BARE HILL POND
TERRESTRIAL HABITAT MONITORING ASSESSMENT REPORT FOR 2004

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INTRODUCTION

One of the major problems facing wetlands and watercourses is the introduction of invasive plant species (both introduced and native or naturalized invasive species). Often these species begin to crowd out native non-invasive plants and choke waterways. There are a number of ways available for control (i.e., chemical, biological and mechanical) and all with a varying degree of success and danger to the environment. Although, chemical controls (i.e., herbicides) are probably the most successful method for eliminating pest species, they are also the most dangerous with the highest degree of secondary effects. Biological controls (e.g., introduction of herbivorous insects) are, at times, also successful, but they too may have significant impacts on the surrounding environment should the intended control agent begin to behave differently than expected. Mechanical controls (e.g., hydrologic manipulations, harvesting) tend to have the fewest secondary consequences but are also the least effective of the three.

At Bare Hill Pond, the invasive problems are in the Pond itself. Submerged aquatic vegetation (SAV) such as variable Milfoil (Myriophyllum heterophyllum) and Robbin's pondweed (Potamogetan Robbinsii) encompass much of the pond and is interfering with recreational use of the system. A study by ENSR in 1998 found that most of the areas of the pond above 8 ft depth were experiencing significant colonization by SAVs with many areas containing 75% or above cover (Bare Hill Pond Water Quality and Aquatic Plant Evaluation, ENSR 1998).

In 2002, the Town of Harvard Conservation Commission issued a permit to the Bare Hill Pond Committee to conduct an SAV control plan with the conditions that the draw-down be accompanied by an assessment of impacts that such a course of action may

include. The permit required the committee to assess (1) the effectiveness of the program and (2) monitor impacts this procedure may have on the surrounding habitats, particularly the fringe wetlands surrounding the system. Based on a series of previous reports completed by ENSR during the mid 1990s, the Conservation Commission laid out a series of studies that would be required in order to address these conditions. The permit relied on professional studies for assessing the habitat, but did not include a source of funding to carry out the initiative. Therefore, when Orson Environmental Consulting (OEC) was contacted to help with the project, it was proposed that the methods of assessment be refined to allow a volunteer force to carry out most of the monitoring. The original permit was amended during the winter of 2003 to simplify the techniques without a significant loss in ability to assess the potential changes to the wetland habitat that may accompany a draw down. The first year investigation was conducted during the 2003 growing season. The results of the first year investigation were submitted in report form (OEC 2003) to the Conservation Commission in August of 2003. This is the second year sampling report (2004). In addition to the analysis of the data, this report also includes recommendations for continuing the project utilizing a volunteer force to conduct the bulk of data collection.

APPROACH

As is the case in any volunteer effort, there are limitations on what information can be gathered and the time that is available to gather such information. To begin, an assessment of the present conditions at the site needed to be conducted. Relying on the previous ENSOR report and site visits to the area, it was decided that simple plant and animal surveys would go a long way in determining what, if any, impact the hydrologic manipulations associated with SAV control may be having on the surrounding wetland systems. Since plant community structure is a difficult topic to comprehend (changes from year to year may be due to a myriad of factors and almost impossible to relate to any one factor), it was decided that a more simplified approach was needed. The direction taken was to look at the transition area between the upland and the wetland and watch for any changes in boundaries conditions.

Wetlands

The plant community structure of the wetland fluctuates annually even if there are no anthropogenic hydrologic manipulations associated with it. Even for the trained scientist, discerning forcing functions are a difficult and time-consuming task. Therefore, since the effort needed to be streamlined for a volunteer force, it was decided that the area best suited for study was the transition area between the wetland and the upland. It is here that the impacts of continued draw down will first appear in the biologic record either as a permanent shift in water levels or a change in the vegetation that colonizes these areas, particularly the herb layer. This area is also more accessible and easier to sample, something that must be considered when a non-professional volunteer force is being utilized. In order to achieve these goals, permanent transects were established in the transition zone between the wetland and the upland. Within these transects, the herb, shrub and tree layers were sampled and recorded, bird and amphibian surveys were conducted, and observations on mammal and reptiles were noted (see Methods section for more detail on sampling protocol).

SAV Control

SAV sampling will be conducted by other members of the pond committee and will not be reported here.

METHODS

Transition Area Vegetation Sampling

A total of four permanent transects were established within the system; two transects above and two transects below the dam. Transects #1 – #3 were established in 2003 and Transect #4 was established in 2004. Transects #1 & #2 are located below the dam and Transects #3 & #4 are located above the dam adjacent to the pond. (Figure 1, General locator map). All transects were established in the following manner:

1. A metal rod was hammered into the transition area soil within ten meters of the edge of the present day wetland (established by surface hydrology and vegetation). Running in a line parallel to the wetland and extending ten meters in length, a second

metal rod was placed in the soil. This ten-meter line established by the position of the metal rods will now be considered the Primary Transect.

2. Starting at the first rod and moving at 2.0 meter intervals along the Primary Transect, Secondary Transects were established perpendicular to the Primary Transect. Each Secondary Transect begins in the upland portion of the habitat and continues through to the wetland edge. Each Secondary is a total of 15 meters in length crossing the Primary line at the 5 meter mark. For purposes of discussion, this division of the Secondary Transect at 5 meters will establish the upland (0 to 5 m) portion from the wetland (5 to 15 m) portion of the transect. The wetland portion of the Secondary Transect always crosses the wetland limit line and includes the upland/wetland transition zone. Each Secondary Transect was sampled for vegetation and the results recorded (Figure 2; Typical sampling plot diagram).

3. Herbs were sampled using a line intercept method at each meter interval (only those that touched the transect were recorded). Shrubs were recorded by species and percent cover (visual estimates of cover) of low canopy as a continuous measurement (any shrub cover overhanging the transect) the entire length of each Secondary Transect (breaks in the shrub canopy were noted as well). All trees (defined as having a trunk greater than 10 cm diameter at breast height (dbh)) that fell within the area encompassed by the outer dimensions of the transect (10 m x 15 m area) were located, identified to species and measured for dbh. Other features such as edge of wetland, surface hydrology characteristics or interesting plants that did not actually touch transects were noted as well.

4. In 2004 we tested and utilized an abbreviated sampling protocol for Transects #1, 2 & 3 established in 2003. Along each transect, the 0, 4, 6 and 10 meter Secondary Transect lines were sampled along the wetland portion only. Since the trees are slow to grow, only the data from the shrub and herb layers were collected. These data were collected using the same techniques established for the original transect sampling. Since the transitional area towards the wetland will be the first section to exhibit signs of change based on the draw down, the upland portion of the transect was not sampled. This abbreviated sampling protocol will allow for more efficient use of volunteer time while still maintaining adequate data collection.

Bird Surveys

Since the Audubon Society collects information on bird species throughout the area, the object here was not to repeat that list, but rather attempt to quantify use and activity within the system. To achieve this, bird census were conducted using the following methods:

1. Using the established vegetation transects as a starting point, an area defined by trees within the marsh and the surrounding uplands (physical boundaries) was established off of Transect #1 as a sampling zone. The bird survey crew led by Susan Hardy is placed at a vantage point on the surrounding hillside (facing over the marsh) and observed and recorded all bird activity over the established area for one hour per sampling period.
2. If a bird flew over the sampling area (height was not an issue), it was recorded as to species and direction, as best as possible. If the bird landed or nested within the sampling area it too was noted and designated with an "L" or "NL" respectively. If the bird was heard but not seen it was recorded as well ("H"). Notes were made on birds that may have been interesting but not necessarily found within the confines of the sampling area.

Mammal and Reptile Information

Due to the mobility of mammals and reptiles and time constraints and limits on expertise of the volunteers, no attempt was made to trap and quantify these animal communities. Rather information for these organisms will be gathered as observations on scat, footprints, burrows and other characteristics providing a qualified approach to the data. These data will be collected by the volunteers whenever they are in the vicinity of the Pond and not necessarily within the confines of the transect. If, in the future, it is deemed necessary to quantify these animal communities additional sampling techniques can be added as needed.

Amphibians

Since one of the volunteers has an interest and expertise in amphibians and these animals are more reliant on the hydrology of the system for their existence, amphibian populations were sampled using quantifiable techniques. The information for this sampling will not be submitted as part of this report.

Fish

Fish census will be conducted by surveying local fishermen as to catch and size. If additional information is deemed necessary, additional fish surveys can be conducted with more traditional techniques (e.g., seine nets).

RESULTS and DISCUSSION

The results of the 2004 sampling are presented below. Transects #1 - #3 were resampled in 2004 using the abbreviated sampling system. Transect #4 was added in 2004 to include an additional site above the dam. Assessments are based on two sample years (2003 & 2004) wherever possible. The data collected in 2003 was verified in 2004. Some adjustments had to be made to some of the vegetation and are noted on the data sheets. Additional information has been added to the sampling protocol (e.g., boundary of standing water) and wooden stakes have been placed in the field towards the wetland along the 0, 4, 6, and 10 m intervals on all transects. The field data from 2004 are found in figures 3-11. Field data sheets (including any revisions) from 2003 are presented in Appendix I.

Transition Area Vegetation Sampling

Table 1 is a frequency analysis of shrub cover for each transect. Transects 1, 2 & 4 are fairly similar in their percent cover, although the distribution of species differs. Transect 3 has fewer shrub cover but more tree cover, therefore its dynamics are somewhat different. Shrub, herb and trees are discussed in more detail below for each transect.

Table 1. Frequency of shrubs along transects expressed as percent. Frequency calculated by taking the number of meter intervals crossed by each species divided by the total number of possible meter intervals for each transect (96). Less than 1% denotes its presence on the transect but not crossing at any individual meter interval. Transect #4 was completed in 2004 and is listed here.

Transect	1	2	3	4
Sweet Pepperbush (*Clethra alnifolia*)	67	34	31	<1
High bush Blueberry (*Vaccinium corymbosum*)	9	9	16	48
Witch Hazel (*Hamamelis virginiana*)	7	45		29
Swamp Azalea (*Rhododendron viscosum*)		1	<1	
Arrowwood (*Viburnum dentatum*)			<1	
Winterberry (*Ilex montana*)			6	
Buttonbush (*Cephalanthus occidentalis*)			2	
TOTAL COVER	78	83	49	77

Table 2. Frequency of shrubs along transects 1, 2 & 3 for the three dominant shrubs using the abbreviated sampling technique and expressed as percent. Frequency calculated by taking the number of meter intervals crossed by each species divided by the total number of possible meter intervals for each transect (44). Less than 1% denotes its presence on the transect but not crossing at any individual meter interval. Comparisons based on 0, 4, 6, & 10 meter sampling points along each transect for the wetland side of the transect only.

Transect	1	1	2	2	3	3
Year	2003	2004	2003	2004	2003	2004
Sweet Pepperbush (*Clethra alnifolia*)	68	66	48	50	30	32
High bush Blueberry (*Vaccinium corymbosum*)	11	9	16	14	5	5
Witch Hazel (*Hamamelis virginiana*)	9	7	20	15		
TOTALS	88	82	84	84	35	37

Comparisons of shrubs (Table 2) utilizing the abbreviated sampling technique show very little change in percent of species between 2003 and 2004. With the exception of witch hazel along Transect #2, the differences noted above are within an acceptable

range of estimates and sampling error for this type of study [Note: although the error is slightly higher for witch hazel along Transect #2, the differences may be due to a slight shift of the transect from the two years but is still within an acceptable level of error given the amateur status of the volunteers under training]. These results support the concept that a volunteer force can produce repeatable results from year to year and collect data useful in this investigation. Overall, the data suggests no shift in the shrub layer between the two sample years.

Transect #1

Transect #1 is located just downstream of the dam. The area is dense with shrubs and consequently, there are few herbs within the grid (Appendix I). The most frequent shrub is sweet pepperbush occurring in 67% (on average) of the sampling area (Table 1 & 2). Most of the herbs are found down towards the wetland limit line and a few scattered trees occupy area as well.

Transect #1 was sampled in 2004 using an abbreviated sampling system (Figure 3 & 4). A comparison of the data (Figures 3 & 4; Appendix I) shows that the differences noted between the two sample years are minimal with no discernable shift in the habitat within the last two growing seasons. These results would suggest that the draw down in 2003-2004 did not have a significant impact on the wetland boundaries along Transect #1.

Transect #2

Transect #2 is located just downstream (north) of Transect #1. This transect is also dominated by shrub cover (Figure 6; Appendix I). Here, the dominant shrubs are witch hazel toward the upland and sweet pepperbush towards the wetland. The wetland limit line is well demarcated with the end of shrub cover and the beginning of herbs such as tussock sedge (*Carex stricta*) and royal fern (*Osmunda regalis*) (see, Appendix I). Trees are few (Appendix I) and are dominated by red maple (*Acer rubrum*) and eastern white pine (*Pinus strobus*).

As noted above, the data from the two sampling years (Figures 5 & 6; Appendix I) are very close and show no sign of change in the habitat. The slight differences in dominant shrubs (Figure 6; Table 2) may be due to sampling error (slight shift in transect

or estimates by volunteers) and will have to be watched for the next few years to discern if this is a trend in the data or an artifact of the sampling technique.

Transect #3

Transect #3 is located above the dam at Barba's Point. Unlike Transects #1, 2 & 4, there is less shrub cover (Table 1; Figure 8) and subsequently more herbs (Figure 7; Appendix I). Although shrub cover is dominated by sweet pepperbush and high bush blueberry, the transect also includes a wider variety of plants such as winterberry, arrowwood, buttonbush and swamp azalea. The wetland limit line is well demarcated by the presence of water and plants such as cattail (*Typha* spp.). Some purple loosetrife (*Lythrum salicaria*) has made its way into the system as well. Trees are few but have a major impact on light distribution within the transect. The trees include some oaks (*Quercus* spp.), red maple, eastern white pine and hemlock (*Tsuga canadensis*), the latter being quite large and providing a significant amount of shade to the wetland portion of the transect area.

A resurvey of the line required some adjustments to the position of trees and wetland boundaries (problem with the meter tapes). They have been corrected and replaced on the data for trees (Appendix I).

Transect #4

Transect #4 was established in 2004 and is located above the dam near the confluence of Clapp's Brook and the pond. Overall, Transect #4 includes shrub (Figure 10) cover that is similar is percent cover to Transects #1 & #2 (Tables 1 & 2) although here the species composition is different with high bush blueberry and witch hazel being the dominant species and sweet pepperbush is very limited in the area. The wetland limit line is well demarcated by the presence of soil characteristics and standing water (Figure 9). Although trees are prevalent (Figure 11), light appears to be sufficient along the transect to allow for a well developed understory. The trees include white and red oaks (*Quercus* spp.), red maple, eastern white pine, black or sweet birch (*Betula lenta*) and elm (Ulmus *americana*). The white oak may be a hybridizing with some of the other oaks in the area. There are specimens where the leaves and even some bark characteristics resemble black oak as well as white oak on the same plant.

This transect was added to the sampling in 2004 and will provide another indicator of potential change in habitat above the dam.

General Vegetation Analysis

Transects #1, 2, and 4 have a number of similarities in the shrub and herb layer. Shrub cover averages about 80% and is dominated by a few species. The differences between these transects are the species that dominate the shrub layer (Table 1). Only Transect #3 show a significant reduction in shrubs and that is due to the presence of an old and large hemlock.

The herbaceous layer can vary dramatically from site to site and year to year. One of the most determining factors in the herb layer is the growing condition early during the season (Spring weather). It is in the herb layer that we can anticipate observing the earliest potential impacts of the draw down on the surrounding habitats. Thus far there has been no appreciable change in the herb community and the draw down of 2003-2004 has not impacted this community.

Bird Surveys

Bird surveys were conducted five times (6/14/03, 6/26/03, 7/3/03, 7/10/03, 7/19/03) during the 2003 season and five times (4/17/04, 5/8/04, 5/30/04, 7/5/04, 7/17/04) during the 2004 season under the direction of Ms. Susan Hardy. The results of the 2004 survey are shown on Figure12, a-e [note: bird survey sheet 7/19/03 was not received prior to the 2003 report and could not be included in that data set. It is being added in here in Appendix II.

Bird surveys are based on activity within the plot only. Data includes species, number of occurrences, direction and general usage (e.g., flyover, landing nesting)(Table 3). In 2003, the most common birds within the survey period are Tree Swallows (78 total sightings) and Red-wing Blackbirds (45) followed by common Grackles, Flycatchers and American Goldfinches. In 2004, the most common birds were Tree Swallows (59) and Red-wing Blackbirds (40) followed by Chimney Swifts, Robins and American Goldfinches. A single bird may fly in and out of the sample area and be counted multiple times for each sighting category. This probably accounts for the relatively high occurrences of Swallows and Red-wing Blackbirds, two species that are both active and

relatively territorial. Ms. Hardy also noted that American Goldfinches were probably actively nesting in the area and may account for multiple sightings of a few individuals.

Table 3. Bird surveys (2003 & 2004). Sightings are based on individual occurrences of birds. A single bird could be responsible for multiple sightings as it moves into and out of the survey area. All data is the result of one-hour sampling periods. Data collected under the direction of Susan Hardy.

Date (2003)	6/14/03	6/26/03	7/3/03	7/10/03	7/19/03
# of identified species	18	28	43	13	16
# of sightings	55	114	129	72	94
# of unidentified sightings (%)	9(16)	13(11)	28(21)	18(25)	18(19)
% Landings within Study Site	32	20	43	43	28

Date (2004)	4/17/04	5/8/04	5/30/04	7/5/04	7/17/04
# of identified species	13	18	13	17	17
# of sightings	43	68	127	143	86
# of unidentified sightings (%)	5(12)	5(7)	21(17)	36(25)	11(13)
% Landings within Study Site	21	24	6	22	17

There are differences between the bird surveys of 2003 and 2004. Fewer species were observed in 2004 than in 2003 (a 50% decrease) and landings within the bird sample plot have dropped as well (166 in 2003 vs. 90 in 2004). The data is difficult to assess due to the inherent nature and movement of birds. Since the vegetation has not changed appreciably over the last year, it is doubtful that the variation in bird observations are tied to any real change in their population structure or utilization of the system. This is further supported by the relative similarities in dominant bird species over the last two years (Tree Swallows, Red-wing Blackbirds and American Goldfinch). For now, it will be assumed that timing of counts (date), improvements in the proficiency with the technique and identification of birds (with practice Ms. Hardy becomes more efficient with the protocol) and natural variation in the populations are responsible for the

changes we have observed within the last two seasons. It will take time to establish if these patterns are due to natural variation or a change to their habitat.

Mammal and Reptile Information

Evidence of **mammals** is limited. Deer scat, and deer and rabbit browsing were observed in the area of all Transects. Coyote scat was noted near Transect #4. Vole and mouse runs were noted around each transect and beaver cuts were noted in the vicinity of Transect #3 and #4. Beaver activity (small beaver dam and chew marks) was also noted along the dam near the overflow culvert/channel. Evidence of muskrat is limited in the sampling sites, although people living around the pond have noted them in the area. It is unknown at this time how active muskrats are within the system. Their burrows are dug into the sides of the banks and are dependent upon water levels for protection, particularly during the late fall to early spring. In the future it may become necessary to conduct a more thorough investigation of muskrat populations around the pond.

Evidence of **reptiles** was also limited within the study area. Snake movements were evident in the mud and at least one turtle track was observed near Transect #1 each year. One box turtle was observed on the soil portion of the dam digging a hole presumably to lay eggs (approximately 10 feet east of the sluice way).

A more inclusive species list is included in the 2002 ENSR report (Appendix C, Wildlife, habitat and vegetative assessment of Bare Hill Pond, with Management Implications, ENSR Report To Town of Harvard, 2002). This list includes both observed and expected wildlife (only 2 of the 57 species listed were actually observed on-site). Mammal and reptile sampling is too time consuming and the results are too ambiguous to use for determining draw down impacts. Therefore, this study will continue to collect information on these organisms through secondary observation and will not attempt to quantify the results.

Amphibians

Data and analysis of amphibians are to be compiled by the Amphibian group under the direction of Mr. Jack Whelan.

Fish

Fish populations were to be surveyed using catch records as a data collection method. To date, few surveys have been distributed and collected and the information is insufficient to assess at this stage in time for this report.

Submerged Aquatic Vegetation (SAV)

SAVs will be sampled and reported by the SAV committee.

CONCLUSIONS and RECOMMENDATIONS

The second year of monitoring has been completed (vegetation and birds). We used this year to finish installing the permanent sampling transects and continue the training for future assessments. Some of the sampling protocol has been modified to fit the volunteer efforts and further recommendations are noted below. Although the data is limited, it is clear that the volunteer sampling effort for vegetation and birds has been successful to date. One of the most difficult sampling protocols is estimating percent cover of shrubs. Based on the data collected between last year and this year, the volunteers are doing a fine job and their results will be usable in the future (see Table 2).

It is still too soon to tell if the draw down is having a lasting impact on the wetlands and habitats surrounding the pond. Based on the limited data collected thus far, the draw down last winter did not impact the vegetation along any of the transects. Given the problems with sampling bird populations, the differences noted between 2003 and 2004 are not sufficient to make any final determination.

This past year was not necessarily the most typical weather year on record. The winter was colder than normal and had fewer snow events. This means that the freezing could reach lower into the ground and have an impact on the system. Certainly, from the perspective of managing SAV populations, this would have been the perfect condition for killing SAVs exposed during the draw down. In a more typical year where snowfall is more plentiful, the insulating effect of the snow could offset the cold temperatures and limit subsurface freezing and its impact on SAVs.

Further, rainfall may not have been typical this past year. Observations made by Michele Girard suggest that the pond was filling very slowly until a series of

uncommonly large storms in March and April put the water over the edge. Since we do not have long-term observations of draw down and refilling of the pond, it cannot be assessed if this was a rare event or something to be expected. It may turn out that the pond will fill each year either by a slow and steady rain and/or snow fall or rapidly fill through a series of large storm events. As long as the pond is filled by early spring, the rate of fill may not be important. If, on the other hand, the pond does not refill after the draw down in time for the spring bloom, then it may be cause for concern. Abnormal weather conditions can have a significant impact on organisms and create annual fluctuations in the data that would be different than the long-term trends we may observe. That is why the question of the draw down cannot be answered quickly or easily. In order to begin to separate annual fluctuations in weather from the long-term impacts of the draw down, data will have to be collected for a number of years. Success controlling SAVs or changes in bird or herbaceous plant populations one year may not carry over to the following season.

As noted in last year's report, the hydrology of the system is now controlled at all levels. Source (input) of water to the downstream wetlands are maintained through the dam and sluiceway that helped create the pond in its present configuration. Drainage is controlled downstream by a series of roads and culverts that drain the landscape. This has not changed over the last year and is not expected to change. The Town of Harvard and the Bare Hill Pond Watershed Management Committee must be patient with this assessment and make decisions based on the data at hand.

Now that the vegetation and birds have been sampled for two years, some changes to the protocols can be anticipated, some of which are noted below. Thus far the SAVs and fish (only two fish survey sheets have been collected) have not been adequately sampled (grants are in place for SAVs this year) and cannot be assessed. This information will be required in the future if this effort is to be judged as a success or failure. It is important to continue to approach these studies with determination and not to overburden the volunteers and their efforts. Given the fine work that Michele Girard and Sue Hardy have accomplished to date, I have no doubt that the vegetation and bird sampling will continue to yield good results. The amphibian survey conducted last year by Jack Whelan and committee was also a good beginning and hopefully will continue

into the future. Based on the data compiled thus far, the following recommendations are being submitted:

VEGETATION TRANSECTS

Now that the transects are fully established:

- sampling can be adjusted to meet the volunteer effort
- transects can be sampled using an abbreviated method
- transects can be sampled every other year
- an abbreviated sampling scheme can be conducted two consecutive periods followed by a full evaluation (all points) the following sample period. This can be limited to the wetland side of the transects.
- the upland portion of the transect can be resampled as volunteer hours permit, although this should be repeated once every ten years.

BIRDS

- continue as they have. This too can be adjusted to fit the volunteer's hours.
- a seasonal sample is recommended, although this too can be completed every other year if necessary.
- if time becomes a problem, then the sampling date should be standardized (e.g., summer solstice) and the number of sample periods per year reduced.

FISH

Fish sampling requires an additional effort. Thus far very little data has been collected. Some tournament data on bass has been received, however that just follows the fate of a certain species. Catch data from a broader variety of fish is also important. More efforts should be undertaken to distribute and collect fish survey sheets. It may be necessary to include a statement on the sheet to report all fish caught, not just the desired or target species. If this method does not provide the necessary information (it all depends on how well the surveys are conducted), then the fish survey techniques will have to be modified to include

seines and other more intense fish sampling techniques. This could put a strain on the volunteer effort and derail some of the assessments required.

AMPHIBIANS

Since there are interested and capable people to conduct this sampling, it should be continued. As noted in the 2003 report, the sampling should be conducted in early spring (if only one sampling period is to be anticipated then early spring is the time period). Amphibian sampling could also be conducted every other year without diminishing the quality and usefulness of the data.

REPTILES/MAMMALS

At this point there does not appear to be a reason to change this protocol. The reptiles and mammals are adaptive to changes in the environment (within some range) and can easily move their den or feeding grounds. Since it will take large scale changes to the habitat to readily impact these critters, it is recommended that the plant community be monitored for change. If changes do begin to appear in the vegetation, then a more intensive sampling scheme for these animals may be necessary.

If any member of the community has an interest and/or training in sampling any of these organisms, then they should be encouraged to move forward with these techniques. Similarly, if an area school (high school, college, graduate program) is looking for a project, it too can be tapped as a valuable resource. In order to answer the question(s) being posed by the Conservation Commission (does the draw down have an adverse impact on the pond and its surrounding habitats), the sampling protocols established over the last few years should provide many of their answers while utilizing a volunteer force. If the volunteers do not maintain their commitment, the Town and/or the Pond Committee may be forced to seek additional funds to hire outside experts to conduct the sampling. Such a change would add a significant cost to the project. Although it is recommended that volunteers continue to collect the data, it is also recommended that a qualified professional be hired (or found within the Town on a volunteer basis) every few years to assess the program and the data collected. The costs for such a program could be relatively minor.

FIGURE LEGENDS

Figure 1. Location Map. Transect locations noted as solid lines.

Figure 2. Typical vegetation sampling plot diagram.

Figure 3. Results of abbreviated herbaceous plant surveys along Transect #1. Sample runs between 5 and 15 meters at 0, 4, 6, and 10 m intervals. Key to species is located at bottom of figure.

Figure 4. Results of abbreviated shrub sampling along Transect #1. Only shrub canopy located directly over the transect was included. Key to the species is located at bottom of figure.

Figure 5. Results of abbreviated herbaceous plant surveys along Transect #2. Sample runs between 5 and 15 meters at 0, 4, 6, and 10 m intervals. Key to species is located at bottom of figure.

Figure 6. Results of abbreviated shrub sampling along Transect #2. Only shrub canopy located directly over the transect was included. Key to the species is located at bottom of figure.

Figure 7. Results of herbaceous plant surveys along Transect #3. Sample runs between 5 and 15 meters at 0, 4, 6, and 10 m intervals. Key to species is located at bottom of figure.

Figure 8. Results of abbreviated shrub sampling along Transect #3. Only shrub canopy located directly over the transect was included. Key to the species is located at bottom of figure.

Figure 9. Results of herbaceous plant surveys along Transect #4. Secondary Transect runs from upland (0 meters) to wetland (15 meters) and crossed by the Primary Transect at 5 meters (horizontal line). Key to species is located at bottom of figure.

Figure 10. Results of shrub sampling collected along Transect #4. Only shrub canopy located directly over the transect was included. Key to the species is located at bottom of figure.

Figure 11. Location, size and species of trees located within the sampling area of Transect #4.

Figure 12, a-e. Bird survey data sheets for survey area between Transects #1 & #2. All observations were conducted over the marsh facing in an easterly direction for one hour periods. Only those birds that entered the plot were recorded. Due to the speed and movement of the birds, some species could not be identified and were noted as such. Fig. 12a – April 17, 2004; 12b – May 8, 2004; 12c – May 30, 2004; 12d – July 5, 2004; 12e -

July 17, 2004. All data collected under the direction of Ms. Susan Hardy. Key to the notations is as follows:

- "arrow" denotes a flyover and direction (all directions relative to facing east)
- "L" denotes a landing within the plot
- "N" denotes a nest within the plot
- "LN" denotes a landing at the nest within the plot
- "H" denotes bird heard but not seen within the plot
- number before a notation denotes number of occurrences

APPENDIX I

Vegetation Transect Samples from 2003 (with revisions)

FIGURE LEGENDS (2003)

Results of herbaceous plant surveys along Transect #1. Transect runs from upland (0 meters) to wetland (15 meters) and crossed at 5 meters (horizontal line) by the permanent markers (metal rods inserted into the ground). Key to species is located at bottom of figure. Data collected June 14, 2003

Results of shrub sampling along Transect #1. Only shrub canopy located directly over the transect was included. Key to the species is located at bottom of figure.

Location, size and species of trees located within the sampling area of Transect #1.

Results of herbaceous plant surveys along Transect #2. Transect runs from upland (0 meters) to wetland (15 meters) and crossed at 5 meters (horizontal line) by the permanent markers (metal rods inserted into the ground). Key to species is located at bottom of figure. Data collected June 14, 2003.

Results of shrub sampling along Transect #2. Only shrub canopy located directly over the transect was included. Key to the species is located at bottom of figure.

Location, size and species of trees located within the sampling area of Transect #2.

Results of herbaceous plant surveys along Transect #3. Transect runs from upland (0 meters) to wetland (15 meters) and crossed at 5 meters (horizontal line) by the permanent markers (metal rods inserted into the ground). Key to species is located at bottom of figure. Data collected July 25, 2003

Results of shrub sampling along Transect #3. Only shrub canopy located directly over the transect was included. Key to the species is located at bottom of figure.

Location, size and species of trees located within the sampling area of Transect #3.

APPENDIX II

Bird Survey Sheet 7/19/03 (new Figure 11e from 2003)

Bird survey data sheets for survey area between Transects #1 & #2. All observations were conducted over the marsh facing in an easterly direction for one hour periods. Only those birds that entered the plot were recorded. Due to the speed and movement of the birds, some species could not be identified and were noted as such.
All data collected under the direction of Ms. Susan Hardy. Key to the notations is as follows:

- "arrow" denotes a flyover and direction (all directions relative to facing east)
- "L" denotes a landing within the plot
- "N" denotes a nest within the plot
- "LN" denotes a landing at the nest within the plot
- "H" denotes bird heard but not seen within the plot
- number before a notation denotes number of occurrences