EXHIBIT D:

Environmental Site Conditions Report

Nutmeg Solar Project

Enfield, Connecticut

Environmental Site Conditions Report

Nutmeg Solar Project
Enfield, Connecticut

Prepared for:

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August 28, 2018

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EXECUTIVE SUMMARY

Nutmeg Solar, LLC (Nutmeg Solar), an affiliate of NextEra Energy Resources, LLC, is proposing the 19.6-megawatt Nutmeg Solar Project (Project) to be located in Enfield, Connecticut; with electrical grid interconnection on-site to reduce overall project footprint. The project has been under development since 2015 and the site has been assessed over multiple years in all seasons. The project area is a mix of existing agricultural field and second growth forest.

A comprehensive natural resource assessment has been performed to evaluate areas being proposed for development (the Study Area - approximately 196 acres). The assessments were conducted to meet the standards of expected environmental due diligence and to address permitting requirements of the Connecticut Department of Energy and Environmental Protection (CT DEEP) and the Connecticut Siting Council.

Environmental field studies completed for this project include wetland and watercourse delineations; two consecutive seasons of vernal pool surveys; northern long-eared bat (*Myotis septentrionalis*) presence/absence surveys; soils investigations; a rare, threatened, and endangered species habitat survey; a general herpetological inventory; and targeted eastern spadefoot toad (*Scaphiopus holbrookii*) surveys. Desktop investigations included but were not limited to review of national datasets such as the National Wetland Inventory and the National Resources Conservation Service, an Information for Planning and Consultation (IPaC) database search, and a Natural Diversity Database (NDDB) request.

No jurisdictional wetlands or watercourses were observed, and one low functioning vernal pool has been identified within the Study Area (Appendix C). Northern long-eared bat and eastern spadefoot toad were not observed to occur within the Study Area. The results of the general herpetological inventory found marginal habitat, and no state or federally listed species were found during the surveys. The complete results of all field studies and database searches are included in this report along with an analysis of the potential impacts and avoidance measures employed to avoid risk to species and natural resources from project development.

To conform with Connecticut natural resource regulations and statutes and to comply with all applicable environmental restrictions, the results of the abovementioned surveys were submitted to CT DEEP for review and concurrence by the NDDB. A final determination indicating the Project is protecting the local natural resources to the greatest extent practicable was received from NDDB on August 3, 2018 (Appendix D).

The Project layout was developed with avoidance as a key tenet, and the project design has been refined based on reducing impacts to natural resources and incorporating agency and community feedback. The implementation of a robust sediment and erosion control plan, along with careful design, avoids direct impacts to natural resources. Other measures will include following seasonal clearing restrictions for northern long-eared bat and other migratory species, and installation of exclusion fencing during the construction phase of the Project. Mitigation strategies to be employed include construction-phase environmental monitoring, on-site environmental training for contractors, minimizing all soil disturbance, and mowing restrictions during Project operation. A Herpetofauna Avoidance and Mitigation Plan has been developed for the Project and is provided in Appendix E.

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ACRONYMS AND ABBREVIATIONS

BCC	Birds of Conservation Concern
CT DEEP	Connecticut Department of Energy and Environmental Protection
Development Area	the approximately 133 acres proposed for project facilities as well as the limits of construction and operation activities
ESA	The Endangered Species Act
IPaC	Information for Planning and Consultation database
NDDB	Natural Diversity Database
NLEB	northern long-eared bat
Nutmeg Solar	Nutmeg Solar, LLC
Project	the Nutmeg Solar Energy Project in Enfield, Connecticut
RTE	rare, threatened, and endangered
Study Area	the approximately 196 acres proposed for development where natural resource survey work was performed
Tetra Tech	Tetra Tech, Inc.
USACE	U.S. Army Corps of Engineers
USDA NRCS	U.S. Department of Agriculture Natural Resource Conservation Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

1 INTRODUCTION

Nutmeg Solar, LLC (Nutmeg Solar), an affiliate of NextEra Energy Resources, LLC, is proposing to construct the Nutmeg Solar energy project in Enfield, Connecticut (Project). This report provides a summary of the existing environmental site conditions for an approximately 196-acre area that has been evaluated during the natural resource evaluations performed for the Project (Study Area). The results of natural resource surveys completed in 2016–2018 are included here, along with an analysis of the Natural Diversity Database (NDDB) state listed species review completed for the Project.

Natural and physical resources described in the following sections include regional ecology and land use, botanical resources, water resources, wildlife resources, protected plant and wildlife species, and soil and geological resources. An assessment of potential impacts to these resources is provided in Section 6. Figures for this report are provided in Appendix A, photographs of the Study Area are provided in Appendix B, and copies of field survey reports completed for the Project are provided in Appendix C. Copies of database review reports and correspondence received for the NDDB Preliminary Assessment and Draft Environmental Site Conditions report that were submitted as part of the Project planning process are provided in Appendix D. Appendix E includes a copy of the draft Herpetofauna Avoidance and Mitigation Plan that has been prepared based on the comprehensive vernal pool and herpetofauna surveys completed in 2018. Resumes for key field staff involved with the environmental field studies are provided in Appendix F.

Project Setting

The natural resource survey work was performed on approximately 196 acres of land comprised of multiple parcels. The Study Area is in the Town of Enfield, Hartford County, Connecticut, located south of Route 190 (Hazard Road), and east of Route 191 (Broad Brook Road). A railroad line, owned by Central New England Railroad, runs north-south on the immediate west side of Broad Brook Road. A transmission line right-of-way owned and operated by Eversource Energy transects the northeastern corner of the Study Area and connects to a substation located north of the Study Area on Bailey Road. An active concrete batch plant is located immediately southeast of the Project and west of Broad Brook Road. The Scantic River occurs north of the Study Area. Figures provided in Appendix A provide an overview of the Study Area.

The Study Area consists of a mixture of agricultural lands and forest habitats. Approximately 70 acres within the western half of the Study Area is currently cleared and actively managed for agricultural operations. The agricultural land is bisected by Broad Brook Road and contain several agricultural outbuildings. The remaining eastern half of the Study Area is gently sloping with mixed second growth forest.

The proposed Project facilities as well as the limits of construction and operation activities (Development Area) total approximately 133 acres and are located entirely within the Study Area. Development Area activities proposed include, but are not limited to, vegetation clearing, grubbing, and minor excavation due to installation of roads, electrical infrastructure, perimeter fencing, and solar panels (Appendix A, Figure 1). The environmental field studies described in this report have been used to inform the siting and design of the Project to minimize potential environmental impacts.

2 ENVIRONMENTAL CONDITIONS

A number of comprehensive field survey efforts were conducted by qualified biologists. Prior to conducting field surveys, the biologists reviewed publicly available data, including, but not limited to: U.S. Geological Survey (USGS) current and historical aerials; U.S. Department of Agriculture Natural Resource Conservation Service (USDA NRCS) soils information; National Wetland Inventory; Information for Planning and Conservation (IPaC) Tool; National Hydrography Dataset; and the Connecticut Department of Energy and Environmental Protection (CT DEEP) NDDB.

Following initial background research, targeted field surveys were conducted to identify any regulated natural resources or habitats on the site that are not identified in the available public literature and databases. Results from these field surveys have been used to inform the design and development of the Project, to identify sensitive resources that may be affected by the Project, and to fulfill the anticipated regulatory requirements of the Project. The following studies have been completed for the Project to date:

- Soils investigation – December 22, 2016;
- Vernal pool surveys – April 17, 2017, May 2, 2017, April 10–11, 2018, May 2–3, 2018, and May 14–16, 2018;
- Northern long-eared bat (NLEB) (*Myotis septentrionalis*) presence/absence survey – July 7–11, 2017;
- Wetland and watercourse delineations – June 13, 2017;
- Rare, Threatened, and Endangered (RTE) species habitat survey – August 1, 2017 and September 13, 2017;
- General Herpetological Survey – May 14–16, 2018; and
- Eastern Spadefoot Toad (*Scaphiopus holbrookii*) Survey – Spring and Summer2018.

Environmental surveys were conducted by qualified field biologists, in accordance with local, state, and federal regulatory guidelines. Resumes for key Project staff are included in Appendix F. Results of these surveys are included herein, and copies of technical reports for these field surveys are included in Appendix C.

Ecoregion

An understanding of the regional ecology of the Study Area provides a framework to evaluate natural resources on the Project site. The Study Area is located within the Northeastern Coastal Zone Ecoregion III and Connecticut Valley Ecoregion IV (Griffith et al. 2009).

Northeastern Coastal Zone Ecoregion

The Northeastern Coastal Zone Ecoregion is one of five level III ecoregions in New England, and includes most of southern New England. This ecoregion is characterized by irregular topography with plains and hills. Appalachian oak forest and northeastern oak-pine forest communities are typical in this ecoregion. Soils are mostly mesic inceptisols and are generally nutrient-poor. Land use within this ecoregion is comprised of forests, woodlands, urban and suburban development, and a small amount of pasture and cropland (Griffith et al. 2009).

Connecticut Valley Ecoregion

The Study Area is located within the Connecticut Valley Ecoregion, which is a subset of the Northern Coastal Zone Ecoregion, and one of 40 level IV ecoregions in New England. Topography in this ecoregion is mostly level to rolling, with some higher hills. The sedimentary geology has distinct basalt layers that form ridges within valleys. Glacial outwash, alluvial, and lake bottom deposits are distinct in this region compared to others within the Northeastern Coastal Zone Ecoregion. Climate is mild, and soils are generally nutrient-rich. Land cover includes urban and suburban development, cropland and pasture, and deciduous forest along the valley ridges (Griffith et al. 2009).

Land Use

The Study Area is primarily comprised of agricultural fields and outbuildings, and mixed second-growth forest. There is evidence of historic, gravel extraction activities on the property. Scantic River State Park, part of the Scantic River Greenway (Scantic River Watershed Association 2017), is located northeast of the Study Area at its closest point.

The forested area within the eastern portion of the Study Area has a small network of recreational vehicle trails and tree stands indicating the current use of this land is primarily for hunting and recreational activities. Agricultural use of the property includes field production of tobacco, pumpkin, and other squash. A small number of livestock are kept on the property as well. The site has been actively used for agricultural purposes, specifically tobacco production, since 1907 (Pers. Comm. Steve Jarmoc, landowner).

Broad Brook Road and a commercial freight railway run north-south and bisect the Study area (Appendix B, Photo 1). The site occurs in a mixed rural and suburban part of the Town of Enfield, Connecticut, with residential homes occurring generally north and west of the Study Area. In addition, a locally-owned orchard also is located to the northeast, and an active concrete batch plant is located immediately southeast of the Study Area.

Botanical Resources

As described above, the Study Area is located on active farmland and mixed second growth forest. The forested area on the eastern side of the Study Area occurs on a small hill made up of well drained silt loam soils. Some invasive plant species were observed along edges of agricultural fields and the forested areas within the Study Area. The forested area that makes up the eastern side of the Study Area is bisected by a small network of recreational vehicle trails. A list of plant species observed within the Study Area during the 2017 surveys is provided in Table 1.

Table 1. Common Plants Observed Within the Study Area.

Common Name	Scientific Name
Tree Species	
Red maple	*Acer rubrum*
Big-tooth aspen	*Populus grandidentata*
Eastern white pine	*Pinus strobus*
Eastern hemlock	*Tsuga canadensis*
Black oak	*Quercus velutina*
Sweet birch	*Betula lenta*
Paper birch	*Betula papyrifera*
Northern red oak	*Quercus rubra*
Gray birch	*Betula populifolia*
Quaking aspen	*Populus tremuloides*
Shrub and Sapling Species	
White ash	*Fraxinus americana*
Maple-leaved viburnum	*Viburnum acerifolium*
Virginia-creeper	*Parthenocissus quinquefolia*
Choke cherry	*Prunus virginiana*
Yellow birch	*Betula alleghaniensis*
Black huckleberry	*Gaylussacia baccata*
Eastern white oak	*Quercus alba*
Sassafras	*Sassafras albidum*
Common lowbush blueberry	*Vaccinium angustifolium*
Sheep-laurel	*Kalmia angustifolia*
Mountain-laurel	*Kalmia latifolia*
Highbush blueberry	*Vaccinium corymbosum*
Asian bittersweet*	*Celastrus orbiculatus*
Rambler rose*	*Rosa multiflora*
Morrow's honeysuckle*	*Lonicera morrowii*
Red maple	*Acer rubrum*
Mountain laurel	*Kalmia latifolia*
American chestnut	*Castanea dentata*
Herbaceous Plant Species	
Flat-branched tree-clubmoss	*Dendrolycopodium obscurum*
Partridge-berry	*Mitchella repens*
Eastern spicy-wintergreen	*Gaultheria procumbens*
Canada-mayflower	*Maianthemum canadense*
Evergreen wood fern	*Dryopteris intermedia*
Interrupted fern	*Osmunda claytonia*
Canada goldenrod	*Solidago canadensis*
Flat-top goldentop	*Euthamia graminifolia*
Poison-ivy	*Toxicodendron radicans*
Spotted wintergreen	*Chimaphila maculata*
Downy rattlesnake-plantain	*Goodyera pubescens*
Hawkweed species	*Hieracium* spp.

*Connecticut Invasive Species (University of Connecticut, Connecticut Invasive Plant Working Group no date)

3 WATER RESOURCES

The Study Area is located within the Scantic River Watershed. While the Scantic River occurs north of the Study Area, there are no mapped floodplain features that occur in the Study Area (CT DEEP 2017a) and no floodplain features were observed during field surveys. Formal wetland and watercourse delineations and vernal pool surveys have been completed within the Study Area (Appendix A, Figure 2). These field surveys were overseen by a Certified Soil Scientist (Maine License Number 479) and registered professional member of the Soil Science Society of Southern New England (see resumes provided in Appendix F).

Wetlands, Watercourses, and Vernal Pools

Wetland and watercourse surveys were conducted in accordance with the definitions described in the Inland Wetlands and Watercourses Regulations of the Town of Enfield (Town of Enfield 2011a). Additionally, wetlands and watercourses under federal jurisdiction were surveyed according to the technical criteria described in the U.S. Army Corps of Engineers (USACE) 1987 Wetland Delineation Manual (USACE 1987), and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Regional Supplement v2 (USACE 2012). Results of these surveys did not identify any wetland or watercourse resources that would be regulated by the USACE or CT DEEP within the Study Area (Tetra Tech 2017a) (Appendix A, Figure 2). There were no hydric soils observed within the survey area that are classified as poorly drained or very poorly drained, or floodplain. Based on USACE, the state of Connecticut, and the Town of Enfield standards, no wetland or watercourse resources were observed within the Study Area.

The first season of vernal pool surveys was completed by Tetra Tech in 2017, and consisted of two site visits completed on April 17, 2017 and May 2, 2017. A second season of vernal pool surveys were completed by FB Environmental during the spring 2018 breeding season on April 10–11 and May 2–3, 2018. The pool also was revisited during the general herpetological inventory on May 14–16, and June 18, 2018. Surveys were conducted in accordance with the definition of a vernal pool outlined in *Best development practices: Conserving pool-breeding amphibians in residential and commercial developments in the northeastern United States* (Calhoun and Klemens 2002) and the Connecticut Association of Wetland Scientists Vernal Pool Monitoring Program Protocol (Connecticut Association of Wetland Scientists no date). Additional guidance concerning pool assessment methods, decontamination procedures, and assessor qualifications was taken from the Maine Association of Wetland Scientists Vernal Pool Technical Committee, Vernal Pool Survey Protocol (Maine Association of Wetland Scientists 2014). Technical reports from both the 2017 and 2018 surveys are provided in Appendix C.

During the 2017 and 2018 surveys, amphibian breeding activity was observed in an excavated vernal pool located near the center of the Study Area (Appendix A, Figure 2). The amphibian breeding activity in this pool is entirely within an existing excavation and haul road located at the bottom of a slope. An active recreational vehicle trail is located directly adjacent to the pool area and vehicles likely utilize the woods road periodically (Appendix B, Photo 6). This area was inundated in the spring and covered an area of approximately 1,360 square feet. The water level was shallow (12-24 inches deep) with the deepest portions occurring in ruts.

Based on recommendations received from CT DEEP during the Project planning process, the excavated pool was revisited during the spring 2018 breeding season. In addition to extensive visual and cover object

surveys, minnow traps were used to attempt capture and identification of adult amphibians using the pool. No adult pool-breeding amphibians were captured during these surveys.

Based on the results of the vernal pool surveys, the pool meets the criteria for consideration as a Tier 1 vernal pool as described in Calhoun and Klemens (2002). This is based on the following criteria: (1) the presence of two indicator species; wood frog (*Lithobates sylvaticus*) and spotted salamander (*Ambystoma maculatum*), (2) the entire vernal pool envelope (100 feet from the edge of the pool) is forested (note, however, that a narrow recreational vehicle trail runs along the west side of the pool), and, (3) 99% of the critical terrestrial habitat (100-750 feet from the edge of the pool) is considered undeveloped. However, low egg mass counts, a short hydroperiod, and agricultural activities within the critical terrestrial habitat reduce the function of this pool on the landscape. Based on the information collected over two years of survey, this pool likely serves as a sink for wood frogs in some years and sotted salamanders in most years. This is discussed further in the FB Environmental report provided in Appendix C.

During the 2017 wetland delineation, the excavated pool was determined not to be a jurisdictional wetland due to the lack of hydric soils and limited hydrophytic vegetation growing in the pool. Soils in this area are characterized as a dull reddish brown (5YR 4/3) with a coarse sandy loam texture. The pool is surrounded by red maple (*Acer rubrum*) and paper birch (*Betula papyrifera*) in the tree stratum with mountain laurel (*Kalmia latifolia*), red maple and highbush blueberry (*Vaccinium corymbosum*) growing sparsely in the shrub stratum. Very few herbaceous plants were observed and included evergreen wood fern (*Dryopteris intermedia*) and eastern spicy-wintergreen (*Gaultheria procumbens*). This area was completely dry when observed on August 1, 2017 (Appendix B, Photo 7) and again on June 18, 2018.

4 WILDLIFE RESOURCES

The Study Area contains open habitat in agricultural fields and deciduous second growth forests. The forested habitat is interspersed with clearings and edge habitats that could be used for foraging by bats (Tetra Tech 2017b). The Study Area also includes some mature and early successional, mixed and deciduous forests that may support a variety of birds and mammals. Grassy clearings and agricultural areas likely provide habitat for small rodents and other small mammals and could provide foraging areas for raptors and predatory mammals. Field surveys conducted in the Study Area during the 2017 growing season included bat acoustic surveys, an RTE habitat survey, and amphibian breeding surveys. An additional vernal pool survey, general herpetological inventory, and eastern spadefoot toad survey were completed in 2018.

An outbreak of gypsy moth (*Lymantria dispar*) was observed during the RTE species habitat survey completed on August 1, 2017, which appeared to impact trees and vegetation, affecting the forest community within the Study Area (Appendix B, Photo 10). Many of the oak (*Quercus* spp.) and pine (*Pinus* spp.) trees on the site were partially or completely defoliated at the time of the survey.

Rare, Threatened, and Endangered Plants and Wildlife

The following RTE species discussions are based on reviews of United States Fish and Wildlife Service's (USFWS) online IPaC tool (Appendix D), consultation with CT DEEP regarding species that could potentially occur within the Study Area (Appendix D), a field survey for habitat that could potentially support RTE species conducted on August 1, 2017; and vernal pool, general herpetological, and eastern spadefoot toad surveys completed in 2018. Appendix A, Figure 3 identifies CT DEEP NDDB information for the Study Area.

Prior to conducting field surveys, all publicly available data was reviewed to identify the potential for state or federally listed species to occur on the site. This background information included review of the Connecticut NDDB map for the Town of Enfield; the CT DEEP County Report of Connecticut's Endangered, Threatened and Special Concern Species list for Hartford County; and the USFWS IPaC database (Appendix D). Bat acoustic and RTE habitat surveys were conducted during the 2017 field season to assess the presence of bat species and to determine if suitable or preferred habitats are present on site for federal and state listed spices. Surveys targeting detection of special status reptiles and amphibians that have the potential to occur in the Study Area were completed in the spring and summer of 2018.

The IPaC resource list indicates the federally threatened NLEB as the only federally listed species potentially located within the Project Study Area. The NDDB review request for the Study Area was submitted to CT DEEP on August 9, 2017. A preliminary assessment letter dated August 28, 2017 was received from CT DEEP that identified three state endangered, one state threatened, ten state special concern species and two significant natural communities that could potentially occur within the Study Area (Appendix D). It should be noted that there are some discrepancies between the list of species identified through consultation with CT DEEP and those identified for the Study Area in the USFWS IPaC database review. For instance, the USFWS IPaC database review for the Study Area identified three migratory bird species, bald eagle (*Haliaeetus leucocephalus*), least bittern (*Ixobrychus exilis*), and short-eared owl (*Asio flammeus*), which are state listed as threatened; however, these were not identified in the August 28, 2017 NDDB request response letter.

Table 2 lists all RTE species that could potentially occur in the Study Area based on field assessments, resource reviews, the IPaC database review, and NDDB correspondence received (Appendix D). A discussion of each of these species, the potential of occurrence, and the potential for the Project to impact each species is provided in this section for federal and state listed species, and state species of special concern. Migratory birds that are not federal or state listed, or identified as state species of special concern also are included in this section, including birds that have USFWS Birds of Conservation Concern (BCC) status, or have special status limited to a seasonal period identified in Table 2 (i.e. breeding or wintering populations). Other than for presence/absence of NLEB, focused surveys for special status amphibians and reptiles (including eastern spadefoot toad), species-specific surveys have not been conducted; however, an analysis of each species' preferred habitat, and their potential for occurrence in the Study Area has been considered.

Table 2. Potential Federal and State Rare, Threatened, Endangered, and Special Concern Wildlife and Plant Species within the Study Area.

Common Name	Scientific Name	Status[1]		Source
		Federal	State	
Mammals				
Eastern red bat	*Lasiurus borealis*	-	SC	IPaC
Hoary bat	*Lasiurus cinereus*	-	SC	IPaC
Northern long-eared bat	*Myotis septentrionalis*	T	E	IPaC
Silver-haired bat	*Lasionycteris noctivagans*	-	SC	IPaC
Birds				
American bittern	*Botaurus lentiginous*	BCC, breeding	E	IPaC
Bald eagle	*Haliaeetus leucocephalus*	BCC (b), year-round	T	IPaC
Black-billed cuckoo	*Coccyzus erythropthalmus*	breeding	-	IPaC

Common Name	Scientific Name	Status[1]		Source
		Federal	State	
Blue-winged warbler	*Vermivora pinus*	BCC, breeding	-	IPaC
Canada warbler	*Wilsonia canadensis*	breeding	-	IPaC
Fox sparrow	*Passerella iliaca*	wintering	-	IPaC
Least bittern	*Ixobrychus exilis*	BCC, breeding	T	IPaC
Olive-sided flycatcher	*Contopus cooperi*	breeding	-	IPaC
Peregrine falcon	*Falco peregrinus*	BCC (b)	T	IPaC
Pied-billed grebe	*Podilymbus podiceps*	BCC, year-round	E	IPaC
Prairie warbler	*Setophaga discolor*	BCC, breeding	-	IPaC
Purple sandpiper	*Calidris maritima*	BCC (nb), wintering	-	IPaC
Savannah sparrow	*Passerculus sandwichensis*	-	SC	NDDB
Short-eared owl	*Asio flammeus*	BCC (nb), wintering	T (wintering)	IPaC
Upland sandpiper	*Bartramia longicauda*	BCC, breeding	E	IPaC
Vesper sparrow	*Pooecetes gramineus*	-	E	NDDB
Willow flycatcher	*Empidonax traillii*	breeding	-	IPaC
Wood thrush	*Hylocichla mustelina*	BCC, breeding	-	IPaC
Worm-eating warbler	*Helmitheros vermivorum*	BCC, breeding	-	IPaC
Reptiles				
Eastern box turtle	*Terrapene carolina carolina*	-	SC	NDDB
Wood turtle	*Glyptemys insculpta*	-	SC	NDDB
Amphibians				
Eastern spadefoot toad	*Scaphiopus holbrookii*	-	E	NDDB
Fish				
Slimy sculpin	*Cottus cognatus*	-	SC	NDDB
Bridle shiner	*Notropis biferenatus*	-	SC	NDDB
Invertebrates				
Big sand tiger beetle	*Cicindela formosa generosa*	-	SC	NDDB
Dune ghost tiger beetle	*Cicindela lepida*	-	E	NDDB
Dark-bellied tiger beetle	*Cicindela tranquebarica*	-	T	NDDB
Eastern pearlshell	*Margaritifera margaritifera*	-	SC	NDDB
Eastern pondmussel	*Ligumia nasuta*	-	SC	NDDB
Ground beetle	*Geopinus incrassatus*	-	SC	NDDB
Plants				
Hooker's orchid	*Platanthera hookeri*	-	SC*	NDDB

1 – BCC – USFWS Bird of Conservation Concern; BCC (b) – BCC breeding population; BCC (nb) – BCC non-breeding population; breeding – of USFWS concern during the breeding season; E – federally or state endangered; SC – state species of special concern; T – federally or state threatened; wintering – of USFWS or Connecticut concern during the wintering season; year-round – of USFWS concern year round

* – Extirpated

Sources: Connecticut DEEP 2017b, USFWS 2017a

Federally Listed Threatened and Endangered Species

The USFWS IPaC tool is an inventory that can be generated for geographic areas to identify federally-listed species and other resources of concern to USFWS. Table 2 identifies the species identified in the IPaC report generated for the Study Area, and their federal and state conservation status. One federally listed mammal species, NLEB, was identified as potentially occurring in the Study Area. An additional 12 birds

identified by USFWS as BCC species and five other migratory bird species also were identified for the Study Area in the IPaC review (USFWS 2017a). None of the BCC species or other migratory birds are listed under the federal Endangered Species Act (ESA); however, they are discussed in this section.

Northern long-eared bat

Northern Long-Eared Bat is a federally threatened species, and a Connecticut endangered species. NLEB was listed as threatened under the federal ESA due to the overwhelming threat of white nose syndrome to the species. In February 2016, a final 4(d) rule for NLEB was published under the ESA (Federal Register 2016). The final 4(d) rule identifies specific prohibitions to protect NLEB, which focus on protecting individuals where they are most vulnerable: maternity roost trees (during the pup-rearing months of June and July) and hibernation sites. The final 4(d) rule allows some activities that do not harm the species to continue, while focusing efforts on the threats that are likely to make a difference in the species' recovery (USFWS 2017b). It is important to note that construction and operation of solar facilities, such as the proposed Project, performed under the guidance contained within the 4(d) rule, is not considered a threat to NLEB.

Due to the presence of potential habitat within the Study Area that could support NLEB, a bat acoustic survey was completed on the nights of July 7–11, 2017 to determine presence/absence of NLEB within the Study Area (Appendix C). The presence/absence survey was conducted in accordance with the 2017 USFWS *Range-wide Indiana Bat Summer Survey Guidelines for Indiana Bat and Northern Long-eared Bat* (USFWS 2017c). The survey comprised two phases: 1) a desktop and field-based habitat assessment; and 2) acoustic surveys. The desktop analysis confirmed that the Study Area contained potential suitable habitat for the NLEB, which includes approximately 114 acres of mixed second-growth forest. This determination was based on forest patch size, proximity to closed-canopy forests, and landscape features that may be used by bats commuting between roosting and foraging habitats (e.g., forested tracts, wetlands, and streams). All relatively contiguous forested lands that were not highly fragmented by residential or commercial developments were considered suitable NLEB habitat, and all densely populated or developed stretches were determined to be unsuitable (USFWS 2017c). No areas that could potentially support natural hibernacula, such as karst or similar geological formations, were identified. Connecticut DEEP has not identified any known NLEB hibernacula in Enfield, Connecticut (CT DEEP 2016a). The closest known NLEB hibernacula is approximately 9 miles southwest of the Project in East Granby, CT (CT DEEP 2016a). No known NLEB maternity roost trees have been identified in Connecticut.

Four bat detectors were micro-sited in suitable habitat within the Study Area and deployed to collect acoustic data on the nights of July 7–July 11, 2017. Detectors were deployed within a road corridor, forest canopy opening, a wooded fence line, and along a woodland edge (Appendix C). Detectors recorded 4,054 bat passes, and analysis of these calls did not identify presence of NLEB (Tetra Tech 2017b). No NLEB bat passes were auto-classified by the acoustic analysis software that was used in the acoustic analysis (Kaleidoscope Pro, version 4.2.0, using the classifier "Bats of North America 4.3" for species of bats in Connecticut at the 0 Balanced "Neutral" sensitivity level). The data analysis and Maximum Likelihood of Expectancy values obtained for NLEB from the software indicate presence of NLEB was unlikely at the survey sites on the nights associated with the survey.

Federal Bird Species of Concern

The following state listed species were identified in the IPaC report; however, they were not identified in the NDDB response received for the Study Area. Due to their specified habitat requirements, these species are unlikely to occur in the Study Area.

Bald eagle

Bald eagle is a Connecticut threatened species, and is protected by the Bald and Golden Eagle Protection Act. The breeding population of bald eagle is a USFWS BCC, and USFWS has identified the year-round population of bald eagle as a concern. Bald eagles use old-growth and mature stands of coniferous or hardwood trees for perching, roosting, and nesting. Bald eagles can be sensitive to human activity, and are most commonly found in areas with minimal human disturbance. The Study Area does not contain large, tall trees suitable for nesting, some nesting and foraging habitat may be located nearby along the Scantic River. Study Area surveys and site visits did not observe any bald eagle use of the site, and no incidental observations were made of this large and readily identifiable raptor within the surrounding area. Bald eagle is unlikely to occur in the Study Area.

Least bittern

Least bittern is a Connecticut threatened species, a USFWS BCC, and the breeding population is a concern to USFWS. Least bittern usually breeds in freshwater marshes, and is considered a solitary to loosely-colonial nester (CT DEEP 1999). Although this species was once considered an abundant summer resident in Connecticut, a rapid decline occurred around the turn of the century. Today least bittern continues to be absent from most parts of the state. Due to the lack of freshwater marsh habitat within the Study Area and the rarity of occurrence of this species in Connecticut since the 1870s, this species is unlikely to occur.

Peregrine falcon

Peregrine falcon (*Falco peregrinus*) is a Connecticut threatened species and the breeding population is a USFWS BCC. This medium to large falcon typically lives along mountain ranges, river valleys, and coastlines; hunting over open water, marshes, valleys, fields, and tundra. It nests on ledges and cliffs approximately 25–1,300 feet high, or transmission towers, quarries, silos, skyscrapers, churches and bridges (Cornell Lab of Ornithology 2015a). Based on the lack of suitable nesting habitat within the Study Area that would support peregrine falcon, this species is not expected to occur.

Short-eared owl

Short-eared owl is a Connecticut threatened species, the non-breeding population is a USFWS BCC, and the wintering population is identified by USFWS as a concern for the Study Area. Short-eared owl nests on the ground, in low vegetation and is found on the ground in grasslands, wet meadows, prairie, tundra, or savanna habitats. Short-eared owl generally hunt at night in open fields and grasslands. Due to the routine management of fields associated with agricultural practices within the Study Area and otherwise lack of suitable habitat, short-eared owl is not expected to occur.

American bittern

American bittern (*Botaurus lentiginous*) is a Connecticut endangered species, it is a USFWS BCC, and the breeding population is identified as a concern to USFWS for the Study Area. This medium-sized heron

nests and forages in bogs, marshes, and thickly vegetated verges of shallow fresh, brackish or saline water. Based on the lack of suitable foraging and nesting habitats that would support American bittern, this species is not expected to occur within the Study Area.

Pied-billed grebe

Pied-billed grebe (*Podilymbus podiceps*) is a Connecticut endangered species, a USFWS BCC, and is identified as year-round species of concern by USFWS for the Study Area. This small brown bird inhabits low gradient rivers, freshwater marshes, lakes, and estuaries, and is capable of diving up to 20 feet. Based on the lack of suitable habitat within the Study Area that would support pied-billed grebe, this species is not expected to occur.

Upland sandpiper

Upland sandpiper (*Bartramia longicauda*) is a Connecticut endangered species, a USFWS BCC, and the breeding population is identified as a concern by USFWS for the Study Area. This medium-sized shorebird prefers native prairie and dry grassland, and are rarely found in wetland or coastal areas. They nest within a scrape in the ground, which may be unlined or lined with leaves and twigs. Based on the lack of suitable habitat within the Study Area that would support upland sandpiper, this species is not expected to occur.

State Listed Threatened, Endangered, and Special Concern Species

State Listed Bat Species

During the bat acoustic data analysis conducted for the NLEB presence/absence survey, 48 bat passes were auto classified as little brown bat (*Myotis lucifugus*) (a Connecticut endangered species); however, the majority of these passes were confirmed through manual review as eastern red bat (*Lasiurus borealis*) and the remainder as unidentified high frequency bat species. Similarly, of the files auto-classified as tri-colored bat (*Perimyotis subflavus*), 11 were determined through manual review to be eastern red bat and the reminder high frequency species. Presence was not confirmed for any state-listed bat species; however, presence of eastern red bat, hoary bat (*Lasiurus cinereus*), and silver-haired bat (*Lasionycteris noctivagans*) was confirmed, all of which are identified in Connecticut as species of special concern. These species are discussed below. Big brown bat (*Eptesicus fuscus*) also was confirmed in the Study Area; however, big brown bat does not have any listing or special concern species status in Connecticut, and is not discussed further in this report. Avoidance and mitigation measures identified for protection of tree-roosting bat species during Project development includes tree clearing restrictions (see Section 6).

Eastern red bat

Eastern red bat is a Connecticut species of special concern. This medium-sized, tree-roosting bat is found across eastern North America. Eastern red bat forage for insects along stream corridors, and are typically found amongst dead leaves on the branches of hardwood trees. Eastern red bat was documented as occurring in the Study Area in 2017 (Appendix C).

Hoary bat

Hoary bat is a Connecticut species of special concern. This dark brown, tree-roosting bat normally roosts alone in coniferous and mixed hardwood-conifer forest. They forage along the edge of clearings, but also

may use heavy forests, open wooded glades, and shade trees along urban streets and city parks. Hoary bat was documented as occurring in the Study Area in 2017 (Appendix C).

Silver-haired bat

Silver-haired bat is a Connecticut species of special concern. Unlike many bat species, this tree-roosting bat hibernates mainly in forested areas, although they may make long migrations from their summer habitats to a winter forest site. Typical hibernation roosts include small tree hollows, beneath exfoliating bark, in wood piles, and in cliff faces; most often roosting within in old growth, mixed coniferous and deciduous forests. Occasionally silver-haired bats hibernate in cave entrances, especially in northern regions of their range. It forages primarily on small, soft-bodied insects. Silver-haired bat was documented as occurring in the Study Area in 2017 (Appendix C).

Natural Diversity Data Base Response

The species discussed in this section were identified in the NDDB request for species that may occur within the Project area. An analysis of each species life history, the habitat that is available within the Study Area, the potential for the species to occur within the Study Area and the measures that will be taken to avoid and mitigate impacts to each species is included in this section.

Invertebrate Animals

Big sand tiger beetle

Life History – Big sand tiger beetle (*Cicindela formosa generosa*) is a Connecticut species of special concern. These beetles inhabit Windsor soils, which consist primarily of windblown sand deposits (Wagner 2015). Larvae require two or maybe three years of development before emerging as adults in late summer. Larvae use burrows to forage for ants and other insects as well as for overwintering (Hoback et al. 2005).

Habitat - Specific information for this subspecies of big sand tiger beetles is limited for Connecticut, but its habitat requirements are expected to be similar to other big sand tiger beetles (*Cicindela formosa*). Connecticut DEEP identifies important habitat for this species as areas with sparsely vegetated sand and gravel (CT DEEP 2014a). This subspecies also occurs in Vermont where they occur in dry upland sandy areas, sand pits, blowouts, dry forest clearings, and edges of sand dunes (University of Vermont no date). The known range of big sand tiger beetles in Connecticut extends from colonies in the vicinity of Barkhamstead Reservoir (approximately 22 miles west of the Project) east into Rhode Island, and they are particularly associated with the glacial sand deposits of Glacial Lake Hitchcock in the Central Valley of Connecticut (approximately 35 miles southwest of the Project), where more than a dozen populations have been identified (Wagner 2015). There also are a couple documented populations at Bradley International Airport approximately 8 miles southwest of the Project (Wagner 2015). Nearly all of the state's colonies are extremely small and vulnerable to both development and succession. Although the USDA NRCS has mapped a small area of Windsor loamy sand within the Study Area (Appendix A, Figure 4), this area contains residential development with no areas of exposed sand and gravel.

Potential to occur – The sandy soils in the Study Area are unlikely to support big sand tiger beetle due to disturbance. These disturbances include residential and agricultural development. Frequent plowing of soils and use of pesticides decrease the likelihood of the Study Area providing suitable habitat.

Furthermore, the mapped area of Windsor loamy sand is located outside of the proposed Development Area, and would not be subject to disturbance. As such, the Project is unlikely to affect big sand tiger beetle.

Avoidance – The Project design has been modified to exclude areas that have been mapped by USDA NRCS as Windsor soils. While the area mapped as Windsor soil on the Project site was determined to not meet the habitat requirements of big sand tiger beetle, the additional avoidance of development activities in this area not only eliminates the potential of affecting this species, but also consolidates Project development to only occur on the eastern side of the existing railway and Broad Brook Road. This will limit Project development activities to areas that are well outside of the area mapped by USDA NRCS as Windsor loamy sand on the western side of the Study Area.

Dune ghost tiger beetle

Life History – Dune ghost tiger beetle (*Cicindela lepida*) is a Connecticut endangered species. They live as larvae for two years in beaches, blowouts, stream banks, or sandy substrates. Adults emerge from pupa in the summer and live for a few weeks. Larvae live in vertical tunnels and catch insects as their main source of food (Panella 2012).

Habitat – Important habitat for this species in Connecticut includes sparsely vegetated sand and gravel (CT DEEP 2014b). This species is considered a specialist on open, deep, dry, sparsely vegetated sands, but over its vast range, such habitats can occur in many contexts such as dunes, openings in various woodlands, old sand pits, and sandy washes (NatureServe Explorer 2017).

Potential to occur – Although the USDA NRCS has mapped a small area of Windsor loamy sand within the Study Area (Appendix A, Figure 4), this area contains residential development. The sandy soils in the Study Area are unlikely to support dune ghost tiger beetle due to past disturbance. Furthermore, the mapped area of Windsor loamy sand is located outside of the proposed Development Area and would not be subject to disturbance. Past disturbances include residential and agricultural development. Frequent plowing of soils and use of pesticides decrease the likelihood of the Study Area providing suitable habitat. As such, the Project is unlikely to affect dune ghost tiger beetle.

Avoidance – The Study Area does not contain any sparsely vegetated sand or gravel areas. Furthermore, the Development Area has been relocated entirely to the eastern and opposite of the existing railway and Broad Brook Road. This will limit Project development activities to areas that are well outside of the area mapped by USDA NRCS as Windsor loamy sand on the western side of the Study Area.

Dark-bellied tiger beetle

Life History – Dark-bellied tiger beetle (*Cicindela tranquebarica*) is a Connecticut threatened species. The literature on dark-bellied tiger beetles is somewhat limited, and the habitat and life history patterns are assumed to be similar among tiger beetle species that occur on the NDDB species list for this Project. Larvae live in burrows, feed on insects and generally pupate after two years.

Habitat – Important habitat for this species in Connecticut includes sparsely vegetated sand and gravel, sandplain and other warm season grasslands, intertidal beaches and shores, lakes and their shorelines, and large rivers and their associated riparian zones (CT DEEP 2014c).

Potential to occur – Although the USDA NRCS has mapped a small area of Windsor loamy sand within the Study Area (Appendix A, Figure 4), this area contains residential development. The sandy soils in the Study Area are unlikely to support dark-bellied tiger beetle due to past disturbance. Furthermore, the mapped area of Windsor loamy sand is located outside of the proposed Development Area and limits of work, and would not be subject to disturbance. As such, the Project is unlikely to affect dark-bellied tiger beetle.

Avoidance – There are no sparsely vegetated sand and gravel areas in the Project area. The Development Area has been moved to the eastern and opposite side of the railway and Broad Brook Road, which will keep development activities associated with the Project well outside of the area of Windsor loamy sand that is mapped by USDA NRCS on the western side of the Study Area.

Ground beetle

Life History – Ground beetle (*Geopinus incrassatus*) is a Connecticut species of special concern. Ground beetles are nocturnal, with adults remaining active year-round (Evans 2014). Ground beetles generally feed on caterpillars and seeds. Adults are large in size with a depigmented body.

Habitat – Ground beetles can be found walking on or burrowing in sandy soils, wet sand and dunes, especially along rivers and streams. This species occurs throughout New England and Quebec, Canada, south to Georgia, and west to Idaho, Nevada, and northern Arizona (Evans 2014).

Potential to occur – Soils mapped within forested areas of the Project are primarily Narragansett silt loam. An area of Manchester gravelly sandy loam mapped by USDA NRCS also occurs in the northern portion of the Study Area, with remaining soils consisting of Haven and Enfield soils types within the agricultural fields. Windsor loamy sand is mapped in the northwest corner of the Study Area. This area was investigated during a fall 2017 site visit, and found to be located within a residential development area. No open sand pits, dunes or other similar features have been observed at the Project. The Project area has no sandy riparian areas that are common habitat for ground beetles. Ground beetles are not expected to occur within the Study Area.

Avoidance – The sandy soils in the Study Area are unlikely to support ground beetle due to past disturbance. Furthermore, the area of Windsor loamy sand mapped by USDA NRCS is located outside of the area proposed Development Area, and would not be subject to disturbance. As such, the Project is unlikely to affect ground beetle.

Eastern pondmussel

Life History – Eastern pondmussel (*Ligumia nasuta*) is a Connecticut species of special concern. They are sedimentary feeders, spending most of their lives partially burrowed in the bottoms of rivers, streams, lakes, and ponds. Details regarding breeding and life history are relatively unknown. They are long-term brooders, spawning in the summer and releasing glochidia in the following spring or summer (Michigan Natural Features Inventory 2007).

Habitat – Eastern pondmussels occupy a variety of habitats including coastal ponds, streams, and rivers. It does not appear to have distinct preferences for substrate, depth, or flow conditions, and has been found in high densities in mud within coastal ponds and in shallow rivers with strong currents and a gravel and cobble substrate (Massachusetts Division of Fisheries & Wildlife, Natural Heritage & Endangered Species Program 2015).

Potential to occur – Based on the complete lack of suitable habitat within the Study Area that would support eastern pondmussel, this species is unlikely to occur.

Avoidance – The proposed Development Area does not have any coastal ponds, streams or rivers within the boundary. The Scantic River is located north and outside of the Project area, and the Study Area does not contain any riparian areas. Potential sedimentation and erosion impacts to waters off-site are addressed in the stormwater plan that is included with the Project design plans.

Eastern pearlshell

Life History – Eastern pearlshell (*Margaritifera margaritifera*) is a Connecticut species of special concern. Eastern pearlshell can live to be up to 200 years old. Millions of glochidia are ejected into the water from an adult over one or two days in June and July. Larvae use fish from the salmonid family as a host for about one year before dropping off and attaching to a substrate of sand or gravel. Adults are sessile, with only limited, passive, downstream movement.

Habitat – This mussel is generally found in cold, nutrient-poor, unpolluted trout streams and smaller rivers with moderate flow rates. Clean substrates and low silt environments are important for juvenile eastern pearlshell. In Connecticut, it is found in many major watersheds but is most common in the northern and northwestern parts of the state (Nedeau and Victoria 2003).

Potential to occur – Based on the complete lack of suitable habitat within the Study Area that would support eastern pearlshell, this species does not occur.

Avoidance– The proposed Development Area does not have any coastal ponds, streams or rivers within the boundary. The Scantic River occurs north and outside of the Project area, and the Study Area does not contain any riparian areas. Potential sedimentation and erosion impacts to waters off-site are addressed in the stormwater plan that is included with the Project design plans.

Significant Natural Communities

The following terrestrial communities were identified in the NDDB response. The wetland and watercourse survey, RTE habitat surveys, and soils investigations completed for the Project did not identify either of the following natural community types as occurring in the Study Area.

Floodplain Forest

Field surveys of the Study Area determined no floodplain forests are present on the site. There are no perennial streams or waterbodies that occur within the Study Area that would provide floodplain or any riparian habitat or alluvial wetlands. The Scantic River occurs north of the Project area, however, there is a residential road that separates the river from the proposed Development Area. Forested parts of the Study Area are dominated by eastern white pine (*Pinus strobus*), red maple, northern red oak (*Quercus rubra*), and eastern hemlock (*Tsuga canadensis*). These tree species are not typical of a floodplain forest community.

Sand Barren

A site visit completed on September 13, 2017 determined the area mapped by USDA NRCS as Windsor loamy sand to consist of residential development; however, a soil test pit dug within the mapped area

determined this soil type to be present. The existing conditions in this area would not classify it as a sand barren (Appendix A, Figure 4, Test Pit 3) (Appendix B, Photos 11 and 12).

Vascular Plants

Hooker's orchid

Life History – Hooker's orchid (*Platanthera hookeri*) is a Connecticut species of special concern, but it is thought to be extirpated in the state. Hooker's orchid is pollinated by butterflies and nocturnal moths (North American Orchid Conservation Center 2018).

Habitat – Connecticut contains the southernmost range of the Hooker's orchid. It grows in New England, the Midwest and up into far northern parts of Canada, including Newfoundland and Labrador. This orchid favors dry to moist forests and forest edges, and blooms in May to July.

Potential to occur – Due to the presence of suitable habitat this species has the potential to occur; however, due to its status as being extirpated from Connecticut, Hooker's orchid is unlikely to occur within the Study Area. No RTE plant species (including Hooker's orchid) were observed during the RTE habitat survey completed on August 1, 2017.

Avoidance – Hooker's orchid was not found to be present during the RTE survey effort. Due to its potentially extirpated status, no further avoidance and mitigation measures are recommended.

Vertebrate Animals

Slimy sculpin

Life History – Slimy sculpin (*Cottus cognatus*) is a Connecticut species of special concern. Slimy sculpin is a nocturnal species feeding on benthic invertebrates and occasionally crustaceans, fish eggs, and small fish. Slimy sculpin are a slow growing species, maturing around age 4 and spawning during early spring.

Habitat – This freshwater species inhabits cold, rocky streams, spending most of its time on the stream bottom, seeking shelter under rocks and logs, especially during the spawning season.

Potential to occur – Due to the lack of suitable habitat to support slimy sculpin in the Study Area, this species is unlikely to occur.

Avoidance– The proposed Development Area does not have any freshwater streams or rivers within the boundary. The Scantic River occurs north and outside of the Project area, and the Study Area does not contain any riparian areas. Potential sedimentation and erosion impacts to waters off-site are addressed in the stormwater plan that is included with the Project design plans.

Wood turtle

Life History – Wood turtle (*Glyptemys insculpta*) is considered a Connecticut species of special concern. Wood turtles hibernate underwater in large streams and rivers during the winter months, and spend summers in aquatic and terrestrial habitats within close range of riparian areas. Nesting occurs in spring and early summer in sandy deposits along stream banks. Eggs hatch later in summer or early fall and may even spend their first winter hibernating in the nest. Wood turtles have an omnivorous and opportunistic

diet, consuming readily available slugs, worms, tadpoles, insects, algae, wild fruit, leaves, grass, moss, and carrion (CT DEEP 2011).

Habitat – Wood turtle utilize different aquatic and terrestrial habitats throughout the year, including rivers and large streams, riparian forests (adjacent to rivers), wetlands, hayfields, and other early successional habitats. They most commonly use terrestrial habitats that are located within 1,000 feet of suitable streams or rivers (CT DEEP 2011).

Potential to occur –In Connecticut, wood turtles occur statewide, though they are rare in the coastal zone and the eastern portions of Windham and New London counties. The species has declined in the Central Connecticut Lowlands due to habitat loss (Klemens 1993), as well as other factors such as habitat fragmentation and associated road mortality (Klemens 1993, Gibbs et al. 2007) (Appendix C). Due to suitable habitat within the Study Area, and the proximity of the Project to the Scantic River, wood turtle has the potential to occur. Based on these conditions, a field evaluation and general herpetological survey of the Study Area was completed spring and summer 2018. Focused surveys for this species did not identify their presence within the study area. Results of the general herpetofauna surveys completed for the Study Area to date are provided in Appendix C.

The Scantic River north of the project does appear to be suitable wood turtle habitat. Although individuals of the species are known to move upwards of 1,000 feet from watercourses, it is possible, though unlikely, that a wood turtle would travel to the Study Area from the Scantic River.

Avoidance and mitigation – Conducting tree and vegetation clearing during the winter months will avoid the incidental take of wood turtles, as they hibernate in streams and rivers. However, during the summer construction phase, exclusion fencing and barriers will be used to keep wood turtles outside of the construction areas. Any temporary barriers and exclusion fencing that is installed will be regularly monitored and maintained throughout the construction phase. Nutmeg Solar has developed a construction-period stormwater phasing plan that is included in the Project's Connecticut Stormwater General Permit that has been provided to CT DEEP. The construction sequencing identified in the stormwater phasing plan will take into consideration exclusion barriers required for turtles. Additional avoidance and mitigation provided for herpetofauna are included in the Herpetofauna Avoidance and Mitigation Plan in Appendix E.

Bridle shiner

Life History – Bridle shiner (*Notropis bifrenatus*) is a Connecticut species of special concern. Bridle shiners use submerged aquatic vegetation for protection, feeding, and spawning. It mainly feeds on zooplankton, aquatic insect larvae, and some vegetation.

Habitat – This small, freshwater minnow inhabits shallow ponds, low-gradient streams, and swamps that contain abundant vegetation.

Potential to occur – Due to the lack of suitable habitat to support bridle shiner in the Study Area, this species does not occur.

Avoidance – The proposed Development Area does not have any coastal ponds, streams, or rivers within the boundary. The Scantic River occurs north and outside of the Project area, and the Study Area does not

contain any riparian areas. Potential sedimentation and erosion impacts to waters off-site are addressed in the stormwater plan that is included with the Project design plans.

Savannah sparrow

Life History – Savannah sparrow (*Passerculus sandwichensis*) is a Connecticut species of special concern. They migrate to Connecticut in the spring and build nests made up of finely woven grasses in densely vegetated areas, usually on the ground or low grasses, within patches of goldenrod (*Solidago* spp.), saltmarsh vegetation, or low shrubs (Cornell Lab of Ornithology 2015b). They feed on spiders and insects during the breeding season, and forage mostly on small seeds from grasses and forbs during the winter.

Habitat – Savannah sparrow inhabits grasslands with few trees, including meadows, pastures, grassy roadsides, sedge wetlands, and cultivated fields planted with cover crops such as alfalfa. These sparrows are susceptible to impacts from eating some crop pesticides, such as granular pesticides scattered in agricultural fields. Savannah sparrow nesting can be disrupted when grassy areas are mowed or fields are hayed before young have fledged.

Potential to occur – Due to the presence of suitable foraging and nesting habitat in the Study Area, savannah sparrow has the potential to occur.

Avoidance and mitigation – Savanah sparrow tend to return to the same nesting locations; however, breeding in Connecticut is uncommon (Audubon no date). Due to the routine management of fields associated with agricultural practices within the Study Area, savannah sparrow are unlikely to nest within the grassland areas of the Project site. Massachusetts Audubon recommends mowing restrictions for protection of grassland birds species, which includes not mowing fields from May 15–August 15 (Massachusetts Audubon no date). The nesting season of grassland species in Massachusetts and Connecticut are expected to be similar. A more restrictive time window for clearing of grasslands, vegetation and trees is proposed, as it would coincide with protection of tree-roosting bat species known or having the potential to occur. Clearing of vegetation will occur between October 1 and March 31, which will would avoid any potential impacts to this species should it occur, as well as reduce potential impacts to other grassland birds and tree-roosting bats species that may occur at the Project site.

Vesper sparrow

Life History – Vesper sparrow (*Pooecetes gramineus*) is a Connecticut endangered species. They migrate to Connecticut in the spring and nest on the ground in nests built of woven grasses. Vesper sparrows forage on the ground, feeding on insects and seeds.

Habitat – This larger sparrow inhabits grasslands and fields, feeding on grass seeds, weeds, grain crops, and occasionally insects during the breeding season. It nests on the ground, within a shallow cup of woven grasses. Vesper sparrow has experienced a population decline between 1966 and 2014, and various farming practices, such as chemical use, large-scale tillage, and early harvesting of hay, likely all contribute to declines of this species (Cornell Lab of Ornithology 2015c).

Potential to occur – Due to the routine management of the tobacco and gourd fields associated with agricultural practices within the Study Area and otherwise lack of suitable habitat, vesper sparrow is not expected to occur.

Avoidance and mitigation – Winter clearing will avoid any incidental take of vesper sparrow during clearing for the Project. Environmental monitors will be employed during Project construction to monitor and communicate with the construction team any observations of RTE species that may occur on site.

Eastern spadefoot toad

Life History – Eastern spadefoot toad is a Connecticut endangered species. They emerge after a period of heavy rains and breed in fishless waterbodies, such as vernal pools. Breeding periods occur any time between April to July in Connecticut. Breeding includes laying strings of egg masses that typically hatch within 1–7 days. Tadpoles grow quickly and metamorphose anywhere between 16 and 63 days, depending on the time of year (CT DEEP 2018).

Habitat – Eastern spadefoot toad prefers dry habitats with sandy soil and Klemens (2002) found occurrences correlate strongly with Hinckley soils; they are nocturnal and usually subterranean, lying dormant for weeks during dry periods. They hibernate underground as well.

Potential to occur – Sandy soils mapped in the Study Area are limited to a small area of mapped by USDA NRCS as Windsor loamy sand located in the northwest corner of the Study Area, which also is located within an area of residential development. These soils are unlikely to support eastern spadefoot toad due to past disturbance such as residential and agricultural development. Furthermore, the area mapped as Windsor loamy sand is located outside of the proposed Development Area, and would not be subject to disturbance from the Project. Based on the lack of suitable habitat within the Study Area that would support eastern spadefoot toad, this species is not expected to occur. In addition to the habitat evaluations, species specific field surveys for eastern spadefoot toad were completed during the spring and summer of 2018. No eastern spadefoot toads were observed during the 2018 surveys. A technical report outlining the methods and results of these surveys is included in Appendix C.

Avoidance and mitigation – Winter clearing will avoid the incidental take of eastern spadefoot toad, as they hibernate deep underground during this time. However, during the summer construction phase, exclusion fencing and barriers may need to be used to keep amphibians outside of the construction areas. Temporary barriers and exclusion fencing will need to be regularly monitored and maintained throughout construction. Nutmeg Solar has developed a construction-period stormwater phasing plan that is included in the Project's Connecticut Stormwater General Permit that has been provided to CT DEEP. The construction sequencing identified in the stormwater phasing plan will take into consideration exclusion barriers required for amphibians. Additional avoidance and mitigation provided for herpetofauna are included in the Herpetofauna Avoidance and Mitigation Plan in Appendix E.

Eastern box turtle

Life History – Eastern box turtle (*Terrapene carolina carolina*) is considered a Connecticut species of special concern. They typically hibernate from October through April in or along the edge of woodlands, by burrowing into loose soil, decaying vegetation, and mud. Box turtles become reproductive around 4–5 years old. Eggs are laid in June and July in nests dug out of loose, sandy soil. Juveniles hatch in early fall and either emerge or go directly into hibernation. Box turtles are omnivorous, they feed on a variety of food items, including earthworms, slugs, snails, insects, frogs, small snakes, leaves, grass, berries, and fungi (CT DEEP 2008).

Habitat – Eastern box turtle is a terrestrial turtle that occurs in woodlands, field edges, thickets, marshes, bogs, and stream banks; although they most commonly occur in well-drained bottomlands and open deciduous forests. They utilize wetlands at various times throughout the season, commonly burrowing into moist soil on hot days.

Potential to occur – Due to suitable habitat within the Study Area, eastern box turtle has the potential to occur. Based on field evaluations and species-specific survey work conducted in the spring and summer of 2018, the portion of the Study Area located east of Route 191 appears to contain suitable box turtle habitat. Within this general area, the most likely areas to encounter box turtles are along the edges of the agricultural fields adjacent to the forest,, the powerline right-of-way, and the edge of an orchard along the eastern boundary of the Project. Within the forested area, patches of common lowbush blueberry (*Vaccinium angustifolium*) and black huckleberry (*Gaylussacia baccata*) with dappled sunlight also appeared to be suitable habitat.

The field evaluation and general herpetological surveys of the Study Area were completed during the spring and summer of 2018 and did not identify the presence of this species. The Study Area is well-drained and very dry. The distance of the Study Area from wetlands and watercourses also reduces their likelihood to occur in the Project area. Results of the general herpetofauna surveys completed for the Study Area to date are provided in Appendix C.

Avoidance and mitigation – Winter clearing will reduce the risk of incidental take of eastern box turtles, should they occur, as they hibernate during this time. However, during the summer construction phase, exclusion fencing and barriers will be used to keep eastern box turtles outside of the construction areas. Temporary barriers and exclusion fencing will need to be regularly monitored and maintained throughout construction. Nutmeg Solar has developed a construction-period stormwater phasing plan that is included in the Project's Connecticut Stormwater General Permit that has been provided to CT DEEP. The construction sequencing identified in the stormwater phasing plan will take into consideration exclusion barriers required for turtles. Additional avoidance and mitigation provided for herpetofauna are included in the Herpetofauna Avoidance and Mitigation Plan in Appendix E.

Migratory Birds

As identified in Table 2, CT DEEP and USFWS have identified 19 migratory bird species protected by the Migratory Bird Treaty Act that could potentially occur within the Study Area. Twelve of these bird species also are identified by USFWS as BCC species (USFWS 2008, 2017a). None of these bird species are listed under the federal ESA, but eight bird species are protected by the Connecticut ESA and one is a Connecticut species of special concern (savannah sparrow). Birds having a state listing designation (endangered, threatened, or species of special concern) have been previously described in the Vertebrate Animals discussion in this section. The following section describes the remaining migratory bird species that have been identified as USFWS BCC species, or are of other concern to USFWS.

Black-billed cuckoo

The breeding population of black-billed cuckoo (*Coccyzus erythropthalmus*) is identified as a concern by USFWS for the Study Area. Black-billed cuckoo is most commonly found around the edges of mature deciduous or mixed forests; however, it also can be found in younger growth forests with shrubs and thickets. Nests are built in trees, and consist of a flimsy cup made of twigs and grasses, lined with dead or

green leaves, pine needles, stalks, rootlets, moss, and spider webs. Due to the presence of suitable habitat to support this species, black-billed cuckoo has the potential to occur within Study Area.

Blue-winged warbler

Blue-winged warbler (*Vermivora pinus*) is a USFWS BCC species, and the breeding population has been identified as a concern by USFWS for the Study Area. Blue-winged warbler is a common bluish-gray bird, typically found in open woodlands, such as abandoned farmland and forest clearings. Blue-winged warbler breed in open, scrubby areas and nests on the ground or in low shrubs. Due to the presence of suitable habitat to support this species, blue-winged warbler has the potential to occur within the Study Area.

Canada warbler

The breeding population of Canada warbler (*Wilsonia canadensis*) is identified as a concern by USFWS for the Study Area. Canada warbler is a small yellow and dark gray songbird, which nests in riparian thickets, brushy ravines, and forest bogs. Due to the lack of habitat, Canada warbler is unlikely to occur in the Study Area.

Fox sparrow

The wintering population of fox sparrow (*Passerella iliaca*) is identified as a concern by USFWS for the Study Area. Fox sparrow is a large, heavily spotted and streaked sparrow that lives in scrubby, brushy woods and forest edges. Fox sparrow forages in the leaf litter of open hardwood forests and swampy thickets and nests in wooded areas on or near the ground. Due to the presence of nesting and foraging habitat, fox sparrow has the potential to occur within the Study Area.

Olive-sided flycatcher

The breeding population of olive-sided flycatcher (*Contopus cooperi*) is identified as a concern by USFWS for the Study Area. Olive-sided flycatcher breeds in montane and northern coniferous forests, at forest edges and openings, such as meadows and ponds. Nests consist of an open cup of twigs, rootlets, and lichens that is placed near the tip of a horizontal tree branch. It forages on insects, especially bees. Due to the presence of suitable habitat to support this species, olive-sided flycatcher has the potential to occur within the Study Area.

Prairie warbler

Prairie warbler (*Setophaga discolor*) is a USFWS BCC species, and the breeding population is identified as a concern by USFWS. This small yellow songbird is commonly found in scrubby fields and regenerating forests throughout the eastern and south-central United States. Nests consist of a cup of long plant fibers and other material, lined with grass, moss, and feathers placed in trees or shrubs, usually less than 10 feet from the ground (Cornell Lab of Ornithology 2015d). Due to the presence of suitable habitat to support this species, prairie warbler has the potential to occur within the Study Area.

Purple sandpiper

The non-breeding population of purple sandpiper (*Calidris maritima*) is a USFWS BCC species, and the wintering population is identified as a concern by USFWS for the Study Area. This small shorebird breeds along low tundra near shorelines and gravel beaches along rivers. Purple sandpiper are late migrants,

moving to rocky areas along the Atlantic coast during the winter. Based on the lack of suitable habitat within the Study Area that would support purple sandpiper, this species is not expected to occur.

Willow flycatcher

The breeding population of willow flycatcher (*Empidonax traillii*) is identified as a concern by USFWS for the Study Area. Willow flycatcher is a small bird that breeds in moist, shrubby, deciduous thickets near standing or running water, and nests in vertical forks in shrubs or trees near water. Based on the presence of suitable nesting habitat within the Study Area, willow flycatcher has the potential to occur.

Wood thrush

Wood thrush (*Hylocichla mustelina*) is a USFWS BCC species, and the breeding population has been identified as a concern by USFWS. Wood thrush is a reddish-brown bird that breeds in deciduous and mixed pine and hardwood forests where there are large trees, moderate understory, shade, and abundant leaf litter for foraging. Based on the presence of suitable habitat, wood thrush has the potential to occur within the Study Area.

Worm-eating warbler

Worm-eating warbler (*Helmitheros vermivorum*) is a USFWS BCC species, and the breeding population has been identified as a concern by USFWS. Worm-eating warbler is a relatively plain bird that breeds in dense deciduous, or mixed deciduous-coniferous forests in the eastern United States, usually on steep, wooded slopes. Marginal habitat to support this species is present, and due to the fact that this species is highly uncommon, its potential to occur in the Study Area is very low.

5 BEDROCK, SURFICIAL GEOLOGY, AND SOILS

As noted in the Section 2 Ecoregion discussion, bedrock geology within the Study Area is primarily sedimentary. A review of CT DEEP bedrock data identified the entire Survey Area as having bedrock geology of Portland Arkose (CT DEEP 2017a). Arkose is a sandstone rich in feldspar, with quartz usually making up the dominant mineral, and feldspars constituting at least 25 percent composition (United States Geological Survey no date). Portland Arkose is reddish-brown to maroon micaceous arkose and siltstone and red to black fissile silty shale. Surface materials include till, thick till, sand and gravel, sand, and alluvium overlying sand and gravel (CT DEEP 2017a). Soils are generally well drained silt-loam and sandy-loam. About 40 percent of the Survey Area soils have been regularly tilled for agricultural use.

A 2016 soils investigation was completed to verify presence of Prime Farmland, Farmland of Statewide Importance, or Locally Important Farmland soils. General soils observations also were made as part of the 2017 wetland and watercourse delineation survey effort. These surveys and the soils description provided were overseen and verified by a current Certified Soil Scientist and Professional Member SSSSNE, as per CT DEEP requirements (see resume in Appendix F). The 2017 wetland and watercourse delineation survey determined that no jurisdictional wetlands occur on the site and no hydric soils were observed during these field surveys.

The soils investigation completed for the Study Area in 2016 served to provide an opinion regarding potential presence of soils identified as Prime Farmland, Farmland of Statewide Importance, or Locally

Important Farmland soils (Tetra Tech 2017c) (Appendix C). Soil types mapped within the Study Area by USDA NRCS are provided in Appendix A, Figure 4.

Two soil series mapped by USDA NRCS on the Project site are Haven and Enfield association and Agawam, both of which are considered Prime Farmland (USDA NRCS 2000) (Appendix A, Figure 4). There also is a small pocket of Manchester soil that is identified as Farmland of Statewide Importance. The entire eastern portion of the site is mapped as Narragansett, which is classified as Farmland of Statewide Importance. No Locally Important Farmland soils have been mapped by USDA NRCS on the Project site.

Overall the results of the soils investigation determined that USDA NRCS mapping is mostly accurate and the site does contain Prime Farmland soil types. There are some small differences in mapped soils versus observed ground conditions, including evidence found during the soils investigation that the forested western section of the site would not be considered Prime Farmland. Site photographs of soil test pits and the Study Area are provided in the survey report provided in Appendix C. Appendix A, Figure 4 shows the locations of the two test pits associated with this survey (Test Pit 1 and Test Pit 2).

6 CONCLUSION AND IMPLICATIONS FOR PROJECT DEVELOPMENT

As described in this report, the Study Area currently contains actively managed agricultural land and mixed forest. The proposed Project is being designed to avoid and minimize natural resource impacts to the greatest extent practicable, and maximize use of existing cleared and disturbed areas in accordance with permitting guidelines and federal and state regulations. Some clearing of trees in forested areas will be required for Project construction and operation along with minor grading for access roads and inverter pads. A total of 133 acres of the Study Area will be used for development of the Nutmeg Solar Project.

Land Use

Although much of the Project would utilize converted agricultural land for the solar development, the land could return to support these uses at the end of the Project life. As described in Section 5, Prime Farmland and Farmland of Statewide Importance is present onsite. However, maintaining majority of the Project as a grass meadow and by refraining from the current agricultural practices will likely increase soil quality and healthy soil development that will support agricultural production at the end of the Project life. Development of the site as an energy Project would be expected to arrest potential conversion of this farmland into another hardscape or residential/commercial development. Conversion of some of the forested lands to solar development would be long-term; however, these habitats have been subject to historic disturbances, and it is anticipated it will return to forest habitat at the end of the Project life.

The Project has been designed to comply with local land use regulations; however, local land use jurisdiction is preempted by the Connecticut Siting Council, and as such, the Project will be developed in compliance with applicable state and federal land use plans. To the extent feasible, the Project also will be designed to meet the intent of local land use regulations and plans, such as the Town of Enfield's Plan of Conservation & Development (Town of Enfield 2011b). This Project will support the goals of the Enfield Clean Energy Committee and Connecticut's energy policy that identify the use of renewables, including solar, as an important strategy for lowering the state's carbon footprint (CT DEEP 2016b).

Water Resources

The Project seeks to avoid direct and indirect impacts to water resources. No jurisdictional wetlands or watercourses, were observed in the Study Area during field surveys. Additionally, the implementation of impact avoidance and minimization strategies, such as erosion and sedimentation controls; time of year restrictions for tree cutting; and environmental protection training for on-site contractors will further reduce the potential for impacts to natural resources that occur outside of the Project area. Construction and operational best management practices, including post-construction restoration of disturbed soils, will be implemented to minimize impacts from potential erosion and sedimentation.

Short term, temporary impacts from construction activities will be minimized with sedimentation and erosion controls designed, installed, and maintained in accordance with the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control (CT DEEP 2001). Disturbed soils will be revegetated to ensure soil movement is minimized during the post-construction period of the Project. The Project's stormwater design will ensure stormwater runoff and minimization of site soil movement will not impact water quality to resources off site. No clearing is proposed within the man-made pool that has been identified to support amphibian breeding. Due to the lack of jurisdictional resources in the Study Area, water resources are not a major concern for Project construction and development.

Wildlife Resources

Construction and operation of the Project would result in habitat alterations, primarily within the forested land of the Study Area. However, much of the Study Area has been disturbed from historic and ongoing agricultural use and is considered to have variable habitat value. The conversion of forested and agricultural lands has the potential to impact bats and breeding birds. Impact avoidance and mitigation strategies proposed include timing vegetation removal (trees, shrubs, grasslands), a limited Development Area within the Study Area, and minimized soil disturbance. Limiting tree clearing to the period between October 1 and March 31 would minimize impacts to nesting birds and tree-roosting bat species that are known to occur in the Study Area during the summer season, as well as avoid potential disturbance during periods of high bird activity. These tree-cutting restrictions also would reduce potential impacts to RTE forest-dwelling and grassland nesting bird species that could occur.

Promoting the growth of native grassland vegetation following construction will provide more suitable habitat for grassland birds and reduce the amount of mowing necessary for regular site maintenance. Mowing later in the growing season will decrease the chances that nesting grassland birds and other species are present during the maintenance activity. Once construction activities are completed and temporary wildlife exclusion fencing is removed, small wildlife access holes will be provided at the bottom of the permanent fences to allow wildlife movement within the Development Area.

Environmental training of Project personnel and contractors, along with internal environmental audits, will ensure compliance with site permit conditions intended to conserve wildlife species and their natural habitat. All of the impact avoidance and minimization strategies and siting considerations for protection of wildlife will be reviewed and approved by CT DEEP prior to implementation of the Project, as required by the permitting process. Regular sweeps along exclusion fencing during the construction period will allow monitors to identify species that may be present during the construction period and inform the construction team to change or modify these strategies in real time.

Nutmeg Solar is committed to working with state agency representatives in identifying conservation seed mixes for restoration of disturbed areas, including establishment of a vegetative cover to be maintained underneath the solar panels.

Rare, Threatened, and Endangered Plants and Wildlife

Three bat species identified as species of special concern in Connecticut have been documented in the Study Area. Presence/absence surveys completed for NLEB within the Study Area did not identify presence of this species. Given the Maximum Likelihood of Expectancy value generated in software analysis, it is unlikely that the Project will negatively impact NLEB. Avoiding tree removal activities during the period when bats are expected to be active within the Project region, April 1 through September 30, will provide for protection of NLEB if their population recovers.

Measures would likely be required for protection of special concern bat species that are known to occur in the Study Area, including seasonal restrictions of certain activities, such as limiting tree clearing to the period between October 1 and March 31 to avoid impacts to tree-roosting bat species known to occur in the Study Area during the summer season. Tree cutting and vegetation clearing restrictions also would reduce potential impacts to RTE forest-dwelling and grassland nesting bird species that may occur. Agency review and approval of any proposed impact avoidance and minimization strategies will be required prior to implementation of the Project, and this will be completed as part of the Project permit approval process.

Measures that avoid impacts to box turtles, wood turtles, and eastern spadefoot toads, which have the potential to occur in the Study Area, may be implemented during Project construction including the use of exclusion fencing or temporary barriers, pre-construction sweeps of the construction areas to ensure no wildlife are present, and seasonal or timing restrictions for construction. Temporary barriers will be routinely inspected and maintained during construction to ensure proper function. All temporary barrier and fencing will be removed in a timely manner following construction. Additional avoidance and mitigation provided for herpetofauna are included in the draft Herpetofauna Avoidance and Mitigation Plan in Appendix E.

To provide additional protection to RTE species that could potentially occur, formal training will be conducted by environmental staff for Project personnel and construction contractors, to include distribution of protected species information sheets to onsite staff, and implementation of a Wildlife Resource Recovery System program to document any species impacts and mortalities. Nutmeg Solar will conduct independent internal environmental audits to ensure compliance with site permit conditions, including staff awareness of the environmental compliance requirements and natural resource protection issues.

Bedrock, Surficial Geology, and Soils

As proposed, the Project would not impact bedrock formations or surficial geology within the Study Area, as installation of the solar panels would not alter the surface geology or require bedrock penetration. Although some alteration of on-site soils may occur, these changes would be minor and limited to the installation of the solar panels, access roads and electrical infrastructure. A net benefit to farmland soils that are present is expected, as taking the existing cultivated areas out of crop rotation would allow the

soil to recover from past agricultural use (where applicable) by following guidelines based on decades of study (Barrow 1991, Eriksson et al. 1974, and Derpsch 2008).

Development of Prime Farmland for use in generating solar power would not be expected to result in degradation of soil quality. After the viable life of the Project, the expectation would be that Prime Farmland soils identified on the site would be in the same, or an improved condition than today. The energy Project would be expected to arrest potential conversion of this farmland into another hardscape or residential/commercial development and allow for natural soil development to occur.

To address potential impacts to Prime Farmland and Farmland of Statewide Importance that occurs in the Study Area, a Soil Mitigation Plan has been developed for the Project. Soil conservation measures that have been identified include:

- Training construction and operations personnel in onsite evaluation of farmland soils to assure those soils are managed in accordance with the Soil Mitigation Plan and other best management practices; and
- Evaluating soils excavated to a depth of greater than 8 inches to determine availability of 12 inches of mineral material soils; and absence of stones, cobble, and boulders.

In addition, if the proposed soil disturbance is greater than 8 inches in depth, excavated topsoil removed in areas mapped as Prime Farmland soil or Farmland of Statewide Importance will be stockpiled and stabilized. Stockpiling of these soils will be located within suitable areas of the Development Area that are identified and staked prior to initiation of construction activities. Suitable soil stockpiling areas will be selected based on their underlying soil types, existing topography, and existing ground cover. Stockpiles will be surrounded by a silt fence throughout the construction period, and temporary stabilization will be achieved through use of jute matting to limit erosion of the stockpile. Permanent stabilization of the stockpiles will be conducted upon completion of construction activities, through use of seed mixes. Stockpiled soils would be potentially available for local beneficial re-use, for agricultural practices, if there is an identified opportunity during the life of the Project; otherwise, they will be stored on site and regraded upon decommissioning of the Project. In addition to these measures, soil compaction within designated areas of important farmland soils will be limited during construction; however, some compaction will be required for access roads, equipment pad areas, and utility trenches to ensure proper construction.

There will be some minimal soil disturbance to place foundations and underground trenching of conduit during construction, but a vegetative cover on the soil surface would be maintained underneath the solar panels. This would allow the soil to recover from past agricultural use. Soil health management systems that are recommended include a suite of practices, such as crop rotations, cover crops, no-till, and mulching that require less soil disturbance, provide living roots throughout the year, improve crop diversity, and keep the soil covered. A solar power development, such as the one proposed, could likely duplicate agricultural conservation practices that generally improve soil health, and would follow the principal of switching from conventional tillage to no-till. Additionally, having a vegetative cover on the soil surface would improve soil health for the lifespan of the solar generation Project.

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APPENDIX A – FIGURES

- Figure 1. Nutmeg Solar Conceptual Layout.
- Figure 2. Wetlands, Surface Waters, and Vernal Pools.
- Figure 3. Rare, Threatened, and Endangered Species and Significant Natural Communities.
- Figure 4. Soils.

LEGEND

- APPROXIMATE PROPERTY LINE
- PROPERTY LINE SETBACK □VARIES□
- PROPOSED VEGETATION CLEARING
- SELECTIVE TRIMMING
- PLANTINGS □AFTER ROAD GRADING□
- PROPOSED VEGETATION SCREENING

Bailey Road

PROPOSED PROPERTY LINE

SUBSTATION

RELOCATED TOBACCO BARNS

TOBACCO BARNS TO BE RELOCATED

CHAIN LINK FENCE

LIMIT OF WORK

AGRICULTURAL FENCE

PROPOSED VEGETATION CLEARING

Broad Broo□Road

WESTERN ARRAY

EASTERN ARRAY

TOBACCO BARNS TO BE REMOVED

PROPOSED VEGETATION SCREENING

PLANTINGS □AFTER ROAD GRADING□

E□UIPMENT PAD

PROPERTY LINE

100' VERNAL POOL ENVELOPE

VERNAL POOL

SELECTIVE TRIMMING

N

SCALE IN FEET
0 200' 400'
GRAPHIC SCALE

□N□□□F□□□□□□□□□□

Tighe&Bond
Engineers | Environmental Specialists

Nutmeg Solar Facility

Nutmeg Solar, LLC

Enfield, Connecticut

VERIFY SCALE
BAR IS 1 INCH ON ORIGINAL DRAWING
0 1 INCH
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

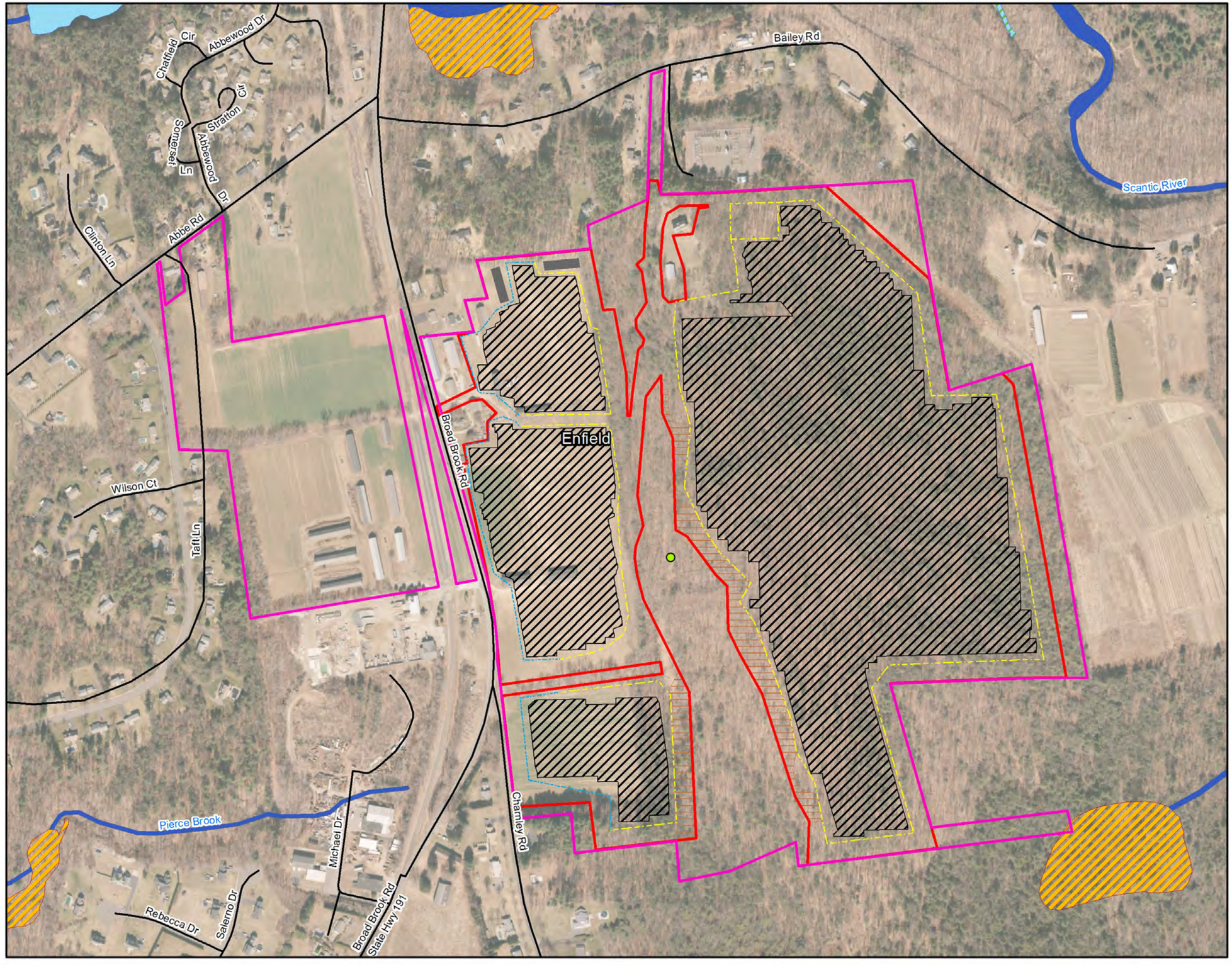
MARK	DATE	DESCRIPTION
-	-	-

PROJECT NO:	R-0317
DATE:	2018/10/11
FILE:	Conceptual Site Layout□10.11.18.dwg
DRAWN BY:	ELD
CHECKED:	BA/BSH
APPROVED:	XXX

CONCEPTUAL LAYOUT

SCALE: 1" = 200'

Last Saved:10/11/2018
Printed On:10/11/2018-11:23am By: AGilchrist
Tighe & Bond:J:\R\R0317 Ranger Solar\R-0317-4 Nutmeg\Drawings\Sheets\Conceptual Layout\Conceptual Site Layout□10.11.18.dwg

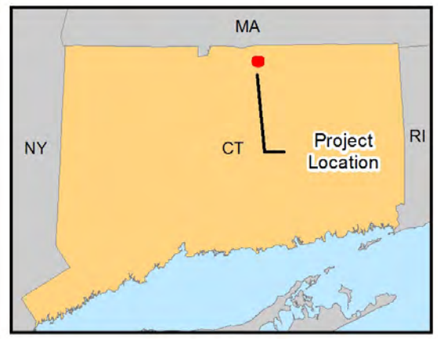


Legend

- Study Area
- Panel Outline
- Relocated Barn
- Selective Vegetation Trimming
- Agricultural Fence
- Chain Link Fence
- Limit of Work
- Road
- Vernal Pool

Wetlands (NWI)

- Freshwater Emergent Wetlands
- Freshwater Forested/Shrub Wetlands
- Freshwater Pond
- Riverine



N

0 250 500 1,000 Feet

Figure 2. Wetland, Surface Waters, and Vernal Pools
Nutmeg Solar Facility
Enfield, CT

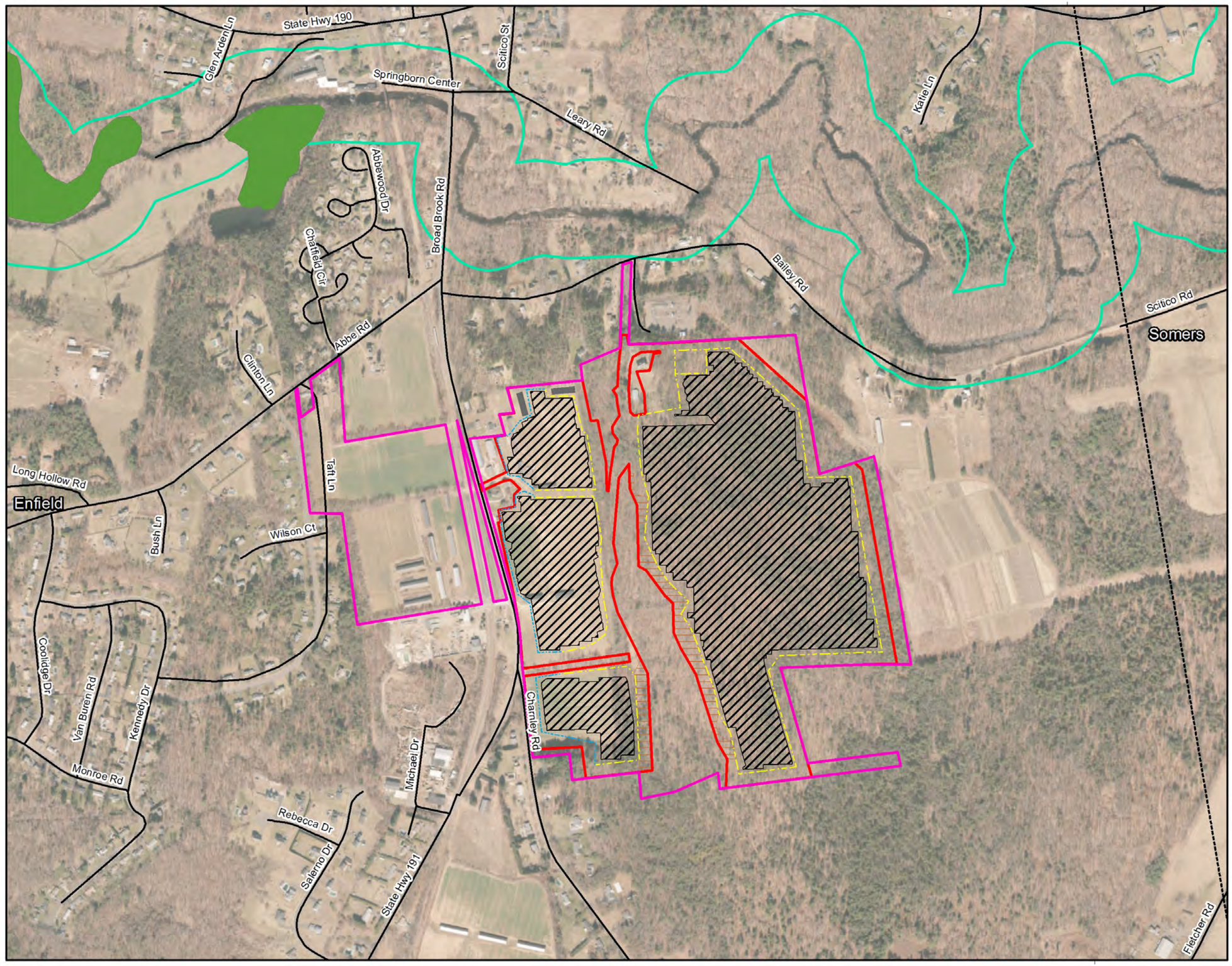
Prepared For: NEXTera ENERGY RESOURCES

Prepared By: TETRA TECH

Date: 10/2018

Source: Esri, et. al., 2014; NextEra, 2017; CT DEEP, 2017; USFWS NWI, 2017

Coordinate System: North American Datum, 1983 Universal Transverse Mercator, Zone 18 North

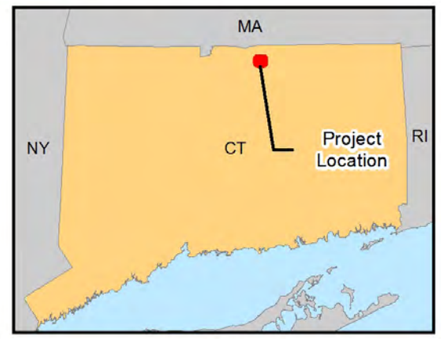


Legend

- Study Area
- Panel Outline
- Relocated Barn
- Selective Vegetation Trimming
- Township Boundary
- Agricultural Fence
- Chain Link Fence
- Limit of Work
- Road
- Natural Diversity Database Area

Critical Habitat

- Floodplain Forest



N

0 400 800 1,600 Feet

Figure 3. Rare, Threatened, and Endangered Species and Significant Natural Communities
Nutmeg Solar Facility
Enfield, CT

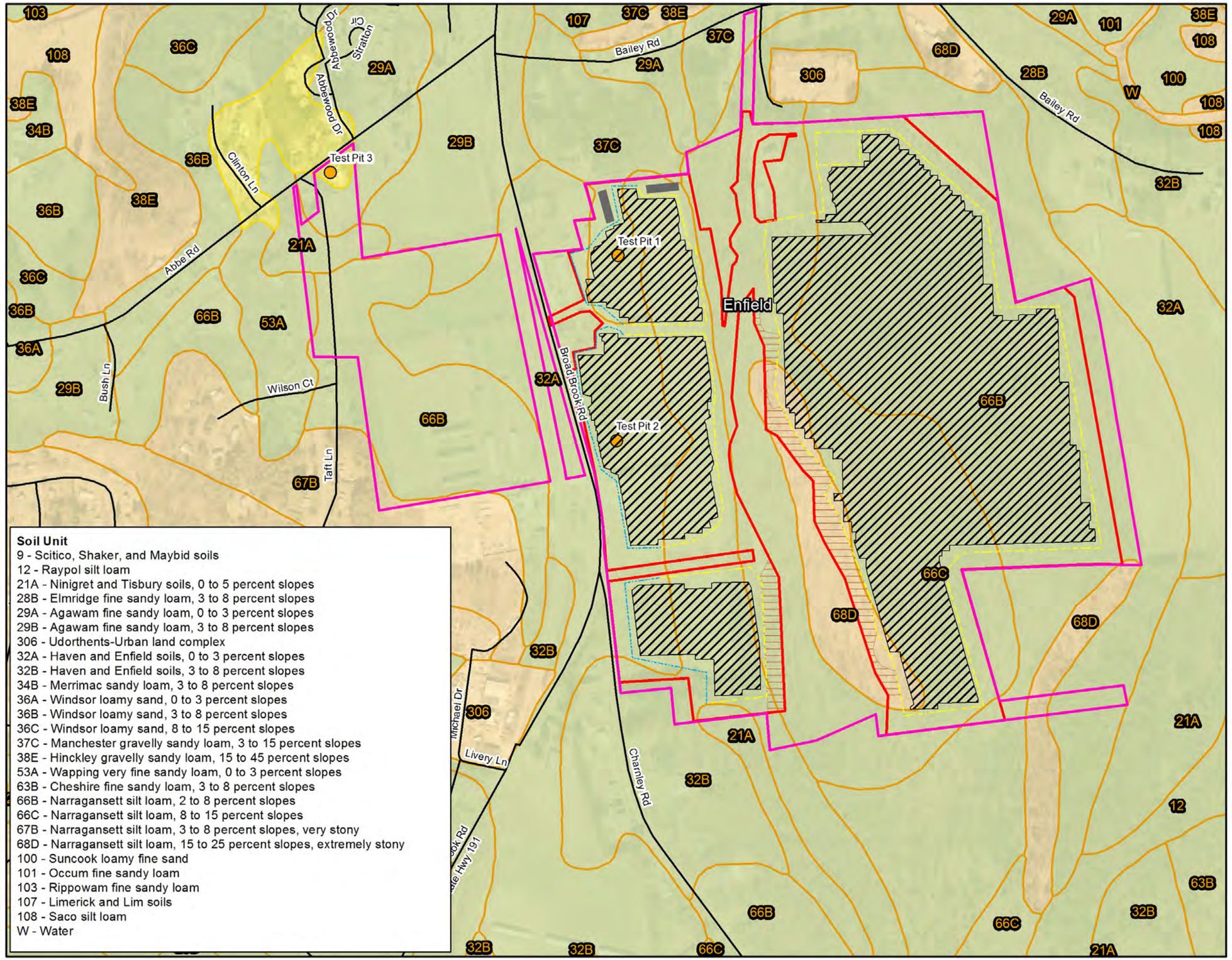
Prepared For: NEXTera ENERGY RESOURCES

Prepared By: TETRA TECH

Date: 10/2018

Source: Esri, et. al., 2014; NextEra, 2017, CT DEEP, 2017

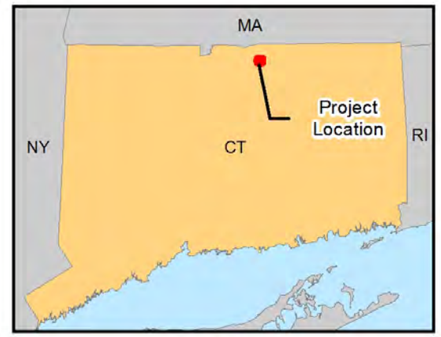
Coordinate System: North American Datum, 1983 Universal Transverse Mercator, Zone 18 North



Soil Unit
9 - Scitico, Shaker, and Maybid soils
12 - Raypol silt loam
21A - Ninigret and Tisbury soils, 0 to 5 percent slopes
28B - Elmridge fine sandy loam, 3 to 8 percent slopes
29A - Agawam fine sandy loam, 0 to 3 percent slopes
29B - Agawam fine sandy loam, 3 to 8 percent slopes
306 - Udorthents-Urban land complex
32A - Haven and Enfield soils, 0 to 3 percent slopes
32B - Haven and Enfield soils, 3 to 8 percent slopes
34B - Merrimac sandy loam, 3 to 8 percent slopes
36A - Windsor loamy sand, 0 to 3 percent slopes
36B - Windsor loamy sand, 3 to 8 percent slopes
36C - Windsor loamy sand, 8 to 15 percent slopes
37C - Manchester gravelly sandy loam, 3 to 15 percent slopes
38E - Hinckley gravelly sandy loam, 15 to 45 percent slopes
53A - Wapping very fine sandy loam, 0 to 3 percent slopes
63B - Cheshire fine sandy loam, 3 to 8 percent slopes
66B - Narragansett silt loam, 2 to 8 percent slopes
66C - Narragansett silt loam, 8 to 15 percent slopes
67B - Narragansett silt loam, 3 to 8 percent slopes, very stony
68D - Narragansett silt loam, 15 to 25 percent slopes, extremely stony
100 - Suncook loamy fine sand
101 - Occum fine sandy loam
103 - Rippowam fine sandy loam
107 - Limerick and Lim soils
108 - Saco silt loam
W - Water

Legend

- Study Area
- Panel Outline
- Relocated Barn
- Selective Vegetation Trimming
- Agricultural Fence
- Chain Link Fence
- Limit of Work
- Road
- NRCS Soil Survey
- Windsor Soil
- Prime Farmland Soil or Statewide Important Farmland Soil
- Soil Test Pit



N

0 250 500 1,000 Feet

Figure 4. Soils
Nutmeg Solar Facility
Enfield, CT

Prepared For: NextEra Energy Resources

Prepared By: Tetra Tech

Date: 10/2018

Source: Esri, et. al., 2014; NextEra, 2017; NRCS, 2017; CT DEEP, 2017

Coordinate System: North American Datum, 1983 Universal Transverse Mercator, Zone 18 North

APPENDIX B – SITE PHOTOGRAPHS

Appendix B
Nutmeg Site Photographs
Enfield, Connecticut

Photo: 1 **Description:** Railroad passes through Study Area parallel to Route 194. **Date:** April 17, 2017	

Photo: 2 **Description:** Old excavation in forested area on the eastern side of the Study Area. **Date:** April 17, 2017	

Appendix B
Nutmeg Site Photographs
Enfield, Connecticut

Photo: 3 **Description:** Mixed woods on the eastern side of the Study Area. **Date:** August 1, 2017	

Photo: 4 **Description:** Old woods road currently used as a recreational vehicle trail. **Date:** August 1, 2017	

Appendix B
Nutmeg Site Photographs
Enfield, Connecticut

Photo: 5 **Description:** View of edge of field and existing barn structures on the property. **Date:** April 17, 2017	

Photo: 6 **Description:** Amphibian breeding was observed in this vernal pool in April 2017. No hydric soils observed. **Date:** June 13, 2017	

Appendix B
Nutmeg Site Photographs
Enfield, Connecticut

Photo: 7 **Description:** Vernal Pool area that was observed to contain amphibian breeding in the spring of 2017 and 2018. Pool was observed contain tire tracks and signs of old excavation on the right side of the photo. A recreational vehicle trail occurs to the left of the photo. **Date: August 1, 2017**	

Photo: 8 **Description:** Defoliated trees due to the Summer 2017 gypsy moth outbreak. **Date:** August 1, 2017	

Appendix B
Nutmeg Site Photographs
Enfield, Connecticut

Photo: 9 **Description:** Photo from soils investigation within the Project area mapped by USDA NRCS as Windsor loamy sand. **Date:** September 13, 2017	

Photo: 10 **Description:** Soil Test Pit 3 (Figure 4) taken within area mapped by USDA NRCS as Windsor loamy sand. September 2017. **Date:** September 13, 2017	

APPENDIX C – NATURAL RESOURCES SURVEY REPORTS

- Eastern Spadefoot Toad (Scaphiopus holbrookii) Survey Results. Prepared by FB Environmental. (July 2018).
- Vernal Pool Survey and General Herpetological Inventory of the Proposed Nutmeg Solar Project. Prepared by FB Environmental. (May 2018).
- Vernal Pool Surveys, and Wetland and Watercourse Delineation – Nutmeg Solar (November 2017). Prepared by Tetra Tech, Inc. for NextEra Energy Resources, LLC.
- Northern Long-eared Bat (NLEB) Presence/Absence Survey (September 7, 2017). Prepared by Tetra Tech, Inc. for NextEra Energy Resources, LLC.
- Prime Farmland Soils Opinion (January 5, 2017). Prepared by Tetra Tech, Inc. for Ranger Solar.

Eastern Spadefoot Toad (*Scaphiopus holbrookii*) Survey Results Prepared by FB Environmental July, 2018

Eastern Spadefoot Toad Survey

Nutmeg Solar Project

Enfield, Connecticut

Prepared for:
Nutmeg Solar, LLC
700 Universe Boulevard
Juno Beach, FL 33408

Prepared by:
FB Environmental Associates
97A Exchange Street
Portland, ME 04011

July 2018

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Executive Summary

Nutmeg Solar, LLC, a wholly owned subsidiary of NextEra Energy Resources, is proposing to construct an approximately 20 megawatt solar energy facility on an approximately 190-acre site in Enfield, Connecticut. FB Environmental (FBE) conducted nocturnal field surveys to determine if the eastern spadefoot toad (*Scaphiopus holbrookii*) is present or likely absent within the study area. After a total of five nights of surveys during suitable weather conditions, eastern spadefoot toads were not detected at the Nutmeg Solar site.

1. Introduction

At the request of Tetra Tech (the lead project consultant for NextEra), FB Environmental (FBE) conducted nocturnal field surveys to determine if the eastern spadefoot toad (*Scaphiopus holbrookii*) is present within the study area. This report presents the results of FBE's spadefoot survey efforts completed in 2018. In addition to the eastern spadefoot surveys, FBE also conducted a vernal pool survey and a general herpetological inventory with emphasis on detection of box turtles (*Terrapene carolina carolina*) and wood turtles (*Glyptemys insculpta*). Results of the vernal pool survey and general herpetological inventory have been delivered under separate cover.

1.1 Eastern Spadefoot Toad

The eastern spadefoot toad is the only member of the spadefoot family (Scaphiopodidae) present east of the Mississippi River. While eastern spadefoots are common from Tennessee west to the Mississippi Valley, New England populations are scattered and disjunct, and typically found in river valleys with sandy, well-drained soils (Klemens, 1993), these are also prefered soil conditions associated resdential and commercial development. Some of these already localized populations have been extirpated, presumably due to habitat loss accompanying urban/suburban development (Klemens, 1993).

An adult eastern spadefoot toad. Photo courtesy of Kevin Ryan. (Photograph taken in 2009 in Plainfield, CT.)

Klemens (2002) observed that the recorded eastern spadefoot toad occurrences in eastern Connecticut coincided well with Hinckley Soils. Hinckley soils are sandy, gravelly, and typically well drained (NRCS, 2008), characteristics that are consistent with reports of soil types preferred by eastern spadefoot toads (e.g., Pearson [1955] and Jansen et al. [2001]). Building on Klemens' observations, Moran and Button (2011) used soils and digital elevation model data from known eastern spadefoot toad sites in Connecticut, Massachusetts, and Rhode Island to create a GIS model that identifies and predicts potential eastern spadefoot toad habitat in the region. Data movement patterns and habitat selection of eastern spadefoot toads in the northeast are sparse; Ryan et al. (in prep.) studied eastern spadefoot toad movement patterns and habitat selection in eastern Connecticut and Timm et al. (2014) conducted a similar study at Cape Cod, Massachusetts.

Eastern spadefoot toads do not breed on a rhythmic, annual cycle that is typical of the large majority of North American pool-breeding amphibian species, and can forgo breeding for numerous, consecutive years

(Ball, 1936; Klemens, 1993). Even in years when breeding occurs, the activity is explosive, typically lasting only one or two days or nights, and can occur anytime from late March through October in southern New England (Klemens, 1993). Because of this irregular and contracted breeding pattern, standard calling anuran (frog and toad) surveys are severely limited as a primary tool to document and monitor local eastern spadefoot toad populations (Cook et al., 2011).

Eastern spadefoot toads spend the vast majority of their lives in the uplands surrounding breeding pools in self-dug underground burrows from which they emerge sporadically at night to feed. When aboveground for feeding purposes, they tend to remain close (<1 to ca. 35 m) to their burrows (Pearson, 1955; Johnson, 2003). Ryan et al. (2015) also monitored non-breeding burrow emergences of eastern spadefoot toads and the results from these studies indicates that the most productive searches for eastern spadefoot toads in New England would be conducted on rainy nights from mid-June through mid-September when the average air temperature is >68F. Note, however, that eastern spadefoots have been observed to be active (emerged from burrows or breeding) as early as April on rainy nights with air temperatures around 55F (D. Quinn, pers. comm.). Additionally, searches conducted during nights following observed emergences, even in the absence of precipitation, may be helpful, as their results indicate that eastern spadefoot toads are more likely to emerge during sequential nights.

2. Study Area

2.1 Site configuration

The Nutmeg Solar project is located in the town of Enfield, which is within the Central Connecticut Lowland (Figure 1). The specific study area consists of approximately 190 acres of land located south of Route 190 (Hazard Road), and east of Route 191 (Broad Brook Road). Elevation at the site ranges from approximately 170 to 320 feet above sea level.

A Central New England Railroad rail line runs north-south on the west side of Broad Brook Road. An Eversource Energy transmission line right-of-way occurs along northeastern corner of the study area. An active concrete batch plant is situated immediately southeast of the study area west of Broad Brook Road. The Scantic River is situated north of the study area across Bailey Road.

West of Route 191, the study area consists of agricultural fields and associated outbuildings, with the exception of a narrow windbreak of trees running east-west separating agricultural fields. East of Route 191, the study area consists of approximately 32 acres of agricultural fields bordering the road and approximately 109 acres of second growth forest which is bisected by a network of recreational vehicle trails. (Personal communication with Owen Jarmoc indicated that some of the trails were formerly a jeep race course.) One of the parcels at the northern portion of the site consists of a residence with approximately 1.25 acres of manicured lawn.

Figure 1. Nutmeg Solar study area, Enfield, Connecticut.

2.2 Soils

A soil map obtained from the U.S. Department of Agriculture Natural Resource Conservation Service's Web Soil Survey shows that the vast majority of soils within the study area consist primarily of Narragansett soils followed by the Haven and Enfield association soils (Appendix A). Ninigret and Tisbury association, Agawam, Windsor, Manchester, and Wapping soils are present to a much lesser extent. A soil survey was conducted by a Certified Soil Scientist from Tetra Tech (see Environmental Site Conditions Report [Tetra Tech, 2018]).

The soil scientist identified that Narragansett, Haven, and Enfield soils are present on site. The Narragansett series consists of very deep, well drained loamy soils formed in a mantle of medium-textured deposits overlying till. The Haven soil series consists of very deep, well drained soils formed in loamy over sandy and gravelly outwash. Enfield soils consists of very deep, well drained loamy soils formed in a silty mantle overlying glacial outwash. Hinckley soils are not present within the bounds of the study area, though small areas exist just north of the site (Figure 1).

2.3 Forest

The forested portion of the study area is dominated by red maple (*Acer rubrum*) and red oak (*Quercus rubra*) with eastern hemlock (*Tsuga canadensis*), black birch (*Betula lenta*), chestnut oak (*Quercus montana*), hickory (*Carya* sp.) and several other species also present. Numerous stump sprouts of American chestnut (*Castanea dentata*) are also present within the forest.

2.4 Hydrologic features

A wetland and watercourse determination and delineation was conducted by Tetra Tech in 2017 (see Environmental Site Conditions Report [Tetra Tech, 2018]). Based on standards and definitions set forth by the US Army Corps of Engineers, State of Connecticut, and the Town of Enfield, no wetlands or watercourses are present within the study area due to the absence of hydric soils.

Two areas with visible hydrology do exist within the study area; however both of these features are the result of human activity. The one vernal pool present on site is an excavated depression within the central portion of the study area east of Route 191. It is situated at the bottom of a slope and bordered on its west side by a recreational vehicle trail; historic tire ruts exist within the depression itself. The second area with hydrology is a small open-canopy excavated area approximately 450' south of the vernal pool. Several sedges (*Carex* sp.) are present in the area. Personal communications with Tetra Tech indicate that soils within the area do not meet the criteria to be considered hydric.

A large forested wetland complex with a scrub-shrub component occurs outside the study area to the southeast. The forested portion of the wetland is dominated by red maple. The scrub-shrub component includes highbush blueberry (*Vaccinium corymbosum*), winterberry (*Ilex verticillata*), and buttonbush (*Cephalanthus occidentalis*).

3. Methods

Prior to the field survey FBE examined U.S. Department of Agriculture Natural Resource Conservation Service Web Soil Survey maps for the presence of Hinckley soils in the vicinity of the survey area. FBE also examined the Predicted Spadefoot Toad Habitat map produced by Kate Moran of the CT Department of Energy and Environmental Protection for the presence of predicted spadefoot habitat within the vicinity of the study area.

3.1 Species detection techniques

Visual encounter surveys

Visual encounter surveys involve qualified field personnel searching a focal area systematically for a known period of time. Visual encounter surveys are an effective technique to rapidly detect species in a given area (Crump and Scott, 1994; Rodda et al. 2007 cited in Vonesh et al., 2010). The technique requires minimal equipment and can be utilized in a variety of habitat types (Vonesh et al., 2010).

To conduct a visual encounter survey, an experienced herpetologist (sometimes accompanied by field assistants) selectively searches small areas of habitat determined most likely to yield amphibians and reptiles. The approach potentially yields more species and individuals per unit effort than randomized sampling approaches. Alternatively, an area may be searched via visual encounter surveys using transects where a researcher walks along a specified compass bearing.

At the Nutmeg Solar site, visual encounter surveys consisted of searching areas deemed most likely to yield eastern spadefoots based on the features of the site and observers' knowledge of the species' habits. As surveys took place at night, LED flashlights were used to search for eastern spadefoots.

Nocturnal vehicular surveys

Conducting a nocturnal vehicular survey (commonly referred to as road running) involves slowly driving along roads at night during and after precipitation events when amphibians are typically most active to observe individuals on roadways and/or listen for choruses (Driving is done with vehicle windows at least partially down). Any amphibians encountered on the road are subsequently captured, identified, and released. The technique allows personnel to quickly search large areas and is a highly useful accompaniment to visual encounter surveys on foot. Flashlights are used to supplement vehicle headlights.

Road running was conducted on Bailey Road, which runs east-west for ¾ miles just north of the study area. Abbe, Taft, and Kennedy roads, which are the roads nearest the west end of the survey area where also surveyed.

4. Results and Discussion

A total of 5 nights (amounting to 26 person hours) of surveys were conducted in May, June, and July 2018 attempting to detect the presence of eastern spadefoot toads at the Nutmeg Solar site (Table 1). During each survey bout, meteorological conditions (Table 2) were conducive to spadefoots being active (i.e., emerged from their burrows) and hence detectable. FBE's Kevin Ryan led surveys solo (three events) or while accompanied by a herpetological field assistant, Rich Brereton of FBE (one event). Dennis Quinn of

CTHerpConsultant, LLC and Jani Quinn conducted one bout of nocturnal searching. No eastern spadefoots were detected at the Nutmeg Solar site.

During the course of the nocturnal searches, the site was examined for potentially suitable breeding pools. During the evenings of May 15 and July 17 two areas of pooled water were observed in the agricultural fields, not far from the edges of Broad Brook Road and Charnley Road. Both pools contained almost no water the following morning. Personal communication with Owen Jarmoc indicated that any pools formed in the agricultural fields during heavy rain events are typically absent of standing water the following day.

The area of Hinckley soil north of the Nutmeg Solar site (Figure 1) was on private property and could not be accessed directly. Instead, vehicular surveys were conducted during each nocturnal survey bout along Bailey Road, which runs adjacent to the Hinckley areas. Numerous amphibian species were observed on the road during the course of the surveys (Appendix A), but eastern spadefoots were not encountered.

Table 1. Summary of eastern spadefoot survey effort at the proposed Nutmeg Solar site, Enfield, CT. Meteorological conditions are presented in Table 2.

Date	Field personnel	Hours on site	Total person-hours
15 May	Kevin Ryan, Rich Brereton	4	8
22 May	Dennis Quinn, Jani Quinn	3.5	7
18 June	Kevin Ryan	3	3
24 June	Kevin Ryan	4.5	4.5
17 July	Kevin Ryan	3.5	3.5
	Total	**18.5**	**26**

Eastern spadefoots were observed to be active elsewhere in Connecticut on nights that the Nutmeg Solar site was searched. An eastern spadefoot was observed alive on a road near a known breeding pool in Plainfield, CT on May 6, 2018. Given that the climate of Enfield is likely almost identical to that of Plainfield, it is not unreasonable to expect that, were eastern spadefoots present in the town of Enfield, they would be active (during suitable conditions) during the month of May as well. On June 24, while Kevin Ryan was surveying the Nutmeg Solar site, a spadefoot was found in the town of Canterbury by Dennis Quinn.

To complement the macrohabitat work conducted by Moran and Button (2011), Ryan et al. (in prep) conducted a study in eastern Connecticut examining the actual groundcover composition at eastern spadefoot burrow locations. The study involved recording habitat variables within 10 m- and 1 m- diameter circular plots centered on known animal locations. Eastern spadefoot presence was positively correlated with percent cover of bare soil at the 10 m- and 1 m- scales, positively correlated with percent cover of

gravel at the 10 m scale, and negatively correlated with percent cover of grass at both scales. Throughout the study, Ryan et al. (in prep) opportunistically located *S. holbrookii* at night, and these individuals were typically found underneath dense cover (e.g., clumps of shrubs).

The agricultural fields within the study area provide areas of open canopy and bare soil. The nearest dense vegetation to these areas were the edges of the fields themselves. It has been the author's experience that while eastern spadefoots will burrow in active agricultural fields; they tend not to remain in the fields for extended periods of time.

Table 2. Meteorological conditions during eastern spadefoot surveys at the proposed Nutmeg Solar site, Enfield, CT. Weather data was obtained from weatherunderground.com.

Date	High Temp. (F)	Low Temp. (F)	Average Temp. (F)	Precip. (Inches)	Remarks
15 May	85	56	71	1.26	Heavy thunderstorms started approx. 5pm, rain/light rain until 7pm.
22 May	64	51	58	0.05	Vegetation and roads damp, but most heavy rain missed the site.
18 June	94	64	79	0.49	Thunderstorm at 9pm, heavy rain at midnight. Steady rain in-between.
24 June	82	52	67	1.33	Heavy thunderstorm 6pm, steady rain thereafter. Spadefoot captured at Quinebaug Solar site.
17 July	91	71	81	2.14	Very heavy afternoon thunderstorms followed by light rain until ~8pm.

The CT DEEP Predicted Spadefoot Toad Habitat map shows no predicted spadefoot habitat at the Nutmeg Solar site. The nearest predicted habitat is a small area approximately 1,500 feet east of the eastern boundary of the Nutmeg Solar site. The nearest confirmed record of an eastern spadefoot is approximately five miles east in the town of Somers.

The Nutmeg Solar site lacks Hinckley soils, dense vegetative cover, and predicted habitat in the DEEP model, suggesting that the Nutmeg Solar site provides marginal habitat at best for eastern spadefoots. Furthermore, FBE's spadefoot surveys did not detect eastern spadefoots, on nights when eastern spadefoots were found elsewhere in Connecticut. Taken together, these findings make it unlikely that the eastern spadefoot occurs at the Nutmeg Solar site.

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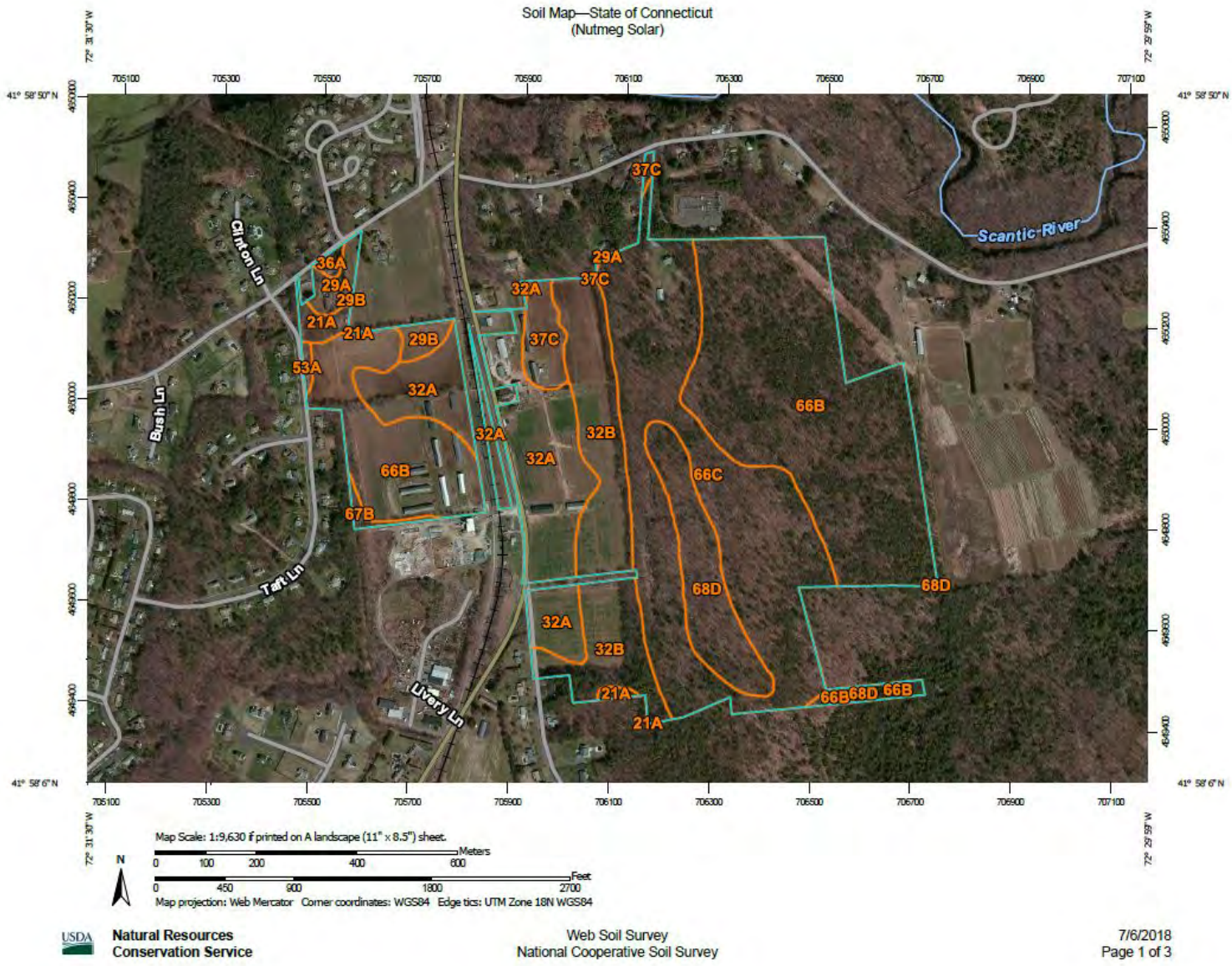
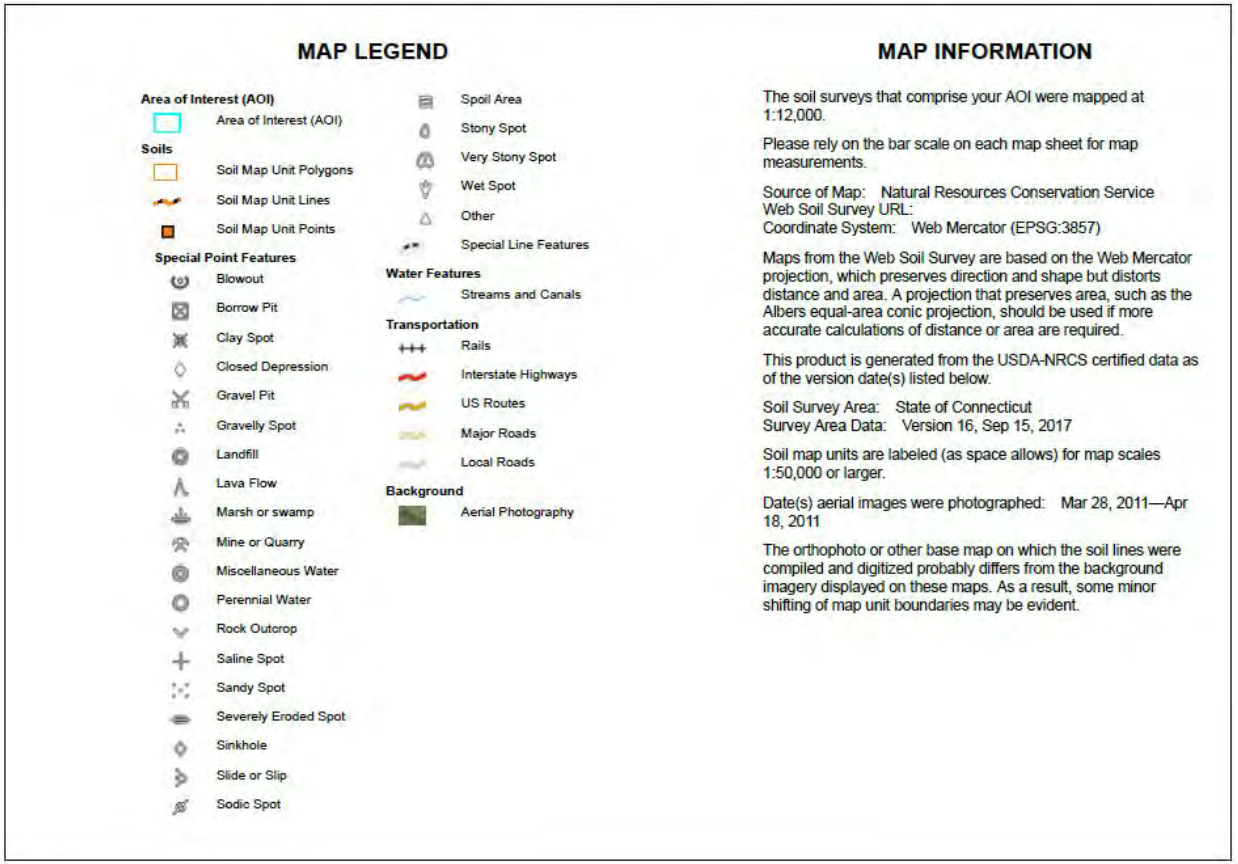
Appendix A. NRCS Web Soil Survey Map of the Nutmeg Solar Site



Soil Map—State of Connecticut
(Nutmeg Solar)



Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
21A	Ninigret and Tisbury soils, 0 to 5 percent slopes	1.9	1.0%
28A	Agawam fine sandy loam, 0 to 3 percent slopes	2.1	1.1%
29B	Agawam fine sandy loam, 3 to 8 percent slopes	1.5	0.8%
32A	Haven and Enfield soils, 0 to 3 percent slopes	27.0	14.1%
32B	Haven and Enfield soils, 3 to 8 percent slopes	22.3	11.7%
36A	Windsor loamy sand, 0 to 3 percent slopes	0.6	0.3%
37C	Manchester gravelly sandy loam, 3 to 15 percent slopes	4.1	2.1%
53A	Wapping very fine sandy loam, 0 to 3 percent slopes	0.4	0.2%
66B	Narragansett silt loam, 2 to 8 percent slopes	69.2	36.2%
66C	Narragansett silt loam, 8 to 15 percent slopes	49.7	26.0%
67B	Narragansett silt loam, 3 to 8 percent slopes, very stony	0.8	0.4%
68D	Narragansett silt loam, 15 to 25 percent slopes, extremely stony	11.6	6.1%
Totals for Area of Interest		**191.0**	**100.0%**

Appendix B. Photographs

Photo 1. An area of pooled water observed in an agricultural field during heavy rain on May 15.

Photo 2. The same area as the previous photo the morning of May 16. Any pooled water in the agricultural fields percolates rapidly into the soil.

Photo 3. An additional area of pooled water identified during heavy rain on May 15.

Photo 4. The edges of agricultural fields bordering the forest contain areas of dense vegetation.

Appendix C. Amphibians detected during nocturnal surveys

Scientific Name	Common Name	Age class	Observation Location(s)
Anaxyrus americanus	American toad	Adults, juveniles	Throughout forest and AOR on Bailey, Abbe, and Taft Roads. Heard calling just offsite.
Hyla versicolor	Gray treefrog	Adults	Observed AOR on Bailey Road. Heard calling just offsite.
Lithobates catesbeianus	Bullfrog	Juveniles	Observed AOR on Bailey Road.
Lithobates clamitans	Green frog	Adults, juveniles	Observed AOR on Baily Road and Kennedy Road.
Lithobates sylvaticus	Wood frog	Eggs, juveniles	Vernal pool (eggs) and surrounding forest (juveniles), AOR on Bailey Road.
Pseudacris crucifer	Spring peeper	Adults	Heard calling just offsite.

Vernal Pool Survey and General Herpetological Inventory of the Proposed Nutmeg Solar Project. Prepared by FB Environmental, May 2018

Vernal Pool Survey and General Herpetological Inventory of the Nutmeg Solar Project

Enfield, Connecticut

Prepared for:
Nutmeg Solar, LLC
700 Universe Boulevard
Juno Beach, FL 33408

Prepared by:
FB Environmental Associates
97A Exchange Street
Portland, ME 04011

July 2018

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View of agricultural fields and tobacco barns at the proposed Nutmeg Solar site.

Executive Summary

Nutmeg Solar, LLC, a wholly owned subsidiary of NextEra Energy Resources, LLC (NextEra), is proposing to construct an approximately 20 megawatt solar power facility on an approximately 190-acre site in Enfield, Connecticut. FB Environmental conducted a herpetological assessment of the entire study area. Specific tasks consisted of 1) a vernal pool survey; and 2) a general herpetological inventory with emphasis on detection of box turtles (*Terrapene carolina carolina*) and wood turtles (*Glyptemys insculpta*). A total of seven days were spent in the field on the subject property to accomplish the aforementioned tasks.

The excavated depression within the study area meets the criteria to be considered a Tier 1 vernal pool according to the standards set forth in Calhoun and Klemens (2002). However, despite having an intact envelope and relatively intact critical terrestrial habitat, the pool is not of high biological value, especially when compared to other wetlands within the general area. This is because it had relatively low egg mass numbers in both years it was surveyed and the pool's short hydroperiod likely makes it a sink for vernal pool amphibians in most years. The pool was observed to be completely dry on June 18, 2018.

Results of the herpetological inventory indicate the site exhibits low herptile diversity, as only a total of six amphibian and one reptile species were detected. Field survey efforts did not detect the presence of either the eastern box turtle or wood turtle. Box turtles are likely absent from the site or exist at a low population density. Wood turtles are likely absent from the site.

1. Introduction

At the request of Tetra Tech (the lead project consultant for NextEra), FB Environmental (FBE) conducted a vernal pool survey and a general herpetological inventory with emphasis on detection of box turtles and wood turtles. In addition, species detection surveys for the eastern spadefoot (*Scaphiopus holbrookii*) were performed in 2018. Results of the eastern spadefoot surveys were delivered under separate cover.

1.1 Pool-breeding amphibians

Pool-breeding amphibians in Connecticut consist of spotted salamanders (*Ambystoma maculatum*), marbled salamanders (*Ambystoma opacum*), Jefferson Salamander complex (*Ambystoma jeffersonianum* complex) (State Species of Special Concern), blue-spotted salamander complex (*Ambystoma laterale* complex) (State Species of Special Concern), pure-diploid blue-spotted salamanders (*Ambystoma laterale*) (State Endangered species), and wood frogs (*Lithobates sylvaticus*). These pool-breeding amphibians spend the majority of their lives in terrestrial habitat adjacent to breeding pools, and thus

From top to bottom: a spotted salamander, marbled salamander, and blue-spotted salamander. Photo courtesy of Kevin Ryan. (Photo taken in 2011 in Canterbury, CT.)

Figure 1. Nutmeg Solar study area, Enfield, Connecticut.

require both aquatic and terrestrial areas for survival. After spring emergence most adult pool-breeding amphibians in Connecticut spend less than one month or their life-cycle in breeding pools; the rest of their lives are spent in adjacent terrestrial or wetland areas (Semlitch 1981, 2000 cited in Calhoun and Klemens 2002). In their terrestrial habitats, both juvenile and adult amphibians require areas of deep, uncompacted organic material (leaf litter), coarse woody material (e.g., logs, sticks, branches), and shade.

An adult wood frog. Photo courtesy of Kevin Ryan. Photo courtesy of Kevin Ryan. (Photo taken in 2009 in Canterbury, CT.)

In a summary of studies examining how far pool-breeding amphibians move from their breeding pools, Semlitsch (1998) found that a "critical terrestrial habitat" zone surrounding a breeding pool should extend approximately 540 feet from the pool's edge would encompass the distance moved from a breeding pool of 95% of the individuals within a breeding amphibian population. Conservation of pool-breeding amphibians has since employed circular "life zones" to surround a wetland in order to meet the terrestrial habitat requirements of the amphibian species breeding within it (e.g., Faccio, 2003; McDonough and Paton, 2007). Conservation strategies that only focus on protecting breeding pools (and not the associated critical terrestrial habitat) will most likely fail to maintain a viable amphibian population. Protection of critical terrestrial habitat therefore must also be a priority (Marsh and Trenham 2001 cited in Calhoun and Klemens 2002).

1.2 Eastern box turtle

The eastern box turtle is a small- to medium-size turtle that is primarily terrestrial. The turtle owes its name to its hinged plastron which enables it to close the front and rear lobes tightly, effectively protecting the soft parts of the turtle. Eastern box turtles have a domed carapace patterned with yellow or orange markings on a black or dark brown background. Patterns on the plastron range from solid black to a mixture of dark yellow or white interspersed with dark areas. Individual variation occurs to a great degree within New England, with a seemingly infinite number of shell shapes and patterns occurring within a single population (Klemens, 1993; Gibbs et al., 2007).

Eastern box turtle. Photo courtesy of Kevin Ryan. (Photograph taken in 2003 in New York.)

Box turtles are long-lived with centenarians being documented on several occasions. The species can take in excess of ten years to reach sexual maturity, and produces a relatively small number of eggs, accompanied by low survivorship of eggs and juveniles (Klemens, 1993).

Box turtles inhabit old fields as well as open and logged-over woodlands, meadows, pastures, and powerline corridors (Klemens, 1993; Gibbs et al. 2007). They seem to prefer habitat situated on sandy, well-drained soil although they have been encountered in wet meadows and lowland swamps. While primarily terrestrial, box turtles box turtles are often found near water, typically a small stream or pond (Klemens, 1993). In Connecticut, box turtles are found in coastal areas, the Central

Connecticut Lowland, and the hilly regions of southwestern portion of the state, most commonly at elevations below 500' in elevation (Klemens, 1993).

Box turtles are strictly diurnal and in Connecticut are typically active from late-April to mid-October. In spring, early summer, and early autumn the turtles may be active throughout the day and are typically found situated in dappled sunlight in old field habitat or along the edges of wooded areas or fields (Klemens, 1993). In hot weather during the summer months they spend much of their time buried under leaves or in soil, becoming active in the early morning or during/just after rainstorms (Klemens, 1993).

Due to their small home ranges and sedentary habits, box turtles appear to be less vulnerable to habitat fragmentation than more widely-ranging species (e.g., wood turtles) (Klemens, 1993). They nevertheless suffer from habitat loss (Klemens, 1993), overcollection (Levell, 2000 cited in Gibbs et al., 2007) and road mortality, which has translated to long-term declines of the species in many parts of its range (Hall et al., 1999 cited in Gibbs et al. 2007).

1.3 Wood turtle

The wood turtle is relatively large species, with a maximum carapace length of 9.2 inches (average 5.5 to 8 inches) (Gibbs et al., 2007). Individuals tend to have a strongly keeled, sculpted, brown or black carapace with flared rear marginal scutes (Klemens, 1993). The plastron is yellow with a black blotch at the rear outer corner of each scute, and has a v-shaped notch at the tail (Harding, 1997). The limbs and head are dark brown or black. In New England, wood turtles typically have bright orange throats and front limbs (Klemens, 1993).

Wood turtle. Photo courtesy of Kevin Ryan. (Photograph taken in 2003 in New York.)

As with box turtles, wood turtles take over ten years to reach sexual maturity, have low reproductive output, and are long-lived (Klemens 1993). Oliver (1955, cited in Klemens, 1993) reported the species living 58 years in captivity, and Klemens (1993) rarely found turtles younger than 15 to 20 years old.

Wood turtles require riparian habitats bordered by floodplain, woodland, or meadows (Klemens, 1993; Compton et al. 2002, Arvisais 2002, 2004, cited in Gibbs et al, 2007). Individuals may have large home ranges, with terrestrial activity ranging up to 1,000 feet of streams and rivers (Kaufmann 1992, Arvisais et al. 2002, Remsberg et al. 2006), however the species typically inhabits open sites close to water with low canopy cover (Compton et al. 2002). They are also known to use agricultural land (Parham and Feldman, 2000 cited in Gibbs et al., 2007). Wood turtles hibernate in streams in either deep pools or lodged below undercut banks (Klemens, 1993). In Connecticut, spring emergence occurs in late March and early April.

In Connecticut, wood turtles occur statewide, though they are rare in the coastal zone and the eastern portions of Windham and New London counties. The species has declined in the Central Connecticut Lowland due to habitat loss (Klemens, 1993), and has also suffered from overcollection, habitat loss and fragmentation, and associated road mortality (Klemens, 1993; Gibbs et al. 2007).

2. Study Area

The Nutmeg Solar project is situated in the town of Enfield, which is within the Central Connecticut Lowland (Figure 1). The specific study area consists of approximately 190 acres located south of Route 190 (Hazard Road), and east of Route 191 (Broad Brook Road). A Central New England Railroad line runs north-south on the west side of Broad Brook. An Eversource Energy transmission line right-of-way is located just outside of the northeastern corner of the study area. An active concrete batch plant is situated immediately southeast of the study area west of Broad Brook Road. The Scantic River is situated north of the study area across Bailey Road. The majority of the study area is situated 850+ feet from the river although an access road to the site comes within 350 feet of it.

West of Route 191, the study area consists of agricultural fields and associated outbuildings, with the exception of a narrow windbreak of trees running east-west separating agricultural fields. East of Route 191, the study area consists of approximately 32 acres of agricultural fields bordering the road and approximately 109 acres of second growth forest which has a small network of recreational vehicle trails. (Personal communication with Owen Jarmoc indicated that some of the trials were formerly a jeep race course.) One of the parcels at the northern portion of the site consists of a residence with approximately 1.25 acres of manicured lawn.

The forested portion of the study area is dominated by red maple (*Acer rubrum*) and red oak (*Quercus rubra*) with eastern hemlock (*Tsuga canadensis*), black birch (*Betula lenta*), chestnut oak (*Quercus montana*), hickory (*Carya* sp.) and several other species also present. Numerous stump sprouts of American chestnut (*Castanea dentata*) are also present within the forest.

A wetland and watercourse determination and delineation was conducted by Tetra Tech in 2017 (see Environmental Site Conditions Report [Tetra Tech, 2018]). Based on standards set forth by the US Army Corps of Engineers, State of Connecticut, and the Town of Enfield, no wetlands or watercourses are present within the study area due to the absence of hydric soils.

Two areas with visible hydrology do exist within the study area; however both of these features are the result of human activity. The one vernal pool present on site is an excavated depression within the central portion of the study area east of Route 191. It is situated at the bottom of a slope and bordered on its west side by a recreational vehicle trail; historic tire ruts exist within the depression itself. The second area with hydrology is a small open-canopy excavated area approximately 450’ south of the vernal pool. Several sedges (*Carex* sp.) are present in the area. Personal communications with Tetra Tech indicate that soils within the area do not meet the criteria to be considered hydric.

A large forested wetland complex with a scrub-shrub component occurs outside the study area to the southeast. The forested portion of the wetland is dominated by red maple. The scrub-shrub component includes highbush blueberry (*Vaccinium corymbosum*), winterberry (*Ilex verticillata*), and buttonbush (*Cephalanthus occidentalis*).

3. Methods

3.1 Vernal pool survey

A second, seasonally appropriate, assessment of the vernal pool habitat originally identified by Tetra Tech in 2017 was conducted following procedures set forth in Calhoun and Klemens (2002), the Connecticut Association of Wetland Scientists Vernal Pool Monitoring Program Protocol (Connecticut Association of Wetland Scientists, no date) and the Maine Association of Wetland Scientists Vernal Pool Technical Committee, Vernal Pool Survey Protocol (Maine Association of Wetland Scientists, 2014). Associated data forms for each monitoring protocol were completed during the survey (Appendix B).

3.2 Species detection techniques

Cover object searches

Terrestrial and semi-terrestrial salamanders and other herptile species (e.g., snakes) are often found underneath natural cover objects (e.g. rocks and logs) on the forest floor, although amphibian and reptiles can be found in anthropogenic debris as well. Cover object surveys were conducted by examining underneath all accessible rocks, logs, and anthropogenic debris for the presence of amphibian and reptiles underneath them.

Visual encounter surveys

Visual encounter surveys involve field personnel searching a focal area systematically for a known period of time. Visual encounter surveys are an effective technique to rapidly detect species in a given area (Crump and Scott, 1994; Rodda et al. 2007 cited in Vonesh et al., 2010). The technique requires minimal equipment and can be utilized in a variety of habitat types (Vonesh et al., 2010).

To conduct a visual encounter survey, an experienced herpetologist (sometimes accompanied by field assistants) typically selectively searches small areas of habitat determined most likely to yield amphibians and reptiles. The approach potentially yields more species and individuals per unit effort than randomized sampling approaches. Alternatively, an area may be searched via visual encounter surveys using transects where a researcher walks along a specified compass bearing.

At the Nutmeg Solar site, visual encounter surveys consisted of searching areas deemed most likely to yield amphibians and reptiles. This method was supplemented by loosely conducting transect surveys by using a handheld gps to traverse the site to specific locations.

Minnow trapping

Aquatic traps used by amphibian researchers are typically of a funnel design that channel individuals into a holding section which can be accessed by the researcher to recover captured animals. Commercially available wire minnow traps have been used in numerous amphibian studies (e.g. Fronzuto and Verrell, 2000, Ghioca and Smith, 2007 cited in Skelly and Richardson, 2010).

Minnow traps were used to capture pool-breeding amphibians when in their breeding pools. Minnow trapping consisted of placing minnow traps in strategic positions (e.g. along logs, near egg masses) partially submerged in the vernal pool in order to intercept amphibians using it.

Dip netting

Dip nets are commonly used to sample amphibian larvae. Dip-netting can be relatively unstructured if the goal is to detect the presence of particular species. Alternatively, dip net surveys in which elapsed time or number of sweeps is counted can be used to provide estimates of relative abundance of species Dip netting is fast and can be performed in a number of environments. A downside, however, is that effective dip netting relies on the experience of the user (Skelly and Richardson, 2010).

Dip netting was utilized to aid in the detection of amphibian larvae and fairy shrimp. Kevin Ryan conducted all dip netting activity.

Nocturnal vehicular surveys

Conducting a nocturnal vehicular survey (commonly referred to as road running) involves slowly driving along roads at night during and after precipitation events when amphibians are typically most active. Any amphibians encountered on the road are subsequently captured, identified, and released.

Road running was conducted on Bailey Road, which runs east-west for ¾ miles just north of the study area.

4. Results and Discussion

A total of 7 separate site visit days, amounting to 65.5 person-hours were spent on site in the field within the study area to accomplish the vernal pool survey and the general herpetological inventory with emphasis on box and wood turtles (Table 1). FBE's Kevin Ryan led field investigations while accompanied by a herpetological field assistant, Rich Brereton of FBE. Dennis Quinn of CTHerpConsultant, LLC and Jani Quinn joined the field effort on the final day of the investigation.

4.1 Vernal pool assessment

The vernal pool assessment was conducted on April 10–11 and May 2–3, 2018. The pool also was revisited during the general herpetological inventory that occurred on May 14–16, 2018 and during an eastern spadefoot survey on June 18. A total of six wood frog and four spotted salamander egg masses were observed during the field investigations (during the 2017 assessment of the pool, Tetra Tech observed two wood frog and ten spotted salamander egg masses). Sixteen dip-net sweeps were completed on April 11, 2018 and did not yield any amphibian larvae (specifically marbled salamander tadpoles) or fairy shrimp. None of the 20 minnow traps set in the pool on April 10 contained any adult amphibians the following day, indicating that breeding had likely already concluded. Extensive visual encounter and cover object searches conducted within the vernal pool envelope and beyond yielded numerous redback salamanders (*Plethodon cinereus*) but no pool-breeding species.

Table 1. Survey effort at the proposed Nutmeg Solar site, Enfield, CT.

Date	Field personnel	Hours on site	Total person-hours
10-Apr-18	Kevin Ryan	2	2
11-Apr-18	Kevin Ryan	4.5	4.5
2-May-18	Kevin Ryan, Rich Brereton	2.5	5
3-May-18	Kevin Ryan, Rich Brereton	5	10
14-May-18	Kevin Ryan, Rich Brereton	7 (KR), 3 (RB)	10
15-May-18	Kevin Ryan, Rich Brereton	11	22
16-May-18	Kevin Ryan, Rich Brereton, Dennis Quinn, Jani Quinn	3	12
	Total	**38**	**65.5**

According to the standards set forth in Calhoun and Klemens (2002), the pool meets the criteria for consideration as a Tier 1 vernal pool. This classification is based on three observations: 1) two vernal pool indicator species (wood frog and spotted salamander) were documented using the pool, 2) the entire vernal pool envelope (100' from the edge of the pool) is forested (note, however, that a narrow recreational vehicle trail runs along the west side of the pool), and 3) 99.2% of the critical terrestrial habitat (100'-750'from the pool) is considered undeveloped (although 31.1% of the critical terrestrial habitat is active agricultural field) (Table 2, Figure 2).

While the pool meets the criteria for consideration as a Tier 1 pool, egg mass counts were low in both 2017 and 2018. The low egg mass numbers indicate populations of both spotted salamander and wood frog using the pool are not robust (wood frogs and spotted salamanders averaged one and two egg masses per female, respectively [Berven, 1988 and Petranka 1998, cited in Faccio, 2011]).

The critical terrestrial habitat surrounding the pool is comprised of 67.1% forest. Combined with the vernal pool envelope, this forested area provides suitable terrestrial habitat for wood frog, spotted salamander, and other amphibian species. The shade, leaf litter, and coarse woody debris within this forest provide protection from desiccation and predation, and also provides habitat for amphibian prey – all components of diurnal refugia.

Table 2. Development status and cover type for the vernal pool envelope and critical terrestrial habitat at the proposed Nutmeg Solar site, Enfield, CT.

Development Status	Cover Type	0'-100' Vernal Pool Envelope (acres)	0'-100' Vernal Pool Envelope (percent)	100'-750' Critical Terrestrial Habitat (acres)	100-750' Critical Terrestrial Habitat (percent)
Undeveloped	Agriculture	-	-	13.1	31.1
Undeveloped	Forested	1.1	100	28.3	67.1
Undeveloped	Open-canopy excavated area	-	-	0.4	1.0
Developed	Building	-	-	0.4	0.8
	Total	**1.1**	**100**	**42.2**	**100.0**

In contrast, the remaining 32.9% of the critical terrestrial habitat zone of the pool is comprised almost entirely of actively managed agricultural fields (see Table 2), and likely does not provide suitable diurnal refuge for amphibians due to full exposure to sunlight and lack of leaf litter and cover objects. While amphibians likely do not use the agricultural fields for shelter or food, it is possible that they could travel across them during precipitation events or otherwise wet conditions at night to reach suitable habitat. Cline and Hunter (2014) quantified the relative permeability of different types of open-canopy vegetation to juvenile wood frogs. The authors found that permeability varied between open-canopy cover types in the following order, beginning with the least permeable: row crop < hayfield < clear-cut < open lawn < moderate-cover lawn. The current condition of the field would be considered the least permeable based on Cline and Hunter (2014). The ground under the panels installed within what is currently agricultural field will be maintained as meadow, which according to the findings of Cline and Hunter (2014) should increase the permeability of the area for amphibians.

The pool was observed to contain no standing water on 18 June. Antecedent precipitation was slightly above average in April and May, indicating that the pool has a very short hydroperiod in most years. In addition to FBE's observation that the pool had dried by mid-June, water in the pool was relatively shallow in April and May, the deepest portion being approximately 24 inches. Furthermore, the pool's predominate substrate is mineral soil with very little muck present, and soil within the pool basin was determined not hydric by Tetra Tech.

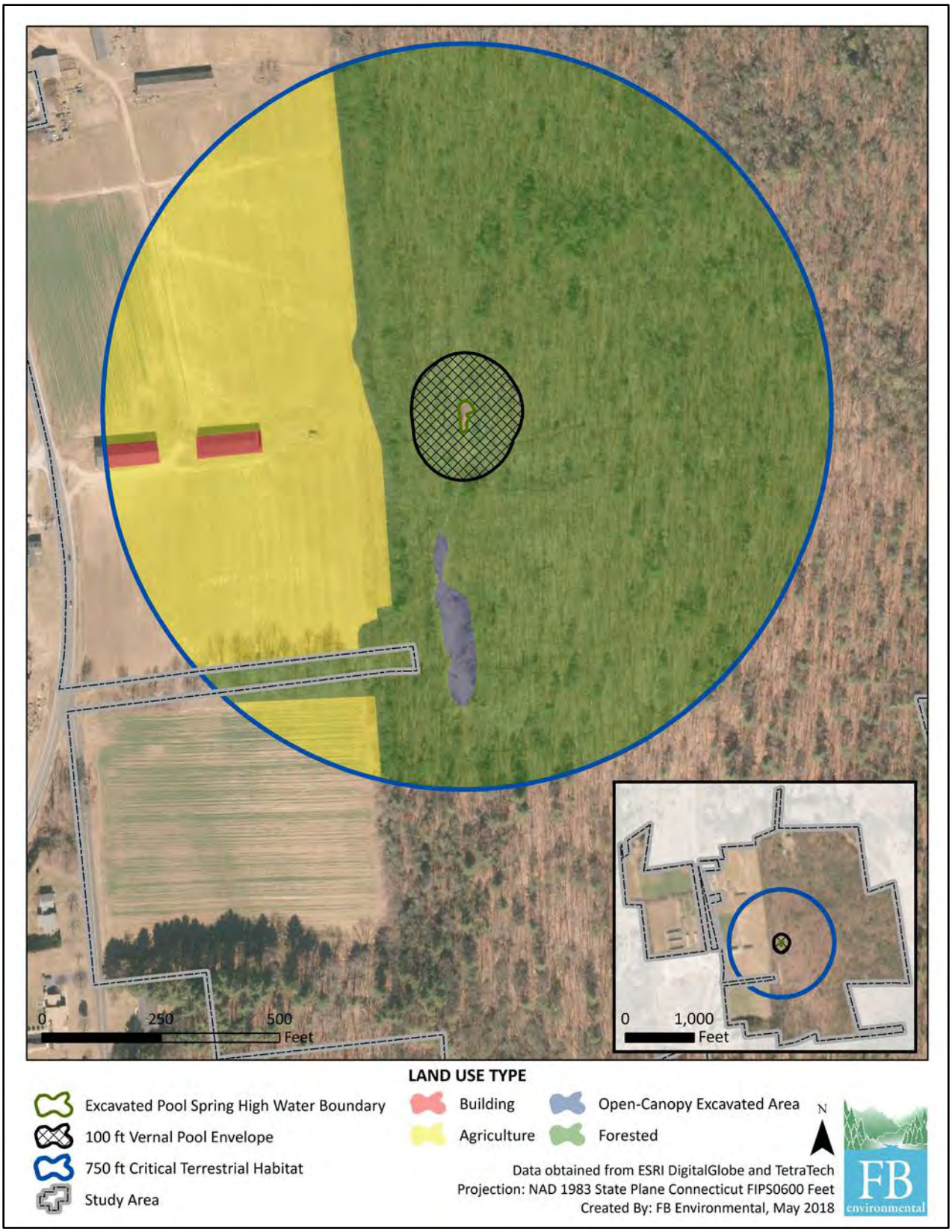

Figure 2. Map of cover types within the vernal pool envelope and critical terrestrial habitat at the proposed Nutmeg Solar site in Enfield, CT.

In Connecticut, wood frog metamorphs typically begin to emerge from their natal wetlands in early- to mid-June. The pool therefore likely produces wood frog metamorphs in years where rain keeps the pool inundated into the month of June. Spotted salamander metamorphs, however, typically do not emerge from their natal wetlands until early- to mid-July. The pool at the Nutmeg site therefore likely serves as a sink for wood frogs in some years and spotted salamanders in most years.

In some instances, a site may contain clustered pools that may have low egg mass numbers due to the abundance of suitable areas for pool-breeding amphibians to deposit eggs, spreading out the breeding and egg-depositing activity. The isolated nature of the pool at the Nutmeg site, however, suggests that it contains low egg mass numbers because of low overall use by wood frogs and spotted salamanders.

Wetlands are present not far from the site boundaries that are very likely significantly more productive than the pool within the study area. While assessing wood turtle habitat along the Scantic River in Scantic River State Park (accessed from Bailey Road) numerous spotted salamander egg masses were observed in pools situated in historic canals. The large forested wetland complex with a scrub-shrub component just outside the study area to the southeast also appears to have the potential to be very productive habitat for pool-breeding amphibians. The wetland also has an expectedly much longer hydroperiod than the pool at the Nutmeg site due to having deep water, deep muck, and obligate wetland vegetation (e.g., buttonbush, *Cephalanthus occidentalis*). It is probable that the excavated pool at the Nutmeg Solar site is colonized by individual salamanders from populations that use the other two aforementioned wetland areas.

In summary, despite having an intact envelope and relatively intact critical terrestrial habitat, the excavated pool at the Nutmeg Site is not of high biological value, especially when compared to other wetlands within the general area. This is because it had relatively low egg mass numbers in both years it was surveyed and the pool's short hydroperiod likely makes it a sink in most years.

4.2 General herpetological inventory with emphasis on box turtles and wood turtles

Searches for box and wood turtles occurred on May 14, 15, and 16, during the early portion of their overall activity season. (The species were also searched for on April 11 and May 2 and 3 as well.) Weather was suitable to conduct searches on all three days (May 14-16) within nighttime temperatures in the 50s Fahrenheit and daytime high temperatures ranging from the high 60s to low 80s Fahrenheit. Heavy thunderstorms occurred during the afternoon and early evening of May 15. The study area was also searched during the evening of May 15 (as part of an effort to detect the presence of the eastern spadefoot toad).

Eastern box turtle

The portion of the study area west of Route 191 appears to contain marginal box turtle habitat. The area consists almost entirely of agricultural fields and is for the most part surrounded by development. It is unlikely that box turtles occur in this area. Furthermore, no solar panels are proposed to be installed in this section of the study area.

The study area east of Route 191 appears to contain some suitable box turtle habitat. Within this general area, the areas where box turtles would most likely be encountered are along the edges of the agricultural fields adjacent to the forest, the small disturbed meadow area, the powerline right-of-way, and the edge of the orchard located along the eastern boundary of the project site. This is especially so during the early

portion of their activity season (late April through May). Within the forested portion of this area, patches of lowbush blueberry and black huckleberry that receive dappled sunlight could also provide suitable habitat.

Assessments of potential box turtle habitat and site surveys were conducted by Kevin Ryan on April 10–11, 2018, and Kevin Ryan and Rich Brereton on May 2–3, 2018. Kevin Ryan and Rich Brereton searched for box turtles extensively on May 14–15, 2018 and did not detect any turtles. Dennis Quinn, whom has a great deal of experience surveying for box turtles, joined the effort with a field assistant, Jani Quinn, on May 16, 2018. Despite extensive searching by persons with demonstrated ability to detect the presence of box turtles, the species was not observed.

Distance of waterbodies from the study area is a possible explanation for the lack of box turtles encountered during the survey effort. Both Klemens (1993) and Gibbs et al. (2007) state that box turtles are seldom found far from small streams or ponds. Harding (1997) emphasizes that access to water (e.g., small ponds, seepages, springs, bogs, or slow streams) is an important factor regarding presence of the turtle in a given area. The entire study area is well-drained and hence very dry.

The forested/scrub-shrub wetland located offsite to the southeast represents a potential water source for box turtle; however, the wetland is situated in hemlock forest, which is not typically considered box turtle habitat. The nearest suitable habitat, consisting of deciduous forest and field forest edge, are located approximately 500 feet and 700 feet from the wetland, respectively.

Wood turtle

The Scantic River is the watercourse nearest the study area from which wood turtles could emanate. The river does appear to be suitable wood turtle habitat, and no wood turtles were observed during observations of the river north of the study area. As individuals of the species are known to move upwards of 1,000 feet from watercourses, it is possible, though unlikely, that a wood turtle would travel to the study area from the Scantic River. An individual turtle would need to cross Bailey Road and the residential development situated along it in order to reach any habitat.

Other reptile and amphibian species

Data on the presence and distribution of amphibians and reptiles was collected throughout the entire field investigation. In general, the site exhibits low herptile diversity, as only a total of six amphibian and one reptile species were detected at the site (Table 3). Additional field surveys later in the activity season could potentially yield several more species.

Table 3. Vernal pool envelope and critical terrestrial habitat calculations for the vernal pool at the proposed Nutmeg Solar site, Enfield, CT.

Scientific Name	Common Name	Age class	Observation Location(s)
		Salamanders	
Ambystoma maculatum	Spotted salamander	Eggs	Vernal pool.
Plethodon cinereus	Redback salamander	Adults	Throughout forest.
		Frogs	
Anaxyrus americanus	American toad	Adults, juveniles	Throughout forest and AOR on Bailey Road. Heard calling just offsite.
Hyla versicolor	Gray treefrog	Adults	Observed AOR on Bailey Road. Heard calling just offsite.
Lithobates sylvaticus	Wood frog	Eggs, juveniles	Vernal pool (eggs) and surrounding forest (juveniles), AOR on Bailey Road.
Pseudacris crucifer	Spring peeper	Adults	Heard calling just offsite.
		Snakes	
Thamnophis sirtalis	Common garter snake	Adults	Forest, powerline corridor, windbreak.

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Appendix A. Photographs

Photo 1. The vernal pool with minnow traps set on April 10, 2018.

Photo 2. The vernal pool and ATV trail that runs alongside it. Ruts are also present within the pool itself. Photograph taken April 10, 2018.

Photo 3. A windbreak separating agricultural fields was identified as potential box turtle habitat. Photograph taken May 14, 2018.

Photo 4. The edges of agricultural fields bordering the woods were identified as potential box turtle habitat. Photograph taken May 14, 2018.

Photo 5. An area of potential box turtle habitat in the forest interior. Photograph taken May 15, 2018.

Photo 6. The forest interior. Hardwoods are dominant in the forested portion of the study area. Photograph taken May 3, 2018.

Photo 7. A hemlock stand within the forested portion of the study area. Photograph taken May 14, 2018.

Photo 8. A wood frog observed within the forest interior. Photograph taken May 14, 2018.

Photo 9. An ATV trail within the forest interior. Photograph taken May 15, 2018.

Photo 10. The small excavated area with an open canopy. Photograph taken May 14, 2018. .

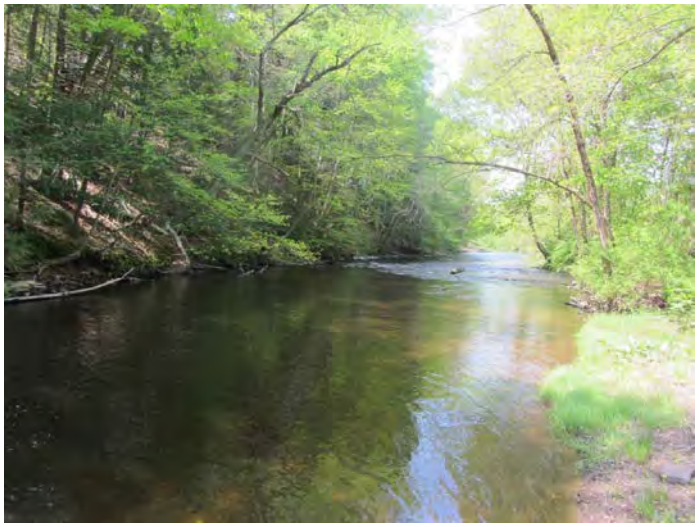


Photo 111. The Scantic River nearest the study area. Photograph taken May 15, 2018.

Photo 12. The Scantic River within Scantic River State Park. Photograph taken April 11, 2018.

Appendix B. Completed vernal pool data forms

VERNAL POOL DATA SHEET

Survey Date: 11 April 2018 | Investigator(s): Kevin Ryan | Town: Enfield | CAWS Pool #: – | CAWS Project #: –

Town Staff Contacted? Yes ☐ No ☒ | Project/property name: Nutmeg Solar | Pool Type: Development: ☒ Reference: ☐

Address/location (*or include annotated map*): | Investigator's Contact information: Kevinr@fbenvironmental.com

SEARCH CONDITIONS AND METHODS *(required)*

WEATHER: 30 F

Precipitation: Within last

Current	24 hours
0	0.09"

Cloud Cover:
clear ☒
partly cloudy ☐
mostly cloudy ☐
full cloud cover ☐

Start time: 0715
End time: 1130

Methods used:
Visual ☒
Dipnetting ☒

Type of Inspection:
baseline ☒
during construction ☐
post construction ☐

Polarized sunglasses used? Yes ☒ No ☐

Comments: Flagging not used due to low # of egg masses in Pool

Temporary flagging used to mark egg masses? Yes ☐ No ☒

AMPHIBIAN EGG MASS COUNTS *(required)*

Wood frogs: ☒ 1-25 ☐ 26-49

condition	Abundance categories			
If condition mixed, note "some", "many" or "most"	<50	☐	250-300	☐
	50-75	☐	300-400	☐
	75-100	☐	400-500	☐
	100-150	☐	500-750	☐
	150-200	☐	750-1000	☐
intact: 6	200-250	☐	1000-1250	☐
breaking up: 0			>1250	☐
hatching: 0				

Describe estimation method used for a large raft:

Spotted Salamanders:

Condition:

	Total Number
intact: 4	4
breaking up: 0	
hatching: 0	

ADDITIONAL NOTES: *(optional)*

Second field visit occured on 2 May 2018*. No additional egg masses detected. Wood frog eggs hatching, spotted salamander eggs have curved embryos.

*2-3:30pm

No precip within previous 24 hours of May 2 = 0"

CONDITIONS/OBSERVATIONS WITHIN POOL *(required data)*

			Flowing	Not flowing
Inlet observed?	No ☒	Yes ☐	☐	☐
Outlet observed?	No ☒	Yes ☐	☐	☐
finfish observed?	No ☒	Yes ☐		

Estimated water depth range? max of ca. 2 feet

Optional Data (see also back of sheet)

Other Vernal Pool Species:
fairy shrimp present? Yes ☐ No ☒
marbled salmander larvae present? Yes ☐ No ☒

Vegetation (within or overhanging pool):
Trees/Saplings: Acer rubrum, Betula populifolia
Shrubs/Vines:
Herbs:
Percent tree canopy closure?
Woody debris content? High ☐ Med. ☐ Low ☐

Pool Substrate: (top three)
Mud/muck ☒ Sand/Silt ☐ Peat ☐ Bedrock ☐ Leaf Litter ☒ Silt/clay ☐ Gravel/cobbles ☐

Water Quality:
ph ☐ conductivity(µS/cm) ☐ temperature (°C) ☐
Nitrate-N (mg/l) ☐ Total P (ug/l) ☐ DO(mg/l) ☐
turbidity(NTU's) ☐ Sulphidic odor? No ☐ Yes ☐
Approximate % cover by algal mat or duckweed? ☐
GPS coordinates:

CONDITIONS IN ENVELOPE WITHIN 100 FT OF POOL *(required data)*

Give approximate percentage or show on sketch on back

Landuses/conditions

forest	100	shrubland	0	meadow	0
pasture	0	lawn	0	building	0
exposed soil	<3	grading	0	ag. field	0
road	0	busy (>1 car/10 min.)	yes ☐	no ☒	
parking lot	0				

Comments: old woods road runs along west side of Pool

Leaf Litter: *If variable, note location (e.g. "N. shore")*

none/low:	
moderate:	X
high:	

Cover Objects:	Logs	Rocks
none:		
low:		X
moderate:	X	
high:		

Dominant vegetation *(optional)*
Trees/saplings: Acer rubrum, Betula populifolia
Shrubs/Vines: –
Herbs: –

CONDITIONS IN ENVELOPE AROUND POOL *(required data)*

Estimate %cover (Hi, Med, Low, VLow, None)

Landuses	Within 100 feet	100'-300' *(optional)*
forest	Hi (100)	
shrubland	none	
exposed soil	vlow (<3)	
pavement	none	
building	none	
lawn	none	
field	none	
busy road (<1 car/10 min.)?	yes ☐	yes ☐

Leaf Litter within 100' (in wooded cover type)

none/low:	
moderate:	X
high:	

Cover Objects:	Logs	Rocks
none:		
low:		X
moderate:	X	
high:		

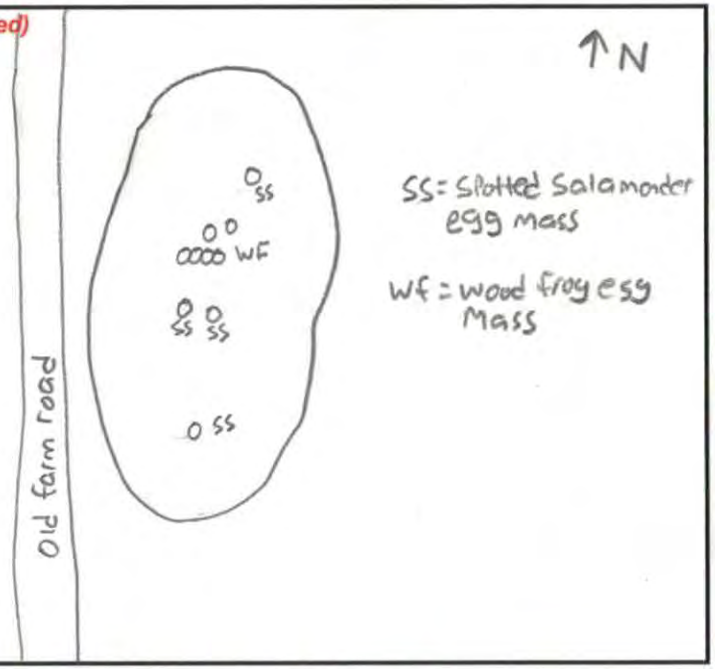
Dominant vegetation within 100 *(optional)*
Trees/saplings:
Shrubs/Vines:
Herbs:

VERNAL POOL DATA SHEET, *p. 2*

Survey Date: 11 April 2018	Investigator(s): Kevin Ryan	Town: Enfield	CAWS Pool #: —	CAWS Project #: —
Project/property name: Nutmeg Solar			Pool Type:	Development: ☐ Reference ☐

*Draw a **rough, quick** sketch of the pool showing **approximate locations of egg mass rafts & clusters** in relation to pool features, like logs, algal mats, and islands. Show inlet/outlet if present. Include north arrow and approximate scale.*

SKETCH OF POOL ***(required)***



WILDLIFE OBSERVATIONS: *(optional)*

Checklist of Facultative Herptile Fauna (Pool & Fringe):

Green Frog	☐	Spring Peeper	☐
Pickerel Frog	☐	Gray Tree Frog	☐
Bull Frog	☐	Pickerel Frog	☐
Eastern Toad	☐	Painted Turtle	☐
Spotted Turtle	☐	Snapping Turtle	☐
N. Water Snake	☐	Blue-spot. salam.	☐

Other Observed Fauna (Pool & Fringe):

*Draw a **rough, quick** sketch of the pool's **terrestrial envelope,** extending at least 200' from pool in all directions. Provide **detail on conditions & landuses within 100 feet of edge of pool.** Include north arrow and approximate scale.*

SKETCH OF TERRESTRIAL ENVELOPE AROUND POOL ***(required)***

Circle any of the following factors that impaired your ability to observe egg masses, and indicate severity of impairment.

Factor	Severity (Low/Mod./High)
1. Surface algae	
2. Surface pollen	
3. Dark, tannin-colored water	
4. Deep water	
5. Turbidity	
6. Dense shrubs	
7. Other (specify)	

ADDITIONAL NOTES: *(optional)*

VERNAL POOL ASSESSMENT SHEET

A. Biological Value of the Vernal Pool

(1) Are there *any* state-listed species (Endangered, Threatened, or Special Concern) present or breeding in the pool?
Yes_____ No__X__

(2) Are there two or more vernal pool indicator species breeding (i.e., evidence of egg masses, spermatophores [sperm packets], mating, larvae) in the pool?
Yes__X__ No_____

(3) Are there 25 or more egg masses (regardless of species) present in the pool by the conclusion of the breeding season?
Yes_____ No__x__

B. Condition of the Critical Terrestrial Habitat

(1) Is at least 75% of the vernal pool envelope (100 feet from pool) undeveloped?
Yes__x__ No_____

(2) Is at least 50% of the critical terrestrial habitat (100-750 feet) undeveloped?
Yes__x__ No_____

NOTE: For these purposes, "undeveloped" means open land largely free of roads, structures, and other infrastructure. It can be forested, partially forested, or open agricultural land.

Cumulative Assessment

Number of questions answered YES in category A	Number of questions answered YES in category B	Tier Rating
1-3	2	Tier I
1-3	1	Tier II
0	1-2	Tier III
1-3	0	Tier III

CAUTION! *This rating system is designed strictly as a planning tool, not as an official assessment tool.* It will enable you to determine the relative ecological value of pools within your community. A Tier I rating—which will most likely apply to only a minority of sites—denotes exemplary pools; Management Recommendations should be applied at these sites. For pools rated as Tier II, proceed with care; you need more information! Tier II pools will probably constitute the majority of your vernal pool resources; Management Recommendations should be applied at these sites to the maximum extent practicable. Tier II pools might also be likely candidates for restoration efforts (e.g., reforestation of the critical terrestrial habitat).

Vernal Pool Surveys, and Wetland and Watercourse Delineation – Nutmeg Solar (November 2017). Prepared by Tetra Tech, Inc. for NextEra Energy Resources, LLC.

Vernal Pool Survey, and Wetland and Watercourse Delineation

Nutmeg Solar Project
Enfield, Connecticut

Prepared for:

Nutmeg Solar, LLC
700 Universe Blvd
Juno Beach, FL 33408

October 11, 2017;
Revised January 29, 2018

TETRA TECH

Table of Contents

Attachments

1 INTRODUCTION

Tetra Tech Inc. (Tetra Tech) conducted vernal pool surveys in April and May 2017, and a wetland and waterbody delineation in June 2017 at the location of the proposed Nutmeg Solar Project (Project) located in the Town of Enfield, Connecticut. This report outlines the results of these natural resource surveys.

2 PROJECT UNDERSTANDING

Nutmeg Solar, LLC (Nutmeg Solar), an affiliate of NextEra Energy Resources (NEER), is proposing this Project. The Study Area consists of 191 acres of land comprised of multiple parcels located south of Route 190 (Hazard Road), and east of Route 191 (Broad Brook Road) in the Town of Enfield, Connecticut (Figure 1). Nutmeg Solar is planning the development of an approximately 20 megawatt (MW) solar development within parts of the surveyed area.

3 SITE DESCRIPTION

The proposed Project site is primarily comprised of agricultural fields and outbuildings, and mixed second-growth forest. The Project site consists of ongoing agricultural operations, and there is evidence of historic, as well as ongoing, gravel extraction activities on the property. The forested area within the eastern portion of the Project has a small network of recreational vehicle trails and tree stands indicating the current use of this land is primarily for hunting and recreational activities. Portions of the property in agricultural use show crop production of tobacco, pumpkin and other squash. A small number of livestock are kept on the property as well. The site has been actively used for agricultural purposes, specifically tobacco production, since 1907 (Pers. Comm. Steve Jarmoc, landowner).

4 SURVEY METHODS

Vernal Pools

Vernal pool surveys were completed by Tetra Tech in April and May 2017 following the Connecticut Association of Wetland Scientists Vernal Pool Monitoring Program Protocol (Connecticut Association of Wetland Scientists). Additional guidance concerning pool assessment methods, decontamination procedures, and assessor qualifications was taken from the Maine Association of Wetland Scientists Vernal Pool Technical Committee Vernal Pool Survey Protocol[1]. To capture the different breeding periods of vernal pool species, two site visits were completed for this survey on April 17, and May 2, 2017.

Wetland and Waterbody Delineation

A wetland and waterbody delineation was completed for the Project during the growing-season, in June 2017. Surveys were conducted in accordance with the definition of a wetland described in the Inland Wetlands and Watercourses Regulations of the Town of Enfield[2]. Additionally natural resource surveys were completed according to the technical criteria described in the U.S. Army Corps of Engineers (USACE)

[1] Maine Association of Wetland Scientists. 2014. Vernal Pool Survey Protocol. Vernal Pool Technical Committee. April 2014. 84 pp. Available online at: https://static1.squarespace.com/static/5113deede4b0a785ada17b27/t/537415c4e4b003ad4653fb5a/1400116676556/Complete+MAWS+2014+VP+Survey+Protocol_v3_05.14.2014.pdf

[2] Town of Enfield. 2011. Inland Wetlands and Watercourses Regulations. March 1, 2011. Available online at: http://www.enfield-ct.gov/documentcenter/view/236. Accessed September 19, 2017.

1987 Wetland Delineation Manual[3], and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Regional Supplement Version 2.0[4]. Our protocol calls for wetland and stream boundaries to be delineated in the field with pink and blue alpha-numeric coded flagging and located using iPads equipped with Collector for Arc GIS connected via Bluetooth to EOS Positioning Systems, Arrow 100 Sub-meter Global Navigation Satellite System (GNSS).

5 SURVEY RESULTS

Vernal Pools

Amphibian breeding activity was observed in one area during the survey. This pool is within an old excavated depression occurring at the bottom of a slope within a forested area located directly adjacent to a recreational vehicle trail. The pool was inundated in the spring and covered an area of approximately 20 feet by 68 feet. Water during the time of visit was very shallow. During the first visit, two wood frog (*Lithobates sylvaticus*) and 10 spotted salamander (*Ambystoma maculatum*) egg masses were observed. At the second visit, the wood frog egg masses had hatched and six spotted salamander egg masses were observed. Appendix A provides photographs of the area, Appendix B provides the Maine State Vernal Pool Assessment Form that was completed during the two site visits. During the wetland delineation, the area was determined to not to be a jurisdictional wetland due to the lack of hydric soils. This area was completely dry when observed on August 1, 2017 and found to contain vehicle ruts. Figure 1 shows the location of this vernal pool where it occurs in the Survey Area.

Wetland and Waterbody Delineation

Results of the wetland and waterbody survey did not identify any wetland or waterbody resources that would be regulated by the USACE, the Town of Enfield, or the Connecticut Department of Environmental Protection. There are no soils observed within the survey area that are classified as poorly drained, very poorly drained, alluvial, or floodplain. Soils in the area of the vernal pool are characterized as a dull reddish brown (5YR 4/3) with a coarse sandy loam texture. The depression is surrounded by red maple (*Acer rubrum*) and paper birch (*Betula papyrifera*) in the tree stratum with mountain laurel (*Kalmia latifolia)*, red maple and high-bush blueberry (*Vaccinium angustifolium)* growing sparsely in the shrub stratum. Very few herbaceous plants were observed and included evergreen wood fern (*Dryopteris intermedia*) and eastern spicy wintergreen (*Gaultheria procumbens)*. No other resources within the survey area were found to meet the definition of a wetland or watercourse by the USACE, Town of Enfield, or Connecticut standards.

6 CONCLUSIONS

Results of the wetland and waterbody, and vernal pool surveys did not identify any wetlands or watercourses in at the Project site (Figure 1). Amphibian breeding was observed in an old excavation within the Study Area, the pool is very low functioning and may not have a hydroperiod long enough to support vernal pool breeding amphibians. The area does not appear to meet the regulatory definition of

[3] Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. USACE. January 1987 – Final Report. 143 pp. Available online at: http://www.cpe.rutgers.edu/Wetlands/1987-Army-Corps-Wetlands-Delineation-Manual.pdf

[4] Wakeley, J.S., Lichvar, R. W., Noble, C. V. and Berkowitz, J. F. 2012. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0), ed. ERDC/EL TR-12-1. U.S. Army Engineer Research and Development Center, Vicksburg, MS.

a wetland or watercourse according to the Enfield Inland Wetlands and Watercourses Regulations. However, this definition does not provide a conclusive determination for this particular resource.

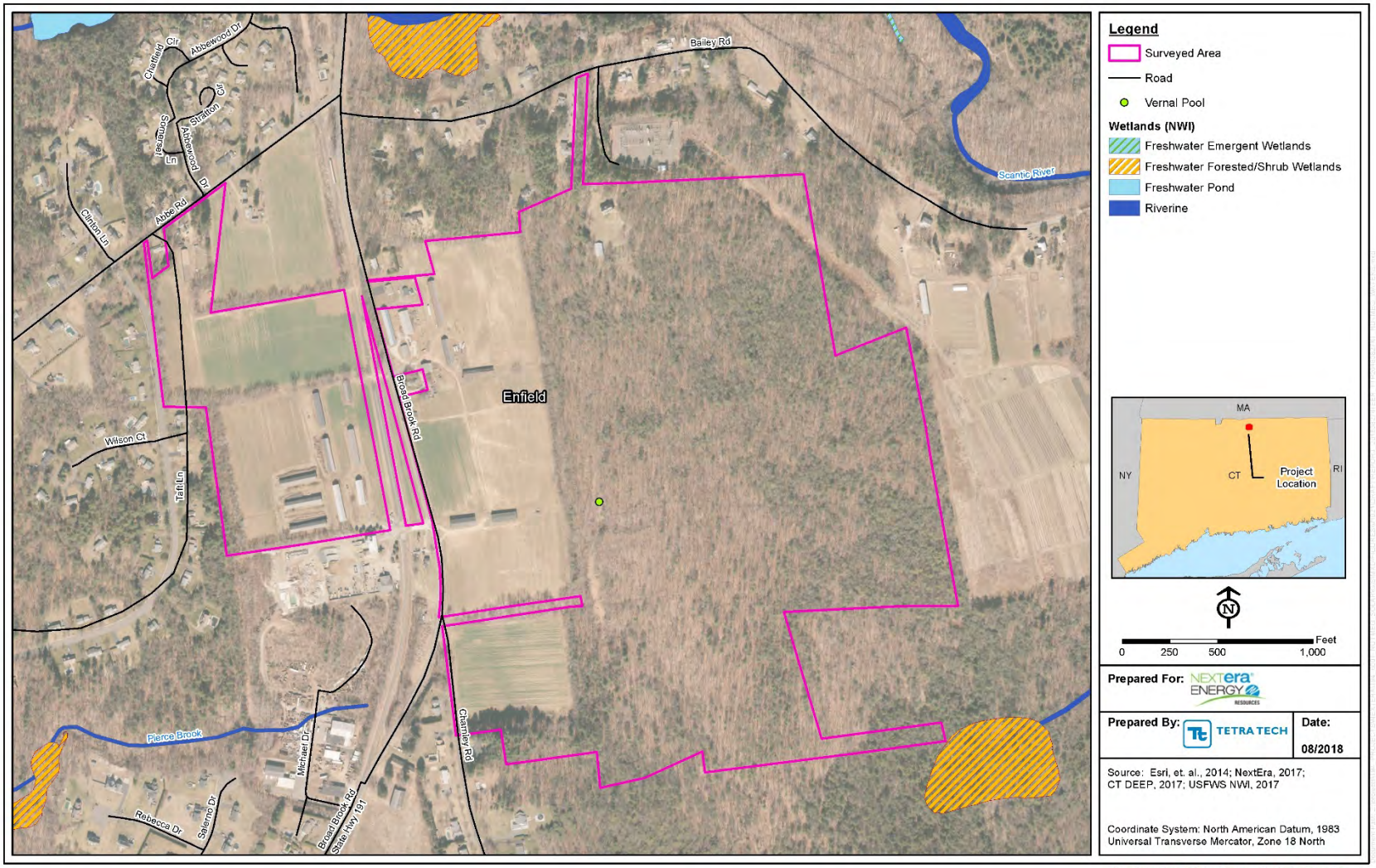


Figure 1. Vernal Pools, Wetlands, and Waterbodies of the Nutmeg Solar Project, Enfield, Connecticut.

Appendix A
Nutmeg Solar
Wetland Delineation and Vernal Pool Survey Site Photographs

Photo 1: Facing north toward the vernal pool observed to contain amphibian breeding activity. This pool is the result of a human-made excavation adjacent to a woods road and at the toe of a slope.

Date: May 2, 2017

Tetra Tech, Inc.

Photo 2: Facing north toward the vernal pool. Old tire ruts are visible within the dry depression, and signs of historic excavation are visible on the right-hand side of the photo. This area does not meet the regulatory definition of wetland due to the lack of hydric soils.

Date: August 1, 2017

Tetra Tech, Inc.

Appendix B
Nutmeg Solar
Maine State Vernal Pool Assessment Form

VPB01 BA, ML

NEER: NUTMEG SOLAR

FLAGS 1 - 12

Maine State Vernal Pool Assessment Form

~~HARTFORD~~, CT ENFIELD

5. VERNAL POOL HABITAT INFORMATION

a. Habitat survey date (only if different from indicator survey dates on page 3): 4-17-2017, 5-2-17

b. Wetland habitat characterization

■ Choose the best descriptor for the landscape setting:

- [x] Isolated depression
- [ ] Floodplain depression
- [ ] Pool associated with larger wetland complex
- [ ] Other: _____

■ Check all wetland types that best apply to this pool:

- [ ] Forested swamp
- [ ] Shrub swamp
- [ ] Peatland (fen or bog)
- [ ] Emergent marsh
- [ ] Wet meadow
- [ ] Lake or Pond Cove
- [ ] Abandoned beaver flowage
- [ ] Active beaver flowage
- [ ] Slow stream
- [ ] Floodplain
- [x] Isolated pool
- [ ] Other: _____

LIKELY UNNATURAL

c. Vernal pool status under the Natural Resources Protection Act (NRPA)

i. Pool Origin: [ ] Natural [ ] Natural-Modified [x] Unnatural [ ] Unknown

If modified, unnatural or unknown, describe any modern or historic human impacts to the pool (required):

APPEARS TO BE THE RESULT OF EXCAVATION. EVIDENCE IS BERMS ALONGSIDE TRAIL (or original wood road at natural slope break)

ii. Pool Hydrology

■ Select the pool's estimated hydroperiod AND provide rationale for opinion.

- [ ] Permanent
- [ ] Semi-permanent (drying partially in all years and completely in drought years)
- [x] Ephemeral (drying out completely in most years)
- [ ] Unknown

Explain:

VERY SHALLOW

■ Maximum depth at survey: [x] 0-12" (0-1 ft.) [ ] 12-36" (1-3 ft.) [ ] 36-60" (3-5 ft.) [ ] >60" (>5 ft.)

■ Approximate size of pool (at spring highwater): Width: 20 [ ] m [x] ft Length: 68 [ ] m [x] ft

■ Predominate substrate in order of increasing hydroperiod:

- [x] Mineral soil (bare, leaf-litter bottom, or upland mosses present)
- [ ] Mineral soil (sphagnum moss present)
- [ ] Organic matter (peat/muck) shallow or restricted to deepest portion
- [ ] Organic matter (peat/muck) deep and widespread

■ Pool vegetation indicators in order of increasing hydroperiod (check all that apply):

- [ ] Terrestrial nonvascular spp. (e.g. haircap moss, lycopodium spp.)
- [ ] Dry site ferns (e.g. spinulose wood fern, lady fern, bracken fern)
- [ ] Moist site ferns (e.g. sensitive fern, cinnamon fern, interrupted fern, New York fern)
- [ ] Moist site vasculars (e.g. skunk cabbage, jewelweed, blue flag iris, swamp candle)
- [ ] Sphagnum moss (anchored or suspended)
- [ ] Wet site ferns (e.g. royal fern, marsh fern)
- [ ] Wet site shrubs (e.g. highbush blueberry, maleberry, winterberry, mountain holly)
- [ ] Wet site graminoids (e.g. blue-joint grass, tussock sedge, cattail, bulrushes)
- [ ] Aquatic vascular spp. (e.g. pickerelweed, arrowhead)
- [ ] Floating or submerged aquatics (e.g. water lily, water shield, pond weed, bladderwort)
- [x] No vegetation in pool

■ Faunal indicators (check all that apply):

- [ ] Fish
- [ ] Bullfrog or Green Frog tadpoles
- [x] Other: EGG MASSES (SPOTTED SAL, WF)

iii. Inlet/Outlet Flow Permanency

Type of inlet or outlet (a seasonal or permanent channel providing water flowing into or out of the pool):

- [x] No inlet or outlet
- [ ] Intermittent inlet or outlet
- [ ] Permanent inlet or outlet (channel with well-defined banks and permanent flow)
- [ ] Other or Unknown (explain): _____

BRAD AGIUS[1,2], MIKE LIN[1], Kaitlin Nickerson[2]

1,2 = visit #

Maine State Vernal Pool Assessment Form

6. VERNAL POOL INDICATOR INFORMATION

a. Indicator survey dates: 4-17-17, 5/2/17.

b. Indicator abundance criteria

- Was the entire pool surveyed for egg masses? (X) Yes ( ) No; what % of pool surveyed?_____
- For each indicator species, indicate the exact number of egg masses, confidence level for species determination, and egg mass maturity. Separate cells are provided for separate survey dates.

INDICATOR SPECIES	Egg Masses (or adult Fairy Shrimp) #			Confidence Level[1]		Egg Mass Maturity[2]		Tadpoles/Larvae Observed		Confidence Level[1]	
Wood Frog	2	H		3		A/H	H	Yes	Yes	3	3
Spotted Salamander	10	6		3	3	M	A		NO		
Blue-spotted Salamander	Ø	Ø		3							
Fairy Shrimp[3]				3							

1-Confidence level: 1 = <60%, 2 = 60-95%, 3 = >95%

2-Egg mass maturity: F= Fresh (<24 hrs), M= Mature (round embryos), A= Advanced (loose matrix, curved embryos), H= Hatched or Hatching

3-Fairy Shrimp: X = present

c. Rarity criteria

- Note any rare species associated with vernal pools. Observations should be accompanied by photographs (labeled with observer name, pool location, and date).

SPECIES	Method of Verification* P	H	S	CL**	SPECIES	Method of Verification* P	H	S	CL**
Blanding's Turtle	☐	☐	☐		Wood Turtle	☐	☐	☐	
Spotted Turtle	☐	☐	☐		Ribbon Snake	☐	☐	☐	
Ringed Boghaunter	☐	☐	☐		Other:	☐	☐	☐	

*Method of verification: P = Photographed, H = Handled, S = Seen

**CL - Confidence level in species determination: 1= <60%, 2= 60-95%, 3= >95%

d. Optional observer recommendation:

☒ SVP ☐ Potential SVP ☐ Non Significant VP ☐ Indicator Breeding Area

e. General vernal pool comments and/or observations of other wildlife:

~~LIKELY GRAVEL ROAD WAS CREATED DURING~~ POSSIBLE SITE OF OLD ROAD THAT MAY HAVE BEEN RELOCATED DUE TO WATER. POOL IS AT BASE OF A HILL, TIRE IN POOL. 55 GALLON DRUMS FOUND NEARBY. INVERTEBRATES INCLUDE MOSQUITO LARVAE, WATER STRIDERS.

Send completed form and supporting documentation to: Maine Dept. of Inland Fisheries and Wildlife
Attn: Vernal Pools
650 State Street, Bangor, ME 04401

NOTE: Digital submission (to Jason.Czapiga@maine.gov) of vernal pool field forms and photographs is only acceptable for projects with 3 or fewer assessed pools; larger projects must be mailed as hard copies.

For MDIFW use only Reviewed by MDIFW Date: Initials:

This pool is: ☐ **Significant** ☐ **Potentially Significant** but lacking critical data ☐ **Not Significant** due to: ( ) does not meet biological criteria ( ) does not meet MDEP vernal pool criteria.

Comments:

Northern Long-eared Bat (NLEB) Presence/Absence Survey (September 7, 2017). Prepared by Tetra Tech, Inc. for NextEra Energy Resources, LLC.

Date: September 7, 2017

TTCES-PTLD-2017-194-6001

Mr. Coke Coakley

700 Universe Blvd

Juno Beach, FL 33408

Project	**Northern Long-eared Bat (NLEB) Presence/Absence Survey**
Location	**Enfield, CT (Harford County)**
Area of Forest for Clearing	**Yet to be determined**
Surveyor Name/Firm	**Clinton Parrish and Derek Hengstenberg/Tetra Tech, Inc.**
Nights of Detector Operation	**July 7–11, 2017**
# of Detectors/Total Detector-nights	**4 Detectors / 20 Detector-nights**
Survey Results	**NLEB NOT DETECTED**

Dear Mr. Coakley,

This report contains summary results of the northern long-eared bat (*Myotis septentrionalis*, hereafter NLEB) summer presence/absence survey performed for the Nutmeg Solar project (Project) located in Enfield, Connecticut. Acoustic detectors deployed by Tetra Tech did not detect the presence of NLEB, no bat passes were classified as NLEB by analysis software, or during qualitative analysis. The presence of four species were confirmed in the Project area during the survey including big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and silver- haired bat (*Lasionycteris noctivagans*).

The following memo provides a summary of the survey. Appendix A includes Project station conditions and photographs illustrating detector orientation. Appendix B includes copies of the completed Phase 1 Summer Habitat Assessment forms for the Project. Appendix C includes a summary of Maximum Likelihood Estimates (MLE), and Appendix D includes resumes for relevant staff members involved with the Project.

1.0 Project Description

The proposed Project consists of a solar power generation facility to be located in Enfield, Connecticut. The total project area is 141 acres and consists of eight parcels. The eastern portion of the Project area is situated on a ridge and comprises approximately 111 forested acres. The western portion of the Project area is agricultural and used for growing tobacco and pumpkins.

Other features within the agricultural area include a wooded fencerows, a home site, and 10 old barns used for drying tobacco.

2.0 Methods

The summer presence/absence survey was conducted in accordance with the 2017 U.S. Fish and Wildlife Service (USFWS) *Range-wide Indiana Bat Summer Survey Guidelines for Indiana Bat and Northern Long-eared Bat* (Guidelines) (USFWS 2017). This survey utilized a two-phased approach: Phase 1, desktop and field-based habitat assessments, and Phase 2, acoustic surveys. Tetra Tech deployed full spectrum acoustic detectors during Phase 2, and the resulting data was processed using Kaleidoscope Pro version 4.2.0 (Wildlife Acoustics, Inc.). Qualified Tetra Tech personnel carried out all phases of the survey. Specific roles are summarized in Table 1; resumes for relevant staff are provided in Appendix D.

Table 1. Personnel involved in NLEB Acoustic Presence/Absence Surveys and analyses for Nutmeg Solar Project, Enfield, Connecticut (July 2017).

Personnel	Desktop Analysis	Field Assessment	Detector Deployment	Acoustic Analysis	Qualitative Analysis
Clinton Parrish Wildlife Biologist	X	X	X	X	X
Derek Hengstenberg Wildlife Biologist	X				

2.1 Habitat Assessment

2.1.1 Desktop Assessment

Prior to conducting field work, Tetra Tech performed a desktop land cover analysis to identify suitable NLEB habitat within the proposed Project area (Figure 1). Tetra Tech reviewed aerial photography and Google Earth imagery to identify areas that may be used by NLEB for foraging and roosting during the maternity and migration seasons. This determination was based on forest patch size, proximity to closed-canopy forests, and landscape features that may be used by bats commuting between roosting and foraging habitats (e.g., forested tracts, wetlands, and streams). All relatively contiguous forested lands that were not highly fragmented by residential or commercial developments were considered suitable NLEB habitat, and all densely populated or developed stretches were determined to be unsuitable (USFWS 2017). The Guidelines indicate that for non-linear projects, a sample "site" requires two locations and comprises 123 acres. Therefore this non-linear project with 111-acres of forested ridge combined with wooded fence lines associated with the agricultural areas suitable habitat exceeds 123 acres and would require two sample sites (four locations).

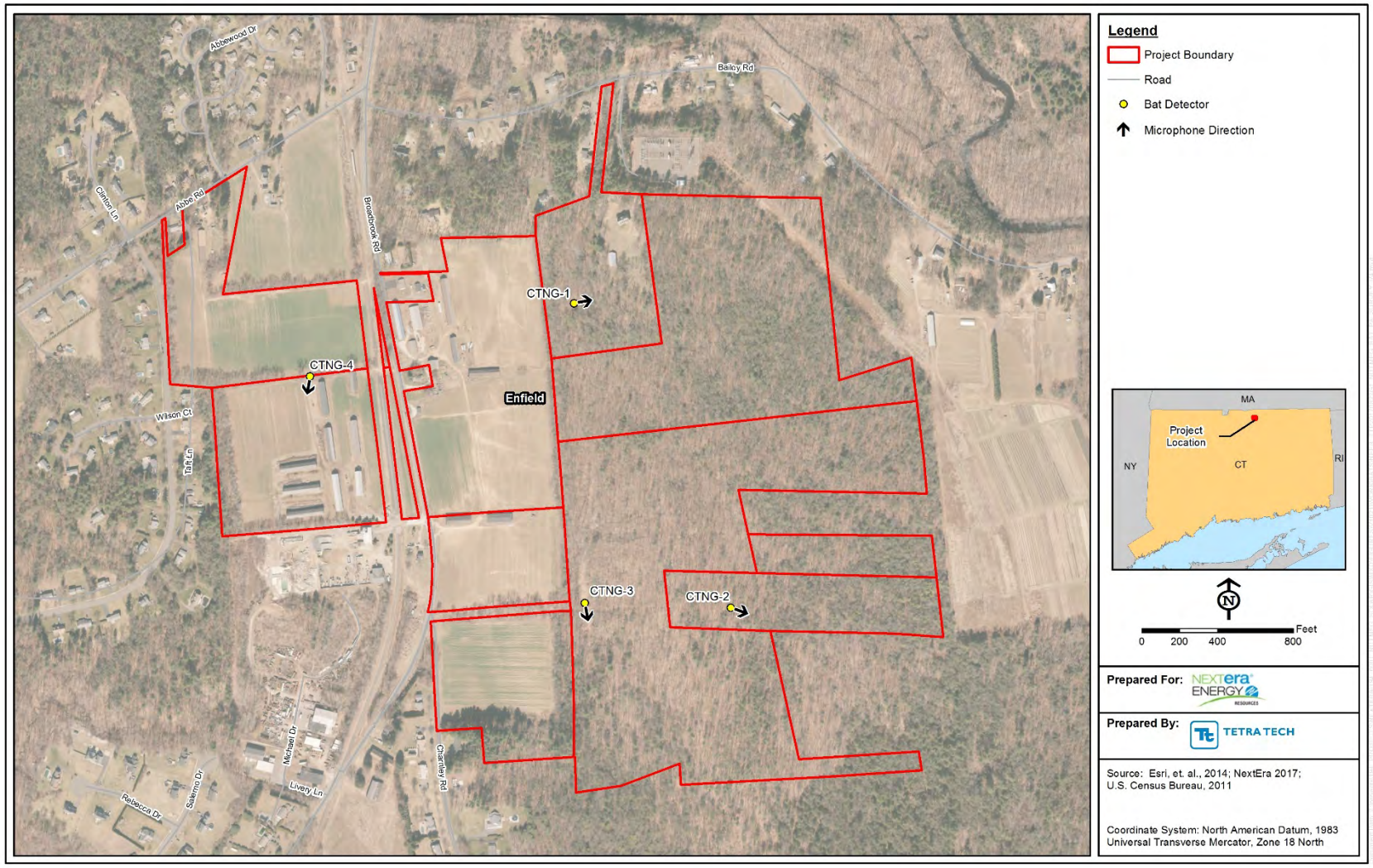


Figure 1. Locations of acoustic detectors deployed at Nutmeg Solar Project, Enfield Connecticut (July 7–11, 2017).

2.1.2 Field-based Assessment

On July 7, 2017, Tetra Tech conducted site visits to describe and verify the presence of the NLEB habitat identified during the desktop analysis, and to deploy full spectrum acoustic detectors. General habitat descriptions are provided in Table 2. The completed Phase 1 Summer Habitat Assessment is included in Appendix B.

Table 2. Detector station descriptions and survey data for the Nutmeg Solar Project, Enfield, Connecticut (July 2017).

Detector Station	Suitable NLEB Habitat	Description	GPS Coordinates	Survey Nights
CTNG-1	Y	Interior Forest- Closed canopy, mature, deciduous forest. Located in a swale with a high canopy and sparse understory. Ground cover dominated by ferns.	41.97656392 -72.51217366	7/07-7/11/2017
CTNG-2	Y	Canopy Opening- Oak dominated ridge top with a small canopy opening at station. ATV trail and is located ~15m north of station	41.97226538 -72.50889952	7/07-7/11/2017
CTNG-3	Y	Woodland Edge- Old two track road bound by a large forested area and a fence row with mature trees. Microphone is oriented towards junction of old roads and potential flight paths.	41.97224770 -72.51173101	7/07-7/11/2017
CTNG-4	Y	Wooded fence line- Adjacent to a cultivated field edge and fence row with mature trees. Six large, old tobacco barns are located within 200m of station and may serve as potential roost sites.	41.97535596 -72.51722837	7/07-7/11/2017

2.2 Acoustic Surveys

2.2.1 Detector Type

Wildlife Acoustics Song Meter-4 BAT ultrasonic bat detectors (Wildlife Acoustics, Inc., Massachusetts, USA) equipped with SMM-U1 microphones with windscreens were used for the duration of the survey effort. Detectors were set to record from a half hour before sunset to a half hour after sunrise (approximately 7:28 PM – 6:21 AM) in full-spectrum mode, and files were saved in .WAV format on internal SD cards.

The detectors were fully waterproof and were powered by internal D cell batteries. Each detector and microphone was tested prior to deployment with a Wildlife Acoustics Ultrasonic Calibrator to ensure equipment was functioning properly and device sensitivity was within the manufacturer's suggested thresholds. A "chirp test" with the Ultrasonic Calibrator was used to confirm all

connections were sound and that the microphones registered high frequency noise once the detectors were set. Tetra Tech performed this test again at demobilization to ensure microphones were still functioning. Log files were reviewed when units were pulled to verify proper functioning for the duration of the survey.

2.2.2 Detector Deployment

Four detectors were microsited in suitable habitat within the Project area to ensure potential habitats were sampled in accordance with the Guidelines. Detectors were deployed on July 7, 2017 and retrieved on July 11, 2017.

The four detectors were deployed in the following habitat types:

- Road corridor;
- Forest-canopy openings;
- Wooded fence line; and
- Woodland edge.

Microphones were mounted at a minimum height of 9 feet to avoid ground vegetation and to elevate the cone of detection. Microphones were oriented in line with suspected flight paths to increase the number of call pulses and quality of recordings. Therefore, specific orientation was determined by microsite conditions (arrows in Figure 1 indicate microphone direction at each station). Appendix A includes station conditions and photographs illustrating detector orientation.

2.2.3 Weather Requirements

Weather requirements outlined in the Guidelines (temperatures remain above 50 degrees Fahrenheit, no precipitation that exceeds 30 minutes, and sustained wind speed less than 9 miles/hour) must be met during the first 5 hours of the survey period for each detector-night for valid survey results. Weather history in 5-minute increments was reviewed from the closest weather station to the Project that had data on temperature, wind speed, wind gusts, precipitation rate, and precipitation accumulation. This ensured that the Guidelines were met for a valid survey night (Weather Underground 2017).

2.2.4 Acoustic Analysis

Tetra Tech analyzed the recorded data according to the Guidelines. Data was filtered and analyzed using Kaleidoscope Pro version 4.2.0, using the classifier "Bats of North America 4.3" for species of bats in Connecticut at the 0 Balanced "Neutral" sensitivity level. Signals of interest ranged from 16–120 kilohertz, lasting 2–500 milliseconds, with a minimum of two call pulses. Full spectrum .WAV files were converted to zero-crossing using a division ratio of eight. All files auto classified as NLEB, Indiana bat, little brown bat, and tri-colored bat were subsequently manually reviewed using SonoBat v 4.2.0. Indiana bat and little brown bat were included in qualitative analysis as well

because they are listed as endangered federally and in the State of Connecticut, respectively. Tri-colored bat was included in qualitative analysis because of the current petition to federally list the species. Results were summarized by station and by night.

3.0 Results

The desktop and field-based habitat assessments revealed approximately 130 acres of suitable NLEB habitat. Agricultural fields are not suitable habitat but wooded fence lines and edges within agricultural areas are and added to the approximately 111 acre forested ridge on the eastern portion of the Project area. Based on the results of the habitat assessment, Tetra Tech deployed two detectors for 5 nights (July7–11, 2017) for a total of 20 detector-nights. Weather conditions were met during 2 of out 5 nights of the survey. Three nights did not pass weather requirements due to high winds and/or precipitation but were included in the analysis and results (Table 3).

Table 3. Summary of Weather Information from sunset to sunrise from Bradley International Airport, Connecticut.

Survey Night	Temperature Range (Fahrenheit)	Wind Range (mph)	Precipitation	Qualifying Night
7/7/2017	66-70	0-4.6	Light rain	No
7/7/2017	60-70	0-6.9	Light rain	No
7/7/2017	52-70	0-10.4	None	Yes
7/7/2017	69-80	0-12.7	Rain	No
7/7/2017	70-78	0-6.9	None	Yes

Source: Weather Underground 2017.

Interpreting results solely on the number of species calls by software auto-classification can be misleading, as there are varying levels of confidence associated each classification. MLEs are used as a secondary measure to determine likelihood of species presence by incorporating known error rates for each species classifier within the software. In most cases, manual review of bat passes by experienced biologists serves as the most accurate method for species identification. MLEs indicate that four (big brown bat, eastern red bat, hoary bat, and silver-haired bat) of the nine bat species occurring in Connecticut are likely present within the Project area (Appendix C). Qualitative analysis corroborated MLE predictions and those four species were confirmed present within the Project area during the survey period (Table 4).

Tetra Tech recorded 4,054 total bat passes at the four stations, on the nights of July 7–11, 2017 (Table 5). All detectors were functional for the entire survey period. No NLEB bat passes were auto classified by the software. A single pass was auto classified as Indiana bat, but was subsequently determined to be an inconclusive high frequency bat species upon qualitative analysis. Forty-eight

bat passes were auto classified as the State Endangered little brown bat, the majority of which were confirmed as eastern red bat and the remainder as unidentified high frequency bat species. Similarly, of the files auto-classified as tri-colored bat, 11 were determined to be eastern red bat and the reminder high frequency species. Overall, bat activity was the highest along a woodland edge at Station 3 with 82% of all bat passes recorded (see Appendix A for more information on Station habitats).

Table 4. Summary of Species Presence by Kaleidoscope Pro at Nutmeg Solar Project, Enfield, Connecticut (July 2017).

Species	MLE Prediction[1]	Qualitative Analysis	Overall Evaluation
Big brown bat	**Present**	**Present**	**Present**
Eastern red bat	**Present**	**Present**	**Present**
Hoary bat	**Present**	**Present**	**Present**
Silver-haired bat	**Present**	**Present**	**Present**
Eastern Small-footed bat	Absent	na	Absent
Little brown bat	Absent	Absent	Absent
Northern long-eared bat	Absent	Absent	Absent
Indiana Bat	Absent	Absent	Absent
Tri-colored bat	Absent	Absent	Absent
1. Based on probability of presence for any site on any night. See Appendix C for complete listing of MLEs by site/night.			

Table 5. Summary of Bat Passes Recorded at Nutmeg Solar Project, Enfield, Connecticut (nights of July 2017).

Detector Station	Survey Night	Big Brown Bat	Eastern red bat	Hoary bat	Silver-Haired bat	Unidentified High Frequency Bat	Total
CTNG-1	**7-Jul**	-	-	-	-	-	-
	8-Jul	1	-	1	-	-	**2**
	9-Jul	1	-	-	-	-	**1**
	10-Jul	2	-	-	-	-	**2**
	11-Jul	1	-	3	1	-	**5**
CTNG-2	**7-Jul**	13	2	10	11	-	**36**
	8-Jul	15	1	9	2	-	**27**
	9-Jul	47	7	6	1	-	**61**
	10-Jul	7	2	18	7	-	**34**
	11-Jul	16	1	12	1	1	**31**

CTNG-3	**7-Jul**	672	35	37	8	4	**756**
	8-Jul	645	73	107	35	2	**862**
	9-Jul	766	42	38	3	1	**850**
	10-Jul	117	43	15	3	4	**182**
	11-Jul	509	114	53	17	1	**694**
CTNG-4	**7-Jul**	59	7	6	10	-	**82**
	8-Jul	68	3	28	6	1	**106**
	9-Jul	53	2	30	6	-	**91**
	10-Jul	80	2	30	3	1	**116**
	11-Jul	58	8	32	18	-	**116**
Overall		**3,130**	**342**	**435**	**132**	**15**	**4,054**

4.0 Conclusion

No bat passes were auto-classified as the federally threatened NLEB by Kaleidoscope Pro software. Additionally, the MLE values generated by the software indicate that presence of NLEB was unlikely during any of the site/nights over the duration of the survey period. This corroborates qualitative analysis results. Given that no NLEBs were detected while following the summer survey protocol, it is unlikely that the Project will negatively impact the NLEB. Avoiding tree removal activities when possible may also improve foraging and roosting opportunities for this species if populations recover.

Additionally, presence was not confirmed for any of the state endangered or threatened species that have experienced steep population declines caused by white-nose syndrome. Several factors likely contributed to the lack of Myotis detections during the survey. First, Hibernacula surveys in Connecticut have documented a dramatic decline in little brown bat, northern long-eared bat and tri-colored bat from 1999 through 2014 which is attributed to white nose syndrome (CTDEEP 2015). Second, a lack of open water sources in the Project area may not attract species such as little brown bat. Little brown bat tends to forage on forest and water edges, and females in particular show a preference for water sources (Krusic et al. 1996, Nelson and Gillam 2016). The Scitico River runs 300- 600m north of the Project area and if little brown bats do occur on the landscape, it is possible they prefer to forage within this riparian corridor.

Acoustic surveys in 2011 and 2012 found that species composition in the state was now heavily skewed towards big brown bat with nearly 70% of bats identified in surveys with tree roosting bats (red bat, silver-haired bats, and hoary bats) comprising 20 to 30% (CTDEEP 2015). Findings from this survey reflect those trends with big brown bats representing 77% of the bat passes recorded

and tree bats the remainder. Big brown bats commonly forage in agricultural areas are have been identified as a valuable control of insect pests (Agosta 2002).

The tobacco barns have been documented as communal roost sites in the southern United States (Florida Fish and Wildlife Commission 2015) and were initially identified as potential roost sites within the project area. However, only 13% of the total bat passes were recorded at Station 4 adjacent to a woodland edge and tobacco barn.

5.0 References

Agosta, S. J. (2002). Habitat use, diet and roost selection by the big brown bat (Eptesicus fuscus) in North America: a case for conserving an abundant species. Mammal Review, 32(3), 179–198.

Connecticut Department of Energy and Environmental Protection (CTDEEP). 2015. 2015 Connecticut Wildlife Action Plan. Small Mammals: Bats. Available online at: http://www.ct.gov/deep/lib/deep/wildlife/pdf_files/nongame/ctwap/CTWAP-Chapter1.pdf. Accessed August 2017.

Florida Fish and Wildlife Conservation Commission. Bats take up residence in Madison's abandoned tobacco barn. November 6, 2015. Available online at: http://myfwc.com/news/news-releases/2015/november/06/madison-bat/ Accessed August 2017. Southeastern myotis and Brazilian free-tailed

Krusic, R.A., M. Yamasaki, C.D. Neefus, and P.J. Pekins. 1996. Bat habitat use in White Mountain National Forest. The Journal of Wildlife Management, 625–631.

Nelson, J.J., and E.H. Gillam. 2016. Selection of foraging habitat by female little brown bats (Myotis lucifugus). Journal of Mammalogy, 98(1), 222––231.

United States Fish and Wildlife Service. 2017. Range-wide Indiana Bat Summer Survey Guidelines. May 2017. 48 pp. Available online at: https://www.fws.gov/midwest/endangered/mammals/inba/surveys/pdf/2017INBASummerSurveyGuidelines9May2017.pdf. Accessed August 3, 2017.

Weather Underground. 2017. PWS data for Hartford, CT. Available online at: (https://www.wunderground.com/history/airport/KBDL)

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APPENDIX A. STATION CONDITIONS AND DETECTOR ORIENTATION PHOTOGRAPHS

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PHOTOGRAPHIC RECORD

Company: NextEra

Project: Nutmeg Solar, Enfield, Connecticut

Photo No.: 01

Station: CTNG-1

Date: July 7, 2017

Comments: Station is located in a wet swale within a closed canopy mature mixed forest. The microphone is outfitted with a directional horn and oriented east (80 degrees) upslope under the sparse canopy. Note the serve defoliation caused be gypsy moth caterpillars. Light transmission in the forest was similar to leaf-out in the spring.

PHOTOGRAPHIC RECORD

Company: NextEra

Project: Nutmeg Solar, Enfield, Connecticut

Photo No.: 02

Station: CTNG-1

Date: July 7, 2017

Comments: Trees with exfoliating bark were immediately adjacent to Station 1.

PHOTOGRAPHIC RECORD

Company: NextEra

Project: Nutmeg Solar, Enfield, Connecticut

Photo No.: 03

Station: CTNG-2

Date: July 7, 2017

Comments: Overview of mature, forested ridge that surrounds Station2 (photo facing northwest perpendicular to microphone orientation, 110 degrees). Note the severe defoliation caused by gypsy moth caterpillars.

PHOTOGRAPHIC RECORD

Company: NextEra

Project: Nutmeg Solar, Enfield, Connecticut

Photo No.: 04

Station: CTNG-3

Date: July 7, 2017

Comments: Woodland edge created by an old roadway that separates forested ridge and crop fields. Microphone is oriented to the south (190 degrees).

PHOTOGRAPHIC RECORD

Company: NextEra

Project: Nutmeg Solar, Enfield, Connecticut

Photo No.: 05

Station: CTNG-4

Date: July 7, 2017

Comments: Station located on wooded fence line adjacent to tobacco barn (potential roosting habitat). Photo facing east.

PHOTOGRAPHIC RECORD

Company: NextEra

Project: Nutmeg Solar, Enfield, Connecticut

Photo No.: 06

Station: CTNG-4

Date: July 7, 2017

Comments: View west, perpendicular to microphone orientation (170 degrees). Tobacco fields are in front of and behind station.

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APPENDIX B. COMPLETED PHASE 1 SUMMER HABITAT ASSESSMENT

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APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: NUTMEG SOLAR Date: 7/12/2017

Township/Range/Section: ENFIELD, CT

Lat Long/UTM/ Zone: 41° 58' 28.06"N 72° 30' 43.52" W Surveyor: C. PARRISH

Brief Project Description

POTENTIAL SOLAR PROJECT TO BE DEVELOPED ON OPEN FARMLAND (TOBACCO & PUMPKIN FIELDS) AND FORESTED AREAS

Project Area

	Total Acres	Forest Acres	Open Acres
Project	138	~90	~50

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres- no clearing
	?	?	?

Vegetation Cover Types

Pre-Project	Post-Project
OPEN, CROPLAND FORESTED AREA (MIXED HARDWOOD & SOFTWOOD)	- OPEN CROPLAND "PRESUMABLY" DEVELOPED PORTION OF FORESTED AREA CLEARED & DEVELOPED

Landscape within 5 mile radius

Flight corridors to other forested areas?

MULTIPLE FORESTED PARCELS IN AREA. MOST CONNECT TO WOODED RIPARIAN CORRIDOR ADJACENT TO THE SCANTIC RIVER.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residencial development, water sources)

PROJECT AREA IS PART OF AN ~200 AC WOODED AREA. THAT IS CONNECTED TO SMALLER WOODED BLOCKS, ~1/4 OF LAND IS CULTIVATED (TOBACCO IS A COMMON CROP). RESIDENTIAL NEIGHBORHOODS LIE DIRECTLY TO THE WEST THE SCANTIC RIVER IS ~.5mi TO THE NORTH

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

SCANTIC RIVER STATE PARK IS ~ 5.0 mi TO THE SW OF PROJECT AREA.

THE SCANTIC RIVER HAS A WOODED RIPARIAN AREA THAT IS A DOMINANT FEATURE ON THE LANDSCAPE W/N 5 mi OF THE PROJECT AREA.

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area

A single sheet can be used for multiple sample sites if habitat is the same

MIC OK @ PULL / NGB

Sample Site Description

Sample Site No.(s): CTNG -2 OAK RIDGE TOP IN SMALL CANOPY OPENING

SM4- 03454 / SMMU1-10R07D (FORESTED)

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial
Pools/Ponds (# and size)	1	Open and accessible to bats? YES	
Wetlands (approx. ac.)	Permanent NA	Seasonal NA	

Describe existing condition of water sources:
- SCANTIC RIVER IS LOCATED ~ 450m TO NE
- SOMERSVILLE POND ~ 1MI TO NE
- SCITICO RESERVIOR ~ 3/4MI TO NW

Forest Resources at Sample Site

Closure/Density	Canopy (> 50')	Midstory (20-50')	Understory (<20')
	4 / 60%	1, 10%	2, 24%
Dominant Species of Mature Trees	RED OAK, WHITE OAK, WHITE BIRCH		
% Trees w/ Exfoliating Bark	1, 1%	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	5 55%	1, 5%	3 40%
No. of Suitable Snags		1	

1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%

TGM 90%

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

RIGHT BEHIND STATION (BROKEN TOP)

NLEB

IS THE HABITAT SUITABLE FOR INDIANA BATS? YES

Additional Comments:

MIC ORIENTED INTO CANOPY OPENING. AN ATV TRAIL IS LOCATED (SMU) AT STATION. HEAVY IMPACT FROM GYPSY MOTH. TREES 95% DEFOLIATED

FOREST: EASTERN HARDWOOD DECIDUOUS SP.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy, examples of potential suitable snags and live trees, water sources

1-4 CARDINALS 5 SNAGS

PHASE I SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area

A single sheet can be used for multiple sample sites if habitat is the same

MIC OK @ PULL / ZOGBONCHED A

Sample Site Description	
Sample Site No.(s): STHG-3	SMALL OPENING @ FOREST ROAD JUNCTION NEAR FIELD EDGE
SM4-0345E / SMMU1-	

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: 4 SMALL PONDS LOCATED ~ 3/4 mi TO SOUTH (ALL OPEN)
Pools/Ponds (# and size)	4	Open and accessible to bats? YES		
Wetlands (approx. ac.)	Permanent NA	Seasonal NA		

Forest Resources at Sample Site				
Closure/Density	Canopy (> 50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
	2, 15%	1, 5%	1, 10%	
Dominant Species of Mature Trees	RED MAPLE, LITHIC OAK, WHITE BIRCH, RED OAK			
% Trees w/ Exfoliating Bark	1, 3%			
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	1, 12%	1, 9%	1, 10%	
No. of Suitable Snags		1		→ PHOTO TAKEN

Total 30%

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable. ~40 m S OF STATION

IS THE HABITAT SUITABLE FOR ~~INDIANA~~ BATS? YES

NLEB

Additional Comments:

MIC IS ORIENTED ALONG FOREST CLEARING AND SET BACK 10m FROM RD JUNCTION & ANOTHER POTENTIAL FLYWAY (SEE WEST PHOTO)

MIC IS ELEVATED ON A LONG POLE TO 5m AGL.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy, examples of potential suitable snags and live trees; water sources

1-4 CARDINALS (4 FLYWAY) 5 SNAGS 40 m SOUTH

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): CTNG-4 ON FENCE ROW ADJACENT TO TOBACCO BARNS
SM9 - 03453 / SMMU1 - 108055

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: SCANTIC RIVER & SCITICO RESERVOIR LOCATED ~600M TO NORTH
			1	
Pools/Ponds (# and size)	1	Open and accessible to bats? YES		
Wetlands (approx. ac.)	Permanent NA	Seasonal NA		

Forest Resources at Sample Site

5% TOTAL

Closure/Density	Canopy (> 50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
	1, 2%	1, 3%		
Dominant Species of Mature Trees	SILVER MAPLE, ELM, BLACK CHERRY			
% Trees w/ Exfoliating Bark	1%			
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
		1, 15%	6, 90%	
No. of Suitable Snags		0		

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR ~~INDIANA~~ NLEB BATS? YES

Additional Comments:

STATION IS POSITIONED ALONG A FENCE ROW, IN BETWEEN FIELDS OF SQUASH & TOBACCO, SIX, LARGE TOBACCO BARNS ARE W/N 200M OF STATION, (POTENTIAL ROOST LOCATIONS?)

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy, examples of potential suitable snags and live trees, water sources

PHOTO SERIES
1-4 CARDINALS, 2 PHOTOS OF TOBACCO BARNS

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description	
Sample Site No.(s): CTNG-1	INTERIOR FOREST AMONG MATURE TREES & OPEN
SMHU1--109044 / SML4 038408 /	UNDERSTORY

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: SCANTIC RIVER IS LOCATED ~400m TO THE NORTH - SCITICO RIVER RESERVIOR ~950m TO NW (SMALL, 1 AC. POND)
			1	
Pools/Ponds (# and size)	1	Open and accessible to bats? YES		
Wetlands (approx. ac.)	Permanent NA	Seasonal NA		

Forest Resources at Sample Site				
Closure/Density (100% TOTAL)	Canopy (> 50') 5, 70%	Midstory (20-50') 2, 15%	Understory (<20') 2, 15%	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
Dominant Species of Mature Trees	ELM, OAK, HEMLOCK, MAPLE			
% Trees w/ Exfoliating Bark	5%			
Size Composition of Live Trees (%)	Small (3-8 in) 2, 15%	Med (9-15 in) 2, 20%	Large (>15 in) 5, 65%	
No. of Suitable Snags		3		

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags W/N 100m without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR ~~INDIANA~~ NLEB BATS? YES

Additional Comments:

MOST OF MATURE TREES ARE HEAVILY DEFOLIATED FROM GYPSY MOTHS.
MIC IS ORIENTED UPSLOPE PAST MULTIPLE TREES W/ EXFOLIATING BARK.
STATION IS LOCATED IN SLIGHT DRAW, FERN GROUND COVER

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy, examples of potential suitable snags and live trees, water sources

1-4 CARDINALS / 2 NEARBY ELMS

APPENDIX C. MAXIMUM LIKELIHOOD ESTIMATES (MLE) SUMMARY

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Summary of Maximum Likelihood Estimates (MLEs) for species presence by Kaleidoscope Pro at Nutmeg Solar Project, Enfield, Connecticut (July2017).

Station	Night	Big brown bat	Eastern red bat	Hoary bat	Silver-haired bat	Eastern small-footed bat	Little brown bat	Northern long-eared bat	Indiana bat	Tri-colored bat
CTNG-1	7/7	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	7/8	0.24	1.00	0.15	1.00	1.00	1.00	1.00	1.00	1.00
	7/9	0.17	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	7/10	**0.03**	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	7/11	0.64	1.00	**0.00**	0.88	1.00	1.00	1.00	1.00	1.00
CTNG-2	7/7	**0.00**	**0.00**	**0.00**	**0.01**	1.00	1.00	1.00	1.00	1.00
	7/8	**0.00**	0.07	**0.00**	1.00	1.00	1.00	1.00	1.00	1.00
	7/9	**0.00**	**0.00**	0.08	1.00	1.00	1.00	1.00	1.00	1.00
	7/10	**0.04**	0.12	**0.00**	0.29	1.00	0.60	1.00	1.00	1.00
	7/11	**0.00**	0.15	**0.00**	1.00	1.00	0.60	1.00	1.00	1.00
CTNG-3	7/7	**0.00**	**0.00**	0.25	1.00	1.00	0.20	1.00	0.62	0.72
	7/8	**0.00**	**0.00**	**0.00**	1.00	1.00	1.00	1.00	1.00	0.42
	7/9	**0.00**	**0.00**	0.52	1.00	1.00	1.00	1.00	1.00	0.96
	7/10	**0.00**	**0.00**	**0.00**	1.00	1.00	0.48	1.00	1.00	0.93
	7/11	**0.00**	**0.00**	**0.00**	1.00	1.00	1.00	1.00	1.00	1.00
CTNG-4	7/7	**0.00**	**0.00**	0.18	0.88	1.00	1.00	1.00	1.00	1.00
	7/8	**0.00**	**0.00**	**0.00**	1.00	1.00	1.00	1.00	1.00	0.31
	7/9	**0.00**	**0.01**	**0.00**	1.00	1.00	1.00	1.00	1.00	1.00
	7/10	**0.00**	**0.03**	**0.00**	1.00	1.00	1.00	1.00	1.00	0.22
	7/11	**0.00**	**0.00**	**0.00**	0.30	1.00	0.45	1.00	1.00	1.00

Note: Maximum Likelihood Estimates (MLEs) interpretation – values <0.05 indicates there is 95% confidence that the species is present. Bold values indicate significance, and species presence is likely.

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APPENDIX D. RELEVANT STAFF RESUMES

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Experience Summary

Mr. Parrish has more than eight years of experience conducting wildlife and habitat projects in the Northeast, California, and Idaho. His responsibilities have been distributed over a wide variety of terrestrial and aquatic projects with a particular emphasis on bat acoustic monitoring, avian ecology, habitat assessment, and avian response to wind development, where Mr. Parrish lead a multiyear investigation in northern New Hampshire on the impacts of wind development on high-elevation avian species with a focus on Bicknell's thrush (*Catharus bicknelli*). Most recently, Mr. Parrish has been involved with acoustic bat monitoring and has participated on more than 30 projects throughout the country and serves as equipment manager and one of the lead analysist for Tetra Tech's bat program. Mr. Parrish is involved in all stages of acoustic bat surveys including: habitat assessment, deployment, analysis, manual vetting, and report preparation. Mr. Parrish regularly participates in bat acoustic workshops to remain current with changing protocols, survey techniques and advances in hardware and software. Mr. Parrish is an experienced field biologist who has served as project lead as a consultant for New Hampshire Department of Fish and Game and as an employee for state and federal agencies. Mr. Parrish is proficient with data management and analysis using MS Access, GIS, BCID, Kaleidoscope Pro, SonoBat, and the program R.

Education

MS, Biology, Plymouth State University
BS, Environmental Biology, Magna Cum Laude, Plymouth State University

Additional Training and Certifications

Bat Acoustic Data Management Workshop, Bat Conservation and Management
2nd International Bat Echolocation Symposium, Bat Survey Solutions
Geographic Information Systems, University of Idaho
Aquatic Invasive Species Detection and Prevention
National Environmental Policy Act
CPR and First Aid Certification

Relevant Project Experience

NLEB Presence/Absence Surveys, ME, CT and NH 2017 – Nextera Energy.

Deployed 32 SM4 Bat detectors for five independent projects and conducted habitat assessments at each location according to USFWS 2017 Indiana Bat Summer Survey Guidelines. Analyzed bat acoustic data, manually vetted recordings to confirm species presence and summarized data for reports.

Data Analyst and Reviewer, Multiple National Wildlife Refuge Acoustic Bat Monitoring Projects, 2013 - Present – USFWS. One of two Tetra Tech employees responsible for manually vetting acoustic bat recordings in an effort to determine the occupancy of Threatened or Endangered bat species on National Wildlife Refuge (NWR) lands. Automated classifications were summarized and qualitatively vetted (i.e., manually reviewed on a spectrogram) to determine accuracy of automated classification. Mr. Parrish worked closely with the client on a vetting protocol to meet the shifting goals of the client, which is now to determine presence of Threatened or Endangered species, allowing for more statistically robust measures of occupancy. Review and summaries of results of 2015 data from 18 NWRs is currently in progress.

Bat Acoustic Monitoring, North Dakota 2014-Present – NextEra Energy. Mr. Parrish served as a task lead on five pre-construction bat acoustic surveys at proposed large-scale wind power projects in North Dakota. Deployed multiple acoustic detectors, both on ground based and with elevated microphones affixed to meteorological towers, to determine the presence/absence of northern long-eared bat (*Myotis septentrionalis*) (NLEB). In addition, acoustic data was used to determine overall species composition and level of temporal activity of bats during the entire season (April- November). Mr. Parrish analyzed data, prepared results, and final reports for these projects.

NLEB Presence/Absence Survey, Maine 2016 – Nextera Energy. This particular project was linear and required the deployment of acoustic detectors at over 20 locations. Surveys strictly followed the *2016 Range-Wide Indiana Bat Summer Survey Guidelines* and the Phase 2 Acoustic Survey protocol. Because the project area was within potential NLEB habitat, a desktop assessment was completed to determine the required level of effort (number of survey nights required within the project area). A field-based habitat assessment was

then conducted in conjunction with deploying acoustic detectors in Phase II. Following initial project screening, a complete Phase II presence/absence survey was conducted by an acoustic survey. SM3BAT detectors were placed in suitable locations with microphones elevated above 3m, and oriented adjacent to a likely flyway. Once detector set up was complete, the unit was tested using a Wildlife Acoustic Calibrator to ensure connections were sound and the microphone was detecting ultrasonic frequencies (units were likewise tested upon retrieval). Weather was closely monitoring during deployment to ensure weather conditions were met and nights were qualifying. If low, temperatures, precipitation, or high winds were reported in the area, detectors where left in the field until conditions were met. Data was processed using an approved version of Kaleidoscope Pro and recordings were manually reviewed using SonoBat v. 3.2 at sites where high frequency or Myotid calls were auto classified. Results were and complete reports were then prepared according to protocol.

NLEB Presence/Absence Survey, ME, NH, VT, CT 2016 – Ranger Solar. Five independent projects that required deployment of 30 detectors. *(see description above)*

NLEB Presence/Absence Survey, MI 2016– US Marine Corp. A single linear project with 17 total detectors deployed *(see description above)*

NLEB Presence/Absence Survey, Maine 2015– Patriot Renewables. A single non- linear project with 4 detectors deployed *(see description above)*

NLEB Presence/Absence Survey, Maine 2015– CES. Two independent projects with seven total detectors. *(see description above)*

Bat Acoustic Monitoring, Maine 2016 – Patriot Renewables. Four detectors were deployed in the project area to determine the species composition, activity levels, and potential presence of threatened or endangered species. Deployment scenarios adhered to the *2016 Range-Wide Indiana Bat Summer Survey Guidelines* and the Phase 2 Acoustic Survey protocol. Detector setups were equipped with solar panels and external batteries for the long-term deployment from June- November. All data was processed using an approved version of Kaleidoscope Pro and recordings were manually reviewed using SonoBat v. 3.2 at sites where high frequency or Myotid calls were auto classified. Results of activity levels by species and time of year were presented in a report.

Bat Acoustic Monitoring, Multiple locations throughout the country 2016. Commercial Wind Projects

Mr. Parrish provide support for 8 different commercial wind projects in 2016 by providing technical support for hardware related issues, by deploying long-term detector set ups, training personnel on detector operation and protocols, selecting sampling locations, managing and analyzing acoustic data, and preparation of reports.

Bat Acoustic Monitoring, New Jersey 2015, Bearfort.

Eight detectors were deployed in the project area to determine the species composition, activity levels, and potential presence of threatened or endangered species. Deployment scenarios adhered to the *2015 Range-Wide Indiana Bat Summer Survey Guidelines* and the Phase 2 Acoustic Survey protocol. Detector setups were equipped with solar panels and external batteries for the long-term deployment from June- November. All data was processed using an approved version of Kaleidoscope Pro and recordings were manually reviewed using SonoBat v. 3.2 at sites where high frequency or Myotid calls were auto classified. Results of activity levels by species and time of year were presented in a report.

NLEB Presence/Absence Survey, Maine 2015 – Maine Department of Transportation, Multiple Road and Bridge Improvement Projects. Equipment manager, field team support, and analyst for completion of presence/absence surveys for NLEB (*Myotis septentrionalis*) for eight projects in Maine. Field surveys include conducting habitat and bat acoustic surveys in accordance with federal protocols established by the United States Fish and Wildlife Service (USFWS) and detailed in USFWS' 2015 Northern Long-Eared Bat Interim Conference and Planning Guidance and USFWS' 2015 Range-Wide Indiana Bat Summer Survey Guidelines. Tetra Tech has teamed with Biodiversity Research Institute to qualitatively vet auto-classifications by software analysis.

NLEB Presence/Absence Survey, Massachusetts, 2015– Massachusetts Department of Transportation, Multiple Road and Bridge Improvement Projects. Equipment manager, field team support, and analyst for

completion of presence/absence surveys for NLEB (*Myotis septentrionalis*) for 22 projects in Massachusetts. Field surveys include conducting habitat and bat acoustic surveys in accordance with federal protocols established by the United States Fish and Wildlife Service (USFWS) and detailed in USFWS' 2015 Northern Long-Eared Bat Interim Conference and Planning Guidance and USFWS' 2015 Range-Wide Indiana Bat Summer Survey Guidelines. Tetra Tech has teamed with Biodiversity Research Institute to qualitatively vet auto-classifications by software analysis.

Baseline Bat Survey, – U.S. Department of the Navy, Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic, Virginia and New Jersey 2014- Deployed 16 acoustic bat detectors at three naval stations in the Norfolk, Virginia area, and at a Navy installation in New Jersey. Detector set ups were operated through the fall to collect information on species composition, and activity levels across an entire warm season. Responsible for managing all incoming acoustic recordings and acting as the lead data analyst for generating results for survey reports.

Baseline Bat Survey, Camp Edwards, Massachusetts 2014-2015 – Massachusetts Army National Guard- Documented decline of bats from white-nosed syndrome, in response to the growing concern regarding negative impacts on this increasingly vulnerable species, and the recent federal listing of NLEB as threatened by the U.S. Fish and Wildlife Service. Collected information on the species richness, activity levels, and spatio-temporal use patterns of bats (Microchiroptera) during the late-summer and fall periods. Passive acoustic bat monitors were used to record calls, which were analyzed using two software programs. Conducted statistical analysis examining spatial and temporal relationships and presented results in a final report.

Wildlife Biologist, NextEra Energy, Acoustic Bat Monitoring, South Dakota 2015 - Conducted a pre-construction bat acoustic surveys at a proposed large-scale wind power project in South Dakota to determine the presence/absence of NLEB, a federally threatened species. Deployed acoustic monitors throughout project area within suitable habitats and preformed a habitat assessment for potential occurrence of bat species using 2013 USFWS Indiana Bat survey guidelines. Prepared reports on habitat suitability for bat species within project area, analyzed all acoustic data, and presented acoustic monitoring for the fall 2014 migration period in a summary report.

Wildlife Biologist, U.S. Department of the Navy, Confidential Project, Bat and Avian Acoustic Monitoring Project, Maine 2014 - Compiled avian vocalizations within a company directory and constructed song recognizers using the program "Song Scope" by Wildlife Acoustics to facilitate analysis of acoustic avian data. Species specific recognizers aided in processing large quantities of avian acoustic data, and responsibilities also included evaluation of acoustic recordings using developed recognizers to identify the presence of species of concern and collection and analysis of bat acoustic data to determine the species composition and activity levels within the project area.

Wildlife Biologist, Patriot Renewables, Spruce Mountain Wind Project, Mortality Searcher Efficiency and Bat Acoustic Monitoring, Maine 2014 - Participated in a study testing the efficacy of carcass searcher efficiency at a wind project in western Maine. These "searcher efficiency trials" are important in determining human bias associated with conducting carcass searches. Results are included in a model to generate predicted estimates of actual fatalities. Collected and analyzed bat acoustic data to determine species composition and relative levels of activity to assess potential collision risk at the wind facility.

Experience Summary

Mr. Hengstenberg is a Certified Wildlife Biologist with 18 years of experience in wildlife biology, wind energy ecology, natural resource assessment, aero-ecology studies, tropical field studies, and project management. Mr. Hengstenberg has extensive knowledge of wildlife studies and is well versed in scientific techniques and equipment including bat acoustic surveys, raptor migration studies, breeding bird surveys, avian radar ornithology, threatened & endangered species surveys, seabird & shorebird surveys, grassland bird surveys, tropical flora and fauna, and mist-netting of birds and bats. Mr. Hengstenberg has worked on natural resources projects across the country and throughout Latin America.

Mr. Hengstenberg has extensive range of field experience throughout New England, the Mid-Atlantic, the Northwest, the Southwest, Puerto Rico, and Mexico. Mr. Hengstenberg is a proficient technical writer and has extensive knowledge of various word processing, presentation, and statistical analysis applications. Mr. Hengstenberg is also experienced with endangered species and has worked closely with both state and federal agencies during the permitting process of wind energy and natural resource projects.

Education

MS, Wildlife & Fisheries Science, Mississippi State University, 2003
BS, Interdisciplinary Studies/Wilderness Research Administration, Plymouth State University, 1998

Registrations/Certifications

Certified Wildlife Biologist- The Wildlife Society; 2011

Training

Bat Acoustic Data Management; 2015
CPR and First Aid Certification; 2015
Airport Wildlife Hazard Management Workshop; 2010
OSHA HAZWOPER Certification and Refresher; 2008
Basic and Advanced Erosion & Sediment Control Course; 2008
Red Card Certification (Wildland Firefighter); 1997

Corporation Project Experience

Lead Project Biologist- March 2016 to January 2017
Northern Long-Eared Bat Planning Level Surveys- Camp Curtis Guild and Camp Edwards

Managing and providing field support of planning level surveys for the northern long-eared bat (*Myotis septentrionalis*) at Camp Curtis Guild and Camp Edwards, Massachusetts. Field surveys mist netting surveys, emergence surveys, and radio telemetry in accordance with federal protocols established by the United States Fish and Wildlife Service. Information collected will be used by natural resources managers to make informed decisions.

Lead Project Biologist- July 2014 to Present
Northern Long-Eared Bat Surveys at multiple United States Department of the Navy Installations – Naval Facilities Engineering Command, Mid-Atlantic

Managing and providing field support for completion of presence/absence surveys for northern long-eared bat (*Myotis septentrionalis*) at multiple Naval installations located along the east coast of the United States. Field surveys include bat acoustic and mist netting surveys in accordance with federal protocols established by the United States Fish and Wildlife Service (USFWS). Information collected will be used by

natural resources managers to make informed decisions at the eight Installations where these surveys are being conducted to avoid negative impacts to this vulnerable species from Naval activities. Tetra Tech has teamed with Biodiversity Research Institute to complete the field work and data analysis.

Lead Project Biologist – May 2015 – Present
State of Maine Department of Transportation (MaineDOT), Two Stand-Alone State-Wide Multi-PIN Project Contracts: Natural Resources and Underwater Sound Monitoring, Maine
Wildlife biologist for Endangered Species Act (ESA) Biological Assessments, consultation, and conferencing support for northern long-eared bat and bat habitat assessment and presence/absence acoustic monitoring. Recent listing of northern long-eared bat has increased the focus on evaluating potential impacts of MaineDOT projects on the species through habitat assessments and presence/absence surveys in accordance with recommended guidance from USFWS: the Northern Long-Eared Bat Interim Conference and Planning Guidance: USFWS Regions 2, 3, 4, 5 & 6 (NLEB Guidance) and the 2015 Range-Wide Indiana Bat Summer Survey Guidelines (Indiana Bat Guidelines).

Lead Project Biologist, May 2015 – Present
Northern Long-Eared Bat Support Services for the State of Massachusetts Department of Transportation (MassDOT), Massachusetts
Wildlife biologist for all northern long-eared bat support services for MassDOT, performing a variety of tasks related to the understanding the potential impacts to the species following its listing under the ESA. Projects are expected to include habitat assessments and presence/absence surveys in accordance with recommended guidance from USFWS: NLEB Guidance and the Indiana Bat Guidelines.

Lead Project Biologist- January 2009 to Present
Spruce Mountain Wind Project, Maine – Patriot Renewables.
Managed and conducted pre-construction and post-construction survey including a bird and bat mortality surveys, avian radar survey, bat acoustic survey, raptor migration survey, migrant stopover survey, RTE species survey, and breeding bird survey as part of the permitting process. Developed and negotiated pre and post-construction monitoring plans with state and federal agencies, authored proposals, designed field studies, and prepared reports and memos. Provided the client advice on erosion and sediment control measures at the newly constructed site so that they comply with permit conditions.

Lead Project Biologist- January 2009 to Present
Saddleback Ridge Wind Project, Maine – Patriot Renewables.
Managed and conducted pre-construction avian surveys including a spring and fall avian radar survey, bat acoustic survey, raptor migration survey, migrant stopover survey, RTE species survey, and breeding bird survey as part of the permitting process. Developed and negotiated pre and post-construction monitoring plans, bird and bat conservation strategy plans with state and federal agencies, authored proposals, designed field studies, and prepared reports and memos.

Lead Project Biologist- January 2010 to Present
Canton Mountain Wind Project, Maine – Patriot Renewables.
Managed and conducted pre-construction avian surveys including a spring and fall avian radar survey, bat acoustic survey, raptor migration survey, eagle aerial survey, migrant stopover survey, RTE species survey, and breeding bird survey as part of the permitting process. Developed and negotiated pre and post-construction monitoring plans with state and federal agencies, authored proposals, designed field studies, and prepared reports and memos.

Prime Farmland Soils Opinion (January 5, 2017). Prepared by Tetra Tech, Inc. for Ranger Solar.

Prime Farmland Soils Opinion

Nutmeg Solar Project
Enfield, Connecticut

Prepared for:

Nutmeg Solar, LLC
January 5, 2017

1 INTRODUCTION

Nutmeg Solar, LLC (Nutmeg Solar) an affiliate of Ranger Solar, LLC (Ranger), is proposing to construct the Nutmeg Solar energy project in Enfield, Connecticut (Project) (Attachment 1). The following memorandum (memo) outlines the results of a December 22, 2016 field visit to the Project site for the purpose of providing a preliminary opinion regarding potential Project impacts to soils identified as Prime Farmland, Farmland of Statewide Importance, or Locally Important Farmland soils.

As defined by the United States Department of Agriculture, Natural Resources Conservation Service (USDA NRCS) Farmland Soils include land that is defined as Prime Farmland; Unique, or Farmland of Statewide Importance; or Locally Important Farmland; and are based on soil type, in accordance with the Code of Federal Regulations (CFR) Title 7, Part 657. CFR Title 7, Part 657 identifies the location and extent of the most suitable land for producing food, feed, fiber, forage, and oilseed crops, and that also is available for these uses (USDA NRCS 2000). Farmland is quality ranked in Connecticut in the following descending order of importance base on assumed soil characteristics as Prime Farmland, Farmland of Statewide Importance, and Locally Important Farmland. These are further described below.

USDA NRCS defines Prime Farmland Soils as those having the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oil seed crops; and that also are available for these uses (the land could be cropland, pastureland, range-land, forestland, or other land; but not urban, built-up land, or water). It has the soil quality, growing season and moisture supply needed to economically produce sustained high yields or crops when treated and managed, including water management, according to acceptable farming practices. They have acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. They are permeable to water and air. Prime Farmland is not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding (USDA NRCS no date).

Farmland of Statewide Importance are soils that fail to meet one or more of the requirements of Prime Farmland, but are still important for the production of food, feed, fiber, or forage crops. They include those soils that are nearly Prime Farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods (C.G.A. - CHAPTER 422a AGRICULTURAL LANDS P.A. 78-232, S. 1, 11).

Locally Important Farmland are soils that are not Prime Farmland or Farmland of Statewide Importance but are used for the production of high value food, fiber or horticultural crops (USDA NRCS 2000). This land may be important to the local economy due to its productivity or value.

A site map of the Project showing the mapped USDA NRCS farmland soils is provided in Attachment 1, and representative Project site photographs are provided in Attachment 2.

2 SITE DESCRIPTION

Nutmeg Solar is located in the town of Enfield, Connecticut. The Project site is bisected by Broad Brook Road/State Route 191. The site is primarily in agricultural use and a portion of the site is forested. During the field visit, a portion of the ground surface showed evidence of production of pumpkin and other squash from the fall of 2016. The agricultural portion of the site has been used since 1907 (Pers. Comm. Steve Jarmoc, one of the landowners) for growing tobacco. There is an active concrete batch plant

immediately southeast of the site. Even the forested portion of the site identified in the eastern part of the project area shows evidence of past agricultural use. The parent material is primarily water borne outwash sediment deposition.

3 EXISTING NRCS SOIL MAPPING

Farmland Soils data is interpreted from soils data mapped by the USDA NRCS and does not represent field performed soil surveys. The data is mapped remotely and field checked. The data has site-specific and scale-based limitations. The information provided by the USDA NRCS does not necessarily portray land that is used currently for farming, but is provided for the purpose of identifying potentially productive soils that may be suitable for farming. The Farmland Soils data does not incorporate current land use or land use changes, which may alter the farmland soil designation. This would be directly related to gravel extraction or other limiting land uses. The publically available data set is not designed by the USDA NRCS for use as a regulatory tool in permitting or siting decisions.

Two soil series mapped by USDA NRCS on the Project site are Haven and Enfield association and Agawam, both considered Prime Farmland. There is a small pocket of Manchester that is identified as Farmland of Statewide Importance. The entire eastern portion of the site is mapped as Narragansett, which is classified as Farmland of Statewide Importance.

No Locally Important Farmland soils have been mapped by USDA NRCS on the Project site.

4 FIELD OBSERVATIONS AND TEST PITS

Based on field observations the fields located on the east side of Route 191 have seen more recent active agriculture. This is likely due to the higher quality soil present in these fields. Field test pit data were collected in two locations to verify presence of soils mapped remotely. Test Pit 1 was located inside of the area mapped as Haven and Enfield soils (Prime Farmland) and Test Pit 2 was located in an area mapped as Manchester (Farmland of Statewide Importance) (Attachment 1). Test pits are summarized in Tables 1 and 2; and photographs of the Test Pits are provided in Figures 1 and 2. Representative Project site photographs are provided in Attachment 2.

The Project site map provided in Attachment 1 indicates a larger pocket of Farmland of Statewide Importance than is actually present on-site. Based on field observations this currently forested area appears to meet the criteria for mapping as Narragansett silt loam, 15-25% slopes, extremely stony, and would not be classified as Prime Farmland or of State or Local Importance. During the field visit this area showed evidence of past agricultural use, but present conditions indicate it has not been in production for some time.

Table 1. Test Pit 1, Enfield, Connecticut.

Horizon	Depth (inches)	Texture	Color	Structure	Other
Ap	0-9	Loamy Sand	7.5 yr 3/2	SBK	No O Horizon
A/B	9-20	Loamy Sand	7.5 yr 3/4	SBK	
Bw1	20-30	Loamy Fine Sand	7.5 yr 5/6	SBK	
Bw2	30-45	Loamy Sand	7.5 yr 5/6	SBK	
B/C	45-56”	Loamy Sand	5yr 4/6	SBK	Refusal 56 inches

Figure 1. Test Pit 1, Enfield, Connecticut (Tetra Tech, Inc. December 22, 2016).

Table 2. Test Pit 2, Enfield, Connecticut.

Horizon	Depth (inches)	Texture	Color	Structure	Other
Ap	0-9	Sandy Loam	7.5yr 3/3	Granular	No O Horizon
A/B	9-25	Sandy Loam	7.5yr 5/4	SBK	
Bw	25-41	Sandy Loam	7.5 yr 4/4	SBK	
B/C	41-48	Fine Sand	7.5 yr 3/2	SBK	
C	48+	Gravelly Fine Sand	10yr 6/2	Single Grain	Loose at 48+ inches

Figure 2. Test Pit 2, Enfield, Connecticut (Tetra Tech, Inc. December 22, 2016).

Test pit results showcase soil texture classes that would be suitable for agricultural use. Test Pit 2, which was investigated to determine if Manchester soil was present in the cultivated field, contained soil characteristics that fall more in line with the Haven soils series, a Prime Farmland soil type. Manchester is a more coarse soil series consisting of 50% gravel within the C horizon and this area would be classified differently based on test pit observations. This is not uncommon to have site specific variation from the much coarser NRCS mapping. The forested area of the site was observed, but no test pits were dug. Due to the slopes present in the forested area, these areas are not expected to be classified as Prime Farmland. Test pit results demonstrate characteristics of Haven and Enfield soils, which are both classified by the

USDA NRCS as Prime Farmland. Although an area mapped as Manchester soil is present, the results for Test Pit 2 in this area did not align with the mapped classification of this area as Farmland of Statewide Importance. Soils observed did not appear to have a high organic content and no vegetative cover was present. Soils show signs of long term agricultural use and management. Over time intense farming degrades soil health and without proper management can be negatively impacted by agriculture. This area shows the effects of long term agricultural use shown in the lack of organic material in the upper horizons, evidence of compaction, intense tillage, and lack of cover cropping or organic material on the surface.

5 CONCLUSION

The soil investigation completed for the Project site determined that NRCS mapping is mostly accurate and the site does contain Prime Farmland soil types. There are some small differences in mapped soils versus observed ground conditions. A formal soil survey was not performed, but this site visit found evidence that the forested western section of the site would not be considered Prime Farmland. All Prime Farmland has the potential to be impacted or degraded by human activity in a number of ways. Several of the top factors include erosion, soil compaction, and nutrient depletion. Often the best solution to recover these factors is to allow the soil to recover by taking it out of crop production. Physical soil disturbance, such as tillage, can results in bare compacted soil that is destructive and disruptive to soil microbes, and it creates a hostile environment for them to live. Misapplication of farm inputs can disrupt the symbiotic relationships between fungi, other microorganisms, and plant roots. Vegetative soil cover conserves moisture, reduces temperature, intercepts raindrops (to reduce erosion), suppresses weed growth, and provides habitat for members of the soil food web that spend at least some of their time aboveground. This is true regardless of land use (cropland, hayland, pasture, or range). The designation of Prime Farmland at the Project site identifies not only the value of the site to contain farmland soils today, but also indicates the Project site will continue to provide valuable farmland in the future.

Development of Prime Farmland for use in generating solar power would not be expected to result in degradation of soil quality. After the viable life of the Project, the expectation would be that Prime Farmland identified on the site would be in the same, or an improved condition than it is in today. The energy Project would be expected to arrest gravel extraction and/or potential conversion of this farmland into another hardscape or residential/commercial development. Soil degradation is not expected to occur as a result of the proposed solar Project.

There would be some minimal disturbance to place foundations during construction, but the Project would maintain a vegetative cover on the soil surface underneath the solar panels. This would allow the soil to recover from past agricultural use (where applicable) by following guidelines based on decades of study, just a few of which include Barrow 1991, Ericksson et al. 1974, and Derpsch 2008. Soil health management systems that are recommended include a suite of practices, such as crop rotations, cover crops, no-till, and mulching that require less soil disturbance, provide living roots throughout the year, improve crop diversity, and keep the soil covered. A solar power development, such as the one proposed, could likely duplicate agricultural conservation practices that generally improve soil health, and would follow the principal of switching from conventional tillage to no-till. Additionally, having a vegetative cover on the soil surface would improve soil health for the lifespan of the solar generation Project.

6 REFERENCES

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_____. 2000. Chapter VI, Part 657 – Prime and Unique Farmlands. Title 7 – Agriculture. Part 657 – Prime and Unique Farmlands. Available from: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_054226

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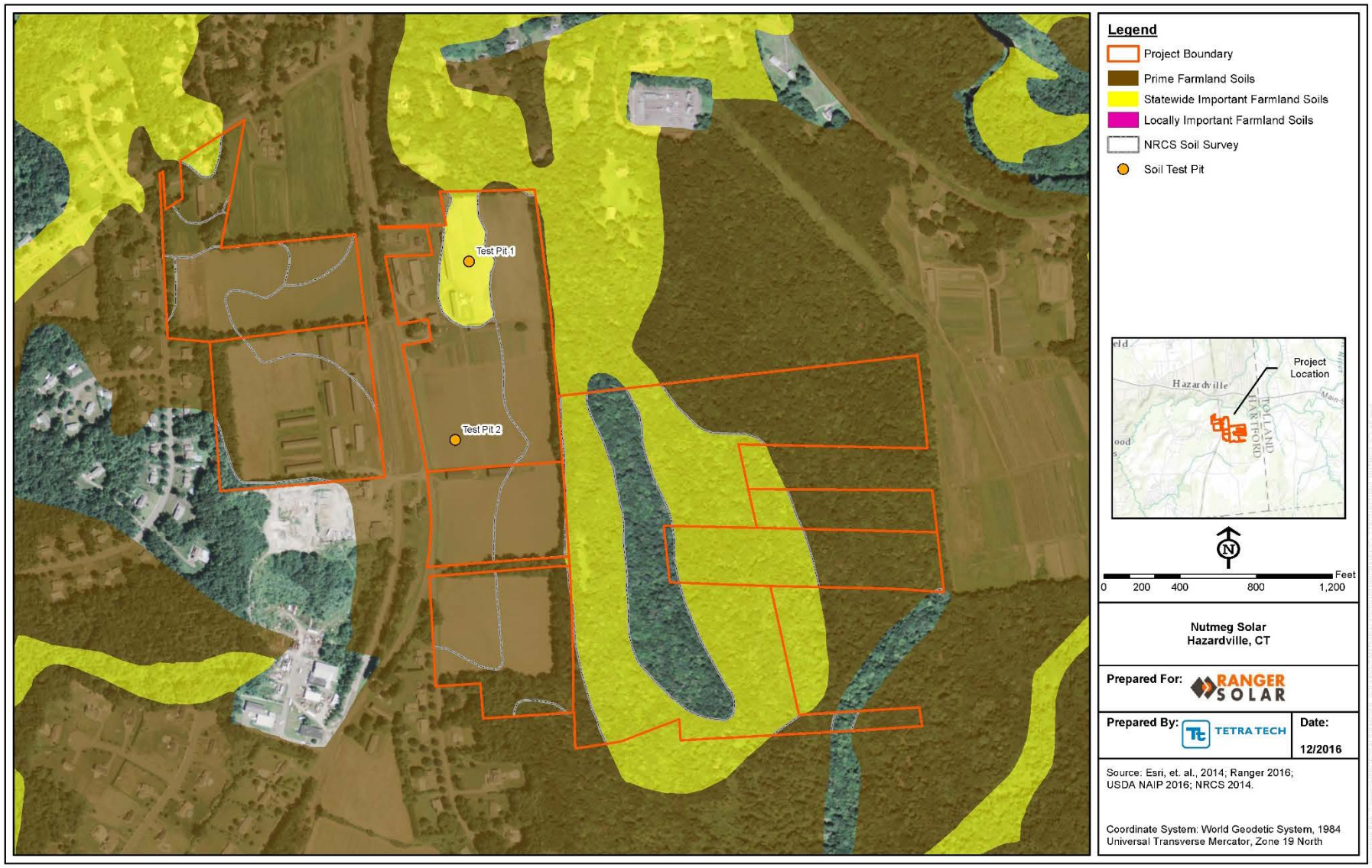
_____. 2016b. Official Soil Series Descriptions. Available from: https://soilseries.sc.egov.usda.gov/osdname.aspx

Attachment 1.

Nutmeg Solar Project Site Map
Enfield, Connecticut


Test Pit 1
Test Pit 2
Legend
Project Boundary
Prime Farmland Soils
Statewide Important Farmland Soils
Locally Important Farmland Soils
NRCS Soil Survey
Soil Test Pit
Project Location
Hazardville
N
0
200
400
800
1,200
Feet
Nutmeg Solar
Hazardville, CT
Prepared For:
RANGER SOLAR
Prepared By:
TETRA TECH
Date:
12/2016
Source: Esri, et. al., 2014; Ranger 2016; USDA NAIP 2016; NRCS 2014.
Coordinate System: World Geodetic System, 1984 Universal Transverse Mercator, Zone 19 North

Attachment 2.

Nutmeg Solar Project Representative Site Photographs
Enfield, Connecticut

Photograph 1. Test Pit 1 Overview. Nutmeg Solar Project, Enfield, Connecticut (Tetra Tech, Inc. December 22, 2016)

Photograph 2. Test Pit 2 Overview. Nutmeg Solar Project, Enfield, Connecticut. (Tetra Tech, Inc. December 22, 2016)

APPENDIX D – DATABASE REVIEWS AND AGENCY CORRESPONDENCE

- NDDB Determination (August 3, 2018).
- United States Fish and Wildlife Service – Information for Planning and Consultation (IPaC) Report for Nutmeg Solar.
- Preliminary Site Assessment for Nutmeg Solar, a Utility-Scale Solar PV Project on Broad Brook Road in Enfield, Connecticut. NDDB Preliminary Assessment No.: 201706175.

NDDB Determination

Connecticut Department of

ENERGY &
ENVIRONMENTAL
PROTECTION

August 3, 2018

Dale Knapp
Tetra Tech, Inc.
451 Presumpscot Street
Portland, ME 04103
dale.knapp@tetratech.com

Project: Nutmeg Solar a Utility Scale Solar PV Project on Broad Brook Road in Enfield, Connecticut
NDDB Determination No.: 20176175

Dear Dale Knapp,

I have re-reviewed Natural Diversity Data Base maps and files regarding the area delineated on the map provided for Nutmeg Solar a Utility Scale Solar PV Project on Broad Brook Road in Enfield, Connecticut. Thank you for providing the July 27, 2018 Supplemental Survey Report for the spring 2018 field work completed at the project site.

I concur with the best management practices included in the July 27, 2018 Herpetofauna Avoidance and Mitigation Plan that will be implemented to protect state listed amphibians and reptiles from project impacts. I have attached a copy of the proposed plan for this project and included with your NDDB materials. If these strategies are implemented it will lessen the impacts of this project on any amphibian or reptile that may occur within this project footprint.

This determination is good for two years. Please re-submit an NDDB Request for Review if the scope of work changes or if work has not begun on this project by August 3, 2020.

Natural Diversity Data Base information includes all information regarding critical biological resources available to us at the time of the request. This information is a compilation of data collected over the years by the Department of Energy and Environmental Protection's Natural History Survey and cooperating units of DEEP, private conservation groups and the scientific community. This information is not necessarily the result of comprehensive or site-specific field investigations. Consultations with the Data Base should not be substitutes for on-site surveys required for environmental assessments. Current research projects and new contributors continue to identify additional populations of species and locations of habitats of concern, as well as, enhance existing data. Such new information is incorporated into the Data Base as it becomes available. The result of this review does not preclude the possibility that listed species may be encountered on site and that additional action may be necessary to remain in compliance with certain state permits.

Please contact me if you have further questions at (860) 424-3592, or dawn.mckay@ct.gov . Thank you for consulting the Natural Diversity Data Base.

Sincerely,

Dawn M. McKay

Dawn M. McKay
Environmental Analyst 3

United States Fish and Wildlife Service – Information for Planning and Consultation (IPaC) Report for Nutmeg Solar.

IPaC **U.S. Fish & Wildlife Service**

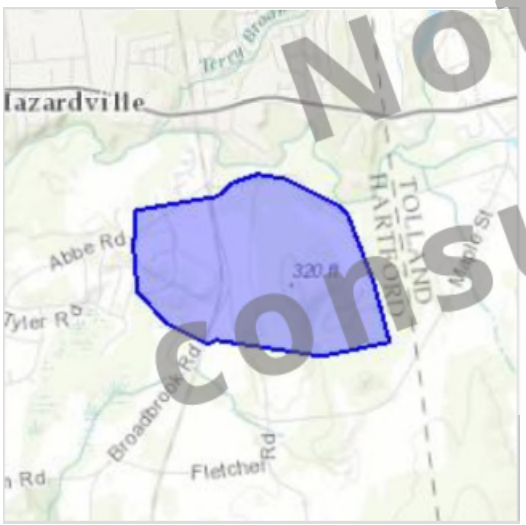
IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Hartford County, Connecticut



Local office

New England Ecological Services Field Office

(603) 223-2541
(603) 223-0104

70 Commercial Street, Suite 300
Concord, NH 03301-5094

http://www.fws.gov/newengland

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species

[1] are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Northern Long-eared Bat Myotis septentrionalis No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9045	Threatened

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act

[1] and the Bald and Golden Eagle Protection Act[2].

Any activity that results in the take (to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service

[3]. There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Conservation measures for birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Year-round bird occurrence data http://www.birdscanada.org/birdmon/default/datasummaries.jsp

The migratory birds species listed below are species of particular conservation concern (e.g. Birds of Conservation Concern) that may be potentially affected by activities in this location. It is not a list of every bird species you may find in this location, nor a guarantee that all of the bird species on this list will be found on or near this location. Although it is important to try to avoid and minimize impacts to all birds, special attention should be made to avoid and minimize impacts to birds of priority concern. To view available data on other bird species that may occur in your project area, please visit the AKN Histogram Tools and Other Bird Data Resources. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

NAME	SEASON(S)
American Bittern Botaurus lentiginosus https://ecos.fws.gov/ecp/species/6582	Breeding
Bald Eagle Haliaeetus leucocephalus https://ecos.fws.gov/ecp/species/1626	Year-round
Black-billed Cuckoo Coccyzus erythropthalmus https://ecos.fws.gov/ecp/species/9399	Breeding
Blue-winged Warbler Vermivora pinus	Breeding
Canada Warbler Wilsonia canadensis	Breeding

Fox Sparrow Passerella iliaca	Wintering
Least Bittern Ixobrychus exilis https://ecos.fws.gov/ecp/species/6175	Breeding
Olive-sided Flycatcher Contopus cooperi https://ecos.fws.gov/ecp/species/3914	Breeding
Peregrine Falcon Falco peregrinus https://ecos.fws.gov/ecp/species/8831	Breeding
Pied-billed Grebe Podilymbus podiceps	Year-round
Prairie Warbler Dendroica discolor	Breeding
Purple Sandpiper Calidris maritima	Wintering
Short-eared Owl Asio flammeus https://ecos.fws.gov/ecp/species/9295	Wintering
Upland Sandpiper Bartramia longicauda https://ecos.fws.gov/ecp/species/9294	Breeding
Willow Flycatcher Empidonax traillii https://ecos.fws.gov/ecp/species/3482	Breeding
Wood Thrush Hylocichla mustelina	Breeding
Worm Eating Warbler Helmitheros vermivorum	Breeding

What does IPaC use to generate the list of migratory bird species potentially occurring in my specified location?

Landbirds:

Migratory birds that are displayed on the IPaC species list are based on ranges in the latest edition of the National Geographic Guide, Birds of North America (6th Edition, 2011 by Jon L. Dunn, and Jonathan Alderfer). Although these ranges are coarse in nature, a number of U.S. Fish and Wildlife

Service migratory bird biologists agree that these maps are some of the best range maps to date. These ranges were clipped to a specific Bird Conservation Region (BCR) or USFWS Region/Regions, if it was indicated in the 2008 list of Birds of Conservation Concern (BCC) that a species was a BCC species only in a particular Region/Regions. Additional modifications have been made to some ranges based on more local or refined range information and/or information provided by U.S. Fish and Wildlife Service biologists with species expertise. All migratory birds that show in areas on land in IPaC are those that appear in the 2008 Birds of Conservation Concern report.

Atlantic Seabirds:

Ranges in IPaC for birds off the Atlantic coast are derived from species distribution models developed by the National Oceanic and Atmospheric Association (NOAA) National Centers for Coastal Ocean Science (NCCOS) using the best available seabird survey data for the offshore Atlantic Coastal region to date. NOAANCCOS assisted USFWS in developing seasonal species ranges from their models for specific use in IPaC. Some of these birds are not BCC species but were of interest for inclusion because they may occur in high abundance off the coast at different times throughout the year, which potentially makes them more susceptible to certain types of development and activities taking place in that area. For more refined details about the abundance and richness of bird species within your project area off the Atlantic Coast, see the Northeast Ocean Data Portal. The Portal also offers data and information about other types of taxa that may be helpful in your project review.

About the NOAANCCOS models: the models were developed as part of the NOAANCCOS project: Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf. The models resulting from this project are being used in a number of decision-support/mapping products in order to help guide decision-making on activities off the Atlantic Coast with the goal of reducing impacts to migratory birds. One such product is the Northeast Ocean Data Portal, which can be used to explore details about the relative occurrence and abundance of bird species in a particular area off the Atlantic Coast.

All migratory bird range maps within IPaC are continuously being updated as new and better information becomes available.

Can I get additional information about the levels of occurrence in my project area of specific birds or groups of birds listed in IPaC?

Landbirds:

The Avian Knowledge Network (AKN) provides a tool currently called the "Histogram Tool", which draws from the data within the AKN (latest,survey, point count, citizen science datasets) to create a view of relative abundance of species within a particular location over the course of the year. The results of the tool depict the frequency of detection of a species in survey events, averaged between multiple datasets within AKN in a particular week of the year. You may access the histogram tools through the Migratory Bird Programs AKN Histogram Tools webpage.

The tool is currently available for 4 regions (California, Northeast U.S., Southeast U.S. and Midwest), which encompasses the following 32 states: Alabama, Arkansas, California, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts,

Michigan, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, North, Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin.

In the near future, there are plans to expand this tool nationwide within the AKN, and allow the graphs produced to appear with the list of trust resources generated by IPaC, providing you with an additional level of detail about the level of occurrence of the species of particular concern potentially occurring in your project area throughout the course of the year.

Atlantic Seabirds:

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAANCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Facilities

Wildlife refuges

Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGES AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands

Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location overlaps the following wetlands:

FRESHWATER FORESTED/SHRUB WETLAND

PFO1E

A full description for each wetland code can be found at the National Wetlands Inventory website: https://ecos.fws.gov/ipac/wetlands/decoder

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Preliminary Site Assessment for Nutmeg Solar, a Utility-Scale Solar PV Project on Broad Brook Road in Enfield, Connecticut. NDDB Preliminary Assessment No.: 201706175.

Connecticut Department of

ENERGY &
ENVIRONMENTAL
PROTECTION

August 28, 2017

Mr. Dale Knapp
Tetra Tech, Inc.
451 Presumpscot Street
Portland, ME 04103
dale.knapp@tetratech.com

Project: Preliminary Site Assessment for Nutmeg Solar a Utility Scale Solar PV Project on Broad Brook Road in Enfield, Connecticut
NDDB Preliminary Assessment No.: 201706175

Dear Dale,

I have reviewed Natural Diversity Data Base maps and files regarding the Preliminary Site Assessment for Nutmeg Solar a Utility Scale Solar PV Project on Broad Brook Road in Enfield, Connecticut. According to our information there are known extant populations of State Listed Species that occur within or close to the boundaries of this property. I have attached a list of these species to this letter.

Please be advised that this is a preliminary review and not a final determination. A more detailed review will be necessary to move forward with any subsequent environmental permit applications submitted to DEEP for the proposed project. **This preliminary assessment letter cannot be used or submitted with your permit applications at DEEP**. This letter is valid for one year.

To prevent impacts to State-listed species, field surveys of the site should be performed by a qualified biologist when these target species are identifiable. A report summarizing the results of such surveys should include:

1. Survey date(s) and duration
2. Site descriptions and photographs
3. List of component vascular plant species within the survey area (including scientific binomials)
4. Data regarding population numbers and/or area occupied by State-listed species
5. Detailed maps of the area surveyed including the survey route and locations of State-listed species

6. Conservation strategies or protection plans that indicate how impacts may be avoided for all state-listed species present on the site.
7. Statement/résumé indicating the biologist's qualifications. Please be sure when you hire a consulting qualified biologist to help conduct this site survey that they have the proper experience with target taxon and have a CT scientific collectors permit to work with state listed species for this specific project.

The site surveys report should be sent to our CT DEEP-NDDB Program (deep.nddbrequest@ct.gov) for further review by our program biologists along with an updated request for another NDDB review.

Natural Diversity Data Base information includes all information regarding critical biological resources available to us at the time of the request. This information is a compilation of data collected over the years by the Department of Energy and Environmental Protection's Natural History Survey and cooperating units of DEEP, private conservation groups and the scientific community. This information is not necessarily the result of comprehensive or site-specific field investigations. Consultations with the Data Base should not be substitutes for on-site surveys required for environmental assessments. Current research projects and new contributors continue to identify additional populations of species and locations of habitats of concern, as well as, enhance existing data. Such new information is incorporated into the Data Base as it becomes available. The result of this review does not preclude the possibility that listed species may be encountered on site and that additional action may be necessary to remain in compliance with certain state permits.

Please contact me if you have further questions at (860) 424-3592, or dawn.mckay@ct.gov . Thank you for consulting the Natural Diversity Data Base.
Sincerely,

Dawn M. McKay

Dawn M. McKay
Environmental Analyst 3

Species List for NDDB Request

Scientific Name	Common Name	State Status
Invertebrate Animal		
Cicindela formosa generosa	Big sand tiger beetle	SC
Cicindela lepida	Dune ghost tiger beetle	E
Cicindela tranquebarica	Dark-bellied tiger beetle	T
Geopinus incrassatus	Ground beetle	SC
Ligumia nasuta	Eastern pondmussel	SC
Margaritifera margaritifera	Eastern pearlshell	SC
Terrestrial Community - Other Classification		
Floodplain forest		
Sand barren		
Vascular Plant		
Platanthera hookeri	Hooker's orchid	SC*
Vertebrate Animal		
Cottus cognatus	Slimy sculpin	SC
Glyptemys insculpta	Wood turtle	SC
Notropis bifrenatus	Bridle shiner	SC
Passerculus sandwichensis	Savannah sparrow	SC
Pooecetes gramineus	Vesper sparrow	E
Scaphiopus holbrookii	Eastern spadefoot	E
Terrapene carolina carolina	Eastern box turtle	SC

E = Endangered, T = Threatened, SC = Special Concern, * Extirpated

APPENDIX E – HERPETOFAUNA AVOIDANCE AND MITIGATION PLAN

Herpetofauna Avoidance and Mitigation Plan

Nutmeg Solar Project
Enfield, Connecticut

Prepared for:

Nutmeg Solar, LLC
700 Universe Blvd
Juno Beach, FL 33408

October 2, 2018

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TABLE OF CONTENTS

APPENDIX A – TABLES AND FIGURES

List of Tables

List of Figures

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HERPETOFAUNA AVOIDANCE AND MITIGATION PLAN

To proactively avoid and prevent impacts to both resident and transient wildlife that could be present on site, an avoidance and mitigation plan will be implemented during Project construction. The use of construction Best Management Practices (BMPs) is key to the effective implementation of this plan. Training of contractors and regular consultation with a specialist or environmental monitor will ensure the plan is being strictly adhered to. An environmental monitor will be employed to work alongside contractors during the construction phase to ensure effective implementation of the plan, as well as make real-time changes and adjustments (i.e., adaptive management) [1] to accommodate changing site conditions and observations made in the field. Appendix A, Table 1 summarizes the general approach to avoiding and minimizing impacts to herpetofauna during Project construction.

Pre-Construction Surveys

All pre-construction surveys were conducted within a larger area (196-acres) that contains the proposed footprint (or Project area) of the Nutmeg Solar Project, herein referred to as the Study Area (Appendix A, Figure 1). A wetland and watercourse delineation survey and a rare, threatened, and endangered species survey were conducted during the summer of 2017. Spring vernal pool breeding amphibian surveys were conducted in 2017 and 2018. Eastern spadefoot toad (*Scaphiopus holbrookii*), eastern box turtle (*Terrapene carolina carolina*), and wood turtle (*Glyptemys insculpta*) surveys were conducted during the spring and summer of 2018. A general herpetological inventory was conducted simultaneously with the turtle surveys.

The results for surveys conducted in the spring and summer of 2017 and 2018 are provided in separate reports. Generally, low species abundance and diversity were documented within the Study Area, with only six amphibian and one reptile species being detected. Results of the general herpetological inventory concluded there exists some suitable box turtle habitat and marginal wood turtle habitat within the Study Area. No box turtles or wood turtles were observed during field investigations targeted for these species, indicating that they are likely absent from the site or exist at a very low population density. No eastern spadefoot toads or other rare, threatened, or endangered amphibians or reptiles were observed within or around the Study Area.

Construction Timing

Avoiding seasonally sensitive time periods by timing construction to coincide with low herpetological activity (e.g., site clearing in winter) will help avoid or minimize impacts to herpetofauna species that occupy the site. Due to the observed presence of vernal pool breeding amphibians, avoiding clearing, grading, and heavy earthwork during the spring vernal pool season (March–June) is recommended. No work is proposed within wetlands or watercourses, and tree clearing will be completed in the winter (November–March) to prevent incidental take of any listed bat species and reduce ground disturbance by working under frozen/winter conditions.

[1] Adaptive management is a structured, iterative process of robust decision making in the face of uncertainty, with an aim to reduce uncertainty over time via system monitoring.

Construction Mitigation Measures

Temporary measures taken during Project construction will help avoid take of individual amphibians and reptiles that may be present on site. While there is an apparent low density of herpetofauna and no detection of listed species in the Study Area, surveys for these species cannot be considered conclusive. Therefore, implementing BMPs to avoid impacts to species that could possibly use the site will ensure appropriate steps are being taken to avoid and mitigate for potential impacts during construction. The following measures are recommended for the Project:

- Contractor training;
- Exclusion fencing;
- Clearing restrictions;
- Regular inspections and monitoring; and
- Documentation and reporting of observations.

Contractor Training

The designated environmental monitor will be responsible for creating a training curriculum prior to the commencement of construction activities. During the initial site safety orientation and contractor on-boarding, new personnel will undergo training on the identification and habits of reptile and amphibians that could be present (e.g., box turtles and wood turtles) within the Study Area. The training will inform contractors that avoiding impacts to amphibians and reptiles is of utmost importance regarding the Project. A handout or flyer will be posted in the operations trailer to remind staff of what these species look like, their preferred habitats and refugia (e.g., thick brush, small mammal burrows), and the necessary procedures to follow if one is observed. The environmental monitor will be the point of contact for personnel to report sightings to and will determine what action(s) should be taken. Additional training sessions will be provided if personnel change, or if changes in site conditions warrant the need.

Contractors responsible for site clearing will be required to follow the 2007 Connecticut Field Guide to Best Management Practices for Water Quality While Harvesting Forest Products[2]. All contractors will adhere to the applicable BMPs described in the Connecticut Department of Transportation Environmental Compliance manual for Water Pollution Control (Section 1.10.03), and the Connecticut Department of Energy and Environmental Protection (DEEP) *Stormwater Management at Solar Farm Construction Projects* guidance issued on September 8, 2017[3].

Exclusion Fencing

Exclusionary practices are commonly accepted measures that are widely used for construction Projects in various regions across the U.S., including the Northeast. Exclusion fencing practices are recommended by

[2] State of Connecticut Department of Environmental Protection, Bureau of Natural Resources, Division of Forestry. 2007. Best Management Practices for Water Quality While Harvesting Forest Products. Accessed online 05 July 2018 at: http://www.ct.gov/deep/lib/deep/forestry/best_management_practices/best_practicesmanual.pdf.

[3] Connecticut Department of Energy and Environmental Protection. 2017. Stormwater Management at Solar Farm Construction Projects.

the United States Fish and Wildlife Service for protecting the desert tortoise (*Gopherus agassizii*) in the Southwestern U.S.[4], and have been used for box turtles in New York[5] and bog turtle (*Glyptemys muhlenbergii*) in Pennsylvania[6]. In addition to being used as a herpetofauna exclusion BMP, exclusion fencing (or silt fence) also is recommended by the Connecticut Department of Transportation as a BMP for water pollution control (Section 1.10, Article 1.10.03).

Exclusion fencing for the Project will be coordinated with the prescribed stormwater phasing and installed to enclose the entire work area at the limit of disturbance, keeping turtles and amphibians outside of active construction zones. Fencing will consist of Department of Transportation-grade silt fence typically at least 2 feet high with ≥ 4 inches buried into the soil (exact specifications can be determined prior to construction). Fencing will be installed prior to any ground-disturbing activities (e.g., grading, tree cutting). The exclusion fencing will be maintained throughout the entire active season for amphibians and reptiles (March–November). In areas where silt fence is used for exclusion, it will be removed as soon as the area has been stabilized to allow for reptile and amphibian passage to resume.

Following initial installation, a search will be made within the enclosed area(s) to detect and remove any enclosed target species (e.g., box or wood turtles). The environmental monitor will be responsible for the pre-construction clearance survey to ensure that no herpetofauna are trapped inside the enclosed area(s). Once the Project is underway, the environmental monitor or a designated contractor will conduct regular (weekly) sweeps of the exclusion fencing to ensure it is functioning properly and to identify any reptiles and amphibians that are near the fencing. Any eastern box turtles or wood turtles that are found within the work area will be carefully collected and relocated to appropriate habitat nearby and safely outside the active construction site.

Clearing Restrictions

Seasonal clearing restrictions established to provide protection for tree-roosting bat species within the Project area also will avoid the spring amphibian breeding season. Additionally, a selective harvesting plan is proposed for this Project to reduce impacts to upland habitat for the vernal pool breeding species that were observed within the Project area. Under this plan there will be no clearing within 100 feet of the pool, and capable tree species outside of the 100-foot pool envelope will be selectively removed leaving the understory vegetation present within the critical terrestrial habitat around the vernal pool depression. In doing so, this approach will maintain the quality of the upland habitat used as a diurnal refuge by spring breeding amphibians, while reducing shading impacts on solar panel output. This approach takes into

[4] United States Fish and Wildlife Service. 2005. Recommended Specifications for Desert Tortoise Exclusion Fencing. September 2005. Accessed online 05 July 2018 at: https://www.fws.gov/southwest/es/arizona/Documents/SpeciesDocs/DesertTortoise/Tortoise%20Fencing.pdf.

[5] Kevin Ryan, personal communication.

[6] Tetra Tech, Inc. 2016. Bog Turtle (*Glyptemys muhlenbergii*) Conservation Plan. Pennsylvania Pipeline Project. Prepared for Sunoco Logistics L.P. April 2016.

consideration to the extent practicable, the Habitat Management Guidelines[7] developed by Calhoun and deMaynadier for silvicultural activities.

While this vernal pool is a potential sink for amphibians as described in the 2018 Vernal Pool Survey Report, the Project plan provides for the conservation of the vernal pool depression, its envelope, and a portion of the pool's critical terrestrial habitat. The upland forest extending southward from the vernal pool depression and towards an off-site wetland complex that likely contains suitable pool-breeding amphibian habitat will be left intact and will provide a landscape connection between these two areas. This "directional corridor" has been designated as part of the Project Site Plan and follows the United States Army Corps of Engineers Vernal Pool Directional Buffer Guidance document[8]. The contract with the leasing landowner has been negotiated to allow no clearing within the landscape connection (directional buffer) for the life of the Project. The critical terrestrial habitat calculations and a visual demonstration of the directional buffer is provided in Appendix A, Figure 2.

Inspections and Monitoring

As mentioned above, a designated on-site environmental monitor will be employed throughout the Project construction period. This individual will be a qualified biologist responsible for conducting inspections of the exclusion fencing and other avoidance and mitigation tactics that may be employed during the construction process. Regular communication with the contractors on site will be essential to a successful avoidance and mitigation outcome. The monitor will be the point of contact between contractors and other Project inspectors as well as state agencies. The monitor will be responsible for regular reporting of site conditions and contacting the appropriate state agencies if rare, threatened, and endangered species are observed within the work areas.

Documentation and Reporting

If rare, threatened, or endangered species are found within the Project area, they will be translocated out of the work area to appropriate habitat and the event will be reported to the appropriate person(s) at Connecticut DEEP. Any necessary handling permits will be acquired prior to the commencement of construction. Regular reports from the environmental monitor will be used to evaluate the effectiveness of the avoidance and mitigation plan and determine whether adjustments need to be made during the construction process to protect certain species. Formal communication such as reports and memos will be used to help inform Project leaders to ensure that the necessary changes are made to the plan. To this end, a regular schedule for reporting and monitoring efforts will be established prior to the commencement of construction.

[7] Calhoun, A.J.K. and P. deMaynadier. 2004. Forestry habitat management guidelines for vernal pool wildlife. MCA Technical Paper No. 6, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, New York.

[8] Calhoun, A. 2010. VP Directional Buffer Guidance. University of Maine. Accessed online 05 July 2018 at: http://www.nae.usace.army.mil/Portals/74/docs/regulatory/VernalPools/VPBufferGuidance.pdf.

APPENDIX A: AVOIDANCE AND MITIGATION PLAN - TABLES AND FIGURES

Table 1: Summary of Herpetofauna Avoidance and Mitigation Measures

Preconstruction	Clearing	Construction	Post Construction
• Field surveys (2017 and 2018) o Vernal pool breeding amphibian surveys o Herpetofauna surveys (eastern spadefoot toad, eastern box turtle, wood turtle) o General herpetological inventory • Contractor training: herpetofauna field identification/reporting	• Restricted to winter (November–March) (bats) • Avoid earthwork during vernal pool season (April–June) • No clearing within vernal pool or vernal pool envelope • Limited selective tree harvesting within Critical Terrestrial Habitat	• Contractor training • Exclusion fencing (April–October) • Regular monitoring • Real-time adjustments during construction • Documentation/reporting	• Vegetation/meadow habitat maintenance • Vernal pool directional buffer: no clearing during life of Project • Perimeter fence with wildlife access gap at bottom

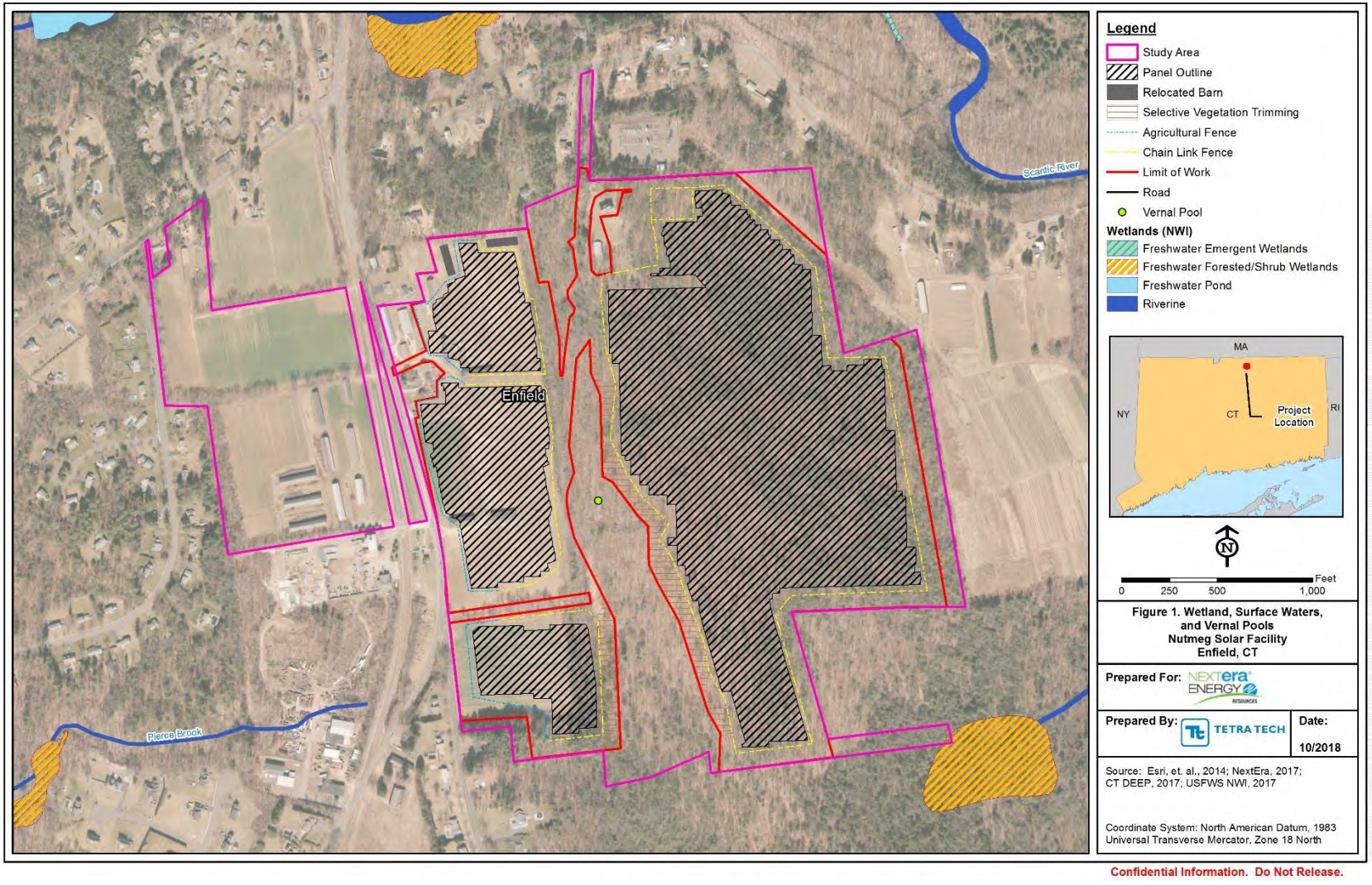

Figure 1: Nutmeg Solar Project Study Area, Development Area and Water Resources

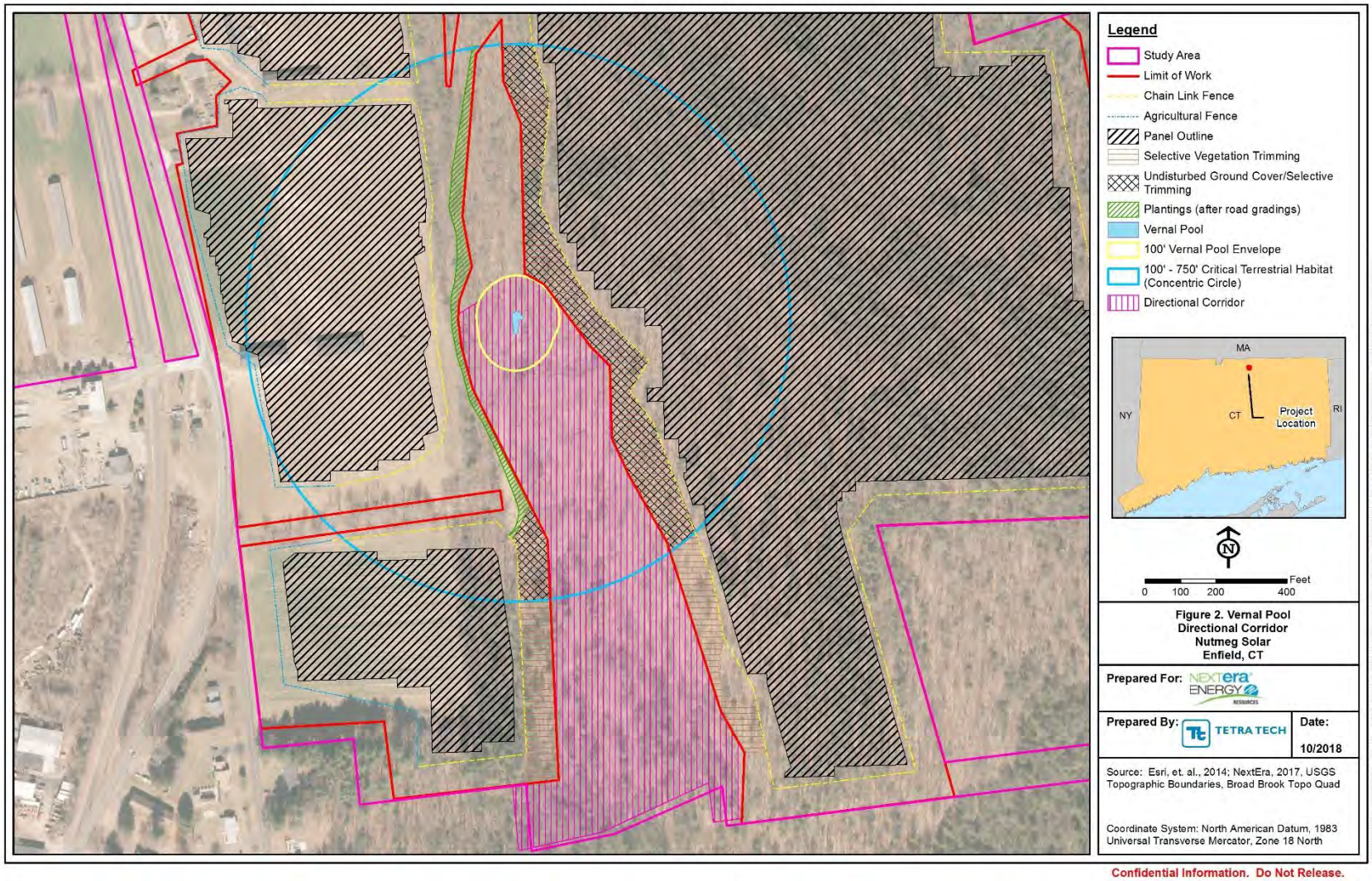

Figure 2: Critical Terrestrial Habitat and Directional Vernal Pool Buffer at the Nutmeg Solar Project

APPENDIX F – FIELD STAFF RESUMES

Professional Summary

Mr. Agius is a Project Manager and Senior Wetland Scientist with 19 years of experience in natural resource project design, implementation and management. He is a certified Geographic Information Systems Professional (GISP) and Professional Wetland Scientist (PWS). He had delineated more than 46,000 acres of wetlands in New England, mapped tens of miles of streams and waterbodies, conducted wetland functional and coastal assessments leading to state and federal permit approval. He has conducted vernal pool surveys on hundreds of vernal pools across New England, and has served on the Maine Association of Wetland Scientists (MAWS) – Vernal Pool Technical Committee since its inception in 2008. Mr. Agius is the past the President of MAWS (2015-2017). He has mapped wetlands, waterbodies, vegetation communities and threatened and endangered species on millions of acres across the country, and beyond. He provides senior advisement and QA/QC review on wetland and waterbody delineation projects across the country.

His experience extends over a broad range of scientific disciplines around the world including: geographic information system (GIS) analysis and mapping (with ESRI ArcGIS-Spatial/3D Analyst, ENVI); rare, threatened and endangered (RTE) species assessment; flora and fauna surveys; coastal habitat assessments using SCUBA; biodiversity studies in marine and estuarine ecosystems; invasive species surveys; fire ecology and mapping; climate change analysis; fish surveys; wetland delineations and functional assessments; vernal pool assessments; soil surveys; site suitability assessments; dredge spoils permitting; stream restoration; iPad/Garmin/Trimble GPS and real-time online mapping; photo-interpretation (PI); aerial surveys; air and water quality assessments; and turbidity monitoring.

He has designed and managed large databases, including field data and equipment, data deliverables, as well as worked on projects from the preliminary siting stage through post construction monitoring ensuring QA/QC consistency and implementation across projects. He has extensive experience leading and managing field teams, as well as reporting and review, and permitting with local, state, and federal agencies.

Education

- MS, Biology, Northeastern University, 2003
- BS, Marine & Freshwater Biology, University of New Hampshire, 1998

Selected Project Experience

Technical Project Manager, Confidential Client, Solar Portfolio, CT, ME, and NH
Responsible for a full suite of permitting activities (local, federal and state) for a portfolio of 10 solar projects in CT, ME, and NH, including critical issues analysis, environmental due diligence studies, agency outreach and development and submittal of CT Siting Board and MDEP/SLODA/USACE permit applications. Supported response to the Tri-State and Massachusetts Clean Energy solicitation in 2017. Lead field teams for wetland delineations and vernal pool mapping. Managed the geospatial analysis and mapping for all phase of the projects. Provided senior review and QA/QC of project deliverables.

Technical Project Manager, Statoil North America, Inc., Hywind Maine Project, ME
Responsible for natural resource surveys on several proposed transmission routes in Boothbay Harbor, ME. Conducted vernal pool surveys, wetland delineation, and stream inventorying. Delineated wetlands using the 1987 Corps of Engineers Wetlands Delineation Manual and Northcentral/Northeast Regional Supplement methods to assess the hydrology, soil type, and vegetation. Vernal pools were surveyed for the presence of vernal pool faunal species to determine if the pools met the criteria of significant habitat based on Chapter 335 Significant Wildlife Habitat of the State of Maine's Natural Resources Protection Act and the USACE State Programmatic General Permit. Additional geospatial oversight and QA/QC for the work plans with state and federal agencies, authored proposals, designed and lead field studies, and prepared reports and memos. Additional project responsibilities include geospatial support of the offshore avian and bat studies, including Trimble GPS data dictionary creation, GPS data processing, geospatial analysis and mapping.

Technical Project Manager, Eolian Renewable Energy LLC, Regulatory Compliance for Orland Wind Project, Vernal Pool Amphibian Breeding Season Surveys, Orland, ME
Responsible for leading vernal pool surveys for a proposed wind farm. Vernal pools were surveyed for the presence of vernal pool faunal species to determine if the pools met the criteria of significant habitat based on Chapter 335 Significant Wildlife Habitat of the State of Maine's Natural Resources Protection Act and the USACE State Programmatic General Permit. Provided the QA/QC of GIS data creation, from GPS, mapping and GIS deliverables.

Task Manager, U.S. Navy, NAVFAC Midlant, Wetland Delineation, Cutler and Great Pond, ME

Responsible for 3,400 acres of wetland delineation for jurisdictional determination by the US Army Corps of Engineers. Oversight of wetland delineation, habitat and stream mapping by multiple crews (including multiple subcontractors) to determine the presence and extent of wetlands and waterbodies in accordance with the guidelines set forth in the Corps of Engineers Wetlands Delineation Manual (USACE 1987) and Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (USACE 2012), criteria of significant habitat based on Chapter 335 Significant Wildlife Habitat of the State of Maine's Natural Resources Protection Act, and Wetlands of Special Significance in Chapter 310 of the State of Maine's Wetlands and Waterbodies protection rules. Tasks included coordinating with NAVFAC and Navy personnel and USACE New England District regulatory division, subcontractor oversight, field survey logistics, field survey completion, post survey Trimble GPS data processing, GIS mapping and reporting.

Wetland Scientist, US Army Corps of Engineers – New York District, Mamaroneck and Sheldrake Rivers Flood Risk Management Project, NY

Responsible for conducting wetland and water resource delineations for the Project in order to meet NEPA requirements. Wetland delineation, habitat and stream assessment to determine the presence and extent of freshwater and coastal wetlands and waterbodies in accordance with the guidelines set forth in the Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (USACE 2009), and the New York State Freshwater Wetlands Delineation Manual (NYSDEC 1995) in Village of Mamaroneck and Town of Harrison, Westchester County, New York.

Task Order Manager, State of Maine, Department of Transportation, Statewide Natural Resource Identification and Assessments, ME

Responsible for leading teams to identify and locate wetland boundaries using the Routine Onsite Determination method as described in the 1987 Corps of Engineers Wetlands Delineation Manual (1987 Manual) statewide. Used the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Regional Supplement) to supplement the field delineation. Identified wetlands were classified by wetland type in accordance with Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979). GPS points were spaced to ensure accurate representation of the wetland boundary and to permit relocation by MaineDOT staff or other regulatory agency personnel. MaineDOT information sheets that include Functional assessment and data required by USACE, with a narrative of the functions of the wetlands within the delineated area to allow an assessment of functions lost.

Technical Project Manager, Plum Creek Land Company, Moosehead Lake Concept Plan, ME

Responsible for natural resource surveys on 25,000 acres proposed for development. Conducted vernal pool surveys, wetland delineation, and stream inventorying. Delineated wetlands using the 1987 Corps of Engineers Wetlands Delineation Manual methods to assess the hydrology, soil type, and vegetation. Vernal pools were surveyed for the presence of vernal pool faunal species to determine if the pools met the criteria of significant habitat based on Chapter 335 Significant Wildlife Habitat of the State of Maine's Natural Resources Protection Act and the USACE State Programmatic General Permit.

Project Manager, Plum Creek Land Company, Photo-Interpretation of Vernal Pool Habitat, Moosehead Lake Region, ME

Responsible for inventory of a 400,000 acres conservation easement with photo-interpretation and GIS image analysis using 3D DAT/EM Systems Summit Evolution software to delineate potential vernal pool habitat. Assisted in database design and schema classification. Provided QA/QC of GIS data, photo-interpretation and ground truthing of vernal pool habitat.

GIS Manager, Patriot Renewables LLC, Wind Energy Project Portfolio, ME

Responsible for conducting spatial analysis and mapping in support of a spring and fall avian radar survey, bat acoustic survey, raptor migration survey, migrant stopover survey, RTE species survey, Bicknell's thrush survey, and breeding bird survey as part of the permitting process for a suite of wind projects. Additional geospatial support for the work plans with state and federal agencies, authored proposals, designed field studies, and prepared reports and memos.

Director of GIS, Burns and McDonnell Engineering, Central Maine Power – Maine Power Reliability Program, ME

Responsible for GIS analysis of flooding potential for the Maine Power Reliability Project using FEMA flood maps and GPS field data points. Flooding potentials were incorporated into resistivity models for a 440 mile transmission line.

Professional Summary

Ms. Craven has over four years of experience as a wildlife biologist conducting projects from Colorado to Maine. She has a broad background in environmental science and wildlife biology. Her responsibilities have been distributed over a wide variety of wildlife species including endangered species and invasive species. She has particular emphasis in mammals and more specifically in bat biology. She has been especially involved with bat acoustic data monitoring and data analysis. Ms. Craven has conducted over 35 northern long-eared bat presence absence studies in Maine, Massachusetts, North Carolina, and Virginia. She has provided data analysis, according to U.S. Fish and Wildlife Service policy and protocols, for Navy facilities across the East and commercial energy facilities in the Midwest, Northeast, and Canada and incorporated the data into summary reports.

Education

- MS, Biology, University of Northern Colorado, 2013
- BS, Environmental Science, The Colorado College, 2007

Selected Project Experience

Wildlife Biologist, MassDOT, NLEB Presence/Absence Habitat Assessment and Detector Deployment, Various Road and Bridge Improvement Projects, Massachusetts

Deployed 40 detectors in 2016 and 67 detectors in 2017 and conducted habitat assessments at each location according to USFWS 2016 and 2017 Indiana Bat Summer Survey Guidelines. Analyzed bat acoustic data with Kaleidoscope Pro and manually vetted calls with Sonobat software. Summarized data for report.

Wildlife Biologist, NextEra, NLEB Presence/Absence Habitat Assessment and Detector Deployment, Various Solar Projects, Maine

Deployed 22 detectors in 2016 and 46 detectors in 2017 and conducted habitat assessments at each location according to USFWS 2016 and 2017 Indiana Bat Summer Survey Guidelines. Analyzed bat acoustic data and manually vetted *Myotis spp*. Summarized data for report.

Wildlife Biologist, United States Navy Facilities, Bat Acoustic Detector Deployment, Data Survey Analysis and Reporting, Various Installations, Eastern U.S.

Deployed Wildlife Acoustic SM3 acoustic detectors and acoustically surveyed Installations according to USFWS 2016 Indiana Bat Summer Survey Analysis Guidelines. Analyzed data for both baseline surveys and presence absence surveys for the federally threatened northern long-eared bat. Analyzed bat calls using Kaleidoscope Pro and manually vetted species of interest and spot checked for accuracy. Summarized mist-netting survey data, emergence counts, and interpreted northern long-eared bat radio-tracking results. Compiled data into summary reports.

Wildlife Biologist, United States Navy Facilities, Bat Mist-netting, Radio Tracking, and Roost Emergence Surveys, Various Installations, Virginia

Mist-netted, radio tracked, and conducted roost emergence counts according to USFWS 2016 Indiana Bat Summer Survey Analysis Guidelines. Experience handling the federally threatened northern long-eared bat and various northeastern bat species.

Data Analyst and Reviewer, United States Fish and Wildlife Service, Wildlife Refuge System, Bat Acoustic Monitoring Analysis, Various refuges, Eastern U.S.

Was one of two biologists responsible for managing and processing up to 32 National Wildlife Refuges (NWR) on the east coast from 2013 and 2014. File formats and level of organization have varied depending on refuge, and were arranged in standardized directories prior to processing using full spectrum (Sonobat) classification software. Automated classifications were then summarized and qualitatively vetted (i.e., manually reviewed on a spectrogram) to determine accuracy of automated classification.

Wildlife Biologist, United States Navy Facilities, Fatality Surveys, Searcher Efficiency Trials, Bat Detector Deployment, and Mist-netting, Cutler, Maine

Conducted fatality survey sweeps of plots preparing for fatality surveys. Conducted five searcher efficiency trials during fatality surveys. Conducted fatality surveys for three weeks. Deployed five Wildlife Acoustic SM3 bat acoustic detectors, checked detectors bi-weekly, downloaded and managed data, and repaired any detector system issues. Conducted mist-net surveys to assess bat assemblage and aimed to attach transmitters to track the federally threatened northern long-eared bat to roost sites with the subcontractor Biodiversity Research Institute.

Wildlife Biologist, NextEra and Capital Power, Bat Detector Deployment, Acoustic Analysis, and Reporting, Various Commercial Wind Energy Projects, North Dakota

Deployed Wildlife Acoustics SM3 detectors at three commercial wind energy projects. Conducted acoustic analysis and incorporated results into summary reports.

Wildlife Biologist, TtEBA, Bat Data Analysis, Various Projects, Alberta, Canada

Analyzed bat acoustic data with Kaleidoscope Pro and manually vetted species in both zero-crossing and full-spectrum formats for seven projects.

Wildlife Biologist, Infinity, Bat Acoustic Analysis and Reporting, Armadillo Flats Commercial Wind Energy Project, Oklahoma

Conducted acoustic analysis and incorporated results into summary reports.

Wildlife Biologist, NextEra, Bat Acoustic Analysis and Reporting, Kingman Commercial Wind Energy Project, Kansas

Conducted acoustic analysis and incorporated results into summary reports.

Wildlife Biologist, Ranger Solar, Bat Acoustic P/A Survey and Reporting, Various Solar Projects, Maine

Deployed SM3 detectors for northern long-eared bat presence absence survey, conducted acoustic analysis, and incorporated results into summary reports.

Wildlife Biologist, Sempra, Bat Data Analysis and Interim Reports, Broken Bow II, Nebraska

Analyzed bat acoustic data with Kaleidoscope Pro and manually vetted *Myotis spp*. calls. Summarized data for report. Determined species from photos of bat fatalities.

Wildlife Biologist, U.S. Navy Facilities, Lynx Camera Traps and Track Survey, SERE School and Cutler, Maine

Deployed camera traps and conducted track survey transects throughout the winter. Deployed and checked camera traps.

Wildlife Biologist, Kinder Morgan, Ecological Assessment of Bats, Birds, and Small Mammals, Bearfort Mountain Natural Area, New Jersey

Analyzed bat calls from four detectors recording from May – Oct using Kaleidoscope Pro and manually vetting species of interest and spot checking for accuracy with Sonobat 3.3.2. Wrote report on findings. Conducted fall small mammal surveys with Sherman traps and edited small mammal report. Co-wrote report on avian surveys including point counts, raptor migration, and nocturnal predator surveys.

Wildlife Biologist, Bat Acoustic Data Analysis, Na Pua Makani Wind Project, Hawaii

Analyzed data using Kaleidoscope Pro and manually vetted unclassified calls in Sonobat 4.0.6 for presence of the federally endangered species, Hawaiian hoary bat. Summarized results and created figures for report.

Wildlife Biologist, NextEra, Northern Long-eared Bat Habitat Assessment Reporting, Crowned Ridge, South Dakota

Wrote report assessing the likelihood of northern long-eared bat presence in the area chosen for a pipeline and the suitability of habitat to be removed for the federally threatened northern long-eared bat.

Wildlife Biologist, NextEra, Pre-construction Nest Clearance Surveys, Dickinson, North Dakota

Conducted grid searches using the iPad Collector App and Trimble for ground nesting birds. Identified nests with eggs or chicks to species, estimated age of chicks, and marked nest for construction avoidance.

Relevant Previous Experience

Master's Student, University of Northern Colorado, Research and Thesis, Colorado

Designed and implemented research over three field seasons on habitat use by bats in forested, edge, and masticated Ponderosa pine forest in Boulder County, Colorado. Used mist nets to capture bats for determination of species, weight, sex, age, and reproductive status. Used Pettersson D240x for acoustic recording and determined call to species with Sonobat 3.0 and manual vetting. Insect sampling with black light traps and keying to order.

Contracted Wildlife Biologist, Maine Inland Fisheries and Wildlife, Bangor Research Office, NA Bat Project, ME

Provided planning assistance for NA Bat monitoring program for the state of Maine. Planned driving transects, assisted volunteers with stationary detector placement, and acquiring land owner permission. Processed, analyzed, and managed incoming data using Kaleidoscope Pro software. Used Anabat, EM3+, and SM2+ detectors.

Professional Summary

Dale is a Senior Environmental Consultant based in the Portland, ME office. Dale has more than 15 years of professional experience in both natural sciences and management. He is a certified soil and wetland scientist and a licensed site evaluator. His responsibilities include client management, business development, project administration and management, proposal response coordination and work scope development, ecological field surveys, strategic planning for permitting, and report preparation. In addition to managing and implementing large-scale permitting and restoration projects, he has led a variety of field biological sampling efforts to determine risk to ecological receptors and water quality determinations. He has provided expert witness testimony regarding the findings of numerous ecological field surveys. He has regionally recognized experience in soil mapping, morphology, and subsurface wastewater design. Dale performs oversight of wetland delineations, vernal pool surveys, threatened and endangered species surveys, ecological community characterizations, permitting, biological assessments, environmental planning, fish and wildlife surveys, wetland mitigation and compensation, project management and document preparation in accordance with the state and federal regulatory agencies. Strategic project planning, creative problem solving, and agency negotiation also are core components of Dale's skill set.

Education

- BA, Liberal Arts & Sciences (concentrations in Soil Science and Geology), University of Maine, 2003
- MS, Organizational Leadership, Southern New Hampshire University, 2012

Selected Project Experience

Chinook Solar Project, New Hampshire – Ranger Solar
Senior Consultant and Client Liaison leading team performing wildlife consulting services for presence/absences surveys for federally listed bats. Surveys involved the deployment of full spectrum acoustic detectors and associated reporting and data analysis for the 50-MW Chinook Solar Project in Fitzwilliam, New Hampshire.

Chariot Solar Project, New Hampshire – Ranger Solar
Senior Consultant and Client Liaison leading team performing wildlife consulting services for presence/absences surveys for federally listed bats. Surveys involved the deployment of full spectrum acoustic detectors and associated reporting and data analysis for the 50-MW Chariot Solar Project in Hinsdale, New Hampshire.

Farmington Solar Project, Maine – Ranger Solar
Senior Consultant and Client Liaison leading team performing wildlife consulting services for presence/absences surveys for federally listed bats. Surveys involved the deployment of full spectrum acoustic detectors and associated reporting and data analysis for the 80-MW Farmington Solar Project in Farmington, Maine. In addition, providing strategic guidance and support with agency negotiation and permitting strategy.

Sanford Airport Solar, Maine – Ranger Solar
Senior Consultant and Client Liaison leading team performing wildlife consulting services for presence/absences surveys for federally listed bats. Surveys involved the deployment of full spectrum acoustic detectors and associated reporting and data analysis for the 50-MW Sanford Airport Solar Project in Sanford, Maine. In addition, also providing strategic guidance and support with agency negotiation and permitting strategy.

Quinebaug Solar, Connecticut – Ranger Solar
Senior Consultant and Client Liaison leading team performing wetland delineation, environmental permitting support, wildlife surveys, and soil assessments for the 50-MW Quinebaug Solar Project in Canterbury, Connecticut. In addition, Tetra Tech's senior environmental staff have been providing strategic guidance and support with agency negotiation and permitting strategy.

Wintergreen Solar Project, Maine – NextEra Energy Resources
Senior Consultant managing the initial development phase for State and Federal permitting. Providing wetland delineation, environmental permitting support, wildlife surveys, cultural surveys and soil assessments for the 150-MW Wintergreen Solar Project in Moscow, Maine. In addition Tetra Tech's senior environmental staff have been providing strategic guidance and have been conducting agency negotiation and developing permitting strategy. Dale was a lead author of the project bid that was submitted to the 2016 Tri-State Clean Energy RFP.

Evergreen Express Project, Maine – NextEra Energy Resources
Senior Consultant managing the initial development phase for State and Federal permitting. Providing wetland delineation, environmental permitting support, wildlife surveys, cultural surveys and soil assessments for the New Hampshire Transmission's proposal to build over 100-mile, above ground electric

transmission line known as Evergreen Express. The line will be capable of delivering more than 800 megawatts of power generated from clean and renewable sources. The preferred route connects power generation in western Maine and Quebec to the ISO New England grid in Auburn, Maine. In addition, also providing strategic guidance and support with agency negotiation and permitting strategy. Dale was a lead author of the project bid that was submitted to the 2016 Tri-State Clean Energy RFP.

Wind, Solar, Storage and Transmission Project, ME, Confidential Client
Providing project leadership and routing study/design support for ongoing strategic vision, agency coordination support, land acquisition, and survey plan development for a planned wind/solar/energy storage and transmission project in Maine, bringing power into New England power grid. Leading negotiations with the agencies and stakeholders to develop a permittable project. Evaluated preliminary impacts of the project and completed detailed critical issues analyses. Also providing strategic planning support, agency support, and consultation advice.

Route 2 and Route 17 Project, ME
Senior Project Manager responsible for organization and oversight of natural resource surveys and assessments along two corridors in western Maine; managed wetland delineations, function and value assessments, and reporting along Route 2 and Route 17 in preparation for road upgrades and expansion.

Sara Mildred Long Memorial Bridge Project, NH
Senior Project Manager responsible for overseeing natural resource surveys and assessments in association with the replacement of the Sara Mildred Long Memorial Bridge which runs between Kittery, Maine and Portsmouth, New Hampshire; managed wetland delineations, function and value assessments, and reporting for the Maine Department of Transportation along the New Hampshire side of the bridge.

Route 302 Project, ME
Senior Project Manager responsible for oversight of natural resource surveys and assessments in preparation for road expansion and upgrades western Maine; managed wetland delineations, function and value assessments, and reporting for the Maine Department of Transportation along three sections of Route 302.

Bingham Wind Project, Somerset and Penobscot Counties, ME
Senior Project Manager on a 62-turbine, 191-MW wind project, responsible for managing, organizing, and overseeing all natural resource evaluations, including, wetland delineations, wildlife, vernal pool, soils, rare and threatened species, and archaeological surveys, as well as shadow flicker analysis. Facilitated design preparation minimizing environmental impacts, federal, state, and local regulatory agency coordination and meeting facilitations, and permit application preparation for state and federal jurisdictions.

Professional Summary

Katelin has nine years of experience in environmental consulting in Maine, the Northeast, and North America. An experienced field biologist, conducting field wetland delineations and natural resource surveys for permitting, feasibility studies and natural resource damage assessments. A Professional Wetland Scientist, Katelin is responsible for creating and implementing study plans, and collecting field data for permitting and natural resource assessment. Katelin contributes to the permitting process and works to balance client needs with regulatory requirements for small and large scale developments. She is experienced with construction oversight, permit compliance, and best management practices for sediment and erosion control.

Education

- BS, Environmental Studies Minor: Biology William Smith College, 2007

Selected Project Experience

Wetland and Natural Resource Services, 2017, Hinckley Solar Project, Fairfield, Maine

Conducted field surveys for vernal pools, and wetland and waterbody delineation. Worked with the developer and the project team to attend public meetings and site visits with regulators. Katelin helped lead the effort to submit a Maine Site Location of Development Act (SLODA) permit application for the proposed 20MW solar project. The application is currently under review by the Maine Department of Environmental Protection (MDEP).

Wetland and Natural Resource Services, 2017, Winslow Solar Project, Clinton, Maine

Conducted field surveys for vernal pools, and wetland and waterbody delineation. Worked with the developer and the project team to attend public meetings and site visits with regulators. Katelin helped lead the effort to submit a joint Maine SLODA and Natural Resources Protection Act permit application for the proposed 20MW solar project. Additionally, Katelin helped develop a Category II permit review with the United States Army Corps of Engineers (USACE). The application is currently under review by the MDEP.

Wetland and Natural Resource Services, 2017, National Grid, Granite State Power Link, multiple locations Vermont and New Hampshire

Conducted field reconnaissance for proposed substation locations in western New Hampshire and Vermont. Lead the field effort for wetland and waterbody delineation at a proposed substation location in Northeast Kingdom, Vermont. Developed a brief report summarizing the survey results.

Wetland and Natural Resource Services, 2017, Dawn Land Solar, Washington County, Maine

Lead field reconnaissance for a proposed solar development in Downeast, Maine. Worked to develop an in-depth review of the proposed project area and the potential permitting needs and environmental restrictions. This critical issues analysis was part of a package submittal by NextEra as part of the New England Clean Energy Request for Proposals.

Wetland and Natural Resource Services, 2017, U.S. Department of the Navy, Great Pond Outdoor Adventure Center, Great Pond, Maine

Lead the field effort for wetland delineations for a jurisdictional determination (JD) at the Great Pond Outdoor Adventure Center in Hancock County, Maine. Katelin developed a report submitted to the USACE for the JD. This report will be used by the Navy for future developments and as an inventory for jurisdictional resources within their property.

Previous Experience

Project Scientist, 2008–2017, Stantec Consulting, Topsham, Maine

Katelin worked for Stantec as a natural resource scientist leading field wetland delineations and natural resource surveys for a variety of projects. She lead the field effort for large and small scale projects, contributed to technical reporting and permit applications, and coordinated with project managers, clients, and stakeholders on complex projects. Contributed to natural community mapping and analysis for energy and transportation projects, and utility corridors throughout New England and various locations in the U.S. and Canada. Contributed to a number of fisheries and wildlife surveys including habitat identification, species identification and stream surveys.

Proposed Oil Pipeline Wetland and Stream Delineation, 2012, Northern Minnesota
Conducted wetland delineations and Global Positioning System surveys over 83 miles of proposed pipeline in Northern Minnesota. Determined wetland boundaries characterized wetland and waterbody resources and

contributed to the data organization and Quality Assurance/Quality Control.

Gas Pipeline Wetland Delineation and Monitoring, 2011–2016, West Virginia, Pennsylvania, and Ohio

Conducted wetland delineation and monitoring work along existing and proposed natural gas pipelines in West Virginia, Ohio, and Pennsylvania. Wetland monitoring work included invasive species surveys.

Stream Characterization and Baseline Survey, 2012, Placerville, Idaho

Worked to collect baseline stream data near Placerville, Idaho to support an Environmental Assessment for the development of a mine in the area. Collected benthic macroinvertebrates and evaluated fish habitat and water quality, and channel and riparian conditions of four stream reaches.

Bingham Wind Project, 2010-2016, Central Maine

Conducted wetland delineations, vernal pool surveys over an area totaling approximately 6,800 acres for a 56-turbine wind project in central Maine. Identified streams and Wetlands of Special Significance Conducted surveys to determine the presence of deer wintering areas, a regulated natural resource. Contributed to a Class D soil survey of a 17-mile transmission line associated with the project.

Hancock Wind Project, 2014, Hancock County, Maine

Project Scientist and field leader responsible for organization, progress, and safety of field staff through the field work phase of the 17-turbine wind project. Conducted wetland delineations, vernal pool surveys, and Global Positioning System surveys. Assisted with field surveys for a Class L soil survey and contributed to the report and mapping of soils identified within the project boundaries. Responsible for data management and associated reporting of findings to accompany permit applications.

Northern Maine Interconnect Transmission Line Project, 2015, Aroostook County, Maine

Project scientist and field lead responsible for organization, progress, and safety of a 4-person field crew for vernal pool surveys and wetland delineations along 30 miles of proposed interconnect transmission line project. Coordinated with the project manager to complete field tasks and meet client needs. Contributed the reporting and permit application.

Bingham Wind Project, 2016, Central Maine

Working as an Environmental monitor on clearing, and earthwork of a 56-turbine wind power project, Duties include construction environmental monitoring, permit compliance, communication with contractors, third party inspectors and the client, and developing daily reports on the conditions of the site.

Meadow Brook Pipeline Exposure, 2016, Casco, Maine

Working as an environmental monitor on a pipeline exposure project for the Portland Montreal Pipeline. Assisted contractors with conducting best management practices during dewatering, pipe repair and construction of a riffle in a perennial stream in Western Maine. While the work was exempt from a permit, the client wanted to make sure that impacts to resources were minimized during the project.

Professional Summary

Mr. Lin has over 12 years of experience as a wildlife biologist, environmental planner, and outreach specialist. He possesses a diverse skill set rooted in environmental science and conservation biology, and is capable of working with various taxa across all northeastern ecosystems with special emphasis on federally listed threatened and endangered species. Mr. Lin also has training and experience developing partnerships, assessing the impacts of climate change, writing strategic plans, designing outreach products, facilitating meetings, and communicating scientific and political concepts to diverse audiences.

Education

- MS, Environmental Studies: Conservation Biology, Antioch University New England (47 credits) (In Progress)
- BA, Environmental Studies: Ecosystems Concentration, Binghamton University 2002

Selected Project Experience

Northern Long-Eared Bat Habitat Assessment and Presence/Absence Surveys, Multiple Road and Bridge Improvement Projects, MA. State of Massachusetts Department of Transportation (MassDOT). Under a sole source Engineering and Environmental Services Master Services Agreement contract with MassDOT, Tetra Tech has performed a variety of support services related to understanding the potential impacts to the northern long-eared bat (*Myotis septentrionalis*) following its listing under the ESA. Wildlife biologist responsible for assessing habitat for the northern long-eared bat and deploying Wildlife Acoustics SM-3 bat acoustic detectors. Deployed 40 detectors in 2016 and conducted habitat assessments at each location according to USFWS 2016 Indiana Bat Summer Survey Guidelines. Summarized data for report.

Rusty Patched Bumble Bee Technical Memorandum to Evaluate Potential Impacts of Multiple Road and Bridge Improvement Projects, MA. MassDOT. Under a sole source Engineering and Environmental Services Master Services Agreement contract with MassDOT, Tetra Tech has performed a variety of support services related to understanding the potential impacts to the rusty patched bumble bee (*Bombus affinis*) (RPBB) following its listing as endangered by the USFWS, effective on March 21, 2017. Wildlife biologist who assisted with preparing a Technical Memo outlining the implications of the recent listing of the RPBB on MassDOT's projects, suggested conservation measures to avoid or minimize impacts and protect the species.

Pre- and Post-Construction Avian and Wildlife Surveys, Multiple Wind Projects, ME. Patriot Renewables. Wildlife biologist responsible for completing eagle, raptor migration, natural community, northern bog lemming, and hiker use surveys. Wrote natural resource survey technical reports. Revised conservation plans in accordance with guidelines and correspondence with USFWS. Drafted a Phase I environmental site assessment. Assessed, mapped, delineated, and demarcated wetlands, vernal pools, and riparian resources.

Natural Resource Surveys, Multiple Road and Bridge Improvement Projects, ME. Maine Department of Transportation. Completed a suite of natural resource assessments in advance of road, bridge, and culvert rehabilitation reconstruction, and maintenance. Assessments included wetlands, coastal wetlands, vernal pools, streams, fish habitat, bat habitat, and bat acoustic deployment.

Natural Resource Surveys, CT and ME. NextEra Energy Resources (formerly Ranger Solar, LLC.) Deployed Wildlife Acoustics SM-3 bat acoustic detectors and assessed northern long-eared bat habitat at each deployment site according to USFWS policy and protocols. Assessed, mapped, and delineated wetlands, vernal pools, and riparian resources. Work was performed in advance of grid-scale solar development.
Natural Resource Surveys, Cutler, ME. U.S. Navy, NAVFAC Atlantic, Naval Computer and Telecommunications Area Master Station Atlantic Detachment. Completed surveys for bird and bat mortality, eagle use, raptor migration, deer abundance, winter tracking, and natural communities. Provided technical review of natural resource survey reports for multiple survey efforts.

Natural Resource Surveys, Great Pond, ME. U.S. Navy, NAVFAC Atlantic, Great Pond Outdoor Adventure Center. Completed surveys for habitat, natural communities, invasive plants, and erosion and sedimentation control. Provided technical review of natural resource survey reports for multiple survey efforts.

Northern Long-eared Bat Survey, ME. TANTARA Corporation. Deployed Wildlife Acoustics SM-3 bat acoustic detectors, conducted desktop and field-based bat habitat assessments at each deployment site, and conducted visual roost inspections for the northern long-eared bat at Fort Gorges located on Hog Island Ledge in Portland, Maine as part of a hazard mitigation

study. Surveys were based on the USFWS 2016 Range-wide Indiana Bat Summer Survey Guidelines.

Mammal Surveys, northern NJ. Tennessee Gas Pipeline Loop 325 Project, Kinder Morgan. Wildlife biologist participating in mammal surveys at the Bearfort Mountain Natural Area. Assessed current populations of small mammals in cooperation with the New Jersey Division of Fish and Wildlife, and with special emphases on northern bog lemming (*Synaptomys borealis*) and other species of concern. Assisted with mist net surveys of bats, with particular focus on northern long-eared bats and incidental capture of other threatened and endangered species in New Jersey.

Northern Long-eared Bat Presence/Absence Surveys, MA. Multiple Projects, SunEdison. Completed time-sensitive reporting requirements for two solar power arrays in Massachusetts. Reports were developed according to USFWS policy and protocols.

Natural Resource Surveys, ME. Wintergreen Solar Project, NextEra Energy Resources. Analyzed critical issues in advance of a proposed grid-scale solar facility. Performed surveys for species of concern including upland sandpiper (*Bartramia longicauda*), northern spring salamander (*Gyrinophilus porphyriticus*), northern bog lemming, and roaring brook mayfly (*Epeorus frisoni*); and natural communities and rare plants.

Various Projects, Northeast US. USFWS Region 5. During 9 years of employment as a wildlife biologist, natural resource planner, and outreach specialist for USFWS, Mr. Lin conducted seabird censuses, aerial surveys, bird banding, monitoring for bird productivity, and invasive species control. Provided planning assistance to national wildlife refuges, compiled refuge comprehensive conservation plans, and managed outreach and communication. Participated in meetings and webinars related to SHC and the North Atlantic LCC. Provided strategic technical support to USFWS conservation efforts including New England cottontail and Atlantic salmon recovery.

Professional Summary

Mr. Johnson has more than six years of experience and a strong educational background in applied environmental science and geographic information systems (GIS). Mr. Johnson has experience in managing multiple aspects of small and large wetland delineations, and incorporating GIS and global positioning system (GPS) data into a wide range of environmental consulting projects. His comprehensive experiences include water quality analysis, wetland habitat assessments, wetland delineations, and vegetation surveys. Additionally, he has experience in soil and groundwater investigation and remediation activities, as well as conducting storm water pollution prevention plan (SWPPP) surveys. His geospatial experiences include field GPS data collection and processing, spatial analysis with ESRI ArcGIS 9.3 - 10.2, and map production for reporting. He has been responsible for collecting and incorporating geographic data from multiple sources and for data quality management.

Education

- BS, Environmental Science and Management
  Minor: Soil Science, University of Rhode Island, 2009

Selected Project Experience

Maine Department of Transportation, Biological Assessments and Surveys, various projects, Maine – Provided GIS and biological survey support for multiple linear and bridge structure transportation projects throughout Maine. Survey work includes completion of wetland delineations in accordance with U.S. Army Corps of Engineers manuals and supplements, vernal pool assessments pursuant to Maine Department of Environmental Protection protocols, and Maine Department of Transportation guidance and instruction. Assists as needed in completion of habitat assessments for northern long-eared bat (*Myotis septentrionalis*) (NLEB), a federally threatened species.

Biologist, Maine Department of Environmental Protection, National Coastal Conditions Assessment, Maine – Tetra Tech performed the NCCA survey for the State of Maine, as part of a nationwide U.S. Environmental Protection Agency (EPA) biological and water-quality sampling program to determine the overall condition of coastal marine waters. Rigorous sampling protocols included a full suite of water quality, benthic characteristics, fish tissue contaminants, and ecosystem health parameters. During 2015, we sampled a total of 40 sites in coastal Maine waters from Wells to Eastport between June and August – completing the sampling effort a full 30 days ahead of schedule.

Biologist, National Grid Transmission Line Wetland Delineation, New York – Delineated and mapped wetlands for over 20 miles of an existing and proposed powerline corridor located in Duchess and Columbia counties, New York, using Trimble GPS units and in accordance with established U.S. Army Corps of Engineers manuals and regional supplement requirements and forms.

GIS Analyst, Marine Corps Base Camp Pendleton, Rare Plant Survey for Thread-leaved Brodiaea, California – Organized field data collected at Camp Pendleton for the federally threatened thread-leaved brodiaea into pre-approved formats. Recent plant community survey data was analyzed using the 7-meter mapping rule to determine true populations of plant species on the base. Submitted all datasets to Camp Pendleton with FGDC-Compliant Metadata.

Biologist and GIS Analyst, U.S. Department of the Navy, Naval Station Newport Bat Survey, Middleton, Rhode Island – Completed an active acoustic monitoring project, including conducting bi-weekly surveys to document abundance of bat species within the project area. Performed a site-wide wetland assessment to determine abundance and extent of wetland habitat on the base. Created figures and site plans for the survey report.

GIS Analyst, U.S. Department of the Navy, Naval Facilities Engineering Command (NAVFAC) Pacific, Marianas Operating Area Marine Resources Assessment Update, and Japan and Okinawa Complexes Operation Area Marine Resources Assessment – GIS analyst responsible for locating data sources and mapping in support of marine resources assessment projects located in the Pacific. Located and mapped data for sea turtles, marine invertebrates, and essential fish habitat within the Pacific Ocean and the Japan and Okinawa study areas. Submitted all GIS data, including map documents, to NAVFAC Pacific, which included organizing data into Navy-approved geodatabases and writing corresponding metadata.

GIS Analyst, U.S. Department of the Navy, NAVFAC, Marine Corps Air Station Miramar Non-Vernal Pool Endangered Plan Species Census and/or Monitoring Surveys, California – GIS analyst responsible for importing and updating GPS data for a biological survey

of willowy monardella (*Monardella linoides* ssp. *viminea*), a federally threatened perennial herbaceous species, conducted at the U.S. Department of the Navy's Marine Corps Air Station Miramar facility, located in San Diego, California.

Biologist, U.S. Army Corps of Engineers New York District, East Rockaway Borrow Area Benthic and Fish Study, New York - Conducted benthic surveys at 50 sites located offshore of Long Island, New York using a Smith-Macintyre grab sampler in support of a proposed beach nourishment project. Benthic samples were sieved and preserved on site and shipped to a subcontracted laboratory for analysis to include benthic infauna taxonomic identification, biomass, grain size, and total organic carbon. Monthly fish trawl surveys also were completed along 12 transects established within the borrow area. Fishes were identified to species, measured, and weighed prior to release. Responsible for setting up and coordinating GPS needs, and preparing all relevant report figures.

Previous Experience

Environmental Scientist, P.W. Grosser Consulting, Various Projects, New York – Worked with clients, subcontractors, and regulatory agencies to ensure prompt and accurate field data collection/ dissemination. Primary tasks included field collection of GPS data, and post-processing to create working GIS databases for clients. Other areas of work included freshwater and saltwater wetland delineations, Phase I Environmental Site Assessments (ESAs), ecological assessments, soil and groundwater investigations and sampling, and supervision of field personnel.

Environmental Scientist, Brookhaven National Laboratory (BNL), Groundwater Contamination Delineation, New York – Environmental scientist responsible for field oversight and groundwater sampling as part of an on-site plume evaluation. Responsibilities included the collection of groundwater sampling and field parameters during sampling events. Was also responsible for construction observation and documentation of 8 monitoring well installations as well as the development of the wells. All field activities were documented and verified in accordance with BNL's Standard Operating Procedures and Project Work Plans. Was also responsible for conducting daily tailgate safety meetings, completing BNL's daily field reports and reporting to a BNL Project Manager and the completion of each day.

Environmental Scientist, Suffolk County Department of Economic Planning and Development, New York – Responsible for performing Phase I Environmental Site Assessments (ESA) on assorted properties within Suffolk County, NY. All Phase I's were performed in accordance with ASTM E1527 – 05 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process.

KEVIN RYAN | PROJECT MANAGER, ECOLOGICAL SERVICES LEAD

Kevin joined FB Environmental in March 2013, shortly before finishing his Ph.D. in Wildlife Ecology at the University of Maine. His research dealt with the ecology and conservation of New England's two rarest amphibians: the blue spotted salamander (*Ambystoma laterale*) and the eastern spadefoot toad (*Scaphiopus holbrookii*). Kevin earned an Associate's Degree in Fisheries and Wildlife Technology in 1999 and a Bachelor's Degree in Wildlife Management in 2001, both from SUNY Cobleskill. His experience includes monitoring loggerhead sea turtle nesting for the Georgia DNR, and serving as field herpetologist, budget manager, and general office manager for the Wildlife Conservation Society's Metropolitan Conservation Alliance. At FB Environmental, Kevin leads the Ecological Services Division and conducts natural resources inventories, wetland delineations, reptile and amphibian surveys, municipal build-out analyses, and permitting. He also provides expert testimony regarding reptiles and amphibians and assists with water quality monitoring projects, watershed/open space planning, technical writing, and GIS mapping.

TECHNICAL EXPERTISE

- → Biostatistical Analyses
- → Build-out Analyses
- → Expert Testimony
- → GIS Spatial Analyses
- → Habitat Characterization and Assessment
- → Permitting
- → Reptile & Amphibian Surveys
- → Scientific/Technical Report Writing
- → Vernal Pool Surveys
- → Wetland Delineation & Functional Assessment
- → Wildlife-Habitat Relationship Analysis

EDUCATION

Ph.D. Wildlife Ecology, University of Maine, Orono, ME (2014)

B.T. Wildlife Management, State University of New York at Cobleskill, Cobleskill, NY (2001)

A.A.S. Fisheries & Wildlife Technology, State Univ. of New York at Cobleskill, Cobleskill, NY (1999)

MEMBERSHIPS

Maine Association of Wetland Scientists (2013-Present); Chair, Ethics Committee (2015-Present)

Society for Conservation Biology, Member (2013-Present)

Society for the Study of Reptiles and Amphibians (2011-Present)

RELEVANT EXPERIENCE

DISSERTATION

Movement patterns, terrestrial habitat use, and conservation of New England's rarest amphibians: the eastern spadefoot toad (*Scaphiopus holbrookii*) and pure-diploid blue-spotted salamander (*Ambystoma laterale*).

Kevin's research focused on the ecology and conservation of two of New England's rarest and most poorly-understood vernal pool-breeding amphibians, the eastern spadefoot toad and the pure-diploid blue-spotted salamander. The project utilized both observational and experimental approaches to assess habitat selection, movement ecology, and behavior of both species. Information was collected using mark-recapture techniques via extensive pitfall trap arrays, radio telemetry, PIT tag telemetry using a backpack tag reader with a modified antenna, PIT tag telemetry using a stationary device, and larval habitat mesocosms. The results of Kevin's research can be used to help determine best management practices for mitigation of land development affecting habitat for these and other pool-breeding species in New England and elsewhere.

FBE HERPETOLOGICAL CONSULTING

Topsham, ME Vernal Pool Survey (2018).

Conducted a vernal pool survey for residential development project in Topsham, Maine.

Freeport, ME Vernal Pool Surveys (2017).

Conducted vernal pool surveys for a residential development project in Freeport, Maine.

Number Nine Wind Farm, Aroostook Co., ME (2014)

Assisted Stantec Consulting with vernal pool surveys within proposed transmission line rights-of way.

Bingham, ME Wind Project (2013)

Conducted spring salamander (*Gyrinophilus porphyriticus*) surveys at selected streams within a proposed transmission line right-of-way.

PREVIOUS POSITION

Field Herpetologist/Program Officer, Wildlife Conservation Society's Metropolitan Conservation Alliance (2003-2007).

Worked under the supervision of Dr. Michael W. Klemens, Senior Conservationist at the Wildlife Conservation Society (WCS). Held the position of Program Officer at WCS's Metropolitan Conservation Alliance and was responsible for conducting herpetological surveys in the New York metropolitan area and managing the associated data, while concurrently serving as accountant, budget manager, and general office manager.

KEVIN RYAN | PROJECT MANAGER, ECOLOGICAL SERVICES LEAD

RELEVANT EXPERIENCE CONTINUED

INDEPENDENT HERPETOLOGICAL CONSULTING

Maine Vernal Pool Mapping and Assessment Program (September 2011). Conducted assessments of several vernal pools in Cumberland, Maine. Conducted assessments of several vernal pools in Cumberland, Maine.

Michael W. Klemens, LLC (March 2003 – August 2007). Conducted herpetological surveys at numerous development project sites in Connecticut, Massachusetts, and New York.

Ridgefield, CT Conservation Commission (April 2007). Conducted ecological assessment of a vernal pool in Ridgefield, Connecticut.
Long Creek Water Quality Monitoring (2013, 2015).

Served as lead field technician and was responsible for maintenance, calibration, and deployment of field equipment including YSI Sondes and Onset® Corporation HOBO® loggers. Also conducted grab sampling and biological monitoring (macroinvertebrate sampling using rock bags).

ADDITIONAL FBE PROJECTS

Forest Hills Farm Natural Resources Inventory (2017). Assisted the North Hampton, NH Conservation Commission with the development of a natural resources inventory for Forest Hills Farm in the town of North Hampton. The inventory included desktop analysis and GIS mapping of natural resource features, including wetlands, geology/soils, land use/land cover, and significant plant and animal habitat. Also conducted field assessments to identify and document natural resource features, identify wetlands, classify natural community types, and assess potential wildlife habitat.

Moultonborough, NH Town-Wide Natural Resources Inventory (2016). Updated the Town of Moultonborough's 2007 Natural Resources Inventory. Project tasks included mapping and describing newly-identified natural resource information and modeling the co-occurrence of important natural resource features to identify resource-rich areas within the town.

Pleasant Hill Preserve Natural Resources Inventory, Scarborough, ME (2015). Assisted the Scarborough Land Trust with the development of a natural resources inventory for the Pleasant Hill Preserve, a 135-acre property in the Town of Scarborough. The inventory included a review of relevant historical information in addition to desktop analysis and GIS mapping of natural resource features, including wetlands, geology/soils, land use/land cover, and significant plant and animal habitat. Also conducted field assessments to identify and document natural resource features, delineate wetlands, classify natural community types, and assess potential wildlife habitat.

Brox Property Natural Resources Inventory, Milford, NH (2014). Conducted a natural resources inventory of a 270-acre property for the Town of Milford, New Hampshire Conservation Commission. The property includes a rich mosaic of wetlands, including vernal pools, and is inhabited by several state-listed endangered and threatened fish and reptile species. The site is slated for extensive sand and gravel mining, industrial development, and construction of public facilities. Project tasks included meeting with project representatives, synthesizing existing information regarding the property, conducting a *de novo* field assessment, and report development.

Payson Property Natural Resources Inventory, Cumberland, ME (2014). Assisted the Chebeague Cumberland Land Trust with the development of a Natural Resources Inventory for a 104-acre property located on the shores of Casco Bay. Tasks included meeting with land trust representatives, reviewing relevant historical information, map development, field classification of natural resources and vegetative communities, and report development.

PUBLICATIONS

Ryan, K. J., D. P. Quinn, and A. J. K. Calhoun. In prep. Movement Patterns and Terrestrial Habitat Selection of Eastern Spadefoots (*Scaphiopus holbrookii*) at the Northern Limit of Their Range.

Ryan, K. J., A. J. K. Calhoun, J. D. Zydlewski, and B. C. Timm. 2015. Monitoring Eastern Spadefoot (*Scaphiopus holbrookii*) response to weather using a passive integrated transponder (PIT) system. Journal of Herpetology 49:257-263.

Ryan, K. J., A. J. K. Calhoun, and J. D. Zydlewski. 2014. Using Passive Integrated Transponder (PIT) Systems for Terrestrial Detection of Blue-Spotted Salamanders (*Ambystoma laterale*) in situ. Herpetological Conservation and Biology 9:97-105.

Ryan, K. J., and A. J. K. Calhoun. 2014. Post-breeding Habitat Use of the Rare Pure-Diploid Blue-spotted Salamander (*Ambystoma laterale*). Journal of Herpetology 48:556-566.

Ryan, K. J., 2010. Blue Spots and Spade Feet: DEP study is focused on two of New England's rarest amphibians. Connecticut Wildlife Magazine November/December 2010.

LaBruna, D. T., M. W. Klemens, J. D. Avery and K. J. Ryan. 2006. Pocantico Hills Biodiversity Plan, Rockefeller State Park Preserve and Associated Private Lands: A public-Private Initiative. MCA Technical Paper No. 12, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, NY.