

Quivet Neck/Crowes Pasture Dennis, Massachusetts

Environmental Review Team (ERT) Study



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**Quivet Neck/Crowes Pasture
Dennis, Massachusetts
Environmental Review Team (ERT) Study**

INTRODUCTION

The Environmental Review Team (ERT) is an inter-agency natural resource study team that brings together people from many disciplines to provide unbiased natural resource information to municipalities. The outcome of an ERT is to provide needed information that helps local municipal officials make better land-use decisions. The ERT is a public service offered by the Pilgrim RC&D Area Council, Inc.

On September 17, 2001 the Dennis Conservation Commission requested an Environmental Review Team (ERT) Study from the Pilgrim Resource Conservation and Development (RC&D) Area Council, Inc. of Quivet Neck/Crowes Pasture in Dennis, Massachusetts. The Quivet Neck/Crowes Pasture Area was designated as a District of Critical Planning Concern (DCPC) by the Cape Cod Commission in 2002. The request was approved by the Pilgrim RC&D Council Board of Directors at their September Board meeting. Specifically, the Conservation Commission requested Environmental Review Team assistance with:

- Soil mapping, soil descriptions, soil potential/limitations for development purposes and wildlife habitat.
- Wildlife and wildlife habitat assessments and inventories, with an emphasis on vernal pools.
- Assessments of rare and endangered plant and wildlife species and recommendations for their protection.

The Environmental Review Team members included scientists and specialists in the fields of soils, amphibians, reptiles, vernal pool ecology, botany, rare species inventories and GIS. Team members include:

- **James D. Turenne**, Certified Professional Soil Scientist, USDA-NRCS. Jim has been a field soil scientist for 15 years, mapping soils throughout southeastern Massachusetts and Middlesex County. Jim has also served as Ground Penetrating Radar Specialist for the New England Region for 13 years. A resume for Jim Turenne can be found at <http://nesoil.com/jimt.htm>.
- **Scott Jackson**, Director, UMass Extension Natural Resources and Environmental Conservation Program. Scott is an amphibian and reptile expert with research interests in vernal pool ecology, salamander breeding behavior, population biology, and the impact of highways on wildlife population movement. He has conducted wildlife habitat evaluations, project reviews and surveys for rare reptiles and amphibians throughout New England. He is one of the principal coordinators for the Amphibian Monitoring Program for Massachusetts.
- **Kasey Rolih**, Researcher, UMass Department of Natural Resources Conservation. Kasey is a researcher and uses geographic information systems to incorporate field based vegetation mapping into fine and coarse-scale conservation and biodiversity assessments. Kasey has worked as a botanist for the USDA Forest Service and is currently a lichen specialist in the Service's Forest Inventory analysis program. She has conducted botanical inventories on the East Coast from Maine to West Virginia. She is currently involved in an ongoing effort to inventory the lichens of Massachusetts.

- **Laurie Sanders** has conducted rare species inventories for the Massachusetts and Connecticut Natural Heritage programs since 1988. Over the years, she has located dozens of new sites for state-listed plants, tiger-beetles, odonates, reptiles, freshwater mussels and amphibians, including a population of previously undiscovered hybrids between green dragon and jack in the pulpit. Currently employed by UMass Extension as an Extension Educator, her past work experience includes work as a botanist for the USDA Forest Service in Vermont and the Nature Conservancy-Connecticut Chapter.
- **Diane Murphy**, Biologist, Cape Cod Cooperative Extension. Herpetologist.

The Quivet Neck Crowes Pasture area consists of approximately 250 acres that borders on freshwater ponds, Quivet Creek and Cape Cod Bay in the northeast region of Dennis. The Conservation Commission owns and controls approximately 100 acres, the balance is owned by others or in dispute. The Conservation Commission is responsible for providing natural resource inventory data and impact evaluations/assessments as Town Committees move through the DCPC process.

DCPCs are areas that are of critical value to Barnstable County. The purposes of a District include, among others, the protection of unfragmented forest habitat, rare plant and wildlife habitat, vernal pools, wildlife corridors, freshwater and saltwater wetlands, coastal plain pond shores, scenic views, passive recreation and the maintenance of open space.

Quivet Creek/Crowes Pasture is located on the north shore of Dennis, MA, on a small peninsula along Quivet Creek. Prior to conducting onsite studies the Town notified property owners; those areas where access was denied or ownership is in dispute were excluded from this study.

SOILS ASSESSMENT

NRCS Participants

Jim Turenne was the principal data collector and soil mapper for the study. Robert Tunstead (CPSS), Soil Scientist with the West Wareham USDA Farm Service Center also assisted on two of the field days.

Sequence of Investigations

1. **April 3, 2002:** Background information was collected in the office. The base map for the inventory was prepared, existing resource inventory maps such as soil maps, topographic maps, surficial geology, wetlands, and flood maps were collected and studied for content.
2. **April 5, 2002:** A day was spent at the site to review existing soil mapping and conduct preliminary data collection. **It was determined from the investigation that soil and geologic conditions were extremely complex and remote sensing using the NCR's ground penetrating radar (GPR) would be needed.**
3. **April 8, 2002:** GPR was used to profile the subsurface. Several long transects were made with the radar and numerous soil cores were dug to assist with interpretation of the radar data.
4. **April 9, 2002:** Meeting with the town officials and a site visit. No soil data was recorded during the visit.
5. **April 10, 2002:** the soils on the town owned land were mapped using traditional National Cooperative Soil Survey techniques.
6. **May 20, 2002:** Jim Turenne met with landowners from the northwestern part of the property; they were Norman Sears, Connie Maney, Robert Lamb and others. Soil survey procedures and soil

science in general were discussed. Their properties were walked, several cores dug, and soils were delineated.

7. **June 4, 2002:** Jim Turenne met with Norman Sears and mapped the remaining property in the NW section (Condominium Property) in the morning. The afternoon was spent mapping the remaining parcels and touching up areas missed.

Methods

A 1:12,000 scale color infrared aerial photograph, flown on April 1993, was used as the base map for the soil inventory. Other aerial images were used along with USGS Topographic maps (1943 and 1974) and Surficial Geology maps (MAP GQ-1114, 1974).

Soil survey procedure followed the guidelines established in the National Soil Survey Handbook (<http://www.statlab.iastate.edu/soils/nssh/>). The soils were mapped at a high level of detail (Order 1 mapping) with minimum delineations down to 0.5 to 1 acres in size. Ad-hoc spot symbols were used to locate areas smaller than 0.5 acres that had major interpretive differences (such as hydric soils in a non-hydric unit) from the adjacent soils.

Access to some of the properties was denied and a thick vegetative under story made some areas inaccessible. These areas were mapped by aerial photo interpretation, knowledge of the soils, geology, and landform position.

Logs of some of the soil test pits were taken as field notes to provide additional and site specific data. Depth to estimated seasonal high water table, restrictive layers, soil texture, and soil type are some of the properties logged. The field notes were compiled into a GIS point file to show the location and information for this report.

The soil data and map unit delineations were digitized onto a true-color digital Orthophotograph, flown on April 2001. Soil attribute data was added to the digitized soil maps using a soil/GIS join table developed by Jim Turenne.

Site Information

Geology of Quivet Neck/Crowes Pasture (for a glossary of soil/geologic terms go to: <http://nesoil.com/gloss.htm>):

Figure 2 is a scanned copy of the USGS surficial geologic map for the Quivet Neck area. Surficial geologic maps show the type of geologic deposits below the soil layer (generally below 2 meters) and above the hard bedrock. Surficial deposits in Southeastern Massachusetts are mainly glacial and post glacial deposits. The surficial glacial geologic deposits mapped in the Quivet Neck area are Ice-Contact Deltaic-Lake Deposits (map unit Q12 on figure 2) which is described as: Sand, gravel, clayey silt, and minor amounts of till which was deposited during an early stage of Glacial Lake Cape Cod. Glacial lake deposits are fine-textured material (silts and clays) deposited in open lakes which have since drained or filled with sediment. Post-glacial deposits mapped on the surficial geology map include Dune and Beach deposits (Qd and Qb on figure 2 - wind deposited sand), Marsh/Swamp deposits (Qs) and Cranberry Bogs (cb on figure 2) both are organic deposits. Surficial deposits are related to the parent material from which the soils formed and play a major role in many soil properties. Surficial geologic deposits are also used for Title V (on-site septic system code) soil evaluations.

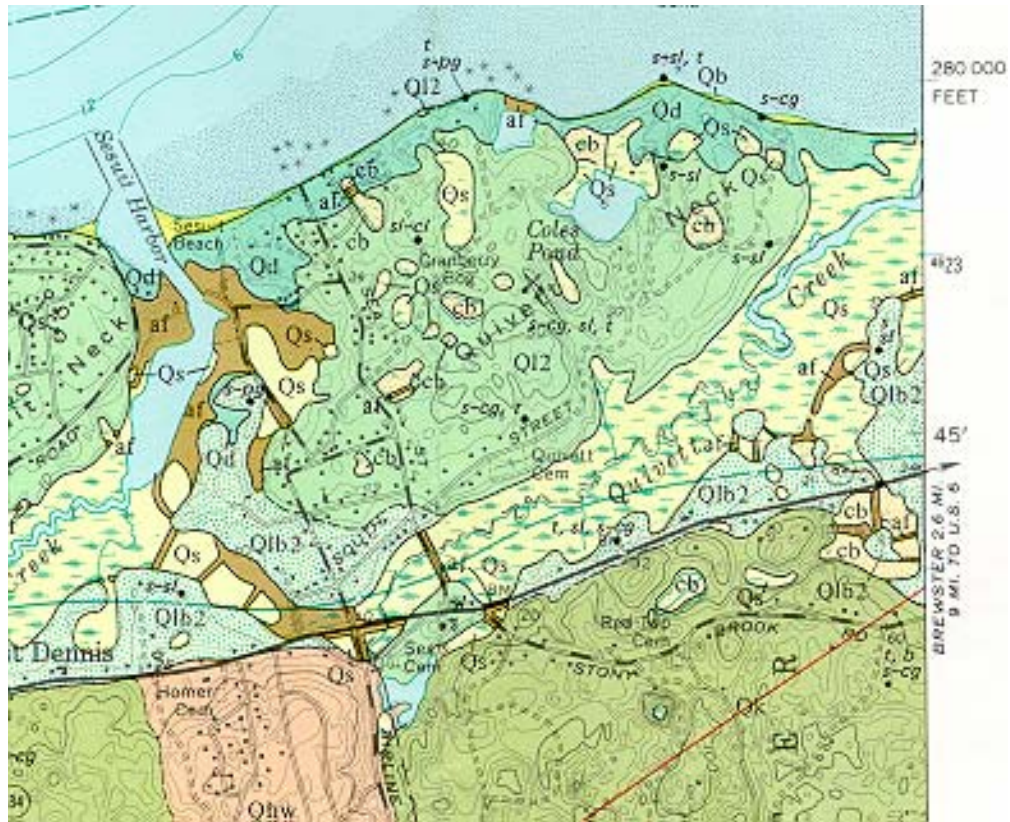


Figure 2: Surficial Geology Map of Quivet Neck Area.

Soils of Quivet Neck/ Crowes Pasture

Previous Investigations

The Soil Survey of Barnstable County, Massachusetts (Fletcher, 1993) is the official published soil survey for the area. The 1993 soil survey is mapped at a scale of 1:25,000 with minimum soil delineations of 5-8 acres in size, it is intended to provide detailed soil information for general land use purposes. Due to the nature of this investigation and the need for more detailed soils data, the 1993 published soil survey was used as a guide for general soil conditions.

A detailed (order 1), updated soil map was made for the Quivet Neck area. The 1993 soil survey (atlas sheet 16) has four major soil types mapped in the area. Excessively drained Plymouth soils are mapped in the southern part of the property and moderately well drained Belgrade soils are mapped in the northwestern part of the property. The shoreline is mapped as coastal soils (Hooksan soils) and beach areas and very poorly drained organic soils (Freetown and Ipswich) are mapped in kettle holes and tidal marshes. The onsite investigation confirmed the mapping to be very accurate for the scale and intended use of the survey.

Updated Mapping

The updated inventory and mapping of the soils in the Quivet Neck area was collected using standard soil survey techniques. In addition, ground-penetrating radar was used to collect subsurface information. The radar was used to show the variability of the soils and geology, identify thick stratified deposits,

locate areas of fine textured lacustrine deposits, and identify areas to investigate with mechanical tools. A power drill was also used in certain areas to provide a deep core of the soil/geology. Field notes were recorded and geo-referenced to help with the field mapping and to provide site-specific data.

Figure 3 (and Figure 3a) is an updated detailed soil map of the DCPC area. The map unit symbols used are the numeric State-wide soil legend with the alpha slope class assigned for soil map units (not used for non-soil areas such as beaches). The map (Figure 3) also has some Ad-hoc soil spot symbols used for areas that were too small to delineate at the scale of mapping.

Figure 4 shows the location and information of the field notes collected for the site. Some of the soil map units were not mapped in the published 1993-soil survey. These include the abandoned cranberry beds or the Hooksan wet substratum. These map units are currently being mapped in Plymouth County.

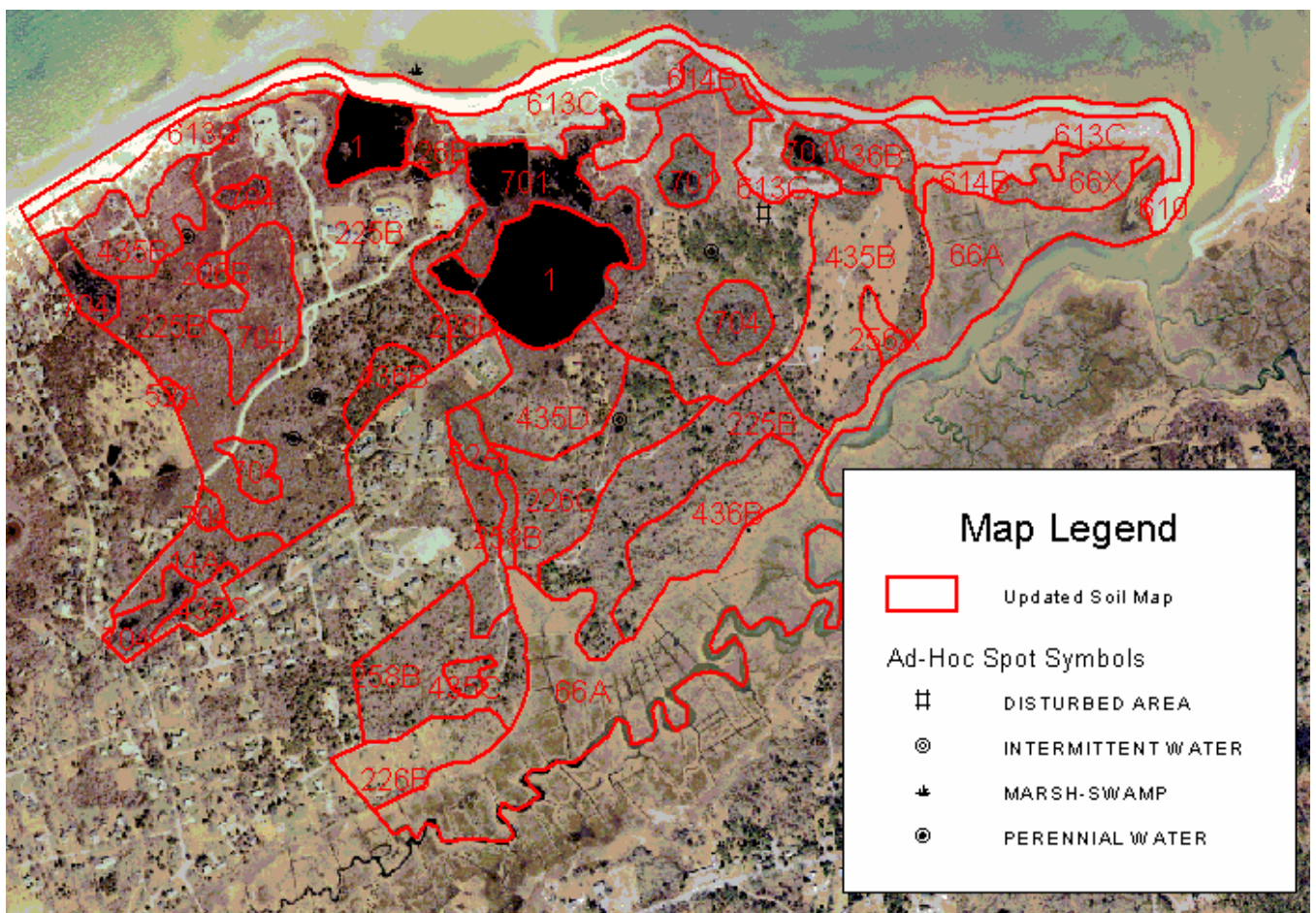


Figure 3: Updated Soil Map, Quivet Neck Area, Dennis Massachusetts (Map Scale = 1:12,000).

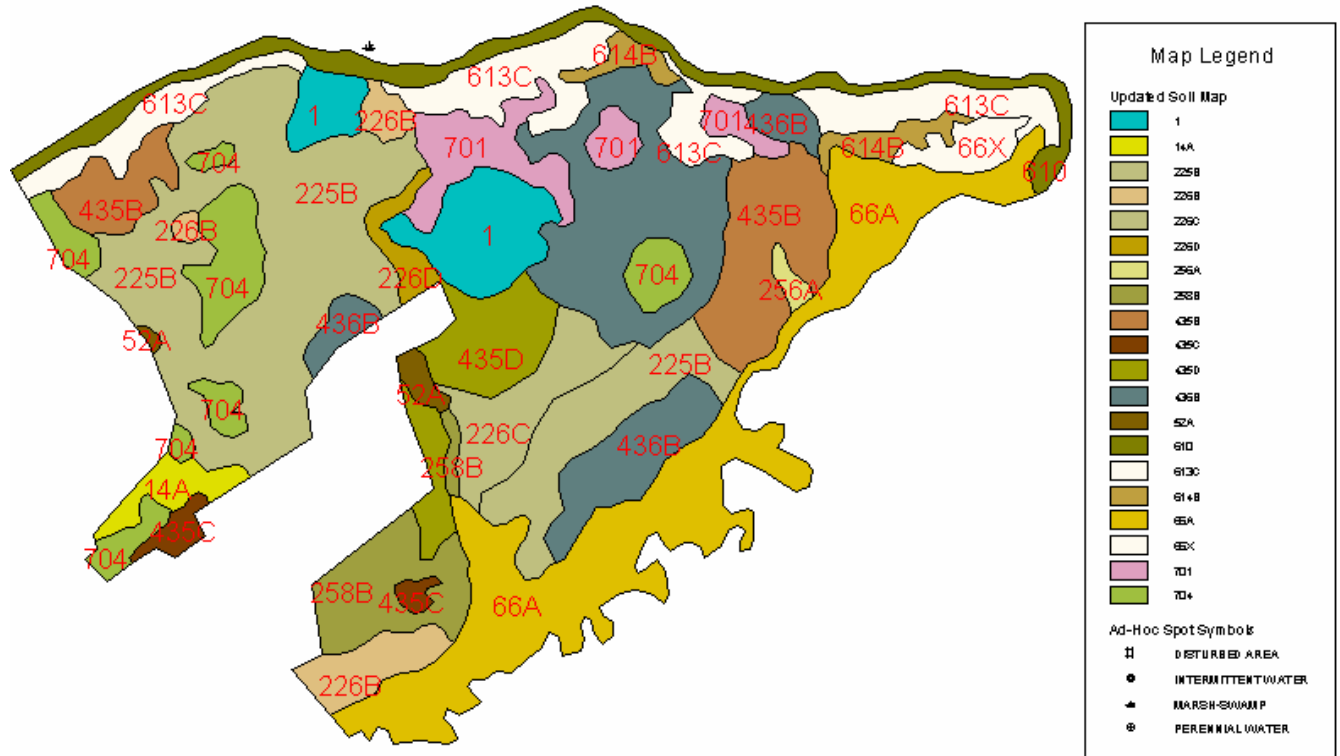


Figure 3a: Updated Soil Map, Quivet Neck Area, Dennis Massachusetts (Map Scale = 1:12,000).

The following are brief descriptions of the soil map units. Detailed descriptions along with the major properties and interpretation can be found at <http://nesoil.com/barnstable/index.htm>.

1 – Water – fresh water, generally more than 3 feet deep, includes some areas of emergent vegetation.

14A – Scitico silt loam, 0 to 3 % slopes - Poorly drained soils formed in silty and clayey glacial lake floor deposits. Scitico soils are hydric associated with wetland areas. Major limitations are related to a seasonal high water table at 0 to 1.5 feet below the surface and very slow permeability of the substratum.

225B – Belgrade silt loam, 3 to 8 percent slopes - Moderately well drained soils formed in silty glacial lake floor deposits. Belgrade soils have seasonal high water tables 1.5 to 3.5 feet below the surface and very slow permeability in the substratum. They are prime farmland soils, well suited for most agricultural uses.

226B, 226C, 226D – Hinesburg fine sandy loam, 3-8 % slopes (B), 8-15 % slopes (C), and 15-25 % slopes (D) - Well drained soils formed in sandy eolian underlain by silty glacial lacustrine deposits. Major limitations relate to slow permeability of the silty substratum. 226D has severe erosion hazards, particularly when excavated. Map unit 226B is a prime farmland soil.

256A – Deerfield loamy sand, 0 to 3 percent slopes - Moderately well drained soils formed in sandy glacial outwash deposits. Deerfield soils have an apparent seasonal high water table 1.5 to 3.0 feet below the surface; they are associated with aquifer recharge areas. Major limitations related to the depth to

water table and potential for aquifer contamination. Agricultural limitations are related to low available water holding capacity.

258B – Amostown sandy loam 3 to 8 percent slopes - Moderately well drained soils formed in sandy eolian material underlain by silty glacial lacustrine deposits. Amostown soils have a seasonal high water table 1.5 to 3.0 feet below the surface. Major limitations are related to the seasonal high water table and the slowly permeable substratum. Amostown soils are prime farmland soils.

435B, 435C, 435D – Plymouth loamy coarse sand, 3-8% slopes (B), 8-15 % slopes (C), and 15-25 % slopes (D) - Excessively well drained soils formed in sandy glacial till. Plymouth soils are associated with aquifer recharge areas; they have few limitations for most non-agricultural uses.

436B, 436C – Plymouth loamy coarse sand, very stony, 3-8% slopes (B), 8-15% slopes (C) - Excessively well drained soils formed in sandy glacial till. Plymouth soils are associated with aquifer recharge areas; they have few limitations for most non-agricultural uses. Stones and boulders on the surface may interfere with excavation.

52A – Freetown muck, 0 to 1 percent slopes - Very poorly drained soils formed in more than 51 inches of highly decomposed organic material. Freetown soils have a seasonal high water table +2.0 feet above the surface to 1.0 feet below the surface. Freetown soils are hydric soils associated with wetlands. They are poorly suited for development uses due to the high water table, and low soil strength. Freetown soils are well suited to wetland wildlife habitat.

613C – Hooksan-Duneland complex, hilly - This map unit consists of a very deep, hilly and steep, excessively drained Hooksan soil and areas of Dune land. The unit is mapped in areas of recent coastal eolian deposits adjacent to beaches and coastal ponds. The difference between Hooksan soils and Dune land is that the Hooksan soils are vegetated and dune land is not vegetated. The unit is poorly suited to development due to wind and water erosion and issues related to coastal regulations (wetlands and Title V). The unit is poorly suited for agricultural uses due to low fertility, droughtiness and erosion.

614B – Hooksan, wet substratum 2 to 8 percent slopes - Moderately well drained soils formed in recent deposits of eolian sand. This map unit is a variant of the Excessively drained Hooksan series, it has a seasonal high water table 1.5 to 4.0 feet below the surface.

66A – Ipswich-Pawcatuck-Matunuck complex, 0 to 1 percent slopes - These very deep, level, very poorly drained soils are in tidal areas (marshes) that are subject to daily inundation by salt water. They are adjacent to shore areas and brackish ponds. The soils are mapped together because no major differences affect their use and management. The map unit consists of hydric soils associated with wetlands. They are very poorly suited for most uses. They are well suited to wetland wildlife habitat.

66X – Pawcatuck, overblown phase - This unit is mapped in a small area in the Northeast corner of the property where Quivet Creek outlets into Cape Cod Bay. It consists of very poorly drained Pawcatuck soils with a 20-30 inch deposit of recent eolian sand deposited over the Pawcatuck soils.

701 – Cranberry bed, abandoned, mineral substratum - Very poorly drained mineral soils which were formerly used for cranberry bed production but have been abandoned for more than 5 years and

have reverted back to wetland vegetation. The map unit consists of hydric soils associated with wetlands. The unit is very poorly suited to development uses due to the seasonal high water table. It is well suited to wetland wildlife habitat.

704 – Cranberry bed, abandoned, organic substratum - Very poorly drained organic soils which were formerly used for cranberry bed production but have been abandoned for more than 5 years and have reverted back to wetland vegetation. The map unit consists of hydric soils associated with wetlands. The unit is very poorly suited to development uses due to the seasonal high water tables and low soil strength. It is well suited to wetland wildlife habitat.

Soil Limitations and Interpretations

The purpose of the soil resources inventory for the Quivet Neck area was to provide information to the Town regarding:

- Soil potentials and limitations for development purposes and
- Soil potentials and limitations wildlife habitat.

Soil survey interpretations predict soil behavior for specified soil uses and under specified soil management practices. Policy about these interpretations can be found at <http://www.statlab.iastate.edu/soils/nssh/617.htm> #00. The criteria used for making soil interpretations are related to soil properties (soil texture, soil color, etc.) and soil qualities (such as soil drainage class, erodibility, etc.). It must be noted that these interpretations are made for the soil resource that generally corresponds to the upper 2 meters from the surface. Material below this depth are geologic deposits.

*These interpretations are NOT intended to tell the user what they can and cannot do with the land or take the place of an onsite investigation, they are intended to highlight problems associated with the soil for various uses and provide information to plan for these problems.

Development Interpretations:

Soil properties and qualities that relate to development interpretations include:

- Depth to seasonal high water table,
- Slope,
- Flooding and ponding potential,
- Soil texture and particle size distribution,
- Depth to restrictive layers,
- Hydrologic factors, and
- Engineering factors.

Since the Quivet Neck area of Dennis is zoned residential (R60 and R40), according to the MassGIS zoning datalayer, the development interpretations listed are for single family dwellings with basements and individual onsite septic systems.

Two major Massachusetts State regulations involving soils that impact development are:

- The Wetlands Protection Act (310 CMR 10.55) and
- The State Environmental Code V: Minimum Requirements for the Subsurface Disposal of Sanitary Sewage (310 CMR 15.00).

These regulations were taken into account during the field inventory of the area (this mapping does NOT take the place of onsite investigations for these regulations).

Figure 4 is an interpretation map for on-site septic systems. The ratings are designed to show soil ability to deliver household sewage effluent into the soil under the State (Massachusetts) Environmental Code Title V: Minimum Requirements for the Subsurface Disposal of Sanitary Sewage (310 CMR 15.00).

These classes are designed for the installation of new septic systems for new single-family residences and do not apply to large systems, repairs, or commercial/industrial systems. The general requirements relating to soil suitability for onsite sewage disposal systems in Massachusetts are:

- Four feet of naturally occurring (C-horizon) pervious material with percolation rates less than 30 minutes per inch.
- Minimum vertical separation distance between the bottom of the crushed stone underlying the soil absorption system and the seasonal high ground-water level is four feet in soils with a recorded percolation rate of more than 2 min/inch and five feet in soils with less than 2 min/inch percolation rates.

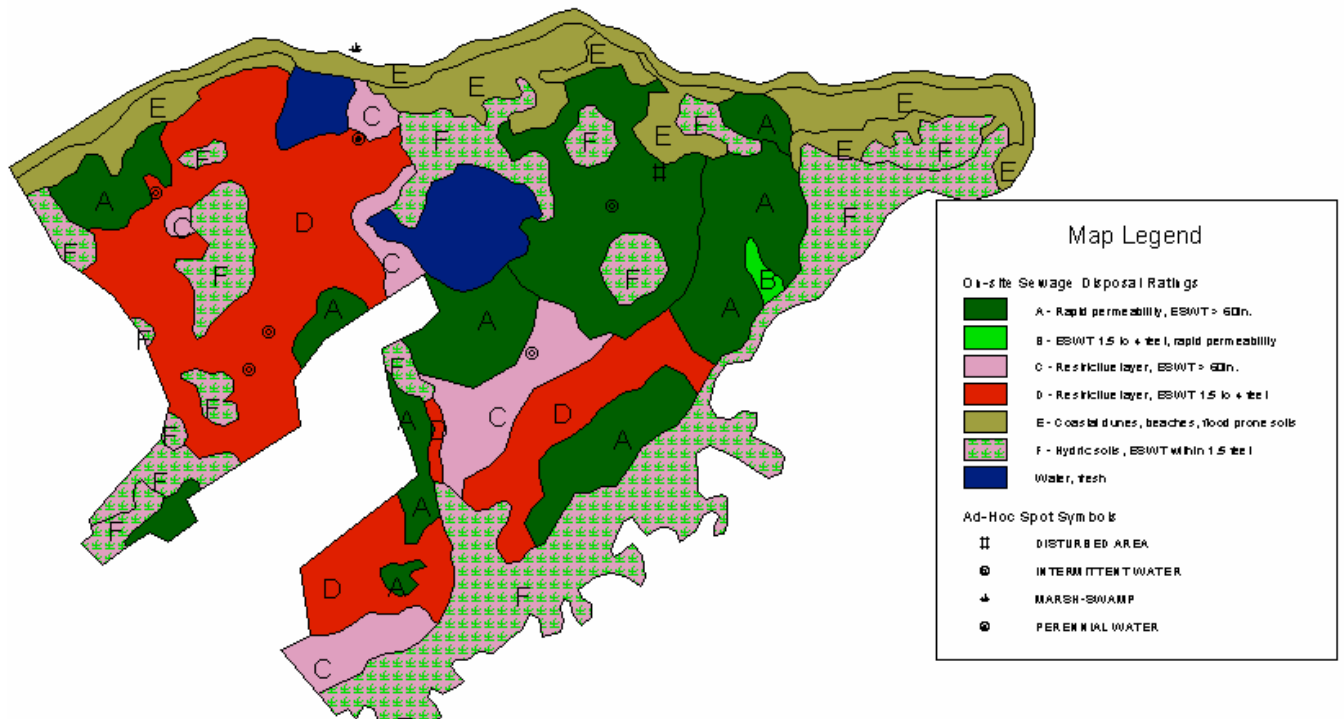


Figure 4: Soil Ratings for Massachusetts Onsite Sewage Disposal Systems, Quivett Neck, Dennis Massachusetts (Map Scale: 1:12,000).

Based on this criteria, the onsite sewage disposal ratings were developed by grouping soil properties such as depth to seasonal high watertable, permeability, depth to bedrock, type of parent material, and

drainage class together. The following table lists the onsite sewage disposal ratings (A through I), a brief description of the class, and the relation to the Massachusetts Title V code for siting onsite septic disposal systems within this type of soil.

On-site Sewage Disposal Class	Class Description	Massachusetts Title V Relation
A	This group consists of soil map units that have a depth to seasonal high water table greater than 60 inches, depth to bedrock is greater than 60 inches, and permeability of the substratum is rapid to very rapid to a depth of 72 inches.	Generally well suited soil for on-site sewage systems. These areas are often associated with aquifer recharge zones. Nitrate reduction systems may be required in some areas.
B	This group consists of soil map units that have a depth to seasonal high water table between 1.5 and 60 inches below the surface, depth to bedrock is greater than 60 inches, and permeability of the substratum is rapid to very rapid.	Generally, these areas require a mounded system so the bottom of the leach field is 4 to 5 feet (depending on the percolation rate) above the seasonal high watertable. Some areas may be required to install nitrate reducing alternative systems to protect the aquifer.
C	This group consist of soil map units that have a depth to seasonal high water table greater than 60 inches, depth to bedrock is greater than 60 inches, and permeability of the substratum is moderate to very slow within a depth of 72 inches.	These soils generally have a restrictive layer within 72 inches and on-site exploration is often required to locate the four feet of pervious material. Removal of the slowly permeable material is often needed and suitable fill material needs to be brought in. The restrictive material is usually dense till, lacustrine silts and clays, human transported fill, or ice contact material.
D	This group consist of soil map units that have a depth to seasonal high water table between 1.5 and 60 inches below the surface, depth to bedrock is greater than 60 inches, and permeability of the substratum is moderate to very slow within a depth of 72 inches.	Generally, these areas require mounded systems and extensive on-site exploration to locate the required four feet of pervious material. Removal of the restrictive layer is often required and suitable fill must be brought in to replace the slowly pervious material.
E	This group consists of coastal dunes, beaches and alluvial (floodplain) soils, subject to wave, tidal, coastal storm action and flooding by streams and rivers.	These areas are considered velocity zones and floodways under Title V (see 310 CMR 15.213).

F	This group consists of areas where the soils are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part (hydric soils).	Hydric soils are associated with wetland areas and are subject to protection under state and federal laws. Onsite systems on these areas are required to be mounded 4-5 feet above the surface. Organic soils need to have the organic material removed and replaced with suitable fill material. Glacial till and lacustrine soils often have a restrictive layer.
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Figure 5 shows the hydric soils within the area. Hydric soils are soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. The Massachusetts Wetlands Protection Act uses hydric soils as an indicator of hydrology in wetland delineations. A combination of wetland plants and hydrology define a wetland boundary in Massachusetts.

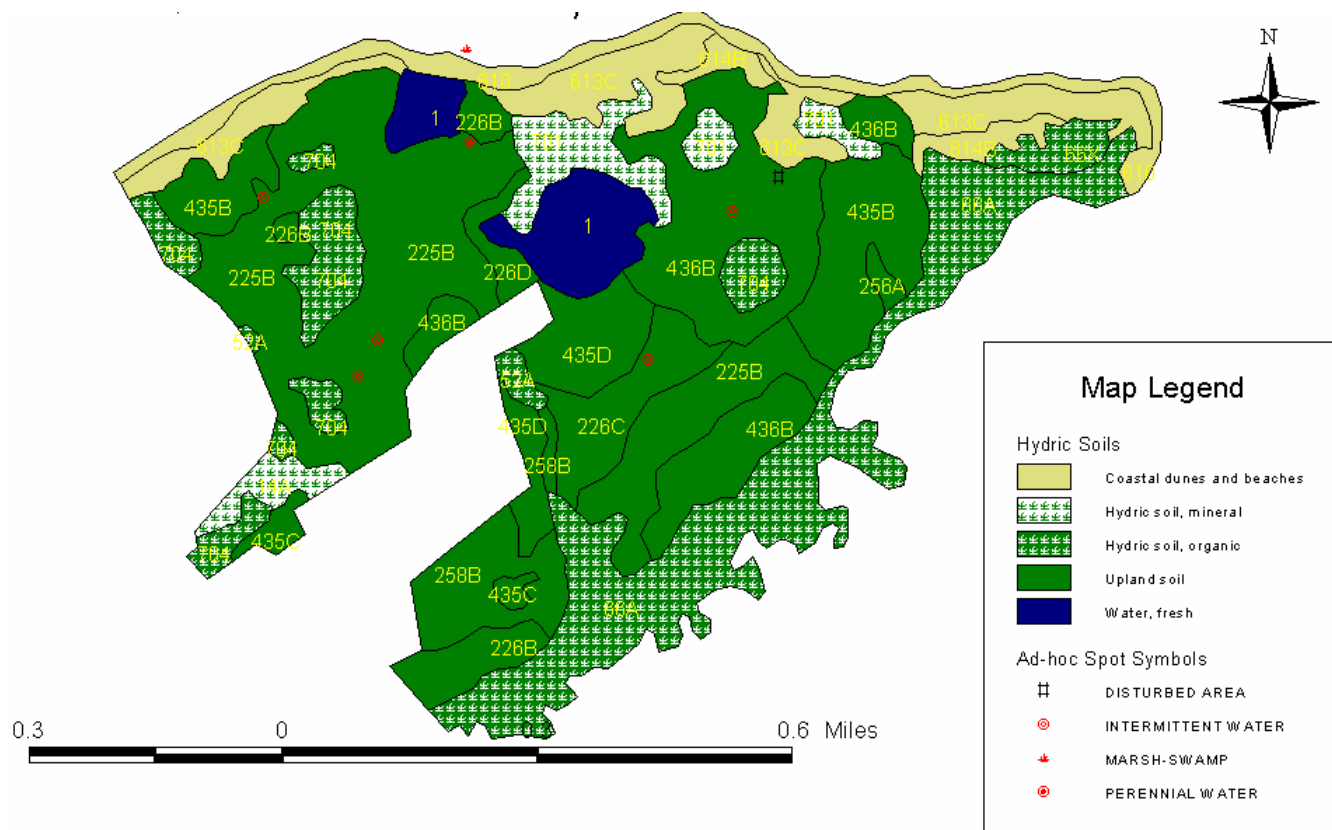


Figure 5: Hydric Soils, Quivet Neck Area, Dennis Massachusetts.

There are other maps showing wetland areas such as the State Wetland Conservancy Maps (1:5,000), National Wetlands Inventory (1:25,000), and other resource maps available. The map in figure 5 only shows the hydric soil resources for the Quivet Neck area.

Highly Erodible Soils

Another important management consideration is soil erodibility and erosion hazards. Soil erosion can occur during site construction when the soil is excavated and stockpiled.

All soils (with the possible exception of the Hooksan soils and dune lands) in the Quivet Neck area have a high erosion hazard during site excavation. Vegetated grass cover and silt fencing will help minimize the soil loss from water and wind erosion for stockpiled soil material.

Natural soil erosion can also occur on areas where the slope is greater than about 8 percent (all soils with C and D slope phases on the soil map). These steeply sloping areas can also experience accelerated erosion if the site is disturbed (vegetation cut, excavation, conversion from wood/shrub land to grasses).

The areas where these steep slopes occur are around the Cole and Frog (un-named pond NW of Coles Pond) ponds; erosion control should be used to protect these coastal ponds. All coastal soils and miscellaneous areas such as beaches and dune land have an extreme hazard for coastal erosion from major storm events, particularly storms which generate gale and storm-force northerly winds.

Other Development Ratings

The only soils mapped in the area with few limitations for most development activities are the Plymouth soils (map units 435 and 436).

Aside from the hydric soils and coastal soils, which have severe limitations for most development activities, the other dominant upland soils in the area are the Belgrade, and Hinesburg series. Both Belgrade and Hinesburg soils formed in silty and clayey lacustrine sediments. The slow to very slow permeability of the material causes perched water tables and is highly erodible when excavated and stockpiled during construction. As mentioned earlier, this material is highly variable in depth and thickness and it may be possible to dig through the material and locate material with higher permeability.

Wildlife Interpretations

(Note the Wildlife Habitat section of the Barnstable County Soil Survey can be found at: <http://nesoil.com/barnstable/barnwildlife.htm>):

Soil properties and qualities that relate to wildlife interpretations include soil texture for water holding capacity, depth to seasonal high water table, flooding and ponding potential, depth to root restrictive layer, soil fertility, and hydrologic factors. Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

Figure 3 is the updated soil mapping for the area. In addition to the soil map units, the map also has several Ad-hoc spot symbols that have significant importance for wildlife in the area. The intermittent water symbol is used for small area with water ponded during certain months and following major precipitation. These spots may correlate with vernal pools.

As mentioned above, aside from the hydric and coastal soils (figure 5), Plymouth, Belgrade, and Hinesburg soils occupy most of the upland acreage. Plymouth soils are located predominately in the eastern part of the property. They tend to support a scrub-oak/pitch pine plant community because they are very sandy, have low available water holding capacity, and ARE low in fertility. Belgrade and Hinesburg soils are prime farmland soils and tend to support hardwoods with a very thick understory of Viburnum, green briar, saplings, and poison ivy.

Table 1 rates the soils in the Quivet Neck area according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife. This information can also be used to select soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and to determine the intensity of management needed for each element of the habitat.

Wildlife habitat soil potentials ratings are good, fair, poor, or very poor. A rating of good indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected.

A rating of fair indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results.

A rating of poor indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive.

A rating of very poor indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible. Complete definition of each wildlife habitat element listed in Table 1 can be found at <http://nesoil.com/barnstable/barnwildlife.htm>. Interpretive maps for each element can be made for the area upon request.

Discussion

Soil Evaluations for Septic Systems:

Several very large houses have been constructed in the Northwest section of Quivet Neck. During the soil inventory of the area, it was noticed that the existing on-site septic systems were not mounded above what was interpreted as a seasonal high water table at about 2 feet below the surface (moderately well drained soils). The Board of Health was contacted to obtain soil logs of the septic systems. The test pit logs were reviewed. On several logs a layer of fines (silty clay loam) is described but the soil evaluator did not think the layer correlated with a seasonal high water table. They were able to dig through the layer and find pervious material. Jim Turenne dug small test pits in the area. He encountered soil mottling (redoximorphic concentrations and depletions) in the silty material which he related as being caused by a seasonal high perched water table. Vegetation in the area also showed signs of wetness in the soil. The investigation was conducted during a very dry period and no water was encountered in the test pits.

Interpreting water tables is extremely important for proper siting and design of septic systems for proper treatment of the effluent. The updated soil mapping may be of use for determining the depth to water tables.

Run-off concerns

Another concern noted near the large houses in the Northwest section of the study area was irrigation runoff. Irrigation runoff was flowing off the grassed area into a stream which flows into Frog Pond (name given by local resident, pond is unnamed on the USGS Topographic maps). The runoff may cause problems to the coastal pond, particularly if lawn chemicals are applied.

COMMENTS

Copies of the soil map can be reproduced at any scale, additional information (acreage figures, statistical information, etc.) and interpretations can be generated from the digital map.

Table 1: Wildlife Habitat

Map unit	Grain & Seeds	Grasses & Legumes	Wild Herbs	Hardwood Trees	Coniferous Plants	Wetland plants	Shallow water Plants	Openland Wildlife	Woodland Wildlife	Wetland Wildlife
14A	POOR	FAIR	FAIR	FAIR	FAIR	GOOD	FAIR	FAIR	FAIR	FAIR
225B	FAIR	GOOD	GOOD	GOOD	GOOD	VERY POOR	VERY POOR	GOOD	GOOD	VERY POOR
226B	POOR	FAIR	GOOD	GOOD	GOOD	POOR	VERY POOR	FAIR	GOOD	VERY POOR
226C	POOR	FAIR	GOOD	GOOD	GOOD	VERY POOR	VERY POOR	FAIR	GOOD	VERY POOR
226D	POOR	FAIR	GOOD	GOOD	GOOD	VERY POOR	VERY POOR	FAIR	GOOD	VERY POOR
256A	POOR	FAIR	FAIR	POOR	POOR	POOR	POOR	FAIR	POOR	POOR
258B	FAIR	GOOD	GOOD	GOOD	GOOD	POOR	POOR	GOOD	GOOD	POOR
435B	VERY POOR	POOR	POOR	VERY POOR	VERY POOR	VERY POOR	VERY POOR	POOR	VERY POOR	VERY POOR
435C	VERY POOR	POOR	POOR	VERY POOR	VERY POOR	VERY POOR	VERY POOR	POOR	VERY POOR	VERY POOR
435D	VERY POOR	POOR	POOR	VERY POOR	VERY POOR	VERY POOR	VERY POOR	POOR	VERY POOR	VERY POOR
436B	VERY POOR	POOR	POOR	VERY POOR	VERY POOR	VERY POOR	VERY POOR	POOR	VERY POOR	VERY POOR
52A	VERY POOR	POOR	POOR	POOR	POOR	GOOD	GOOD	POOR	POOR	GOOD
704	VERY POOR	POOR	POOR	POOR	POOR	GOOD	GOOD	POOR	POOR	GOOD
701	VERY POOR	POOR	POOR	POOR	POOR	GOOD	GOOD	POOR	POOR	GOOD
613C	VERY POOR	VERY POOR	POOR	POOR	POOR	VERY POOR	VERY POOR	VERY POOR	POOR	VERY POOR
614	VERY POOR	VERY POOR	POOR	POOR	POOR	VERY POOR	VERY POOR	VERY POOR	POOR	VERY POOR
66A	VERY POOR	VERY POOR	VERY POOR	VERY POOR	VERY POOR	GOOD	GOOD	VERY POOR	VERY POOR	GOOD
66X	VERY POOR	VERY POOR	VERY POOR	VERY POOR	VERY POOR	GOOD	GOOD	VERY POOR	VERY POOR	GOOD

RAPID ECOLOGICAL ASSESSMENT

Introduction

In response to mounting development pressure on Cape Cod, the Quivet Neck/Crowes Pasture land in Dennis, MA was designated as a District of Critical Planning Concern by the Cape Cod Commission in 2002. The purposes of the District include, among others, the protection of unfragmented forest habitat, rare plant and wildlife habitat, vernal pools, freshwater and saltwater wetlands, coastal plain pond shores, scenic views, passive recreation and the maintenance of open space. As part of the planning process attendant with that designation, the Dennis Conservation Commission requested assistance from UMass Extension's Natural Resources and Environmental Conservation Program to conduct a natural resources, wildlife and plant habitat inventory of the area of interest. The town requested an evaluation of wildlife habitat (with an emphasis on vernal pools and rare species), a summary of the peninsula's natural plant communities, inventories of selected flora and fauna, and management recommendations.

Site Information

The Quivet Creek/Crowes Pasture focus area is located on the north shore of Dennis, MA, on a small peninsula along Quivet Creek. Approximately 120 acres are currently owned by the Town as conservation land, while an additional 35 are protected through conservation restrictions. The remaining 100+/- acres are owned by private landowners. Prior to conducting field work, letters were sent to all the property owners; those areas where access was denied were excluded from the survey.

Land Use Acreage	
Category	Acreage
Developed (house sites, major roads, cemetery)	18
No access or disputed (33 woodland, 1 saltmarsh, 1 shrub swamp)	35
Forested	91
Shrubland	43
Open	54
Freshwater wetlands	31
Estuarine	55
Open freshwater	13
Total acres mapped: 340	

Methods

The team visited the Quivet Creek/Crowes Pasture area on three separate field days in June, July and August 2002. The objectives were to map natural communities, identify rare species that might potentially occur on the site, conduct targeted searches for lichens and rare plants, conduct opportunistic searches for rare animals, identify potential vernal pools, and locate infestations of invasive species. Species in the following groups were recorded when they were encountered: plants, lichens, dragonflies and damselflies, tiger beetles, butterflies, amphibians, reptiles, birds and mammals. Location information from the MA Natural Heritage and Endangered Species

(MA NHESP) database was relied upon to re-locate historic records of species protected under the Massachusetts Endangered Species Act as well as those maintained on the state's "Watch-List", a non-regulatory list of species that may be listed in the future based on population and observation data.

Natural communities were mapped according to the Natural Heritage Endangered Species Program (NHESP) Draft Classification of the Natural Communities of Massachusetts (Swain & Kearsley July 2001; <<http://www.state.ma.us/dfwele/dfw/nhesp/nhclass.htm>>). Delineations were based on aerial photography interpretation, soil and vernal pool datalayers, wetland conservancy maps and ground-truthing. Maps identifying natural communities were generated using geographic information systems (GIS). A 1:5000 color aerial orthophoto flown April 2001 and a 1:12000 color infrared flown 1995 were used as base maps for the natural community mapping and plant inventory.

A digitized map was created with the following datalayers:

- Potential vernal pools (NHESP),
- Natural communities,
- Aerial photographs, and
- DCPC locus area.

Wetlands mapping was amended using the Wetlands Conservancy Program (<<http://www.state.ma.us/mgis/w.htm>>) datalayer and updating from field observations where necessary.

Although several potential vernal pools are known from this site, none were certified during these visits.

Results & Discussion

Fourteen distinct natural community types were identified within the focus area. Of these, 8 are wetland and 6 are upland. Although detailed, the natural community descriptions in the Classification of the Natural Communities of Massachusetts are also generalized. The descriptions below are based on the species actually observed in Dennis.

Upland Natural Communities

Coastal Forest Woodland (CFW)

As is typical of coastal forests, the woodlands within the Quivet Creek/Crowes Pasture study area are shorter than forests further inland. The most common canopy trees growing in the dry,

Natural Community Types Observed at Quivet Creek/Crowes Pasture

Upland

1. Coastal Forest Woodland (CFW-BG, CFW-O, CFW-S)
2. Cultural Grassland (CG)
3. Maritime Beach Strand (MBS)
4. Maritime Dune (MD, MD-I)
5. Maritime Shrubland (MS)
6. Pitch Pine – Oak/Red Cedar Forest (PPO)

Freshwater

1. Deep Emergent Marsh (DEM)
2. Shallow Emergent Marsh (SEM)
3. Kettlehole Level Bog (KLB, KLB/SS)
4. Shrub Swamp (SS)
5. Wet Meadow (WM)
6. Vernal Pools-Potential

Estuarine

1. Intertidal Salt Marsh (SM)
2. Estuarine Intertidal Brackish Marsh (BTM)

acidic soils include scarlet oak (*Quercus coccinea*), black oak (*Q. velutina*), white oak (*Q. alba*) and post oak (*Q. stellata*). The narrow forest zone closer to the ocean has an even greater percentage of post oak, a species that MA NHESP continues to track. Other canopy species regularly observed include black cherry (*Prunus serotina*), tupelo (*Nyssa sylvatica*), pitch pine (*Pinus rigida*), and red cedar (*Juniperus virginiana*). The shrub layer includes arrowwood (*Viburnum recognitum*), shadbush (*Amelanchier sp.*), bayberry (*Myrica pensylvanica*), Morrow's honeysuckle (*Lonicera morrowii*) and occasionally huckleberry (*Gaylussacia sp.*). In areas with higher soil moisture, sweet pepperbush (*Clethra alnifolia*) is extremely common. The herbaceous layer is fairly sparse, with poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*) and greenbrier (*Smilax rotundifolia* and *S. glauca*). In addition to oak dominated coastal forest woodland two additional sub-categories were identified; one is dominated by sassafras (*Sassafras albidum*), the other is dominated by tupelo.

Wildlife Habitat

Most of the coastal forest woodland on Quivet Neck occurs as dense thickets with occasional mature oaks. These thickets are ideal habitat for shrubland birds such as rufous-sided towhee, brown thrasher, gray catbirds, common yellowthroats, Carolina wrens and song sparrows. Coastal thickets are also important stopover habitats for migratory songbirds in both the spring and summer as well as the hawks that hunt them during migration. Mature oaks provide acorns used by a variety of species, including deer, squirrels, chipmunks, white-footed mice and voles. These habitats are also used by cottontail rabbits, black racers, box turtles, redback salamanders raccoons, skunks, foxes, weasels and coyotes.

Conservation Notes

Although no box turtles were observed, this Species of Special Concern was historically observed in the area. These turtles maintain a home range of approximately four acres and can live as much as a century, breeding for half that time. The species is at risk due to (1) illegal collecting, (2) egg mortality due to the increase in skunks, raccoons and opossums resulting from suburbanization, (3) mortality due to roads, and (4) loss of breeding habitat due to forest fragmentation (roads, development) and building. These thickets also provide habitat for cottontails rabbits (either eastern cottontail or new England cottontail or both). New England cottontails have declined dramatically throughout their range, but still persist on Cape Cod. The MA Division of Fisheries and Wildlife should be able to provide habitat management recommendations for the New England cottontail. The coastal forest woodlands of Quivet Neck are characterized by dense, almost impenetrable thickets of non-native invasive species mixed with catbrier and poison ivy. These areas do provide wildlife habitat, but are not good representations of the coastal forest woodland community type.

Cultural Grassland/Pasture (CG)

Three patches exist within the study area, including the recently brush-hogged Crowes Pasture. The other two areas are on or partially on private land and are maintained through mowing and grazing. These areas are characterized by grasses (*Holcus lanatus*, *Deschampsia flexuosa*, *Dactylus glomerata*, Sweet Vernal Grass (*Anthoxanthum odoratum*), *Agrostis*, Panic grasses (*Panicum spp.*), and many species of herbaceous plants, including Rough Goldenrod (*Solidago*

rugosa), Blackberry (*Rubus* spp), Virginia creeper, strawberry (*Fragaria virginiana*), Hawkweeds (*Hypochoeris radicata*, *Hieracium florentinum*), Yarrow (*Achillea millefolium*), Spurge (*Euphorbia* spp.) and Oxeye daisy (*Chrysanthemum leucanthemum*). Large oaks, scattered pitch pines and cedars create an almost savannah-like landscape.

Wildlife Habitat

Grasslands and very early successional stages of forest provide habitat for common grassland species as well as species that utilize both open habitats and forest edges. These include meadow voles, goldfinches, field and chipping sparrows, prairie warblers, Great horned owls, red-tailed hawks, kestrels, garter snakes, green snakes, box turtles and Fowler's toads. Bats, swallows, dragonflies and butterflies will forage over and in these habitats and woodcocks may use them for their mating displays. It is possible that some of these habitats—especially Crowes Pasture—might be used by less common species, such as northern harriers, grasshopper sparrows, meadowlarks and hognose snakes. Wet meadows and wet depressions (possible vernal pools) in these habitats could potentially support spotted turtles and Eastern spadefoot toads, two state-listed species.

Conservation Note

As might be expected, these habitats contain a number of invasive non-native species, including non-native honeysuckles (*Lonicera*), privet (*Ligustrum* sp.), multiflora rose (*Rosa multiflora*), Asiatic bittersweet (*Celastris orbiculata*) and barberry (*Berberis* sp.). Robur oak (*Quercus robur*), a non-native species, also occurs occasionally in the pasture in the northwest corner of the study area. Wet depressions in these habitats should be surveyed for spotted turtle and spadefoot toads.

Maritime Beach Strand (MBS)

The open beach at Dennis ranges from accreting sands near the mouth of Quivet Creek to eroding headlands. Occasionally large granite glacial erratics occur on the beach. Most of the beach lacks vegetation, however, at the foot of the bluffs one can find dusty miller (*Artemisia stellariana*), seabeach sandwort (*Honkenya peploides*), seabeach orache (*Atriplex pentandra*) and seaside goldenrod (*Solidago sempervirens*).

Wildlife Habitat

These areas of Quivet Neck provide wildlife habitat typical of much of Cape Cod for shorebirds, gulls, terns and Fowler's toads and raccoons, skunks, foxes and coyotes that prey on them.

Conservation Note

These habitats are important shorebird staging areas for several shorebird species, including the federally "threatened" piping plover. This beach, however, appears to be too heavily trafficked and too narrow to support suitable breeding habitat. By restricting access during nesting periods these areas and the adjacent coastal dune areas might become suitable for nesting piping plovers and terns. A consultation with the MA Division of Fisheries and Wildlife is recommended. The wrack line is a particularly valuable feature for wildlife use and should be protected.

Maritime Dune (MD)

We identified two maritime dune sub-categories: coastal and interior. The coastal maritime dune community occurs along the beach and on the sandy uplands of the peninsula that stretch between the salt marsh and mouth of Quivet Creek. The interior dune communities occur behind a narrow strand of maritime forest dominated by post oak, black oak, beach plum (*Prunus maritima*) and bayberry.

Coastal: The open coastal dunes are characterized by sand blowouts with sparse vegetation. The most common species is beach grass (*Ammophila breviligulata*), with occasional beach pea (*Lathyrus japonicus*), pinweed (*Lechea* spp.) and beach plum. Poison ivy and poverty grass (*Danthonia spicata*) are also present. Several areas support extensive lichen communities.

Interior: Extensive open sands are also present in the interior dunes as are rich lichen communities. The difference is that you frequently encounter beach plum, pitch pines and oaks, surrounded by and covered with lichens, broad patches of golden heather (*Hudsonia ericoides*), sickle-leaved aster (*Chrysopsis falcata*), and bearberry (*Arctostaphylos uva-ursi*). Isolated clumps of beach grass and stiff aster (*Aster rigida*) are also found here. Bayberry is common along the edge, as is red cedar and black cherry.

Wildlife Habitat

Coastal dune blowouts provide breeding habitat for piping plovers although it is not clear whether the adjacent beaches are suitable to support nesting in this area. These open, dry areas provide habitat for Fowler's toads, meadow jumping mice, New England cottontails, Savannah sparrow and horned lark. Because some of these sites have wetlands nearby, it is likely that these are also important nest sites for turtles (painted and snapping turtles and possibly state-list spotted and box turtles and diamondback terrapins).

Conservation Note

These areas, with their hot, harsh conditions, are one of the special communities found within the study area. Along the margins of the dunes near the edge of the saltmarsh and oak woodland is a very small population of New England Blazing Star (*Liatris borealis*), a species of Special Concern. Dunes are vulnerable to disturbance from vehicular as well



as foot traffic which breaks the surface structure and removes vegetation. Both vehicular and foot traffic should be restricted to a limited number of clearly defined trails.

Maritime Shrubland (MS)

This habitat type is found on the northwestern side of the property and along the roadside edges. It is a thicket dominated by a mix of arrowwood, bayberry, black cherry, shadbush, and Morrow's honeysuckle. Other common species include beach plum, high-bush blueberry (*Vaccinium corymbosum*), tupelo, pitch pine, and stunted oaks (scrub, post, scarlet, black). It appears from historic aerial photographs (1971) that this is a successional plant community following historic clearing for pasture. Stonewalls run through this community type. Poison ivy and Virginia creeper are common.

Wildlife Habitat

As habitat, the maritime shrubland community support a variety of shrubland birds, including rufus-sided towhee, brown thrasher, gray catbirds, common yellowthroats, Carolina wrens and song sparrows. Coastal thickets are also important stopover habitats for migratory songbirds in both the spring and summer as well as the hawks that hunt them during migration. These habitats are also used by cottontail rabbits, black racers, box turtles, raccoons, skunks, foxes, weasels and coyotes.

Conservation Note

Several invasive species are found within this community type, and certain species, most notably Morrow's honeysuckle, appear to be so well-established such that it is beyond any form of management, save a controlled burn.

Pitch Pine/Oak/Red Cedar Forest (PPO)

A common natural community type found in southeastern Massachusetts, PPO is found on approximately 30 acres within the locus area. Pitch pine dominates, but oaks (white, scarlet and black) are also common elements. In areas that were historically pasture or open land, red cedar is frequently found. The understory includes almost impenetrable thickets of *Smilax rotundifolia* are common. The herb layer is thin, with grasses (*Deschampsia flexuosa*, *Festuca filiformis*) frequently observed. Other species commonly observed include: arrowwood, highbush blueberry, Virginia creeper, Poison ivy, bayberry, honeysuckle (*Lonicera morrowii/bella* and *japonica*), scrub oak (*Quercus ilicifolia*), and black cherry. Also present: Chokeberry (*Aronia* sp.), little blue stem (*Andropogon scorparia*), Yarrow, winged sumac (*Rhus copallina*), bearberry, Sweet Goldenrod (*Solidago odora*) and dewberry (*Rubus* spp.).

Wildlife Habitat

The mix of pine and oak in these habitats means that they will support a diverse mix of species. Pine warblers, red squirrels, red-backed voles and red-breasted nuthatches will typically be found in and around pines. Gray squirrels, white-breasted nuthatches, white-footed mice, and southern flying squirrels will be more closely associated with oaks. A variety of habitat generalists are also expected to use these habitats, including fox, coyote, skunk, raccoon, weasels, short-tailed shrew and meadow vole.

Conservation Notes

These areas, like almost all of the upland habitats on Quivet Neck, are infested with exotic invasive plants (honeysuckle, privet, etc.).

Freshwater Wetlands

Deep Emergent Marsh (DEM)

This habitat is found only around the pond owned by the Condominium Association. It is characterized by common cattails (*Typha latifolia*), water willow (*Decodon verticillata*) and small patches of *Phragmites*. Narrow-leaved cattails (*Typha angustifolia*), woolgrass (*Scirpus cyperinus*), swamp candles (*Lysimachia terrestris*), marsh mallow (*Hibiscus palustris*), slender-leaved goldenrod (*Euthamia tenuifolia*) and marsh fern (*Thelypteris palustris*) are also common.

Wildlife Habitat

This area provides habitat for green frogs and bullfrogs, Fowler's toads, northern water snakes, a variety of turtles including snapping and painted and possibly spotted and box turtles, red-wing black bird, herons and egrets, raccoon, and possibly muskrat and mink.

Conservation Note

With only a limited time available for exploration, it is possible that more species of greater conservation interest might occur within the deep emergent marsh habitat. It is contiguous with the open water of the large pond. Additional searches may reveal damselflies of conservation interest, including *Enallagma recurvatum* and *Enallagma laterale*. Patches of *Phragmites* should be removed before they spread.

Shallow Emergent Marsh (SEM)

This habitat occurs in one small area within the pasture on the northwestern corner of the study area. It is dominated by wool grass, Marsh Fern, and Marsh St. Johnswort (*Triadenum virginicum*). Candlewick rush (*Juncus effuses*), *Scirpus americanas* and Swamp candles are also common. Other species found here include water willow, marsh bedstraw (*Galium palustre*), button bush (*Cephalanthus occidentalis*), rush (*Juncus canadensis*), and reed canary grass (*Phalaris arundinacea*).

Wildlife Habitat

Shallow emergent marshes provide habitat for spotted and snapping turtles, garter and ribbon snakes, red-wing blackbirds, song sparrows, common yellowthroats, herons, egrets, cottontails, muskrats and mink. This area may also support breeding Fowler's or American toads.

Conservation Note

This area may also function as a vernal pool and should be investigated next year for breeding amphibians. It was the only site where Meadow Beauty (*Rhexia virginicum*) was found within the study area.

Kettlehole Level Bog (KLB)

Two significant areas of kettlehole level bog occur within the study area: one occurs around Coles Pond, the other in a small kettlehole depression closer to Quivet Creek. A third kettlehole bog area was historically cultivated for cranberries, but has now grown up into a shrub swamp (KLB/SS), and is dominated by swamp azalea (*Rhododendron viscosum*), Sweet Pepperbush, Highbush Blueberry, red maple (*Acer rubrum*) and catbriar (*Smilax* sp.).

The kettlehole level bogs are underlain by a thin layer of muck over sand, and are dominated by large cranberry (*Vaccinium macrocarpon*), candlewick rush, water willow, marsh fern and marsh St. Johnswort. The perimeters are dominated by swamp azalea, sweet pepperbush, high bush blueberry, chokeberries (*Aronia melanocarpa* and *A. arbutifolia*) and scattered red maples. Within the bogs, *Scirpus americanus*, *Scirpus cyperinus*, *Juncus canadensis*, cottongrass (*Eriophorum virginicum*), swamp candles, cattails and poison ivy are also common growing in and around the *Sphagnum* moss. *Spartina pectinata* is also present in these habitats near Coles Pond.

Wildlife Habitat

Kettlehole level bogs provide limited breeding habitat for amphibians, although spring peepers are likely to breed here. They are likely to provide foraging and rehydration areas for other amphibians, such as wood, green, and pickerel frogs and bullfrogs. Spotted and box turtles may use the areas and when including the shrubby fringe, they provide nesting habitat for Common yellowthroats, catbirds, kingbirds, and grackles.

Conservation Note

Although no rare plants were found within these settings, bog coppers—a watch-listed butterfly—was observed. A large patch of *Phragmites* is present on the northwestern side of Coles Pond and should be controlled.

Shrub Swamp (SS)

Scattered throughout the pockmarked landscape of the Quivet Creek peninsula are dozens of kettleholes that intercept groundwater and have developed into shrub swamps. Many of them, however, are virtually inaccessible. We visited many of the shrub swamps that are near or adjacent to the roads, but did not inspect all of the sites in the field. The mapping classification is based on aerial interpretation, soils data and the information from the wetlands conservancy map. This habitat type also rings the kettlehole level bogs, much of Coles Pond as well as the pond/wetland complex owned by the condominium association. Common species encountered included arrowwood, sweet pepperbush, swamp azalea, inkberry (*Ilex glabra*), tupelo, and where open water is present, water willow. Fetterbush (*Leucothoe racemosa*), buttonbush, Bebb's willow (*Salix bebbiana*) and Dwarf huckleberry (*Gaylussacia dumosa*) were occasionally found in this wetland type as well. Open areas of *Sphagnum* moss are also common.

Wildlife Habitat

What areas of shrub swamp could be accessed, appear to be too shallow to provide good breeding habitat for amphibians, although some areas might support spring peepers, gray treefrogs and, perhaps wood frogs. Netting was done in several potential pools in June,

but no amphibian larvae were found. These areas might be used by box turtles but are too congested to provide good habitat for spotted turtles. Within these shrub swamps may occur sphagnum hummocks and pools that could provide breeding habitat for state-listed four-toed salamanders (Special Concern). Shrub swamps also provide nesting habitat for catbirds and grackles.

Conservation note

Because of varying hydrology, many of these shrub swamps may also function as vernal pools.

Wet Meadow (WM)

Within the pasture, several areas of wet meadow were identified. These open, seasonally flooded areas are kettlehole depressions. A drainage ditch connects three of the wetlands, and was probably dug in an attempt to drain the wetlands. These sites are presently dominated by wool grass, Marsh fern, Marsh St. Johnswort, Candlewick Rush, Swamp Candles and *Scirpus americanus*. Water willow, buttonbush, steeplebush (*Spiraea tomentosa*), inkberry, sensitive fern (*Onoclea sensibilis*), Marsh bedstraw, water horehound (*Lycopus* sp.) and grapes (*Vitis* sp.) are common. Several species of sedges and spikerushes (*Eleocharis* spp.) were also observed. Commonly encountered grasses include Reed Canary Grass, blue joint grass (*Calamagrostis Canadensis*) and rice cut grass (*Leersia oryzoides*). In some areas, *Sphagnum* moss and cranberries can also be found.

Wildlife Habitat

Wet meadows provide habitat for meadow voles and meadow jumping mice, star-nosed moles, spotted and box turtles, garter and ribbon snakes, red-wing blackbirds, song sparrows, common yellowthroats, and cottontails. A potential vernal pool, this area may also support wood frogs and spotted salamanders, Fowler's toads and possibly state "threatened" eastern spadefoot toads.

Conservation Note

This community type was investigated during August, and it appeared that many of the shallow swales that support wet meadow vegetation also function as vernal pools. In the moist soils in two of the four ponds inspected, fingernail clams—which are vernal pool specialists—were found. It is recommended that a follow-up inspection of these areas be conducted next spring to see if these sites also provide breeding habitat eastern spadefoot toads and other vernal pool species of interest.

Open water ponds (OW)

Three areas with year-round annual water were observed—Coles Pond, the Condominium Pond and a small kettlehole pond surrounded by a shrub swamp, to the northeast of Coles Pond. Black willow (*Salix nigra*) is occasionally found on the boundaries; water willow is the only species that occurs in the deeper water around the pond's margins. On the eastern shore of Coles Pond are six small sub-populations of the state-listed Plymouth gentian (*Sabatia kennedyana*-SC), which was first observed at this site in 1919. There is a shallow

margin of muddy shoreline where this species occurs. Other potential state-listed species that may occur here include: Comet Darner (*Anax longipes*-SC) and New England Bluet (*Enallagma laterale*) and Pine Barrens Bluet (*E. recurvatum*).

Wildlife Habitat

These areas provide important staging areas for waterfowl and habitat for many species of dragonflies and damselflies, frogs and turtles. Northern watersnakes are likely to use the area, as well as herons, egrets and osprey. Bats and swallows prefer to forage over open water. Kingbirds, phoebes and cedar waxwings hawk insects from shrubs and trees along the pond margins.

Conservation Notes

Efforts should be taken to protect the six sub-populations of Plymouth's gentian along the pond margin. Other state-listed species that may potentially occur here include: Comet Darner (*Anax longipes*-SC) and New England Bluet (*Enallagma laterale*) and Pine Barrens Bluet (*E. recurvatum*).

Estuarine Natural Communities

Intertidal Salt Marsh (SM)

The area between the low and mean high tide is dominated by saltwater cordgrass (*Spartina alterniflora*), while the zone between the mean high tide and spring high tide (the high marsh) is dominated by broad patches of salt marsh hay (*Spartina patens*), spike grass (*Distichlis spicata*) and toward the upland edge black grass (*Juncus gerardii*). Other species found near the upper edges include sea lavender (*Limonium carolinianum*), seaside goldenrod, large-flowered saltmarsh aster (*Aster tenuifolius*), saltmarsh germander (*Teucrium canadense*), saltmarsh wheatgrass (*Agropyron pungens*), and three-square (*Scirpus pungens*). Near the freshest edges, switch grass (*Panicum virgatum*), marsh bentgrass (*Agrostis stolonifera*), saltmarsh elder (*Iva frutescens*), *Scirpus robustus*, *Scirpus americanus* and groundsel tree (*Baccharis halimifolia*). Scattered in low, poorly drained salty areas are glassworts (*Salicornia spp.*), saltwort (*Salsola kali*) and *Triglochin maritima*.

In the uplands, beyond the edge of the saltmarsh, are beach grass, stiff aster, red cedar, bristly locust (*Robinia hispida*), rugosa rose (*Rosa rugosa*), sassafras, black cherry, winged sumac, bittersweet, shadbush and other species.

Wildlife Habitat

The community provides important breeding habitat for ospreys, marine organisms and possibly sharp-tailed sparrows. Salt marshes are also the preferred habitat for diamondback terrapins. Salt marshes are exceptionally important to the productivity of the coastal marine environment. These marshes provide foraging habitat for New England cottontails, raccoons, mink, foxes, coyotes, herons, egrets, ospreys, kingfishers, and waterfowl.

Conservation Note

One of the most scenic and distinctive habitats within the study area, the salt marsh should be protected against the spread of *Phragmites*, which is found along the margins

of the high marsh. Along the margin of the high saltmarsh, from the cemetery to the Y-shaped marsh, is a narrow zone where *Eleocharis rostellata* grows, a watch-listed species.

Intertidal Brackish Marsh (BM)

Brackish marshes occur along free-flowing coastal rivers (Swain & Kearsley 2000). The break between saltmarsh and brackish marsh begins roughly at the cemetery's eastern boundary. Within the brackish marsh is a large population of *Spartina cynosuroides*, a species of Special Concern. This grows in association with *Spartina alterniflora* in the areas between the low and mean high tides. Other common species include salt marsh hay, spike grass, black grass, saltmarsh elder, and seaside goldenrod. Switch grass, *Spartina pectinata*, *Scirpus robustus*, *Scirpus americanus* and *Phragmites australis* are also present.

Wildlife Habitat

Intertidal brackish marshes support many of the same species as are found in salt marshes (see above). In addition, garter and northern watersnakes may venture into brackish habitats to forage. Fowler's toads may hunt for insect within the least salty portions of the marsh.

Conservation Note

This habitat also plays an important role in cleaning water, mitigating flood damage, providing habitat for wildlife and rare plants. Although it currently appears secure, this area should be protected against contaminated stormwater runoff from future upstream development and street runoff. The greatest threat at present is the spread of *Phragmites*.

Potential Vernal Pools

Although six areas were identified and mapped as potential vernal pools by the MA Division of Fisheries and Wildlife, the Rapid ecological Assessment Team found that most did not fit the definition of a classic vernal pool. Based on their survey, only one of the PVPs as well as two areas not mapped by the Division are considered as likely vernal pools. Other areas of the site (shrub swamps, shallow emergent marsh, kettlehole level bog) might contain areas that meet the technical definition of vernal pool habitat.



Those areas that we considered likely vernal pools had clearly defined basin depressions and were not permanently flooded. Surveys were not conducted during the breeding season for typical vernal pool breeding amphibians.

The eastern most pool is located in a patch of very dense underbrush with an area of coastal forest woodland. The pool is very small, but was the only place where amphibian larvae (gray treefrogs) were detected. The other two locations lacked amphibian larvae but did have other

indicators of appropriate hydrology (dragonfly and damselfly larvae, fingernail clams). All three lacked fish and were “certifiable” based on the presence of facultative indicators.

All three vernal pools appear to be suitable for breeding wood frogs, spring peepers, American and Fowler’s toads, and gray treefrogs. It is unclear whether any of these areas has sufficient hydrology to support spotted salamanders. The western two pools are suitable for use by eastern spadefoots, although it is not known whether or not this state-listed species occurs on Quivet Neck.

Diane Murphy surveyed for vernal pools on three separate dates March 23, 2002, April 23, 2002, May 20, 2002 and May 29, 2002.

Methodology

Potential vernal pools and shallow wetland margins were visually examined and dip-netted for evidence of breeding amphibians and/or fairy shrimp.

In addition to vernal pool surveys, Diane reviewed existing species accounts from the Museum of Comparative Zoology at Harvard and Skip Lazell’s book, *This Broken Archipelago: Cape Cod and the Islands, Amphibians and Reptiles*, 1976. Unfortunately, neither of these sources contained any herpetological records from the Quivet Neck area.

Findings

Due in part to the paucity of spring rainfall many pools did not retain sufficient water to sustain amphibian egg masses or fairy shrimp.

This lack of evidence does not preclude the possibility that these areas are functioning as vernal pool habitat in other years. In fact, alternating wet and dry years point out the significance of repeating the survey the following spring.

Summary

The Quivet Neck/Crowes Pasture study area contains a valuable mix of estuarine and freshwater wetlands and upland communities. High quality coastal communities (salt marsh, brackish marsh, beach strand and dunes) appear to be in relatively good shape and provide high-quality habitat for plants, lichens and wildlife. A variety of freshwater wetlands (deep marsh, shallow marsh, level bog, wet meadow and vernal pools) provides a high-quality wetland complex that provides habitat for a host of wetland plant and animal species.

The terrestrial communities of Quivet Neck have been significantly degraded by invasive exotic plants and fragmentation by numerous roads, driveways and development. Even so, as one of the few remaining areas of coastal thicket and forest, it provides valuable stopover habitat for migrating songbirds during both spring and fall. These upland communities also buffer the wetland and estuarine habitats and provide important adjacent upland habitat for wildlife that use both wetlands and uplands. The presence of intact terrestrial habitats increases the wildlife habitat value of the wetland areas. Habitat management of Crowes Pasture has improved upland habitat conditions. Similar management of additional upland areas should be encouraged.

Quivet Neck contains a diversity of lichen species and a handful of state-listed and watch-listed rare plants and animals either previously recorded or documented by this study. These species are not concentrated in any one community, but occur at various sites within Quivet Neck. Additional rare species may occur on the site. Additional targeted surveys for rare amphibians (eastern spadefoot and four-toed salamander), reptiles (spotted turtle, box turtle and diamondback terrapin), dragonflies, damselflies, butterflies and moths would likely turn up additional state-listed species.

Recommendations

1. One of the most significant habitats for rare species and intact natural communities is the brackish intertidal and salt marsh areas along Quivet Creek. Of concern are the populations of *Phragmites australis*, giant reed, which has established along the edges and is encroaching into the salt marsh hay/*Distichlis* areas. This is the same zone where a watch-listed spike rush, *Eleocharis rostellata*, is found. Efforts should be taken to control or eliminate *Phragmites* from these areas.
2. Restrict vehicular and foot traffic in coastal dune areas, especially interior dunes.
3. Consult with the Division of Fisheries and Wildlife to consider whether seasonally limiting beach access would improve the area's potential as nesting habitat for piping plovers and terns.
4. Monitor and control the spread of *Phragmites* and purple loosestrife in freshwater wetlands.

5. Continue management of Crowes Pasture for more open, early successional habitat. Consider similar management of additional upland areas, especially those already degraded by invasive species.
6. Consult with the Division of Fisheries and Wildlife on possible management options for the New England cottontail.
7. There is an abundance of non-native invasive species throughout much of the upland forest area, especially along the roadside edges and those lands that have recently grown up from pasture. The most common of these is honeysuckle, *Lonicera morrowi*, but barberry, multiflora rose, privet and other aggressive non-native species are also present. As they are so widespread, eradication is not an option, rather these species should be excluded from any of the sensitive natural communities described above or areas of special management attention (e.g. Crowes Pasture).
8. The scenic pasture land on the northwestern edge is of great conservation interest because of the presence of several small vernal pools that also function as open meadow wetlands. It is ideal for passive recreation, where a series of trails could be established with ease.
9. Avoid further fragmentation of terrestrial habitats.
10. Conduct targeted rare species surveys for amphibians, turtles, dragonflies, damselflies, butterflies and moths.
11. Perhaps, the ultimate “worth” of the Quivet Neck/Crowes Pasture site lies within the entire landscape block itself. This area comprises approximately 250 acres of *relatively* undisturbed coastal land. The myriad of habitats found within this acreage form a diverse and complex landscape that has been minimally fragmented. As development progresses and the area becomes further divided, there will be a net loss in habitat integrity and subsequent species declines and/or extirpations.

**Species of Special Concern or Watch-listed Species Reported from
Quivet Neck/Crowes Pasture Study Area
Dennis, MA
MA NHESP 2001**

Species of Special Concern		Status
<i>Abagrostis nefascia</i>	Coastal Heathland Cutworm	Seen in the past
<i>Bagisara rectifascia</i>	Straight-Lined Mallow Moth	Seen in the past
<i>Liatrix borealis</i>	New England Blazing Star	Observed 2002
<i>Sabatia kennedyana</i>	Plymouth Gentian	Observed 2002
<i>Spartina cynosuroides</i>	Salt Reedgrass	Observed 2002
<i>Terrapene Carolina</i>	Eastern Box Turtle	Seen in the past
Watch-Listed Species		
<i>Lycaena epixanthe</i>	Bog Copper	Observed 2002
<i>Eleocharis rostellata</i>	Saltmarsh Spike-rush	Observed 2002
<i>Quercus stellata</i>	Post Oak	Observed 2002

Species documented during field surveys, Summer 2002

Lichens

Lichens are relatively abundant and diverse in the DCPC locus area. Only macrolichens, however, were identified for this survey. An inventory of crustose lichens could reveal some unusual species but is more time-consuming. Crust cover is high and varied on hardwoods throughout the site. The natural communities with the highest lichen abundance and diversity are the pitch pine-oak stands and dune areas. *Cladonia* and *Cladina* species, the shrubby and “reindeer” lichens, are the most conspicuous lichen flora, dominating late-successional ground vegetation on dry sites. They are plentiful in open dunes or open forests, growing on dry, sandy, nitrogen-poor soils with shallow humus layers. Since these species can take up moisture from the air they don’t need to rely on the underlying substrate to provide water; the humidity in coastal settings is usually sufficient. These types of lichens can therefore dominate settings where vascular plants are limited. Typically slow-growing and long-lived they are important for soil stabilization, contribute significantly to the development of an organic layer, and provide important cover to many organisms. As sensitive indicators of air quality the presence of a diverse community of lichens is a positive sign. The fruticose beard lichen, *Usnea strigosa*, is abundant on hardwoods throughout the site but especially on trees and shrubs in the eastern part where its growth is luxuriant. *Usnea* species provide nesting material to birds, and refuge, camouflage, and food to many invertebrates. Following is a list of some of the most common macrolichens found in the Quivet Neck/Crowes Pasture area:

Cetraria arenaria
Cladina arbuscula
Cladina rangiferina
Cladina stellaris
Cladonia boryi
Cladonia cristatella
Cladonia macilenta
Cladonia rei
Flavoparmelia caperata
Hypogymnia physodes
Imshaugia aleurites
Imshaugia placarodia
Melanelia subaurifera
Parmelia sulcata
Parmotrema hypotropum
Phaeophyscia rubropulchra
Physcia stellaris
Physia millegrana
Punctelia rudecta
Punctelia subrudecta
Ramalina americana
Tuckermanopsis fendleri
Usnea strigosa
Xanthoria parietina

Dragonflies & Damselflies

As with any rapid assessment approach, some species were likely missed due to timing, weather, and luck. Although not observed during the three field days, the four species of conservation interest which may occur in the Quivet Creet/Crowes Pasture landscape are the Comet Darner (*Anax longipes*—Special Concern), *Enallagma laterale*, *Enallagma recurvatum* and the Little Bluebell (*Nannothemis bella*—Watch List). The first three species inhabit coastal plain ponds, while the latter is a specialist in bogs and seepy, nutrient poor wetlands.

Dragonflies

Green Darner	<i>Anax junius</i>
Calico Pennant	<i>Celithemis elisa</i>
Martha's Pennant	<i>Celithemis martha</i>
Seaside Dragonlet	<i>Erythrodiplax berenice</i>
Common Baskettail	<i>Epitheca cyanosura</i>
Eastern Pondhawk	<i>Erythemis simplicicollis</i>
Lancet Clubtail	<i>Gomphus exilis</i>
Dot-tailed Whiteface	<i>Leucorhinnia intacta</i>
White Corporal	<i>Libellula exusta</i>
Slaty Skimmer	<i>Libellula incesta</i>

Wandering Glider
 Blue Dasher
 Saffron-winged Meadowhawk
 Ruby Meadowhawk
 Saddlebag

Libellula pantala
Pachydiplax longipennis
Sympetrum costiferum
Sympetrum rubicundulum
Tramea carolina

Damselflies

Northern Bluet
 Atlantic Bluet
 Little Bluet
 Fragile Forktail
 Slender spreadwing

Enallagma cyathigerum
Enallagma minisculum
Enallagma doubledayi
Ishnura verticalis
Lestes rectangularis

Tiger Beetles

Insects are often among the first species to respond to environmental changes. Tiger beetles are of additional conservation interest because they depend on habitats that are generally rare within our landscape—beaches, sand blowouts, clay banks, gravel shores. Of the two dozen species found in Massachusetts, nearly a third are protected under the MA Endangered Species Act. On the coast, the most endangered species is the Northeastern Tiger Beetle (*Cicindela dorsalis* var. *dorsalis*), which is known from historic as well as extant records on Cape Cod and the islands. Although there appears to be abundant habitat for several tiger beetle species, only the common *Cicindela punctata* was found. It is recognized by dark elytra (wing coverings) with rows of “punctuate” dots. Another species to watch for is the bank tiger beetle (*Cicindela limbalis*), a species of Special Concern in Massachusetts that is found along maritime erosional cliffs.

Butterflies

Butterflies

Pearl Crecent
 Buckeye
 Tiger Swallowtail
 Common Cabbage White
 Mourning Cloak
 Bog Copper***
 American Copper
 Gray Hairstreak
 Broad-winged skipper
 Northern Broken Dash
 Least Skipper

Watch-listed

Phyciodes tharos
Junonia coenis
Papilio glaucus
Pieris rapae
Nymphalis antiopa
Lycaena epixanthe
Lycaena phlaeas
Strymon melinus
Poanes viator
Wallengrenia egeremet
Ancyloxypha numitor

Terrestrial Vertebrates

Amphibians

Green frog	<i>Rana clamitans melanota</i>
Bullfrog	<i>Rana catesbeiana</i>
Gray treefrog	<i>Hyla versicolor</i>

Reptiles

Painted turtle	<i>Chrysemys picta</i>
Black racer	<i>Coluber constrictor</i>

Mammals

Eastern gray squirrel	<i>Sciurus carolinensis</i>
Red squirrel	<i>Tamiasciurus hudsonicus</i>
Eastern chipmunk	<i>Tamias striatus</i>
White tail deer	<i>Odocoileus virginianus</i>
Cottontail (Eastern?)	<i>Sylvilagus transitionalis</i>
Skunk	<i>Mephitis mephitis</i>
Weasel	<i>Mustela frenata</i>
Red fox	<i>Vulpes vulpes</i>
Eastern Coyote	<i>Canis latrans</i>

Birds

Osprey	<i>Pandion haliaetus</i>
Red-tailed hawk	<i>Buteo jamaicensis</i>
Northern Bobwhite	<i>Colinus virginianus</i>
Ring-billed gull	<i>Larus delawarensis</i>
Black-backed gull	<i>Larus marinus</i>
Mourning Dove	<i>Zenaida macroura</i>
Belted Kingfisher	<i>Ceryle alcyon</i>
Eastern Phoebe	<i>Sayornis phoebe</i>
Eastern Kingbird	<i>Tyrannus tyrannus</i>
Blue Jay	<i>Cyanocitta cristata</i>
American Crow	<i>Corvus brachyrhynchos</i>
Tree swallow	<i>Tachycineta bicolor</i>
Black-capped Chickadee	<i>Poecile atricapillus</i>
Carolina Wren	<i>Thryothorus ludovicianus</i>
American Robin	<i>Turdus migratorius</i>
Gray Catbird	<i>Dumetella carolinensis</i>
Northern Mockingbird	<i>Mimus polyglottos</i>
Cedar waxwing	<i>Bombcilla cedrorum</i>
Yellow Warbler	<i>Dendroica coronata</i>

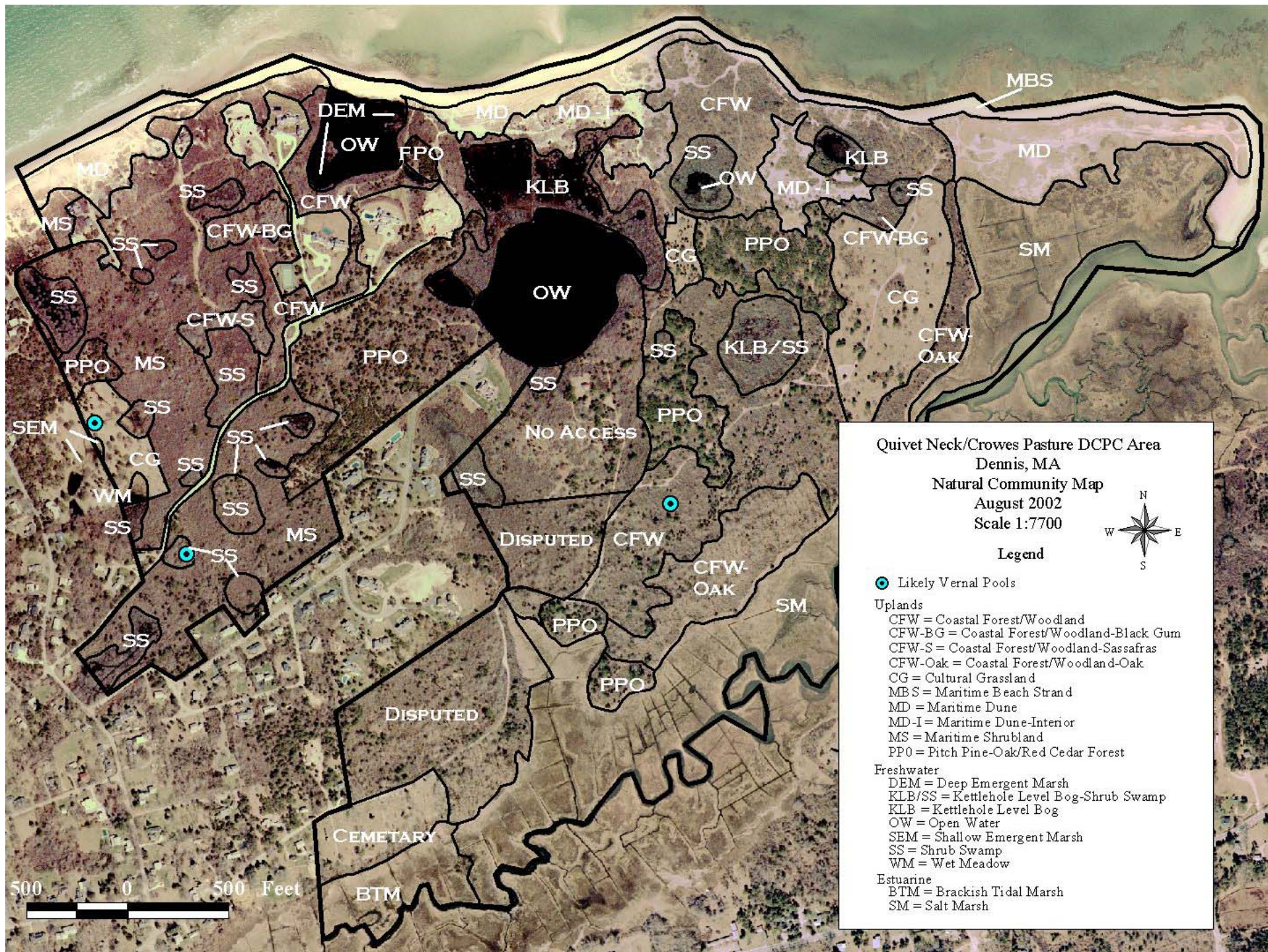
Pine Warbler
Prairie Warbler
Common Yellowthroat
Eastern Towhee
Song Sparrow
Northern Cardinal
Red-winged Blackbird
Common Grackle
Baltimore Oriole
American Goldfinch

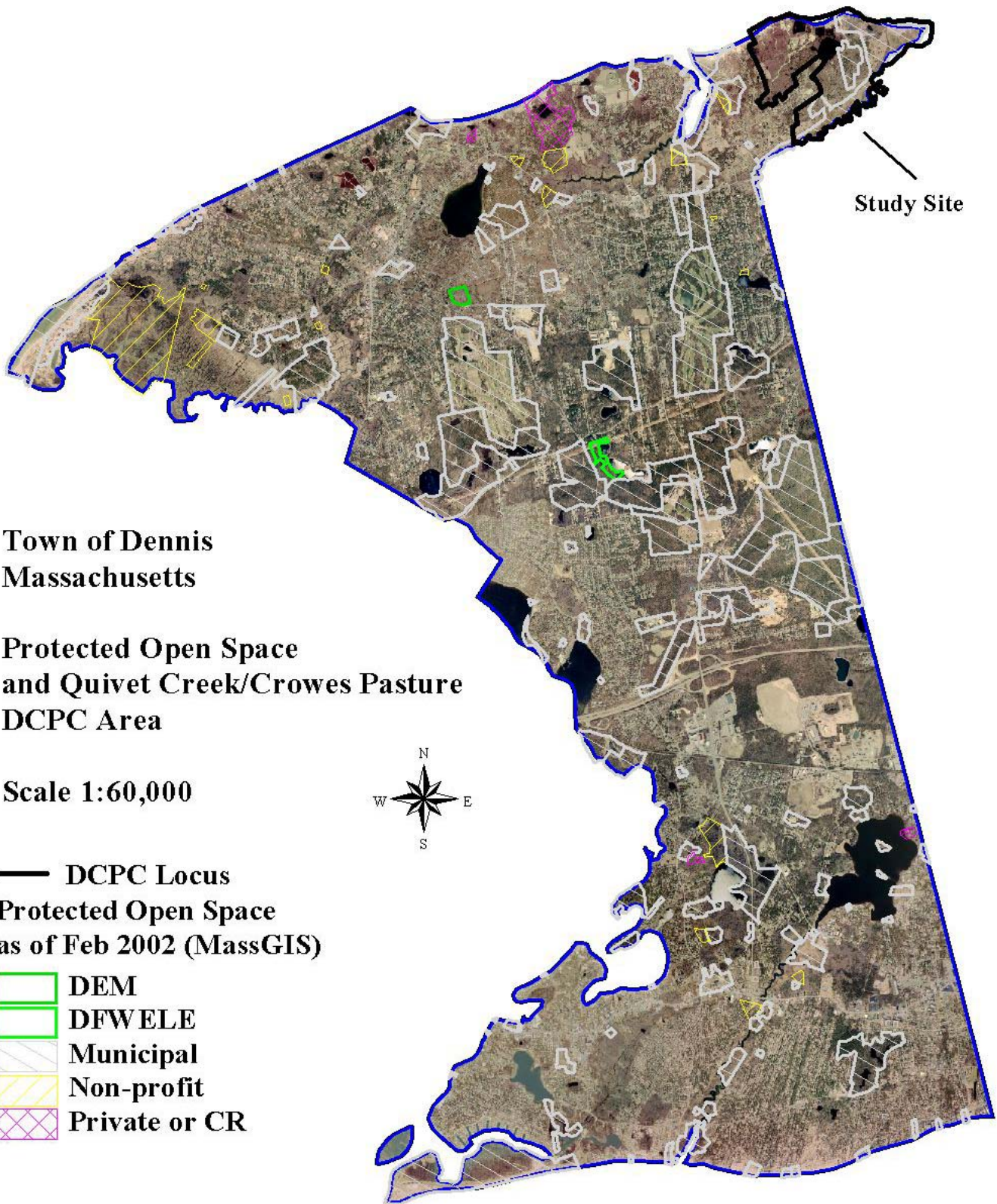
Dendroica pinus
Dendroica discolor
Geothlypis trichas
Pipilo erythrophthalmus
Melospiza melodia
Cardinalis cardinalis
Agelaius phoeniceus
Quiscalus quiscula
Icterus galbula
Carduelis tristis

Additional Species Not Listed in the UMass Extension's NREC Program Report

Redback salamander
Garter snake
Snapping turtle
Pink ladyslipper
Spring Azure butterfly
Fiddler crab

Plethodon cinereus
Thamnophis s. sirtalis
Chelydra s. serpentina
Cypripedium acaule
Celastrina ladon
Uca pugnax





**Quivet Neck/Crowes Pasture DCPC Area
Natural Community Mapping
GIS Data Layers
August 2002**

**Natural Resource and Environmental Conservation Program—UMass Extension,
Amherst, MA**

Images

Cape2.sid

Source

Color Orthophotos, MassGIS

Shapefiles

DCPC Locus.shp

Dennis.shp

Nat_comm.shp

Osp75p1.shp

PVP-Crowe.shp

PVPstate.shp

Derived from paper maps provided by Town of Dennis

Town Boundary, Town Layer, MassGIS

Natural Communities, UMass Extension

Open Space Layer, MassGIS

Likely Vernal Pools, UMass Extension

NHESP Potential Vernal Pools, MassGIS