

TOWN OF OLD SAYBROOK
SELECTMEN'S OFFICE

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**CONSERVATION MANAGEMENT COMMITTEE
HYBRID MEETING**

AGENDA

Friday, September 10, 2021

9:00 A.M.

Old Saybrook Town Hall – First Floor Conference Room

Public Zoom Link:

<https://zoom.us/j/98156173166?pwd=NWdVdEd2aE5XR2kyc3JBWmZqa3R6Zz09>

Dial In: 929-436-2866

Meeting ID: 981 5617 3166

Passcode: 302302

One Tap Mobile: <tel://9294362866,,98156173166#>

- I. CALL TO ORDER**
- II. COMMENTS FROM THE PUBLIC**
- III. COMMENTS FROM THE AD HOC COMMITTEE**
- IV. COMMENTS FROM THE COMMITTEE**
- V. APPROVAL OF MINUTES- June 11, 2021**
- VI. BUSINESS BEFORE THE BOARD**
 - A. Update on the Preserve Parking Lots: Route 153 and Ingham Hill Road parking lot and turnaround.
 - B. NDDDB letter concerning the Preserve Forest Stewardship Plan
 - C. Update on the monitoring and control efforts for invasive weeds
- VII. OTHER BUSINESS**
- VIII. NEXT MEETING DATE**
- IX. ADJOURNMENT**



Connecticut Department of
**ENERGY &
ENVIRONMENTAL
PROTECTION**

August 20, 2021

Mr. David B. Terry
GEI Consultants, Inc.
455 Winding Brook Drive, Suite 201
Glastonbury, CT 06033-4315
dterry@geiconsultants.com

Project: Forest Stewardship Plan, Recreational Use Assessment and Natural Resource Assessment for The Preserve, Old Saybrook, Essex, Westbrook, Connecticut
NDDDB Determination No.: 201900871

Dear David Terry,

I have reviewed Natural Diversity Data Base maps and files regarding the area delineated on the map you provided for the proposed Forest Stewardship Plan, Recreational Use Assessment and Natural Resource Assessment for The Preserve located in Old Saybrook, Essex and Westbrook, Connecticut.

According to our information, there are many State-listed plants, animals, Critical Habitats, and Other Significant Natural Communities that occur within the boundaries of this property. The species and habitats are listed below.

State-listed Plants

Endangered

Platanthera ciliaris (Yellow-fringed orchid)
Polygala cruciata (Drum-heads milkwort)
Liparis liliifolia (Lily-leaved Twayblade)

State Special Concern

Acalypha virginica (Virginia copperleaf)
Aristida longespica var. *geniculata* (Needlegrass)
Desmodium glabellum (Smooth tick-trefoil)
Endodeca serpentaria (Virginia Snakeroot)
Hottonia inflata (American featherfoil)
Lycopus amplexans (Clasping-leaved water-horehound)
Opuntia humifusa (Eastern prickly pear)
Oxalis violacea (Violet wood sorrel)
Rubus cuneifolius (Sand blackberry)

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Proposed for State Special Concern Plant Listing (2021/2022)

Carex striatula (Lined sedge)

Carex styloflexa (a sedge)

Ranunculus micranthus (Small-flowered crowfoot)

All of the above, except for *Liparis liliifolia*, were documented to be extant at The Preserve as of 2019 or 2020. All of the above, except for some populations of *Oxalis violacea*, occur in one or more of the below-listed Critical Habitats and Other Significant Natural Communities (see Table 2).

State-listed Animals

Myotis septentrionalis (Northern long-eared bat)-Federal and State Endangered

Myotis lucifugus (Little brown bat)-State Endangered

Lasiurus borealis (Red bat)-State Special Concern

Thamnophis sauritus (Eastern ribbon snake)-State Special Concern

Terrapene carolina carolina (Eastern box turtle)-State Special Concern

Table 2. Critical Habitats and Other Significant Natural Communities identified by Moorhead at The Preserve, 2017-2019.

Community Type	Community Sub-Type	In ROW	Out-side ROW	Cumulative Area (acres)	Comment
Acidic Atlantic White Cedar Swamp	Cedar/Hardwood		X	1.51	
Acidic Rocky Summit Outcrop	Grassy Glade/Bald	X	X	1.31	
Acidic Rocky Summit Outcrop	Other/Unique	X		0.82	The same as Grassy Glade/Bald sub-type but called Other/Unique because it occurs in the Eversource ROW. Part of a 1.59-ac meta-occurrence in the ROW on both Preserve and adj. Old Saybrook Land Trust property
Acidic, Sandy, Wet Meadow	Other/Unique	X		0.61	
Acidic Seepage Forest				1.10	
Dry Acidic Forest	Oak Woodland		X	2.5	
Dry Subacidic Forest	Ash/Hickory Glade		X	23.9	
Dry Warm Season Grassland	Other/Unique	X		1.10	
Headwater Seepage Swamp			X	≥ 37	Only the largest occurrences mapped; perhaps 5-10 acres more exist as smaller occurrences at The Preserve

Table 2. Critical Habitats and Other Significant Natural Communities identified by Moorhead at The Preserve, 2017-2019.

Community Type	Community Sub-Type	In ROW	Out-side ROW	Cumulative Area (acres)	Comment
Medium Fen	Decodon		X	0.18	
Medium Fen	Other/Unique (1)	X		0.004	Bog-like community on wet sand in Eversource ROW
Medium Fen	Other/Unique (2)		X	4.8	<i>Clethra</i> -subshrub-dominated peatland community
Medium Fen	Sedge Fen		X	1.6	Several Sub-sub-types, some of which might turn out, with closer study, to actually be Poor Fens
Medium Fen	Shrub Thicket		X	9.6	Shrub Thicket Sub-type was largely unexplored - I suspect that Species H likely occurs there in some measure
Medium Fen	<i>Phragmites</i>		X	0.7	Shrub Thicket Sub-type was largely unexplored - I suspect that Species H likely occurs there in some measure
Moderately Well-drained acidic sandy Grass-/heath-land	Other/Unique	X		0.47	In Eversource ROW
Telephone ROW thru sandy acidic seasonally wet forest	Other/Unique		X	0.15	
Sand Barren	Other/Unique	X		0.95	In Eversource ROW
Subacidic Rocky Summit Outcrop	Cedar Woodland		X	1.09	
Subacidic Rocky Summit Outcrop	Other/Unique	X		5.27	Large meta-occurrence in Eversource ROW
Vernal Pool (includes several Potential Vernal Pools)			X	13	
Cold and/or Cool Headwater Streams			X	1-3	At least 3.5 miles of headwater streams
Acidic Seepage Wet Meadow on Till	Other/Unique	X		0.4	Two occurrences in Eversource ROW

A description and discussion of each Critical Habitat and Other Significant Natural Community is found in the attachment to this letter.



Federal and State Listed Bat Species Protection

Bats are found throughout Connecticut between April- October in a variety of forested habitats. Some roost out in the foliage of deciduous and coniferous trees, camouflaged as dead leaves or cones. Some bats roost in groups while other roost in solitary trees. They can be found roosting and feeding around forest edges and clearings. Typically, larger diameter trees (12-inch DBH and larger) are more valuable to these bats. Additionally, trees with loose, rough bark such as maples, hickories, and oaks are more desirable than other tree species due to the increased cover that the loose bark provides. Large trees with cavities are also utilized by this species. Forested areas of Connecticut's coastal towns may also serve as important migratory habitat for bats. Numbers of bats utilizing these areas can increase dramatically as bats from other northeast locations pass through Connecticut during spring and autumn migration.

The following conservation actions are required to protect bats:

- Do not remove trees or conduct forestry harvests between April 1st and November 1st
- Preserve natural roosting resources (safety permitting) including snags, trees with cavities, cracks or crevices, trees with exfoliating bark (e.g. shagbark hickory), coniferous trees (e.g. tamarack, hemlock, white pine) as well as preserving talus slopes
- Identify and protect summer roosts in man-made structures, such as barns
- Provide artificial roost structures (i.e., bat houses) and promote their use in the surrounding community
- Minimize erosion and maintaining clean and open water resources free of siltation
- Protect native vegetation which promotes insect availability and diversity
- Avoid the use of pesticides that will affect their invertebrate food source
- Preserve open, edge of forest habitat corridors to allow bats to freely move among roosting, watering and foraging areas

The presence of northern long-eared bat (*Myotis septentrionalis*), a federally threatened and state endangered species, may require consultation with the US Fish and Wildlife Service Ecological Field Office in order to be in compliance with the Federal Endangered Species Act if the proposed project requires federal permits or uses federal funds. For more information on federal requirements visit: [http://www.fws.gov/midwest/endangered/mammals/nleb/Forest Management Considerations](http://www.fws.gov/midwest/endangered/mammals/nleb/Forest%20Management%20Considerations)

Protection and Management of State Listed Plant Species, Critical Habitats, and Other Significant Natural Communities

A professional certified forester should be hired to work closely with the NDDDB Program botanist/ecologist to develop some specific forest management plans to enhance this property for State listed plant species, Critical Habitats and Other Significant Natural Communities. The majority of the above State listed plants occur in the above-listed Critical Habitats and Other significant Natural Communities, and protection and management of the State listed plants requires protection and management of their host habitats.

This plan may include some of the following elements:

1. A survey of breeding forest specialist birds and their productivity should be conducted prior to moving on recommendation #2 (see below- opening up the forest canopy in certain sections). The object of this survey would be to determine the significance of The Preserve, in its current condition, as a resource for forest specialist birds. This information is needed to determine the potential impacts of creating forest openings on breeding forest specialist bird productivity and strike a reasonable balance between the conservation of the forest specialist birds and light-demanding State listed plants.

2. Several of the State listed plant populations at The Preserve are evidently in decline due to succession and canopy closure by trees and/or shrubs. These sites are found both within the Eversource ROW (where succession to shrub thicket is the threat) and outside of the Eversource ROW (where succession to closed-canopy forest is the threat). Three State listed plant populations are in imminent peril due to succession, and the habitats should be prioritized for management. Some of the dry knoll and ridge summits and upper slopes may be opened up, through tree cutting and/or girdling and/or prescribed burn and/or herbicide use to restore eastern red cedar woodlands and bald/glade habitat that existed in more abundance in The Preserve in the past. Those occurrences of these habitats that have rare plant populations that are declining due to canopy closure should be prioritized for management.
3. As part of any forest management program, there must be a comprehensive plan developed to control and, if possible, eradicate terrestrial invasive plant species. The most significant occurrences of Dry Subacidic Forest and Subacidic Rocky Summit Outcrop, which host multiple State listed plant species, are threatened by a rapidly increasing invasive shrub thicket. Sites with rare plants require specialized invasive control techniques, employed by personnel with specialized experience, in order to avoid damage to the rare plants. This is also true of steep-sloping Critical Habitats with thin-to-bedrock soils. These plants and sensitive habitats co-occur with invasives at some locations in The Preserve.
4. All forest harvests and/or new recreational projects should be submitted to the NDDDB Program for review. New information on state listed species, Critical Habitats, and Other Significant Natural Communities are continually being added to the NDDDB and this will ensure that no adverse impacts will occur to the populations or habitats.
5. Never deposit invasive cuttings anywhere in piles thick and deep enough to mulch out the herb layer below, but rather spread the cuttings diffusely on the ground, so that they will not mulch/suppress the herb layer, and will rot and disappear in a 1-2 years. Thick piles of Japanese Barberry, for example, can take more than 10 years to rot and stop suppressing the herb layer.
6. The Preserve is rich in Seepage Swamps and Vernal Pools, which are important habitat for amphibians and reptiles as well as several State listed plants. These should be protected from sedimentation and nutrient impacts by strictly adhering to water quality standards.
7. Control of trail proliferation. The Preserve is very rich in trails, some of which are “sanctioned” and blazed, and many of which have been created without landowner permission, by mountain bikers and ATV users. To the knowledge of the NDDDB Botanist/Ecologist, there is only one existing conflict of a trail with a known State listed plant occurrence, as of 2020. This is a former wood or farm road that transects a State listed plant population, and it is heavily used and widening, and thus encroaching on the State listed plant population. This trail section should be relocated. The Forest managers should coordinate with the NDDDB to determine the best resolution of this conflict. There is also one known “near-miss” of an apparent un-sanctioned bike trail with a Critical Habitat and multiple State listed plant occurrences. This situation should at least be monitored, since the trail is narrow has little or no impact as of 2020. Based on the experience of the NDDDB biologists, the impact of trails on State listed plant species occurrences may be either negative or positive, depending on the individual plant species and its ecology, the habitat that the trail transects, and the specific nature of the trail. Thus, the NDDDB should be consulted before and about any change in the trail system in The Preserve.

State Listed Reptile Species Protection and Considerations

According to our information there are state special concern *Terrapene carolina carolina* (eastern box turtle) and *Thamnophis s. sauritus* (eastern ribbon snake) within The Preserve. Best management practices to protect turtles and snakes should be implemented throughout the entire Preserve. No wood chips or slash can be placed in any eastern box turtle or spotted turtle upland habitat. Instead, wood chips or tree slash should be removed and used elsewhere (off site).

Eastern Ribbon Snake: The state special concern eastern ribbon snake inhabits areas with shallow water, grassy or shrubby areas bordering streams and wooded swamps. They also prefer sunny areas with low dense vegetation near shallow water areas. Their diet consists of insects, fish, frogs, salamanders and toads. They are most often encountered in high quality wetlands and riparian areas. They are quite sensitive to habitat degradation.

Protection for Eastern Ribbon Snake:

- Conservation practices to protect this snake include the protection of high-quality wetlands by leaving 300 - foot no-cut buffers around wet meadows or wetlands;
- And working when they are less active during the fall and winter months.

If you must work when these snakes may be more active (April 1 through October 15th) then implement the following best management practices:

- A contractor awareness program should be implemented to ensure that contractors working in the area have been instructed on the proper response in the event that an eastern ribbon snake is observed in the work area.
- If any snakes are observed, construction personnel will safely relocate them to an area immediately outside of the work area.
- Any silt fence utilized will be removed after clearing is complete and soils are stabilized.
- Any confirmed eastern ribbon snake sightings must be reported to the NDDB.

Eastern Box Turtle (*Terrapene c. carolina*): Eastern box turtles inhabit old fields and deciduous forests, which can include power lines and logged woodlands. They are often found near small streams and ponds. The adults are completely terrestrial but the young may be semiaquatic, and hibernate on land by digging down in the soil from October to April. They have an extremely small home range and can usually be found in the same area year after year. Eastern box turtles have been negatively impacted by the loss of suitable habitat. Some turtles may be killed directly by construction activities, but many more are lost when important habitat areas for shelter, feeding, hibernation, or nesting are destroyed. As remaining habitat is fragmented into smaller pieces, turtle populations can become small and isolated. Reducing the frequency that motorized vehicles enter box turtle habitat would be beneficial in minimizing direct mortality of adults.

Maintaining forested habitat is essential for the conservation of Eastern Box Turtles. The impacts of timber harvesting are recognized as having significantly fewer lasting effects as compared to other permanent changes in land use, such as residential and commercial development. However, certain precautions should be taken during timber harvesting in order to maintain the long-term viability of Eastern Box Turtle populations within forested areas. The primary concern about forestry practices within Eastern Box Turtle habitat is the direct mortality of adults due to crushing by motorized vehicles during harvesting and scarification. This could occur at any time during the Eastern Box Turtle activity season since they are primarily terrestrial and it could even occur during the winter since the turtles overwinter in upland forests, usually within a few inches of the soil surface. Habitat alterations that are of concern include suppression of plant growth from wood chips since these turtles forage on the forest floor. Disturbance of fallen trees and removal of snags that serve as future sources of large woody debris are also concerns, because these turtles will overwinter beneath fallen trees, often in the pit created by the root mound. Also, fallen trees are used for cover during the active season. Any confirmed sightings of box, wood or spotted turtles should be reported and documented with the NDDB (nddbrequestdep@ct.gov) on the appropriate special animal form found at (http://www.ct.gov/deep/cwp/view.asp?a=2702&q=323460&depNav_GID=1641)

If you conduct forest harvest work during the species dormant period (Nov 1- April 1):

- Use Best Management Practices to avoid soil compaction
- Limit total area impacted by motorized vehicles to less than 25%

If you conduct harvests when the species is active (April 1-Nov 1)

- The logging crew be made aware of the species description and possible presence
- The immediate area to be harvested each day should be searched for turtles before starting work
- Any turtles found during the harvest should be moved out of the way, just outside of the work area. This animal is protected by law and should never be taken off site.

- Work conducted during the early morning and evening hours should occur with special care not to harm basking or foraging individuals

General recommendations for forest management that benefit Eastern Box Turtle include:

- Avoid disturbing pits from tipped root mounds which can serve as overwintering locations.
- Discontinue logging roads after operation are complete so they do not provide new access points to sensitive stream habitat or provide increased vehicle or recreational traffic in general area.
- On sites where options exist, favor site preparation techniques that minimize soil disturbance and compaction.
- Seek to minimize impacts to the forest floor.
- Give special consideration to unique habitat features within the forest such as ephemeral wetlands, springs, seepages, and rock outcrops.
- Maintain a patchwork of harvest practices in this area to meet the different life stages of this species. Including both mature forest and forest openings. If the only available sun-exposed ground is along roadsides, road mortality may occur as females seek nesting grounds and individuals bask.
- If wood is chipped, chips shall be removed from the site or left in piles in an area disturbed by other harvest activities, preferably at the landing.

Herbicides and Invasive Species Work:

- Avoid *vehicle* broadcast of pesticides during most active times (May15-Sept 15), to avoid crushing females traveling to nesting spots.

Regarding Recreation:

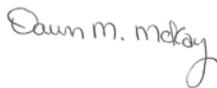
Recreational activities can increase incidental collection and contribute to local turtle population decline. Most often turtles collected are adult females traveling to and from nesting. These turtles of reproductive age are the most valuable individuals in the population to maintain population persistence. Even infrequent collection poses a long-term conservation problem.

- To avoid collection by the public, do not post signs alerting the public to the presence of this species.
- Litter from recreation can pose a choking hazard. Ensure there is a plan for how garbage will be managed.
- Control all terrain vehicles on the parcel to avoid adverse impacts along trails.

This determination is good for two years. Please re-submit an NDDDB Request for Review if the scope of work changes or if work has not begun on this project by August 20, 2023.

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. A more detailed review may be conducted as part of any subsequent environmental permit applications submitted to DEEP for the proposed site.

Sincerely,



Dawn M. McKay
Environmental Analyst 3

Attachment: excerpt from Moorhead, W.H. 2021. Baseline Inventory of the Vascular Flora and Natural Communities of The Preserve, Old Saybrook, Essex, and Westbrook, Connecticut. Pp. 44-67.

Maps of the Critical Habitats and Other Significant Natural Communities of The Preserve are presented in Appendix E.

Discussions of Critical Habitat and Other Significant Natural Community Units.

In the following sections I provide descriptions of Critical Habitat and Other Significant Natural Community and Vegetation Type Units I have identified and mapped at The Preserve. I have provided discussions, where necessary, of a unit's significance and differences in the significance between individual occurrences of that unit. For those units for which identification and classification are debatable, I have provided an explanation of the factors and data on which I based my classification decision.

Regarding taxonomy conventions I have used to name habitat and natural communities, I have, as much as possible, followed the conventions used in the attribute data table of 2009 CTDEEP Critical Habitats GIS coverage. That classification has two hierarchical levels, Community Type ("COMMTYPE" field in the attribute data), and beneath that one or more Community Sub-types ("COMMSUBTYP" field in the attribute data). For Critical Habitat types and sub-types that are essentially equivalent to type and sub-type habitat concepts used in the 2009 Critical Habitats coverage, I have used those names without modification (though in some cases with qualification, which is found in my "Subsubtype" field and/or my "Class_cmnt" (for "Classification Comment") field. In some cases, I have identified a Critical Habitat type at The Preserve, but for which there is no match at the Sub-type level in the 2009 Critical Habitat coverage, for these I have "coined" a provisional new Sub-type.

For a number of the ecological entities that I have mapped as Critical Habitats and/or Other Significant Communities, there is are no equivalent entities found in the 2009 Critical Habitat coverage, but they are recognized in 2005 CWCS and 2015 WAP as "sub-habitats [of Key Habitats] that are most important to wildlife". Some of these "sub-habitats" listed in those documents (e.g., "oak forests") are very common and abundant in Connecticut, and I have not included every occurrence of these "sub-habitats" at The Preserve as Critical Habitats and/or Other Significant Communities. Other entities, such as Vernal Pools, occupy only a tiny percentage of most landscapes in Connecticut, and are of biodiversity maintenance function far out of proportion to their area occupied. These entities I have included in my coverage of The Preserve's Critical Habitats and/or Other Significant Communities.

Finally, I have included in this coverage Other Significant Natural Communities, which are entities that are not a recognized Critical Habitat, but which I judge to have actual or potential special biodiversity significance, based my knowledge and experience of Connecticut and the Northeast. Natural communities I have mapped in this class include: communities that have unusual floristic composition and/or are actual or potential habitat for uncommon and rare/imperiled plants; a community that itself is known or suspected

to be rare or uncommon in a state, regional, or global context; a community that is rare or uncommon in a certain condition (e.g., a common forest type in old growth condition); a community that is disjunct from the region where it is may be common or abundant (e.g., an occurrence of a well-developed northern hardwoods community); a community that I know or reasonably suspect to be, or potentially important habitat for GCN animals. In this last category are some entities that could potentially be restored by management, such as bald habitats that have shrunk due to succession to forest.

Acidic Rocky Summit Outcrop (Grassy Glade/Bald Sub-type).

This is among the Critical Habitat types that were included in the 2009 CTDEEP Critical Habitats GIS coverage. These are a type of so-called “open-canopy” habitat (i.e., little or no cover of trees) that occurs primarily on convex summits and upper slopes of knolls and ridges where bedrock is exposed and/or very close to the soil surface and the pH of the substrate is very low. These are among the areas referred to as “balds” in the 2004 and 2005 Klemens reports on his herpetological surveys. The vegetation is an admixture of grasses, forbs, subshrubs, mosses, and lichens that are tolerant of xeric, low nutrient, low pH conditions. Except where there are larger expanses of bare rock, open-canopy conditions are the result of past human disturbance and/or on-going management (i.e., preventing the areas from growing up into forest). The largest single occurrence in The Preserve (1.22 acre) is in the Eversource power transmission ROW, and this occurrence is part of a 1.6-acre meta-occurrence that extends in the ROW onto the adjacent Old Saybrook Land Trust parcel. In The Preserve outside of the ROW, I have identified 5 other smaller occurrences ranging from 0.04 to 0.50 acre.

Characteristic plants of the Acidic Rocky Summit Outcrop type are:

<i>Juniperus virginiana</i> *	<i>Silene antirrhina</i>
<i>Aristida dichotoma</i> var. <i>dichotoma</i>	<i>Trichostema dichotomum</i>
<i>Dichanthelium sphaerocarpon</i>	<i>Smilax glauca</i>
<i>Ionactis linariifolia</i> *	<i>Andropogon virginicus</i> var. <i>virginicus</i> *
<i>Lechea pulchella</i>	<i>Baptisia tinctoria</i> *
<i>Schizachyrium scoparium</i> var. <i>scoparium</i>	<i>Dichanthelium meridionale</i>
<i>Viola pedata</i>	<i>Hypericum gentianoides</i>
<i>Vaccinium pallidum</i>	<i>Nuttallanthus canadensis</i> *
<i>Krigia virginica</i>	<i>Comptonia peregrine</i>
<i>Danthonia spicata</i>	<i>Viola sagittata</i> var. <i>ovata</i>
<i>Crocianthemum canadense</i>	<i>Symphyotrichum pilosum</i> var. <i>pilosum</i>
<i>Cladonia</i> sp. (reindeer lichen)	<i>Rubus flagellaris</i>
<i>Polytrichum commune</i> (a haircap moss)	<i>Rubus hispidus</i>
<i>Polytrichum piliferum</i>	

The asterisked species above are listed in the 2015 WAP as GCN plants, because they are host plants for GCN invertebrates.

This habitat is similar in the open-canopy structure, landscape position, and a portion of its floristic composition to Subacidic Rocky Summit Outcrop. The two habitats differ in



Figure 14. Acidic Rocky Summit Outcrop (Grassy Glade/Bald Sub-type) in Eversource ROW.



Figure 15. Acidic Rocky Summit Outcrop (Grassy Glade/Bald Sub-type) on a ridge summit outside the ROW.



Figure 16. Example of Acidic Rocky Summit Outcrop (Grassy Glade/Bald Sub-type) in ROW with less bare rock and more soil and herbaceous cover.



Figure 17. Small Acidic Rocky Summit Outcrop (Grassy Glade/Bald Sub-type) on a ridge summit outside the ROW.

soil pH, which appears most likely to be due to differences in bedrock chemistry. The soil pH in the Acidic Rocky Summit Outcrop is strongly acidic, while that of the Subacidic Rocky Summit Outcrop. This difference is reflected in significant differences in floristic composition, with the Subacidic Rocky Summit Outcrop supporting many plants with an affinity for higher pH, and the absence or lower abundance of the more acidophilic plants. The best marked occurrences of the two habitats occur at the ends of a

soil pH gradient, and, as one might expect, there are some occurrences that are floristically intermediate between the two, where I infer that the soil pH is intermediate between the extremes. In some cases, I have mapped these as a separate unit (e.g., Dry Warm Season Grassland), and in other cases, I have classified the unit as Acidic Rocky Summit Outcrop or Subacidic Rocky Summit Outcrop, depending on which unit the site leans more toward floristically, but explain in the attribute data that the unit is intermediate between the two entities.

Based both on indicators in the field (i.e., mature *Juniper virginiana* shrubs and trees and hardwood wolf trees) and my analysis of historic aerial photos of The Preserve, it is evident that, except for within the ROW, occurrences of this habitat were once more abundant and more extensive in The Preserve. In the absence of periodic disturbance, forest succession gradually closes in over the openings except where there are large enough expanses of bare rock. However, these bare rock expanses do not have the same ecological function as the areas of shallow-to-bedrock soils, which support a well-developed herbaceous community of drought-tolerant plants support many of the They were almost certainly originally created and maintained by humans using fire and/or cutting of forest, and grazing by livestock likely also helped to maintain the open-canopy conditions.

Cold and/or Cool Headwater Streams.

This Critical Habitat is not among those mapped for the 2009 CT-DEP “Critical Habitats” GIS coverage, but Cold Water Streams were identified in the 2005 CWCS and 2015 WAP as a “sub-habitat” determined to be important to [GCN] wildlife. I mapped approximately 3.5 of the headwater streams in The Preserve as Cold and/or Cool Water streams, based on their being nearly 100 percent under closed canopy forest, the evident abundant input of spring seepage maintaining the stream flows, some late summer stream



Figure 18. Headwater stream downstream of extensive Seepage Swamp complex, in late March 2020. This stream still had surface water, as intermittent pools, during the late summer drought.

temperature measurements, and the large number of detections of Dusky Salamander by herpetologist Michael Klemens during his surveys in the early 2000s. My late summer stream temperature measurements (54° to 64° F) were consistent with my inference that the streams are Cold Water Streams, but I did not collect enough temperature data to

conclusively prove this, hence the “Cold and/or Cool” in this unit’s name. I also did not collect enough rigorous flow monitoring data to characterize how persistent flow is in all the streams I mapped, but subjectively noted that I never observed a number of these streams without surface water.

Dry Subacidic Forest (Ash/Hickory Glade Subtype).

This is among the Critical Habitat types that were included in the 2009 CT-DEP “Critical Habitats” GIS coverage. Occupying a cumulative 21.5 acres, it is the Critical Habitat type that occupies the largest cumulative area in The Preserve; I have mapped 29 separate occurrences. It occurs on dry knoll summits and convex upper slopes with aspects mostly in the two southern quadrants, and on shallow-to-bedrock soils that are weakly to moderately acid (in some cases the soil pH may be circumneutral), most likely due to the chemistry of the bedrock. The trees are stunted due to dry conditions and hickories are prominent in the canopy layer. Oaks are usually co-dominant trees, and White ash is usually present, though seldom as more than the occasional tree or shrub. Hop-hornbeam (*Ostrya virginiana*) is characteristically the most abundant shrub in the likewise characteristically very open woody understory. In contrast with acidic dry oak forests, low heaths (i.e., lowbush blueberries [*Vaccinium* spp.] and black huckleberry [*Gaylussacia baccata*]) are absent or not prominent, and the herb layer is well-developed, often species-rich, with the sedge *Carex pensylvanica* often a dominant species (at least on the occurrences on summits). Eastern Redcedar (*Juniperus virginiana*) occurs in the majority of occurrences at The Preserve as live and/or dead trees and tall shrubs that have been overtopped by the deciduous trees. This, together with scattered wolf trees and 1934 aerial photography of The Preserve, tell us that a number of these sites once supported Subacidic Rocky Summit Outcrop, Cedar Woodland sub-type habitat, and these sites have succeeded to the present forest over the last 85 years. In several Dry Subacidic Forest occurrences there are small (< 12 m in diameter) openings in the hardwood canopy that actually still support Subacidic Rocky Summit Outcrop, Cedar Woodland, but I have not mapped these inclusions as separate from the Dry Subacidic Forest. Thus, for the purposes of this classification, the map unit Dry Subacidic Forest, Ash/Hickory Glade can be considered a complex, with a small amount of the total area occupied by Subacidic Rocky Summit Outcrop, CW.

I recorded 160 vascular plant taxa (144 native) in this habitat -- the second highest for any single habitat type at The Preserve. Characteristic species in the herb layer of the Dry Subacidic Forest include the following (not all are found in every occurrence):

Anemone quinquefolia
Antennaria plantaginifolia
Aquilegia canadensis
Asclepias quadrifolia
Asplenium platyneuron
Boechera canadensis
Aureolaria virginica
Bromus pubescens
Cardamine parviflora
Carex digitalis
Carex retroflexa
Cinna arundinacea
Desmodium rotundifolium
Dichanthelium boscii
Dichanthelium latifolium
Eupatorium sessilifolium
Festuca subverticillata
Geranium carolinianum
Hedeoma pulegioides
Lespedeza frutescens
Lespedeza procumbens
Muhlenbergia tenuiflora
Paronychia canadensis
Ranunculus abortivus
Scrophularia lanceolata
Silene antirrhina
Solidago ulmifolia
Sphenopholis intermedia
Sphenopholis nitida
Symphotrichum undulatum
Teucrium canadense
Thalictrum revolutum
Trichophorum planifolium
Triodanis perfoliata
Triosteum aurantiacum
Viola palmata
Viola subsinuata



Figure 19. Summit expression of Dry Subacidic Forest type, Ash/Hickory Glade sub-type



Figure 20. Steep South-facing Rocky Slope expression of Dry Subacidic Forest type,

In addition to the above-listed species, there are at least 4 PCC plants, possibly as many as 7, that are associated with this habitat type.

There are two expressions of this habitat at The Preserve: one which occurs on the summits and upper slopes of knolls and ridge, and an expression that occurs on steep,

rocky south-facing slopes. The latter expression is much rarer in The Preserve than the former. The two expressions have a substantial number of plant species in common (42% of total species for the summit expression, 64% of the total for the steep rocky slope expression) including many dominants and the less common species, so I have “lumped” them together as the same type and sub-type in this classification. However, given the also substantial number of species that they do not have in common, and the rarity of the steep rocky slope expression in The Preserve compared with the summit expression, I have distinguished them at the “Sub-sub-type” level in my attribute data table.

The occurrences of this community have strong correlation with the mapped extent of the Hebron Formation (also called the Hebron Gneiss) and with mapped patches of amphibolite. Those occurrences with the highest biodiversity significance (i.e., higher species richness and greater representation of rare and uncommon plants) are almost certainly those with the highest soil pH, and probably also those that have most recently had more open-canopy conditions. Dry Acidic Forests on Glacial Till, which is a very much more common community in CT, occurs on similarly dry sites with strongly and very strongly acid soils (i.e., very low pH). This natural community occupies some summits in The Preserve, and on some summits there are forests that are floristically intermediate between Dry Acidic Forest and Dry Subacidic Forest, which probably reflects soil pH intermediate between strongly acid and weakly to moderately acid. I have mapped these as Dry Subacidic Forest when there have been at least several of the indicator species, including Hop-hornbeam, and lowbush blueberries and/or Black Huckleberry and/or Mountain Laurel (*Kalmia latifolia*) have not been too abundant.

I have classified one occurrence of Dry Subacidic Forest on a smaller summit as Other/Unique sub-type, because it supports a good complement of the herb layer indicator species, but the species in the shrub and tree layers (Mountain Laurel and Black Birch [*Betula lenta*] are dominant).

Subacidic Rocky Summit Outcrop (Cedar Woodland sub-type and Other/Unique sub-type).

This is among the Critical Habitat types that were included in the 2009 CT-DEP “Critical Habitats” GIS coverage. It is a community with no tree canopy or scattered trees that do not form a continuous canopy. It occurs on dry convex summits and steep rocky slopes with aspects in the 2 southern quadrants. Usually there is much exposed bedrock and/or very shallow-to-bedrock soils, where the underlying bedrock evidently contributes to moderately to weakly acid soils. Eastern Redcedar (*Juniperus virginiana*) is the dominant or co-dominant tall shrub and low tree, there typically are a number of light- and nutrient-demanding species in the herb layer that are tolerant of dry conditions and very little soil, such as Red Columbine (*Aquilegia canadensis*). In terms of floristic composition, it is very similar to that of the Dry Subacidic Forest, but with greater representation of the more light-demanding species, and supports many of the same rare

and uncommon plants. This Critical Habitat, together with Acidic Rocky Summit Outcrop, GG/B is another type of what are called “balds” in the Klemens 2003 and 2005 herpetological survey reports.



Figure 21. Subacidic Rocky Summit/Outcrop type, Cedar Woodland sub-type, on a steep rocky south facing slope.



Figure 22. Subacidic Rocky Summit/Outcrop type, Cedar Woodland sub-type, on a convex summit.

At The Preserve, I have mapped as Subacidic Rocky Summit Outcrop - Cedar Woodland only those occurrences associated with hardwood tree canopy gaps of at least 12-15 m in diameter and larger. As explained in the previous section, this habitat also occurs as inclusions in Dry Subacidic Forest occurrences in canopy openings smaller than 12-15 m in diameter, at sites such as the rocky south-facing brow of a summit occupied by Dry Subacidic Forest. I have not mapped these smaller occurrences as separate from the Dry Acidic Forest. I have identified at The Preserve only 4 occurrences of Subacidic Rocky Summit Outcrop, CW that were large enough to map based on the above-mentioned size criteria, and those for cumulatively occupy only ~1.1 acre. As noted elsewhere in this report it is evident from historic aerial photos, the distribution of overtopped live and dead Eastern Redcedar and older wolf trees in Dry Subacidic Forest occurrences that the Subacidic Rocky Summit Outcrop, CW sub-type was once much more extensive at The Preserve.

Some characteristic indicator plants of the Subacidic Rocky Summit Outcrop-Cedar Woodland that do not occur in the Dry Subacidic Forest, or occur only in or near canopy openings that are essentially small Subacidic Rocky Summit Outcrop-Cedar Woodland

inclusions, are *Myosotis verna*, *Micranthes virginiensis*, *Woodsia obtusa*, *Cardamine parviflora*, *Paronychia canadensis*, *Piptochaetium avenaceum*, *Hedeoma pulegioides*, *Capnoides sempervirens*, *Trichostema dichotomum*, and the moss *Hedwigia* sp.

Much more extensive than the Cedar woodland Sub-type of Subacidic Rocky Summit Outcrop at The Preserve is what I have designated as the Other/Unique sub-type of Subacidic Rocky Summit Outcrop, because it occurs entirely within the Eversource power transmission ROW, which is a special ecological space with unique management⁴². The Subacidic Rocky Summit Outcrop habitat in the ROW has many occurrences,



Figure 23. Subacidic Rocky Summit/Outcrop, Other/Unique sub-type, in the power transmission ROW. This expression occurs higher on the north-facing slope, where there is more shading by adjacent forest, and Haircap moss is a dominant ground cover.



Figure 24. Subacidic Rocky Summit/Outcrop, Other/Unique sub-type, in the power transmission ROW. This expression occurs low on the north-facing slope, where there is relatively more sun exposure, and Haircap moss is not important as a ground cover.

occurring frequently at interval along 1.8 mile of the ROW, cumulatively occupying 5.27 acres. Some of these occurrences are on landscape positions similar to those where Subacidic Rocky Summit Outcrop occurs outside of the ROW, i.e., rocky convex summits of knolls and ridges, south-facing brows and upper slopes. Based on my examination of 1934 aerial photography, it appears these sites may have supported Subacidic Rocky Summit Outcrop Cedar Woodland communities⁴³. In any case, the

⁴² “Other/ Unique Sub-type” classification is adapted from the 2005 CWCS and 2015 WAP classification, which designates Public Utility Transmission Corridors as a sub-habitat of Unique; Natural or Man-made Key Habitats [most important to GCN species]

⁴³ Based on their appearance in the 1934 aerial photos, these sites almost certainly supported grassland or meadow vegetation with scattered Eastern Redcedar, thus either a cedar woodland or shrubland. However, in southern CT, the prominence of Eastern Redcedar as an early successional invader of open herbaceous

clearing of the ROW in the 1970s or 1980s re-established open-canopy conditions in these areas, and they now support a number of uncommon/habitat-restricted/indicator and light-demanding plants, including several PCC plants, which compels me to classify them as Subacidic Rocky Summit Outcrop. About 0.6 cumulative acre of this type of Subacidic Rocky Summit Outcrop - Other/Unique in the ROW is on these kinds of sites.

The greatest part of the Subacidic Rocky Summit Outcrop - Other/Unique in the ROW (4.7 acres) occurs low on the north slope of The Preserve, a landscape position at which Subacidic Rocky Summit Outcrop habitat is not typically found, and based on analysis of historic aerial photography, there appears to have deciduous and mixed evergreen-deciduous forest in these areas before the ROW was installed. Except for some sites, soils appear to be deeper than is typical for the dry to xeric sites where Subacidic Rocky Summit Outcrop usually occurs, and the forests that occur on both sides of the ROW are mesic.



Figure 25. Subacidic Rocky Summit/Outcrop, Other/Unique sub-type, in the power transmission ROW. This expression occurs on a broadly convex ridge summit.

Thus, it is something of a mystery that so many plants characteristic of Subacidic Rocky Summit Outcrop and Dry Subacidic Forest have become established in this section of the ROW. Open-canopy conditions created and maintained by the utility companies, together with the often steep slopes that are in places convex, combined with some disturbance/modification of the soils by the utility companies⁴⁴, and with the evident native higher pH of the substrate, have created conditions that favor plants that prefer dry but rich soils, in spite of the northern aspect, low slope position, and partial shade by the mature forest immediately up-slope and south of the ROW. This 4.7-acre portion of the Subacidic Rocky Summit Outcrop-Other/Unique in the ROW is entirely over the Hebron Gneiss Formation.

The Subacidic Rocky Summit Outcrop-Other/Unique habitat in the ROW has many species in common with Subacidic Rocky Summit Outcrop and Dry Subacidic Forest habitat outside of the ROW, but also a large number of species that I did not find in

habitat (such as dry pasture) occurs on strongly acid sites as well as higher pH sites, one cannot presume subacidic (or higher pH) conditions from the presence of an open-canopy cedar woodland or shrubland on an aerial photo. But soil pH, especially if underlying bedrock chemistry is influencing it, would not be expected to change over time, so I think it likely that these areas were Subacidic Rocky Summit Outcrop 85 years ago.

⁴⁴ Cut and fill is obvious in some areas. There may have been also compaction and/or removal of topsoil in other area.

Subacidic Rocky Summit Outcrop or Dry Subacidic Forest habitat outside of the ROW, including the following:

Actaea pachypoda
Agalinis tenuifolia (in vast abundance)
Andropogon gerardii
Andropogon virginicus
Anemone americana
Anemone virginiana
Asclepias syriaca
Aureolaria pedicularia
Botrychium dissectum
Collinsonia canadensis
Comptonia peregrina
Corylus americana
Crocanthemum bicknellii
Desmodium paniculatum
Eupatorium pilosum
Galium pilosum
Linum striatum (in vast abundance)
Polygala sanguinea
Polygala verticillata
Pycnanthemum muticum
Schizachyrium scoparium
Tridens flavus
Viola primulifolia
Viola pubescens var. *pubescens*
Viola sagittata var. *ovata*

The Subacidic Rocky Summit Outcrop is the Critical Habitat with the highest vascular plant diversity in The Preserve, with 238 taxa (174 native) recorded in both sub-types, Cedar Woodland and Other/Unique, together. I recorded many more taxa (171 total, 146 native) in the Other/Unique than in the Cedar Woodland (107 total, 98 native). This is partly due to the Other/Unique subtype simply covering so more area than the Cedar woodland, but also due to more extensive open-canopy habitat and greater variety of micro-habitat diversity across 1.8 mile by 75 feet of ROW, and likely also due to the connectivity of ROW habitat (as opposed the Cedar Woodland occurring as small islands in a sea of forest. Another notable feature of the sub-set of Subacidic Rocky Summit Outcrop- Other/Unique in the ROW on the north slope of The Preserve is the abundance of forbs (i.e., broad-leaved herbaceous plants) versus graminoids (i.e., grasses and grass-like plants). Graminoids are wind-pollinated and produce pollen but no nectar, while many if not most forbs are insect-pollinated and produce nectar and pollen. Of the plants I recorded in the Subacidic Rocky Summit Outcrop-Other/Unique in the transmission ROW, 24 taxa were not recorded anywhere else in The Preserve.

It is evident from a review of aerial photography that the transmission ROW was created sometime between spring 1970 and spring 1986. It is clear that much of what is now Subacidic Rocky Summit Outcrop-Other/Unique was forest prior to the construction of the ROW, and open-canopy conditions have since been maintained by ROW vegetation management. However, it is also evident from historic aerial photographs that some of what is now Subacidic Rocky Summit Outcrop-Other/Unique was once “natural” Subacidic Rocky Summit Outcrop Cedar Woodlands on dry ridge or knoll summits, though the Eastern Redcedar has largely been eliminated⁴⁵. Several PCC plants and a large number of the uncommon/restricted indicator species occur in the ROW in both situations.

Vernal Pools.

Vernal Pools are depressions that are seasonally full of water from late fall through spring, and in which the water gradually draws down until surface water disappears by mid- to late summer. Vernal pools lack permanently flowing inlet and outlet streams and this together with their seasonal draw down causes them to be fishless habitats, and in turn they are critical breeding habitat for a number of animals that are intolerant of fish predation. Vernal pools were originally classified in the 2005 CWCS as a subhabitat of the Key Habitat “Sparsely vegetated Inland Wetland” that has been “determined to be important to [GCN] wildlife”. In the 2015 WAP, Vernal Pools were put under the Key Habitat “Unique; Natural or Man-made”. Vernal Pools are recognized in both documents as essential habitat for a large number of GCN animals, and thus it is reasonable to include them in my Critical Habitat coverage of The Preserve. As I explain in the Methodology section, I relied for the bulk of this Vernal Pool coverage on the reports of herpetologist Michael Klemens’ herpetological surveys in 2003, 2004, and 2005, which included mapping produced by BL Companies. Klemens drew also on the survey work of Ed Pawley in 2002 and Ron Gautreau in 1999. Klemens confirmed⁴⁶ 38 Vernal Pools at The Preserve. I visited most of these in the field and remapped all of them that I was able to relocate (which was not all). In addition, I discovered a number of new “potential” vernal pools. In these pools, I observed evidence of breeding by one or more obligate vernal pool amphibian, but did not confirm completion of their breeding cycle. My final coverage of Vernal Pools at The Preserve includes between 39 and 43 confirmed VPs, and 6 additional potential VPs. The reasons for the uncertainty about the number of Vernal Pools are explained in the Methodology, but if all potential VPs are confirmed the total number of VPs at The Preserve will be between 45 and 49, occupying about 12.5 acres, cumulatively.

⁴⁵ Eversource, unlike their predecessor Northeast Utilities, treats Eastern Redcedar as an “incompatible” woody species and has been removing all of any size from their ROWs

⁴⁶ A Vernal Pool is “confirmed” by the presence of one or more obligate vernal pool species completing their life cycle in the pool (Klemens 2004)

Klemens considered the majority of vernal pools at The Preserve to be “cryptic”, which means the vernal pool is a part of a larger wetland system⁴⁷, and a minority of them to be “classic” vernal pools, which are seasonally flooding depressions that are isolated from other wetlands. Klemens collected data on vernal pool obligate amphibian productivity, hydroperiod, water chemistry, May and late June water depths, and dimensions of vernal pools ca. mid-May. Klemens then ranked the biodiversity significance of each vernal pool, and I have carried over those rankings to my Preserve Critical Habitat attribute data. Klemens classified as “High Priority” vernal pools that had all 3 obligate vernal pool amphibians (wood frog, spotted salamander, and marbled salamander), had high obligate species productivity (i.e., large numbers of adults, egg masses, and larvae), had vernal



Figure 26. A "classic" Vernal Pool, Klemens' #20, ranked a "High Priority" pool, in early September, 2019.



Figure 27. A "cryptic" Vernal Pool, Klemens' #10, a "High Priority" pool, in late March, 2019.

pool facultative species such as spotted turtles and four-toed salamanders and/or State-listed Special Concern species such as ribbon snake, box turtle, and spotted turtle. Using these criteria, Klemens classified at least 13 of The Preserve’s vernal pools as High Priority in his 2004 report, and 1-4 more in his 2005 report. Klemens found no State-listed amphibians at The Preserve. However, he considered the abundance of the marbled salamander, the less common of the 2 obligate vernal pool salamanders that are not State-

⁴⁷Klemens 2004

listed, at The Preserve to be “quite unique to the site” and the uniformity of its abundance across the entire Preserve to be “remarkable”. Klemens attributed this to the abundance at The Preserve of cryptic vernal pools imbedded in and connected by larger headwater wetlands, which supported longer hydroperiods in these vernal pools⁴⁸ than is typical for classic vernal pools.

Another important characteristic of The Preserve’s vernal pools is that a very high percentage of the 750-ft radius to the vernal pools is forested, which is the most suitable habitat for mole salamanders during the period of the adults’ life cycle when they are away from the vernal pool.

With respect to plant biodiversity, the vernal pools at The Preserve support a variety of common native wetland plants, and 2 PCC plants. One (Species G) is currently listed as Special Concern and has a robust occurrence in one of Klemens “High Priority” vernal pools that has a gap in the tree canopy above the pool. One Watch List (Species O) occurs in 5 different pools, with the most robust occurrence in the same pool with the canopy gap overhead. This species appears to gradually decline under a closed canopy, but all the while building up a seed bank in the bottom sediments and shoreline of the pool. Then, a disturbance such as a wind-throw opens up a gap in the tree canopy, and there is a flush of germination and new plants. The vernal pools, especially the cryptic pools, are the stronghold at The Preserve for large specimen Pin Oaks (*Quercus palustris*) and Swamp White Oaks (*Quercus bicolor*).

Acidic Atlantic White Cedar Swamp

Acidic Atlantic White Cedar Swamp (a.k.a. AWC swamp) is the only Critical Habitat Type previously mapped at The Preserve as part of the CTDEEP 2009 GIS coverage. There is about 1.5 acres of it on the glaciofluvial sand sediments in the northeast part of the Preserve. It is classified in the CTDEEP 2009 GIS coverage as the Cedar Swamp subtype, but I have classified it as Cedar/Hardwood, based on the relative co-prominence of Red Maple and Black Gum. It appears to be one of 2 small fragments that remain in the area of a ~20-acre Acidic Atlantic White Cedar Swamp that existed as late as the 1934 aerial photo flight. Atlantic White Cedar (*Chamaecyparis thyoides*) is an uncommon and habitat-restricted species in the northeast that is also a GCN species and host plant for the State-Endangered butterfly, Hessel’s Hairstreak (*Callophrys hesseli*) and the State-Special Concern (Historic) moth, Lemmer’s Noctuid Moth (*Lithophane lemmeri*). Also, AWC Swamps are among the habitats in which the State-Endangered dragonfly Ringed Boghaunter (*Williamsonia lintneri*) occurs. Besides the AWC itself, another uncommon and habitat-restricted plant that occurs in this habitat at The Preserve is *Utricularia intermedia* (Flat-leaved Bladderwort).

⁴⁸ Longer hydroperiod vernal pools have surface water for a longer portion of the year

Several mature AWC trees occur in a small group just east of the Eversource ROW, which appears to have cut through part of the original ~20-acre stand. This small stand was not, in my opinion, large and floristically distinct enough to map as an AWC Swamp.



Figure 28. Atlantic White Cedar Swamp, in glaciofluvial outwash soils portion of The Preserve.

Medium Fen

Medium Fen is among the Critical Habitat types included in the CTDEEP 2009 GIS coverage, and included in the 2015 WAP as the Bogs and Fens subhabitat of Shrub Inland Wetland Key Habitat. Medium Fen is a type of bog, in the old and/or colloquial and/or broad sense. It often occurs on deep organic peaty and/or mucky deposits, but it also occurs also on wet acidic sand or very shallow organic deposits over wet acidic sand. Often when the substrate is deep organic deposits, it can be a floating/quaking mat of dead peat moss (*Sphagnum* spp.) and sometimes other mosses and liverworts. MFs are distinguished from the similar Poor Fen by the relatively higher nutrient regime of the Medium Fen, due to the greater influence of minerotrophic surface water and ground water on the Medium Fen. There is a consequent absence from the MF of a suite of bog plants tolerant of or preferring the more acidic, lower nutrient conditions found in the Poor Fen (e.g., *Eriophorum vaginatum* ssp. *spissum*, *Kalmia polifolia*) and likewise certain plants that occur in the MF (e.g., the sedges *Cladium mariscoides* and *Carex lasiocarpa*) which are absent from, or much less abundant than in, Poor Fens. In parallel with the relationship of ASRO and Subacidic Rocky Summit Outcrop, there are some occurrences of that are floristically transitional between MF and PF and if is difficult to assign to one or the other type.

There is a large occurrence of Medium Fen (~17 acres) at The Preserve that occupies most of the area of Pequot Swamp Pond. It occurs as 4 subtypes: Other/Unique (~4.8 ac), Sedge Fen (~1.6 ac), Decodon (~0.2 ac), Shrub thicket (~9.6 ac), and Phragmites (~0.7 ac). Of these subtypes, the Other/Unique and Sedge Fen subtypes (~6.4 ac, collectively) are the most bog-like and have the highest known biodiversity significance (i.e., the rare and uncommon plants occur only in these subtypes or only in large numbers in these subtypes). There is an extensive occurrence of one

PCC plant (Species H) that occurs in these two subtypes, and it is unique at The Preserve to the Pequot Swamp Pond fens. The Sedge Fen is the most bog-like in appearance, being a continuous



Figure 29. Large Cranberry in flower in late June.



Figure 30. Medium Fen, Other/Unique sub-type with Sweet Pepperbush a dominant sub-shrub. This part of the fen is also buoyant but with well-developed hummock-and-hollow microtopography.



Figure 31. Medium Fen, Sedge Fen sub-type, in interior of Pequot Swamp Pond. Quaking Sphagnum mat is relatively level and very buoyant.

floating quaking mat of Sphagnum moss with a saturated moisture regime, and lacking a well-developed woody subshrub or shrub strata (therefore called “bog meadow” in some literature). The Other/Unique subtype also occurs on a floating quaking substrate, but has well-developed hummock-and-hollow microtopography, with the hummocks and hollows supporting different micro-communities. I have called it Other/Unique because it has a well-developed subshrub layer (i.e., shrubs well under 1 m in height) dominated by Sweet Pepperbush (*Clethra alnifolia*). This is a type of fen that has not been previously described in Connecticut and I have been advised to

classify it as the Other/Unique subtype⁴⁹. I have called this Other/Unique subtype the Sub-shrub-height *Clethra - Vaccinium macrocarpon - Rhynchospora alba* fen.

The Shrub Thicket subtype occurs on less buoyant substrate, is dominated by low shrubs (i.e., 1-2 m in height) and has well-developed hummock and hollow microtopography. The hollows support marsh-like vegetation and the mossy hummocks support several of the below-listed fen indicator species in much less abundance than the Sedge Fen and Other/Unique subtypes, but there are occasional small inclusions in the Shrub Thicket subtype that lean toward the Other/Unique subtype. Over the 2017-2019 period of this survey, the water level at Pequot Swamp Pond has been raised by beaver activity, and at least some portions of the Shrub Thicket subtype have not floated up, and hummock microhabitat has been submerged. Stress and die-back of the shrubs have occurred, and these areas are in transition to open water habitat, rather than fen. The other more buoyant subtypes appear to be rising with the water level and maintaining their fen character, at least for the most part.

The following characteristic uncommon/habitat-restricted plants occur in these subtypes. Single-asterisked species are unique at The Preserve to the Pequot Swamp Pond fen complex. Double asterisked species also occur in the Medium Fen - Other/Unique - “Sand Bog” in the ROW in the northeast corner of The Preserve (see discussion of this habitat in final paragraph).

Vaccinium macrocarpon (Large Cranberry)*
Pogonia ophioglossoides (Rose Pogonia)**
Rhynchospora alba (White Beaksedge)*
Lycopodiella appressa (Southern Bog-clubmoss)**
Rhynchospora fusca (a beak-rush)*
Cladium mariscoides (Twig-rush)*
Drosera intermedia (Spatulate-leaved Sundew)**
Drosera rotundifolia (Round-leaved Sundew)**
Eleocharis tuberculosa (a spike-rush)**
Rhexia virginica (Virginia Meadow-beauty)
Spiranthes sp.* (unidentified ladies'-tresses)
Xyris difformis (a yellow-eyed grass)**

The Medium Fen complex at Pequot Swamp Pond was very difficult to survey by conventional on-foot methods during the growing season. In many places, my weight would submerge the entire substrate, and often I would break through the peat mat and struggle to escape. Thus, I did not thoroughly explore the entire complex. The occurrence of the PCC plant is very likely more extensive than I was able to document, and the chances are reasonably good that there are additional rare plants in the fen complex. See recommendations for additional botanical survey in “Biological Inventory” section.

There is also a tiny occurrence of Medium Fen over glaciofluvial sand deposits in the Eversource ROW in the northeast corner of The Preserve. This entity I have classified as the Other/Unique subtype and called a “Sand Bog” sub-subtype. It is similar to many working and former working cranberry bogs in that it occurs not on deep organic peat deposits but rather on wet sand with very little accumulation of organic material in the upper horizon. This occurrence at The Preserve lacks the cranberry, however, but hosts a PCC plant.

⁴⁹ Ken Metzler, personal communication



Figure 32. *Rose Pogonia* in Medium Fen “Sand Bog” occurrence on glaciofluvial sandy soil in Eversource ROW. This is a northern-affinity, circumboreal.



Figure 33. *Southern Bog-clubmoss* in Medium Fen “Sand Bog” occurrence on glaciofluvial sandy soil in Eversource ROW, growing next to *Rose Pogonia*.

Sand Barren (Other/Unique).

Sand Barren is among the Critical Habitat types included in the CTDEEP 2009 Critical Habitats GIS coverage, and included in the 2015 WAP as the “Sand Barrens and Sparsely Vegetated Sand and Gravel” subhabitat of Upland Herbaceous Key Habitat. In the 2009 Critical Habitats classification, 2 subtypes are recognized: Sparsely Vegetated Sand, Sandplain grassland, Pitch Pine Scrub. I have classified the subtype of occurrence at The Preserve as Other/Unique, because it is in the Eversource ROW and is subject to both the disturbance of ROW maintenance and ATV use. This ~1 a-acre occurrence is in part sparsely vegetated sand maintained mainly by recreational ATV and traffic, and in part, dry warm season-grass- and low-heath-dominated habitat, and occurs on sandy substrate that appears to be excessively drained. This habitat supports 2 PCC plants, one of which is unique at The Preserve to this habitat. It also supports Wild Indigo (*Baptisia tinctoria*), a host plant for State-Threatened butterfly Frosted elfin (*Callophrys irus*), and several other GCN host plants for State-listed invertebrates. I recorded a total of at least 46 vascular plant taxa in this habitat, 45 of which are native. Much of the herbaceous plant diversity occurs in the ecotone between the heavily trafficked middle of the service road (in which there is little vegetation and ATV track and the grass- and low-heath- co-



Figure 34. Sand Barren, Other/Unique sub-type in power transmission ROW.

dominated zones on either side, which illustrates the importance of a certain amount of disturbance to maintaining the plant diversity.

Other Significant Natural Communities and Vegetation Types.

I have mapped the following entities as significant because they are, in my opinion, based on my experience and the best existing information available, distinguished in one or more ways and are important elements of the biodiversity captured and protected of The Preserve. In some cases, I have assigned these entities so-called “place-holder” names that do not exactly coincide with the name of habitats or communities or vegetation types found in the classification sources given at the beginning of this section. This is intentional and due to my provisional assessment that they warrant recognition as separate ecological entities from anything in the existing classifications, and/or their relation to named entities in the existing classifications it is not clear.

Headwater Seepage Swamp

This habitat occupies in excess of 37 acres cumulatively at the Preserve, and is thus the largest single community to which I have assigned higher biodiversity significance. In the 2015 WAP, it is included in a larger entity, the Red Maple Swamps sub-habitat of the Key Habitat Forested Inland Wetland. The NAHSS is a clearly an ecological subset of the Acidic Seepage Swamp natural community in Metzler & Barrett 2006, but I have called it out as a separate entity based on floristic characteristics that appear, based on my experience, to be distinguished conceptually with the modifier “Headwater” because the large acreage of Seepage Swamps at The Preserve are the origins of multiple 1st order, cool and/or cold headwater streams. They also, according to Klemens⁵⁰, contribute to the maintenance of longer hydroperiod cryptic vernal pools, which are support the exceptionally large populations of marbled salamander at The Preserve. Seepage swamps

⁵⁰ Klemens 2004

are distinguished from basin swamps by occupying slopes that are kept wet by groundwater spring seepage, and because of this there is little build of organic sediments.



Figure 35. Headwater Seepage Swamp, June aspect.

Groundwater seepage can be a source of minerals leached from bedrock and the overlying soils, or in some cases, the groundwater may be relatively oligotrophic and leach away of nutrients from the root zone. This results in a variety of plant assemblages that is often more diverse than that of acidic basin swamps, and which may include uncommon and rare species. With respect to rare species, the large network of AHSS's at The Preserve supports multiple populations (i.e., a

“meta-occurrence”) of a PCC plant (Species M) that is otherwise only known historically from Connecticut, and is otherwise in New England known from Rhode Island (where it is in the rarest category), and is Endangered in New York State (with less than 5 occurrences). This species is in a relatively cryptic group (sedges), and so it may have been overlooked by modern botanizers, but for the time being, The Preserve hosts the only known occurrences of this regionally quite rare plant in Connecticut. The majority of the population at The Preserve is in this habitat, but some plants occur also in the Acidic Seepage Forest.

With respect to floristic richness, I recorded 98 vascular plant taxa (95 native) in the AHSS, 8 of which appear to occur only in this community. Three uncommon/habitat-restricted plants occur in this unit, though none are unique to it.

Acidic Seepage Forest

Acidic Seepage Forests occur on low slopes where seasonal and periodic seepage discharge brings nutrients leached from bedrock and upland soils into the root zone, and plants with higher nutrient demands are prominent. The name of this community (from Metzler & Barrett 2006) is somewhat misleading: the soil pH is most likely in the subacidic range, and soils are moderately well drained to somewhat poorly drained, not hydric, because the seepage does not persist for long enough in the growing season to produce hydric soil characteristics (as is true for Seepage Swamps). This community is classified in the 2015 WAP as a subset of the Mixed Hardwood Forests sub-habitat of the Key Habitat Upland forest. It is not included in the CTDEEP 2009 Critical Habitats GIS coverage, probably because it is a common habitat type. This habitat is fairly common at The Preserve, occurring low on ridge and valley side-slopes, at heads of valleys and in hollows, and other places where concave slope shape concentrates seepage and nutrients, often just upslope of wetlands and streams. Generally, in most of Connecticut, Sugar

Maple and often White Ash are dominant canopy trees in this community, but at The Preserve, Tuliptree (*Liriodendron tulipifera*) is most frequently the dominant canopy tree, and Sugar Maple and White Ash are local as dominant trees. I have some reason to



Figure 36. Acidic Seepage Forest, in late May.

hypothesize that the prevalence of Tuliptree in this community and the relative unimportance of Sugar Maple and White Ash may be an expression of consistent floristic differences between near-coastal forests and inland occurrences of this community.

I have mapped one occurrence of this community as significant in a Connecticut and regional context. This occurrence supports occurrences of 2 PCC plants, both of which are also of regional conservation concern. For one of these PCC plants, this occurrence is exceptional in a Connecticut context, in terms of number of individuals and number of flowering/fruitleting plants (a number of the known occurrences of this plant have few to no flowering/fruitleting individuals). The 2nd PCC plant of regional conservation concern is the same species that occurs in The Preserve more extensively in the Near-coastal Acidic Headwater Seepage Swamp community. Two uncommon and/or habitat-restricted occur at this site, and this site is the only place I observed one of these plants.

I mapped one other occurrence of Acidic Seepage Forest as potentially significant in a regional context. It may host a plant that is considered regionally rare in New England and whose status in Connecticut is currently unknown. This is the only site in The Preserve at which I observed this species. Unfortunately, my identification was tentative because the plants were not mature, and I neglected to return to the site later to confirm, hence the “potentially significant” above. In the context of The Preserve, this site is one of the most intense concentrations of helophytic rich woods plants.

Acidic, Sandy, Wet Meadow (Other/Unique)

This community is in the portion of the Eversource power transmission ROW that traverses glaciofluvial sand deposits. Wet meadows are a 2015 WAP sub-habitat of the Key Habitat Herbaceous Inland Wetland, but this occurrence is in a Public Utility Transmission Corridor, which is a 2015 WAP sub-habitat of the Key Habitat Unique; Natural or Man-made. I have mapped this as a significant community occurrence because it hosts one PCC plant and several uncommon and habitat-restricted plants. It occupies an area that was originally Atlantic White Cedar Swamp, as evidenced by the

1934 aerial photographs, and young plants of AWC are frequent in the community today. This community is maintained as a wet meadow by ROW vegetation management. The invasive Common Reed (*Phragmites australis*) has become established in a portion of this community, but has not yet completely displaced the native plants in this area and not yet become a monotypic stand. The above-described very small occurrence of Medium Fen - Other/Unique - “Sand Bog” is an inclusion in this community.

Moderately Well-drained Acidic Sandy Grass-/heath-land (Other/Unique).

This community also occurs in the in the portion of the Eversource power transmission ROW that traverses glaciofluvial sand deposits, at a slightly higher elevation than the above-described Wet Meadow community. The soil hydrologic regime in this community is moderately well drained or somewhat poorly drained, with a seasonally high water table. This community is maintained by ROW vegetation management. It is not clear



Figure 37 Moderately Well-drained Acidic Sandy Grass-/heath-land (Other/Unique), in July 2018. Shrubs barely 3 ft high.

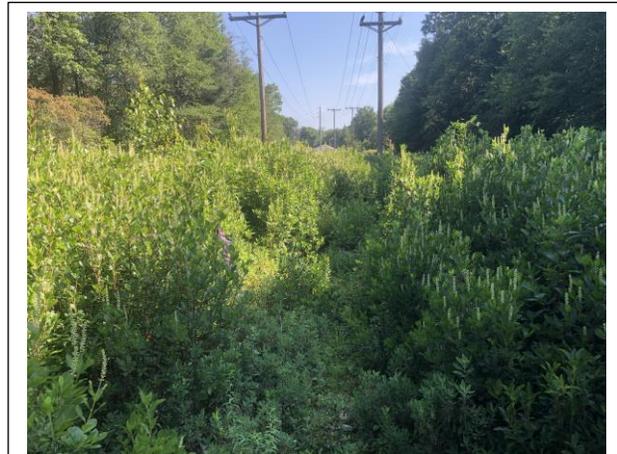


Figure 38. Same habitat in July 2020, growing up into shrubland.

where this community fits into the 2015 WAP classification. It could be put in the Key Habitat Upland Herbaceous or into Unique; Natural or Man-made. I have mapped this community as significant because it hosts 3 PCC plants and several uncommon habitat-restricted plants. In this community, the rare and uncommon species are concentrated in the ROW service road, while the less frequently disturbed areas outside the service road have become dominated by low heaths and Sweet Pepperbush (*Clethra alnifolia*), and there is a deeper surficial layer of organic material (i.e., duff) than in the service road habitat. At present, it appears that the woody shrubs are gradually invading the service

road habitat, to the detriment of the rare and uncommon herbaceous plants. It is clear that some more specialized management than what has taken place in the recent past is needed here to maintain the occurrences of the rare and uncommon plants.

Telephone ROW/ dirt road thru sandy acidic seasonally wet forest.

This herbaceous community occurs on glaciofluvial sand deposits in the lower, wetter parts of an old dirt road running through a forested area. I have mapped it as a significant community because it supports (or did support as recently as 2017) one PCC plant. The hydrologic regime is probably moderately well drained and/or somewhat poorly drained and/or possibly poorly drained in places. The plant assemblage is fairly diverse and, together with the presence of the PCC plant, suggests that there may have been other rare plants in the past, and may still exist as viable seed in the seed bank. This community was once more open and the closing in of the maturing forest canopy has probably caused the loss of plant species and the gradual diminishment of the numbers of the PCC plant that was still hanging on in very small numbers in 2017. Management, in the form of opening up the tree canopy over the road, will likely rejuvenate this community and possibly restore the numbers of the one known PCC plant and perhaps others that are in the seed bank.

Dry Acidic Forest, Oak Woodland Sub-type.

In the 2015 WAP, this community is classified under the Oak Forests sub-habitat of the Key Habitat Upland Forest. In the 2006 Metzler & Barrett natural community classification, these are Dry Acidic Forests on Glacial Till, and the two vegetation subassociations Black oak - Chestnut oak / Black huckleberry (*Quercus velutina* - *Quercus prinus* / *Gaylussacia baccata*) community and Black oak / Blue Ridge blueberry (*Quercus velutina* / *Vaccinium pallidum*) community. These subassociations are very common in Connecticut and at The Preserve, and generally do not have PCC and



Figure 39. Dry Acidic Forest, Oak Woodland Sub-type.

uncommon/habitat-restricted plants associated with them. However, I have mapped two

occurrences at The Preserve as at least potentially significant, because they are large semi-open woodlands⁵¹, as opposed to closed canopy forests. These woodlands, which occur on rocky hilltops, were probably Acidic Rocky Summit Outcrop habitat (or “balds”) not many years ago, and still may be important habitat for reptiles that use openings in upland forest for basking.

Acidic Seepage Wet Meadow on Till (Other/Unique).

I have mapped this open-canopy herb-dominated community as significant at two locations in the power transmission ROW, because one hosts a PCC plant (Species M) currently, and the other formerly hosted the rarest class of PCC plant (Species B). I was unable to find the PCC plant in the latter Wet Meadow occurrence during my survey, but this plant is an annual and may be viable in the seed bank. Both occurrences also host a diverse assemblage of other native plants, and invasives are absent or relatively unimportant. An increase in nearby non-native *Phragmites australis* potentially threatens both occurrences in the long term. One of these occurrences is shown in Figure 12 (page 37).

Dry Warm Season Grassland.

This community now occurs in The Preserve only in the power transmission ROW, and I have designated it as a significant natural community because one occurrence hosts a robust population of one of the PCC plants (Species K), and the other is potential habitat for the same species. These communities are dominated by the native warm season grasses Little Bluestem (*Schizachyrium scoparium*) and Virginia Bluestem (*Andropogon virginicus*). And they are very similar to, and perhaps could be considered a form of, Acid Rocky Summit Outcrop- Grassy Glade/Bald, but I have made it a separate entity because it is relatively less dry and more densely vegetated than that community, and lacking in many of the more xerophytic species that occur in the more diverse expressions of that community.



Figure 40. Dry Warm Season Grassland in Eversource ROW, late fall aspect.

Floristic Inventory.

During field survey from April 2017 through September 2020, I observed at The Preserve approximately 617 vascular plant taxa⁵² that are not known or suspected to have been

⁵¹ “woodland” as used in this report, means a treed habitat with gaps between the trees, or openings in the tree canopy frequent. Areal cover of tree canopies, when leafed out, is from 25% to 60%.

⁵² The generic terms “taxon” and its plural “taxa” are used in this report, rather than “species”, because in