetlands are those that scored > 12 using the wetland scoring system (Table 2) and were not surveyed after the first survey period.

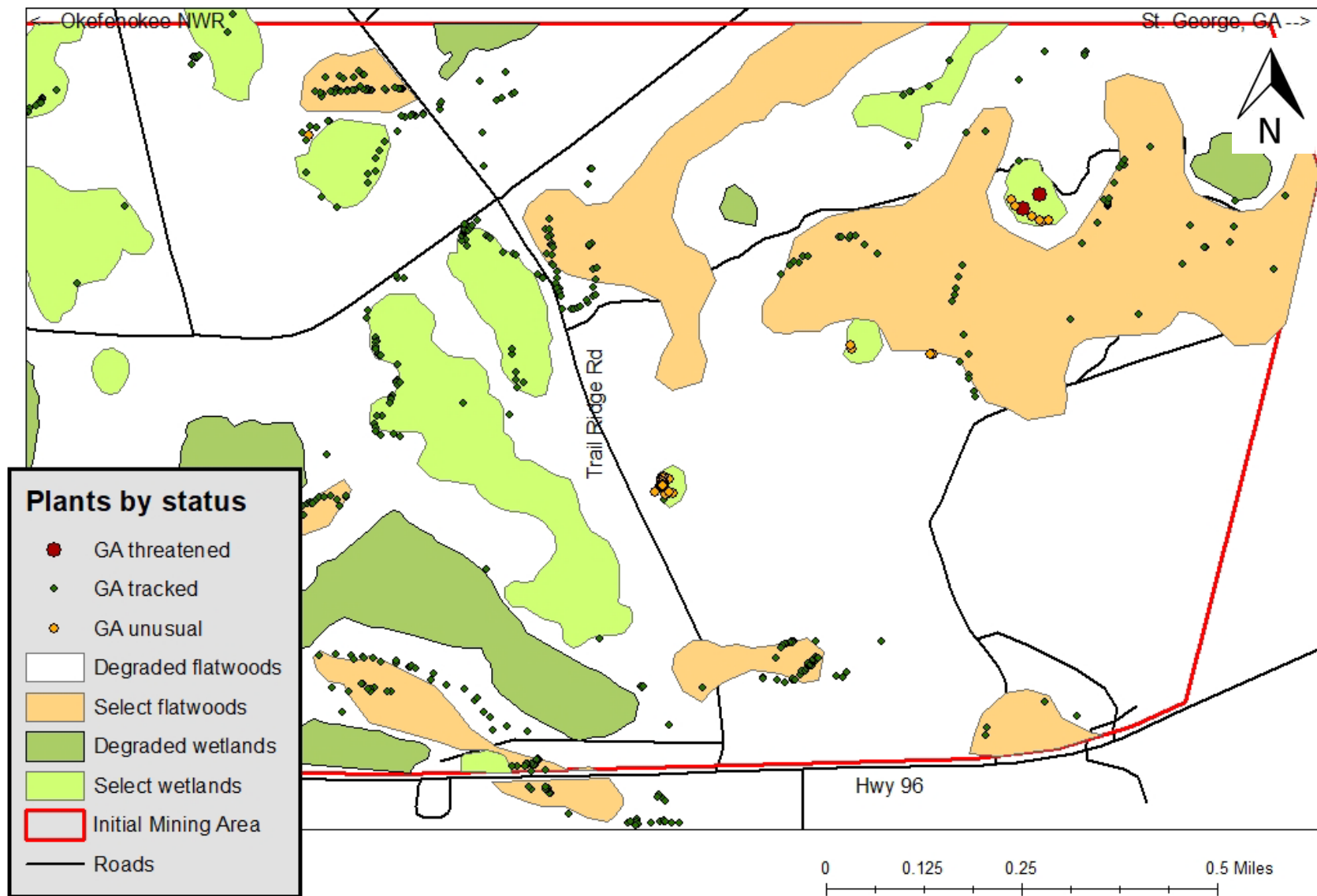


Figure 4. Twin Pines 2019 proposed mining project area eastern section with select flatwoods, wetlands and target plant locations. Degraded flatwoods areas were only surveyed opportunistically. Degraded wetlands are those that scored > 12 using the wetland scoring system (Table 2) and were not surveyed after the first survey period.



Figure 5. Typical post-wildfire salvage-logged upland habitat. Dominant groundcover is dense *Andropogon virginicus*, a species common on agricultural sites (i.e. 'old fields') and a symptom of past intensive silvicultural activity.



Figure 6. Typical upland habitat that escaped wildfire and has not been recently logged. This was likely the condition of most of the proposed project site before the 2017 wildfire. The dominant midstory/groundcover is *Serenoa repens*, a symptom of long-term fire suppression and intense herbicide use. This density of midstory structure precludes establishment or persistence of herbaceous species.



Figure 7. Fresh mechanical site preparation showing disturbance to soil and groundcover.



Figure 8. Young planted *Pinus elliotii* and rank *Andropogon sp.* in uplands/flatwoods precludes establishment or persistence of other herbaceous groundcover.



Figure 9. Typical degraded wetland habitat impacted by silviculture and wildfire, and dominated by dense shrubs, especially *Lyonia sp.* and *Cyrilla racemifolora*, with few herbaceous areas.



Figure 10. Many of the more herbaceous wetlands were impacted by feral swine. This image is typical of the damage caused by these pests that are abundant in the project area.



Figure 11. Every wetland in the proposed project area was impacted by intensive silvicultural activity. This is typical of the hydrologic impacts caused by mechanical site preparation (ditching and bedding) and planting pines. The area in the center is a planting bed and more open water areas on either side are ditches up to 0.5 m deep.

THREATENED & ENDANGERED SPECIES HABITAT ASSESSMENT REPORT

APPROXIMATELY 53.095-ACRE CHIP MILL PROPERTY
SAINT GEORGE, CHARLTON COUNTY, GEORGIA

Submitted to:



Twin Pines Minerals, LLC

Attn: Mr. Steve Ingle, P.E.
2100 Southbridge Parkway
Birmingham, Alabama 35209

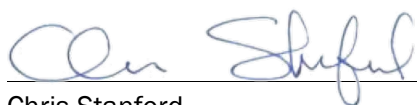
SAS-2018-00554
TTL Project No. 000180200804.00

June 19, 2020



SIGNATURE OF ENVIRONMENTAL PROFESSIONALS

TTL, Inc. has performed a Threatened and Endangered Species Survey within the project site. Environmental professionals with specialized understanding of the listed species and the habitats of concern conducted the survey and developed this report.



Chris Stanford
Project Professional

June 19, 2020

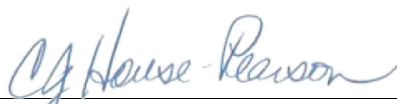
Date



Chris Terrell
Project Professional

June 19, 2020

Date



Cindy House-Pearson
Senior Natural Resources
Client Manager

June 19, 2020

Date

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APPENDICES

Appendix A	Site Photographs
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1.0 INTRODUCTION

TTL, Inc. (TTL) was contracted by Twin Pines Minerals, LLC (Twin Pines) to perform habitat assessment for federally listed threatened or endangered species within the proposed project area. Twin Pines proposes to convert an existing lumber chip mill into a material processing facility for a proposed heavy mineral mining operation in Saint George, Charlton County, Georgia. TTL conducted the field activities for this project from March 23, 2020 to March 25, 2020. The U.S. Army Corps of Engineers (USACE) project number is SAS-2018-00554.

A list of federally protected species is maintained by the U.S. Fish and Wildlife Service (USFWS) for each county within the U.S. Consultation with the USFWS is required if project activities have the potential to impact listed species. The purpose of the survey is to observe the presence or probable absence of listed species and to evaluate the potential for suitable habitat. Site photographs are included in Appendix A.

2.0 SITE DESCRIPTION

The site is an approximately 53.095-acre area depicted on the U.S. Geological Survey (USGS) 7.5-minute Topographic Map of Saint George, Georgia (Figure 1). The center of the site is located near latitude 30.518411 and longitude -82.087495. According to the USGS Topographic Map, the elevation at the site ranges from approximately 120 to 155 feet above mean sea level.

The northern portion of the delineation area is located north of Highway 94. The southern portion of the review area is located between Highway 94 and the railroad right-of-way.

Driving directions to the site are as follows: from the intersection of GA-23 and GA-94 (in St. George, GA), travel west along GA-94 for approximately 2.96 miles and the chip mill is located along the southern portion of GA-94 (Figure 2).

3.0 LITERATURE AND RECORDS REVIEW

Prior to conducting the field effort, TTL performed a literature and records review to develop an understanding of the potential for the presence of ecosystems that may support species identified by the USFWS. These data sources and the review findings are described below.

3.1 Soils

The Natural Resource Conservation Service (NRCS) maintains a database of soil types (map units) for most areas of the U.S. The map unit descriptions, along with the maps, can be used to determine the composition and properties of the unit which represents a large area dominated by one or more major soil types. Map units are useful for planning purposes to provide an overall understanding of whether the soils that occur in a general area are likely to provide habitat support for listed species. Table 1 presents the soil map unit within the survey area. A map of the onsite and adjacent soils with the hydric rating classification is presented in Figure 3.

Table 1: Soil Map Unit Classification

Map Symbol	Map Unit Description
LeA	Leon Fine Sand, 0 to 2 percent slopes
LyA	Lynn Haven Fine Sand, 0 to 2 percent slopes
MaA	Mandarin Fine Sand, 0 to 2 percent slopes

3.2 Wetlands & Waters

The U.S. Fish and Wildlife Service (USFWS) created and maintains the National Wetland Inventory (NWI) database of information on the characteristics, extent, and status of the wetlands and deepwater habitats within the U.S. This information is useful for planning purposes and provides an overall understanding of the habitats that may be present in or around the site. The NWI classifies habitat types as marine, estuarine, riverine, lacustrine or palustrine with additional modifiers as appropriate to identify the water regime, water chemistry, soil or other characteristics based on *Classification of Wetlands and Deepwater Habitats of the U.S.* (Cowardin, 1979).

TTL reviewed the NWI data for the site using the USFWS NWI Wetlands Mapper web-based tool to determine the potential for wetlands to exist on the site. The USFWS NWI Mapper identified numerous stream features along the locations of constructed roadside and railroad right-of-way within the review area boundary as well as a small area of forested wetland along the southeastern

portion of the review area. Figure 4 depicts the NWI Map, and Table 2 summarizes the habitat below.

Table 2: NWI Classifications

Map Unit Symbol	Description of Habitat
R4SBC	Riverine; Intermittent; Streambed; Seasonally flooded.
PFO6F	Palustrine; Forested, Deciduous; Semipermanently Flooded

Furthermore, from March 23, 2020 to March 25, 2020 TTL delineated waters of the United States (WOTUS) on the property. The review area contains one, approximately 3.604-acre, wetland and one, approximately 1.247-acre, constructed storm water basin. The wetland is located on the northwestern portion of the review area (Figure 5). The hydrology for this area is supported by localized stormwater and a shallow water table. The wetland vegetation communities within the delineation area vary from large areas of bedded, planted pine habitat [dominated by slash pine (*Pinus elliottii*) whose growth has been stunted due to hydric conditions, inkberry (*Ilex glabra*), red maple (*Acer rubrum*), Carolina redroot (*Lachnanthes caroliniana*), loblolly bay (*Gordonia lasianthus*), broomsedge (*Andropogon virginicus*) and Virginia chain fern (*Woodwardia virginica*)], to forested bayhead/riparian habitat that exhibited few signs of silvicultural activities [dominated by pond cypress (*Taxodium ascendens*), swamp tupelo (*Nyssa biflora*), large gallberry (*Ilex coriacea*), myrtle leaf holly (*Ilex myrtifolia*), manyhead rush (*Juncus polycephalus*) and Virginia chain fern].

3.3 Ecoregion

Areas with generally similar ecosystems, with respect to the type, quality and quantity of environmental resources have been divided into “ecoregions” by the U.S. Environmental Protection Agency (EPA). The U.S. is divided and sub-divided into successively smaller regions: Level I is the coarsest scale and Level IV is the finest scale of division. The project site is located within the Sea Island Flatwoods (75f) Level IV ecoregion within the Southern Coastal Plain Level III ecoregion (Griffith et al., 2001).

The Southern Coastal Plain ecoregion is described below:

The Southern Coastal Plain extends from South Carolina and Georgia through much of central Florida, and along the Gulf coast lowlands of the Florida Panhandle, Alabama, and Mississippi. From a national perspective, it appears to be mostly flat plains, but it is a heterogeneous region

also containing barrier islands, coastal lagoons, marshes, and swampy lowlands along the Gulf and Atlantic coasts. In Florida, an area of discontinuous highlands contains numerous lakes. This ecoregion is generally lower in elevation with less relief and wetter soils than ecoregion 65. Once covered by a variety of forest communities that included trees of longleaf pine, slash pine, pond pine, beech, sweetgum, southern magnolia, white oak, and laurel oak, land cover in the region is now mostly slash and loblolly pine with oak-gum-cypress forest in some low lying areas, citrus groves, pasture for beef cattle, and urban. (Griffith et al., 2001)

The Sea Island Flatwoods ecoregion is described below:

The **Sea Island Flatwoods** are poorly-drained flat plains with lower elevations and less dissection than 65l. Pleistocene sea levels rose and fell several times creating different terraces and shoreline deposits. Spodosols and other wet soils are common, although small areas of better-drained soils add some ecological diversity. Trail Ridge is in this region, forming the boundary with 75g. Loblolly and slash pine plantations cover much of the region. Water oak, willow oak, sweetgum, blackgum and cypress occur in wet areas. (Griffith et al., 2001)

4.0 POTENTIAL SPECIES AND HABITAT DESCRIPTION

4.1 Potential Species Overview

According to information maintained by the U.S. Fish & Wildlife Service (USFWS) Environmental Conservation Online System (ECOS) IPaC Species List (**Consultation Code: 04EG1000-2020-SLI-1378, Event Code: 04EG1000-2020-E-02535**), four (4) federally-listed species may be located within the project area; there are no critical habitats identified within the project area. A copy of the Official Species List Letter is included as Appendix A. The species list is also provided in the table below:

Group	Name	Status
Reptiles	Eastern Indigo Snake (<i>Drymarchon corais couperi</i>)	Threatened
	Gopher Tortoise (<i>Gopherus polyphemus</i>)	Candidate
Amphibians	Frosted Flatwoods Salamander (<i>Ambystoma cingulatum</i>)	Threatened

Group	Name	Status
Birds	Red-cockaded Woodpecker (<i>Picoides borealis</i>)	Endangered

4.2 Gopher Tortoise

The Gopher tortoise is a large brownish-gray land turtle. The gopher tortoise grows slowly, with female shells (carapace) reaching at least nine inches in length while male carapaces can be slightly smaller. The gopher tortoise has large flipper-like, heavily scaled front legs and strong toenails for digging while the back legs are muscular. In North America, there are four extant species (desert tortoise, Texas tortoise, Bolson tortoise and the gopher tortoise), all occurring in deep sand habitats.

The largest populations of gopher tortoises occur in deep, dry sandy soils with a moderately open tree canopy such as the longleaf pine-scrub oak-wiregrass sand hills that are frequently burned. This habitat is ideal for digging deep burrows and allows sufficient sunlight to reach the ground to provide thermo-regulation necessary for nesting and incubation of the eggs. This open canopy also allows abundant herbaceous vegetation necessary for their preferred herbivorous diet.

Clear cuts that are created by timber harvesting activities may support a small population for a few years, but as the canopy closes, the tortoises move toward areas with a more open canopy. Dense hardwood and unburned pine/hardwood areas are not suitable habitat. While agricultural fields provide support for a few individuals, it is considered marginal habitat.

Gopher tortoise survey methods closely followed those recommended by Smith et al. (2009). From a review of soil maps and vegetation, combined with initial field reconnaissance, it became apparent that, on-site, gopher tortoise burrows were limited to habitats underlain by the soil type classified as Mandarin Fine Sand (MAA). Mandarin is classified as a suitable soil, but not as a preferred soil, for the tortoise (U.S. Department of Agriculture Natural Resources Conservation Service, 2013).

To locate burrows, TTL walked line transects, with observers spaced approximately 5 meters apart, through all areas of potential habitat. TTL flagged and collected geospatial data for all active (i.e., intact burrows with fresh tortoise tracks) and inactive (i.e., intact burrows, but lacking fresh tracks) tortoise burrows on the Chip Mill property.

TTL identified 31 active and inactive gopher tortoise burrows in close proximity to the railroad spur right-of-way as shown on Figure 6. Site photographs are provided in Appendix A.

4.3 Eastern Indigo Snake

Due to known occurrences in the region and gopher tortoise burrows present onsite, wintering habitat may be present for the eastern indigo snake. Although not surveyed for due to the time of year of the field inspection, no specimens, associated fresh snake tracks, or snake shed skins of the eastern indigo snake were observed during the field inspections.

4.4 Frosted Flatwoods Salamander

The frosted flatwoods salamander is endemic to mesic longleaf pine-wiregrass flatwoods and savannahs where it breeds in isolated, ephemeral depressional wetlands (Palis 1997; Jensen and Stevenson 2008). Optimal breeding habitats are kept open-canopied by occasional fire events and the basins of these wetlands are typically carpeted with graminaceous vegetation (Bishop and Haas 2005, Palis 1997; US FWS 1999). Adult salamanders spend over 90% of their lives in fire-maintained, mesic longleaf/slash pine-wiregrass flatwoods surrounding breeding sites (Palis and Means 2005). Late winter-early spring surveys for larvae are the most effective and efficient way to document the presence of this salamander (Bishop et al. 2006, Bevelhimer et al. 2008).

TTL reviewed the on-site wetland habitats for their suitability of potential breeding pond habitats for the frosted flatwoods salamander (i.e., isolated depressional wetlands forested with pond cypress (*Taxodium ascendens*), black gum (*Nyssa biflora*), slash pine (*Pinus elliotii*), and myrtle-leaved holly (*Ilex myrtifolia*). The on-site forested wetland was evaluated as to its potential suitability for the frosted flatwoods salamander based on a ranking system developed by Palis (2002). For each wetland; the hydrology, fire history, presence/absence of graminaceous vegetation within the pond basin (including *Carex*, *Rhynchospora*, *Eriocaulon*, *Xyris*, *Panicum* spp.) as well as the condition of pine uplands (e.g., fire history, integrity of ground cover, soil type and disturbance) surrounding the wetland was considered. TTL did not identify any suitable habitat for breeding sites within the review area. The onsite forested wetland appeared riparian in nature and was not an isolated, depressional feature.

4.5 Red-cockaded Woodpecker

Red-cockaded woodpecker are residents of the Okefenokee National Wildlife Refuge. Suitable habitat consists of well-drained, sandy areas dominated by old-growth, longleaf pine communities with sparse mid-story vegetation and dense diverse herbaceous groundcover. Pine trees must be of sufficient size and spatial distribution to be inhabited by red-cockaded woodpeckers. Due to the site's current use as a commercial forestry operation (north of Highway 94) and chip mill (south of

Highway 94), this habitat does not exist within the review area. No red-cockaded woodpeckers, cavity trees, or signs were observed during field reconnaissance.

5.0 CONCLUSIONS

Within the survey review area, TTL observed 31 gopher tortoise burrows, which are located in close proximity to the railroad rail spur right-of-way. Therefore, potential wintering habitat is present onsite for the eastern indigo snake. No suitable habitat was observed onsite for the frosted flatwoods salamander or the red-cockaded woodpecker.

Due to the historic use of this property as an industrial facility and no proposed construction within burrow areas, this project may affect but is not likely to adversely affect the gopher tortoise or the eastern indigo snake.

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FIGURES

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| Figure 2 | Site Location & Aerial Photograph |
| Figure 3 | Natural Resource Conservation Service (NRCS) Soil Map |
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| Figure 5 | Waters of the U.S. Delineation Map |
| Figure 6 | Burrow Location Map |

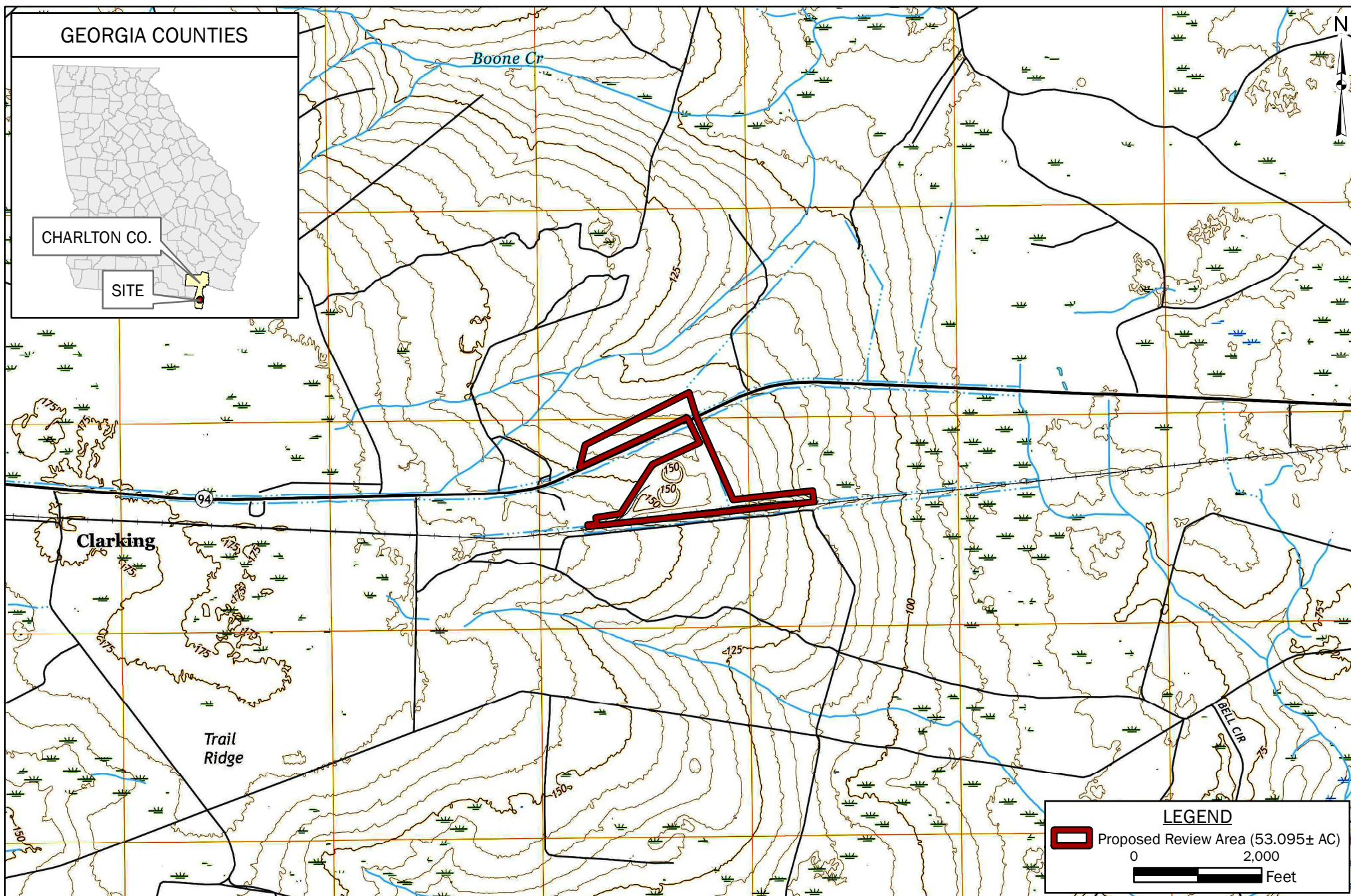


FIGURE 1: SITE LOCATION & TOPOGRAPHIC MAP
THREATENED & ENDANGERED SPECIES REPORT
TWIN PINES MINERALS
ST. GEORGE, CHARLTON COUNTY, GEORGIA

BASEMAP: Saint George, Georgia USGS 7.5 Minute Quadrangle Map, 2017 (5-ft Contour Interval).

DRAWN BY: DEK

CHECKED BY: CMS

DRAWING DATE: 6/17/2020

REVISION DATE: N/A

TTL JOB NO.: 000180200804.00

APPROX. SCALE: 1 in = 2,000 ft

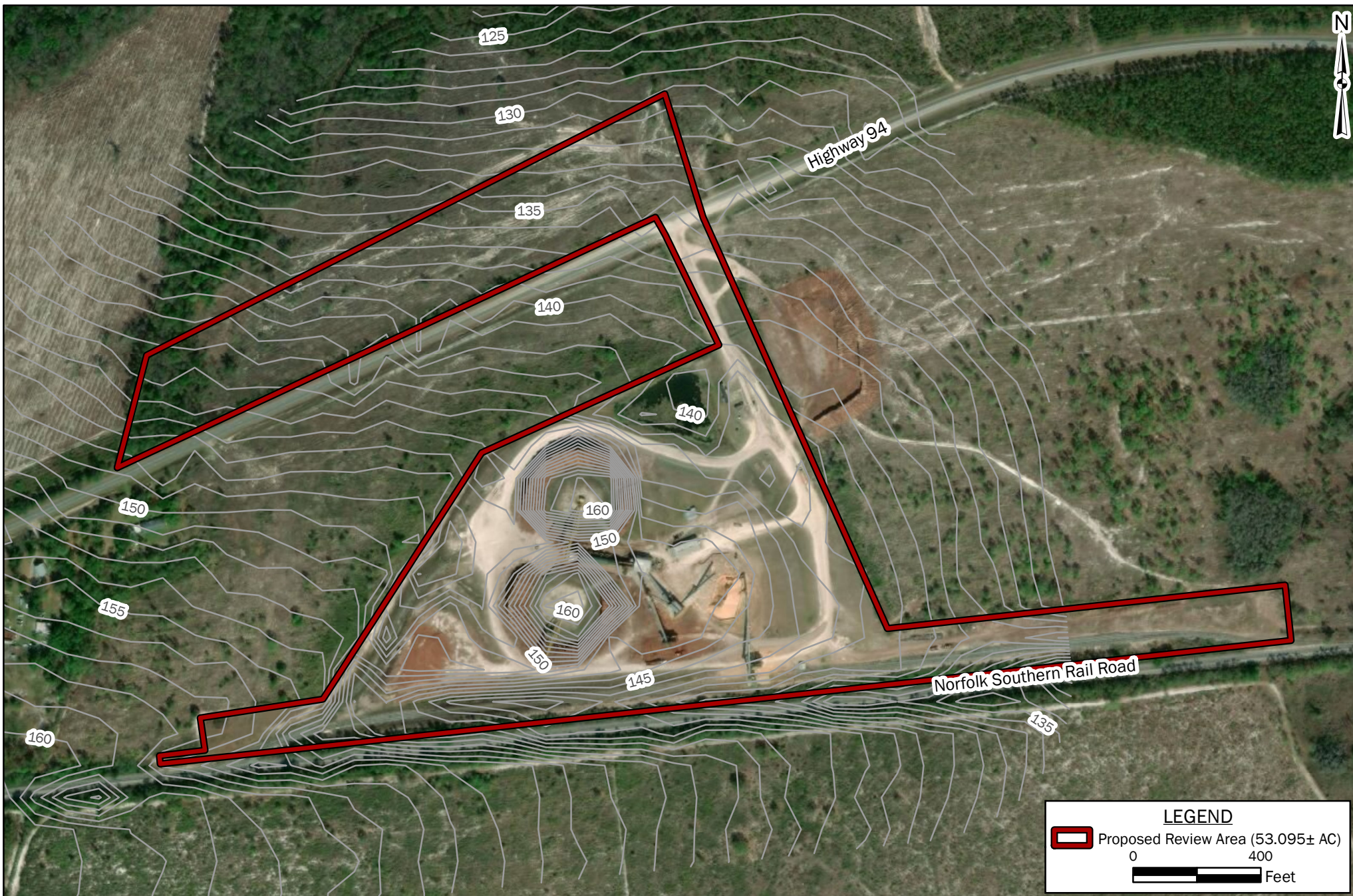


FIGURE 2: SITE LOCATION & AERIAL PHOTOGRAPH THREATENED & ENDANGERED SPECIES REPORT

TWIN PINES MINERALS
ST. GEORGE, CHARLTON COUNTY, GEORGIA

BASEMAP: Maxar, Vivid Imagery, 3/24/2018 (0.46 m Resolution).

DRAWN BY: DEK

CHECKED BY: CMS

DRAWING DATE: 6/17/2020

REVISION DATE: N/A

TTL JOB NO.: 000180200804.00

APPROX. SCALE: 1 in = 400 ft

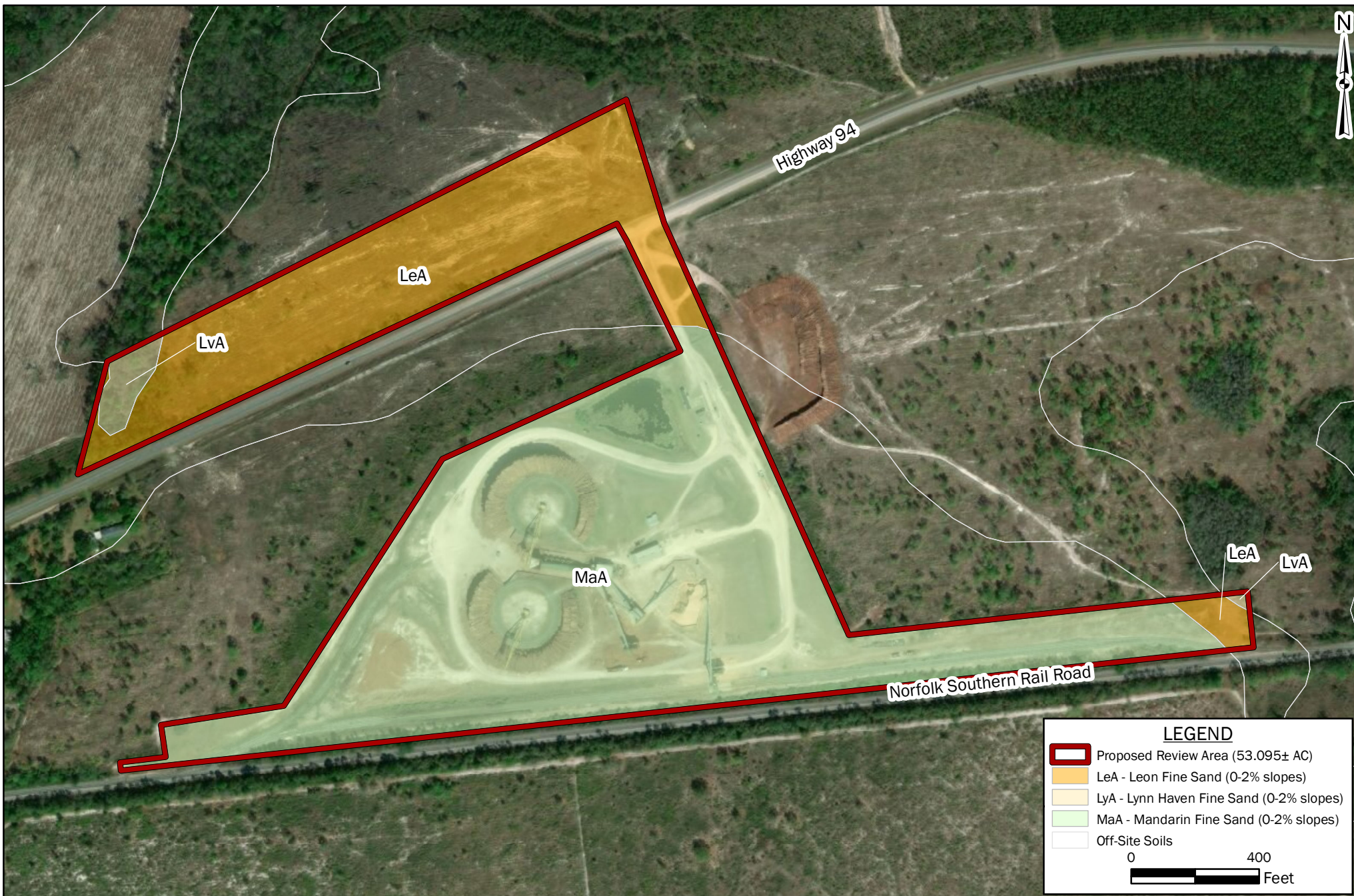


FIGURE 3: NATURAL RESOURCES CONSERVATION SERVICES (NRCS) SOIL MAP
THREATENED & ENDANGERED SPECIES REPORT

TWIN PINES MINERALS
ST. GEORGE, CHARLTON COUNTY, GEORGIA

BASEMAP: Maxar, Vivid Imagery, 3/24/2018 (0.46 m Resolution).

DRAWN BY: DEK

CHECKED BY: CMS

DRAWING DATE: 6/17/2020

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TTL JOB NO.: 000180200804.00

APPROX. SCALE: 1 in = 400 ft

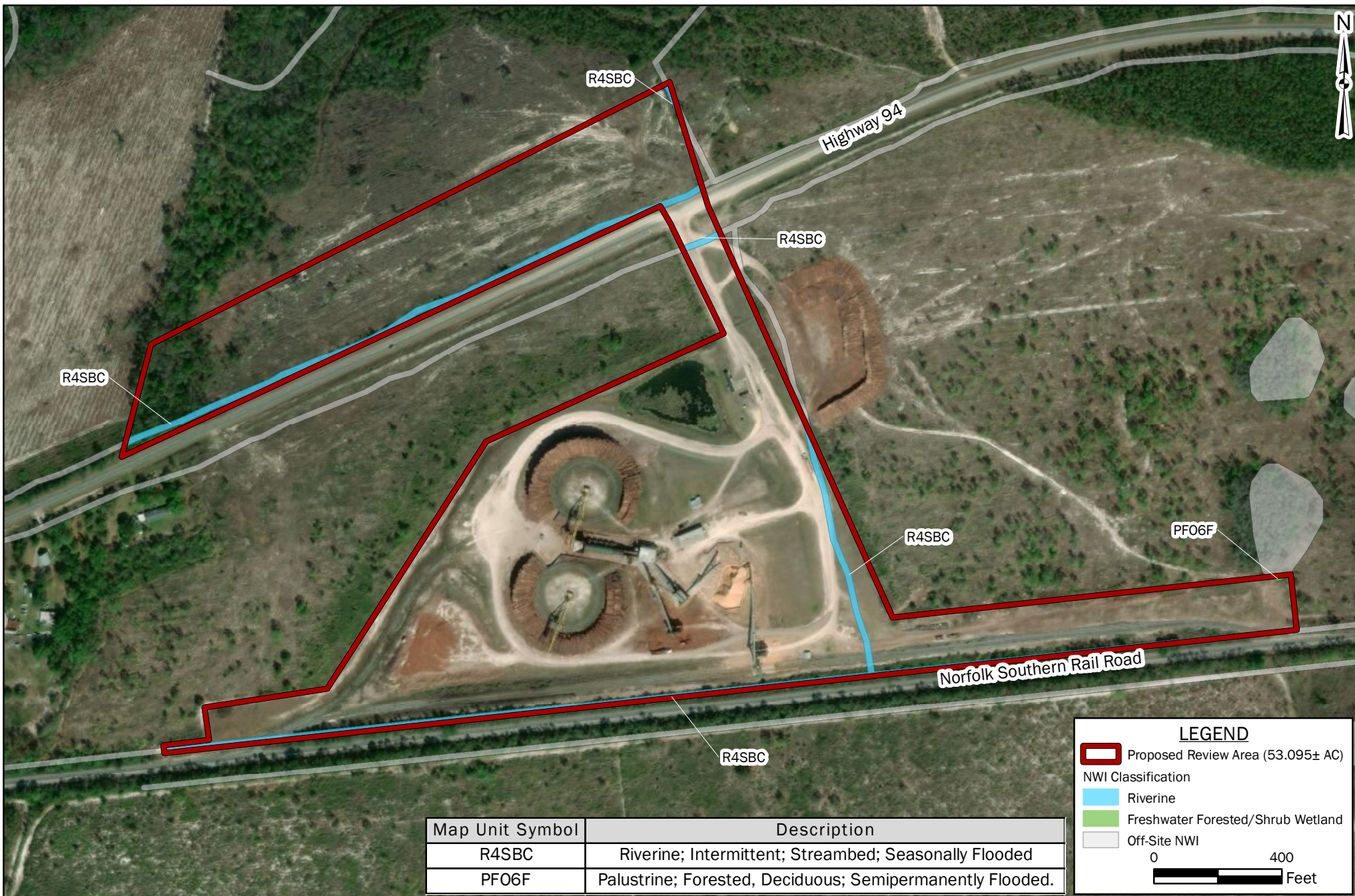


FIGURE 4: NATIONAL WETLAND INVENTORY (NWI) MAP THREATENED & ENDANGERED SPECIES REPORT TWIN PINES MINERALS

ST. GEORGE, CHARLTON COUNTY, GEORGIA

BASEMAP: Maxar, Vivid Imagery, 3/24/2018 (0.46 m Resolution).

DRAWN BY: DEK

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TTL JOB NO.: 000180200804.00

APPROX. SCALE: 1 in = 400 ft

This map is not a survey and represents features that were mapped with a Trimble Geo7x GPS unit set to submeter accuracy. These features are subject to verification by the USACE.

VERIFICATION DATE: _____

USACE FILE NO.: _____

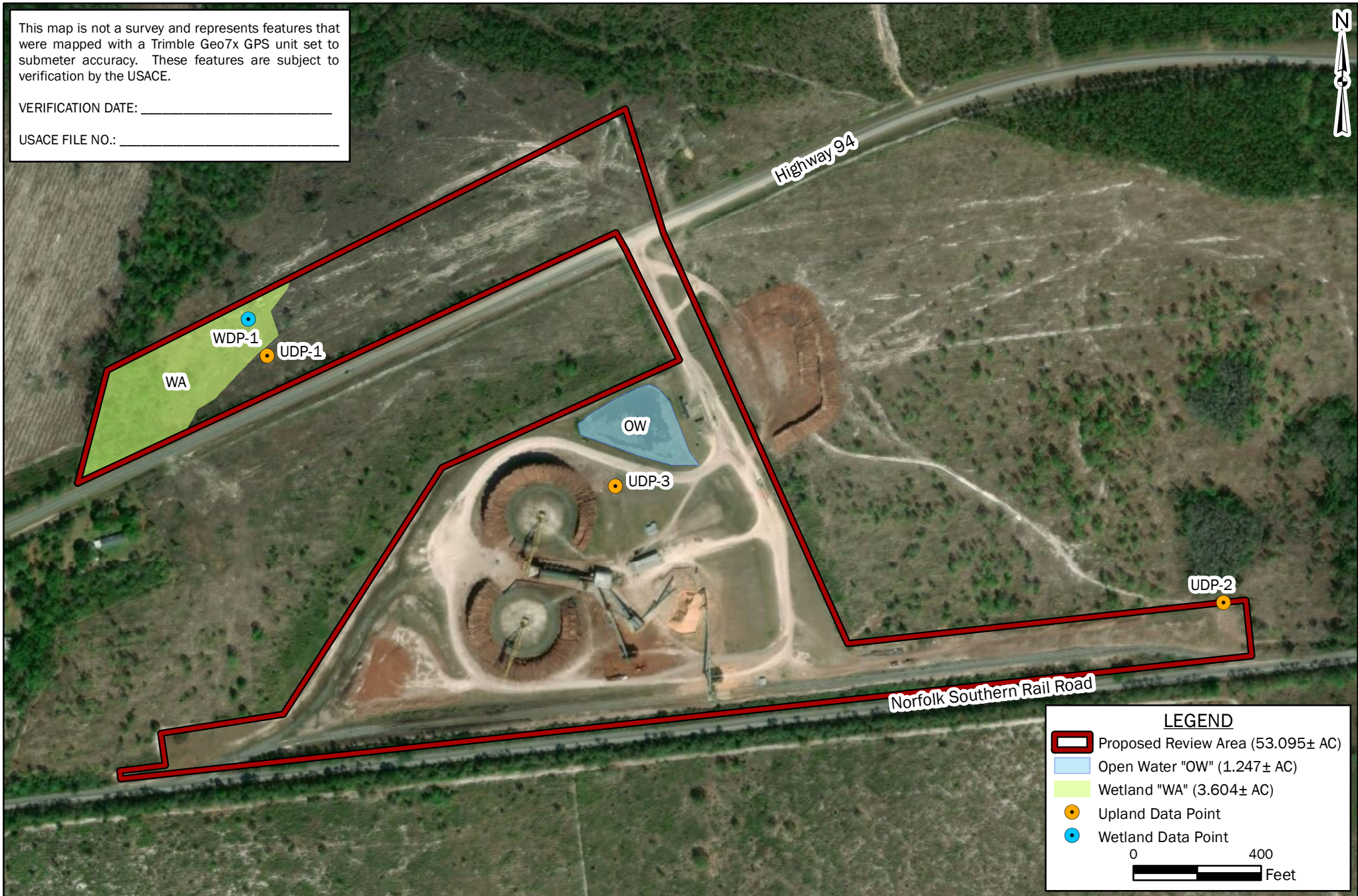


FIGURE 5: WATERS OF THE U.S. DELINEATION MAP
THREATENED & ENDANGERED SPECIES REPORT

TWIN PINES MINERALS
ST. GEORGE, CHARLTON COUNTY, GEORGIA

BASEMAP: Maxar, Vivid Imagery, 3/24/2018 (0.46 m Resolution).

DRAWN BY: DEK

CHECKED BY: CMS

DRAWING DATE: 6/17/2020

REVISION DATE: N/A

TTL JOB NO.: 000180200804.00

APPROX. SCALE: 1 in = 400 ft



FIGURE 6: GOPHER TORTOISE BURROW LOCATION MAP
THREATENED & ENDANGERED SPECIES REPORT

TWIN PINES MINERALS
ST. GEORGE, CHARLTON COUNTY, GEORGIA

BASEMAP: Maxar, Vivid Imagery, 3/24/2018 (0.46 m Resolution).

DRAWN BY: DEK

CHECKED BY: CMS

DRAWING DATE: 6/17/2020

REVISION DATE: N/A

TTL JOB NO.: 000180200804.00

APPROX. SCALE: 1 in = 400 ft

APPENDIX A

SITE PHOTOGRAPHS

Site Photographs

Threatened & Endangered Species Habitat Assessment: Chip Mill Property

TTL Project No. 000180200804.00

Twin Pines Minerals • Charlton County, Georgia

Photos taken March 23, 2020 – March 25, 2020



Photograph 1: View of Wetland Data Point 1 (WDP-1) location.



Photograph 2: View of Upland Data Point 1 (UDP-1) location.

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Site Photographs

Threatened & Endangered Species Habitat Assessment: Chip Mill Property

TTL Project No. 000180200804.00

Twin Pines Minerals • Charlton County, Georgia

Photos taken March 23, 2020 – March 25, 2020



Photograph 3: View westward of the southeastern portion of the delineation area.



Photograph 4: View of Upland Data Point 2 (UDP-2) location.

TTL

Site Photographs

Threatened & Endangered Species Habitat Assessment: Chip Mill Property

TTL Project No. 000180200804.00

Twin Pines Minerals • Charlton County, Georgia

Photos taken March 23, 2020 – March 25, 2020



Photograph 5: View of the constructed recirculation open water located on the central portion of the delineation area.



Photograph 6: View of Upland Data Point 3 (UDP-3) location.

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Site Photographs

Threatened & Endangered Species Habitat Assessment: Chip Mill Property

TTL Project No. 000180200804.00

Twin Pines Minerals • Charlton County, Georgia

Photos taken March 23, 2020 – March 25, 2020



Photograph 7: View of gopher tortoise burrow in close proximity to rail spur along the southeastern portion of the review area.



Photograph 8: View of gopher tortoise burrow in close proximity to rail spur along the southwestern portion of the review area .

TTL