4

Findings & Recommendations

Through the course of this project, several valuable lessons have been learned regarding the use of GIS to assess wetland restoration, as well as the value of and prospects for wetland restoration in the Merrimack River watershed. This chapter discusses specific ideas and recommendation arising from the study.

4.1 Suggested Model Refinements

Section 2.4 of this report provides information on how the performance of the model was evaluated. In addition to the procedures outlined there, additional insights into the model were gathered during the field evaluation phase. In general, we believe the model performed quite well considering the time and resources available. It seemed to do a good job of identifying and of estimating the value of each as a restoration site.

Obviously, many key issues important to a successful restoration project cannot be measured within a GIS model. For example, no information on land ownership could be incorporated into the model since such data does not exist on a watershed basis and since the compilation of local records into a usable form would have greatly exceeded the resources available to the project.

And, while the model performed well, it is clear that several refinements would improve its overall value as a tool for finding and prioritizing wetland restoration sites. Therefore, based on information gained during this project, the following modifications and improvements to the WRAM are recommended:

1. Refine the Site ID Model to exclude impoundments, except in special cases.

As discussed in Chapter 2, the Site ID Model used NWI data to identify potential restoration sites. During development of this part of the model, one objective was to find potential stream restoration sites. Including impoundments made sense in this context because impoundments on perennial streams generally have an adverse effect. However, the project objectives were refined to focus exclusively on terrestrial palustrine wetlands, rather than riverine classes. In the context of terrestrial wetlands, inclusion of impoundments in the Site ID model proved less valuable.

Flooding wetlands to create or enhance their value is a tricky proposition. Although temporary and permanent wetland impoundments have been created in an effort to manage waterfowl or to control invasive species, it can be argued that such modifications benefit only a certain set of species while impacting others. Thus, the benefits of impoundments (and their removal), must be very carefully studied and reduces to a question of management priorities for each specific wetland. Such detailed study is beyond the scope of this project.

A number of impounded wetlands were visited during the field review. It became apparent that removal of impoundments, while potentially beneficial, should certainly be considered lower priority than other forms of restoration such as elimination of drainage or fill removal. In the end, we believe that exclusion of impoundments would limit the number of "false positives" (i.e., sites selected by the Site ID Model which were found to be a marginal restoration opportunity). The more specific the Site ID model can be, the more benefit it will have to focus efforts on the best opportunities. We note that there may be situations in which inclusion of an impounded wetland in the Candidate Sites would be useful. An effort should be made to better define these situations such that they can be incorporated into the model.

2. Refine the Site ID model to use data on the distribution of Udorthents.

The location of Udorthents, or "made lands," is an excellent indicator of landscape disturbance. This soil type is common to dominant in urbanized areas, where oftentimes the majority of the landscape has been cut or filled. It is in these areas that large-scale wetlands were filled by past activities.

The existing Site ID model did not take advantage of the set of data represented by Udorthents as mapped in county soil surveys. It is expected that exploration of this data set will allow for a more robust Site ID Model. Wetland areas mapped as Udorthents may largely overlap with other Site ID Model criteria such as the land cover classification data. But, it is expected that the data could be used to supplement the land cover classification data and may be used to eliminate false positives or to capture the few true restoration sites that are not currently included in the Site ID Model.

3. Categorize candidate sites rather than rank them in a linear fashion.

The existing WRAM results in a set of GIS polygons which represent likely wetland restoration sites. Each polygon has a number of attributes including a final "Prioritization Score" and final rank. However, given the nature of restoration ecology, and the fact that restoration priorities are a reflection of management goals (and thus human preferences and biases), it is not appropriate to rank sites in a linear order. Rather, it is more appropriate to talk about restoration sites in terms of a few categories or types. It is recommended that a set of categories be defined based on biological and management considerations or based on statistical methods, and that the model be refined to categorize sites according to this scheme.

4. Refine the WRAM to assess the "feasibility" of each restoration site.

As described in Chapter 1, certain forms of wetland restoration are less expensive and more effective than others. And, other non-ecological factors can make a restoration more or less difficult. While an attempt was made to model the "restoration feasibility" for each candidate site, no suitable methodology could be developed within the available schedule. We continue to believe that site feasibility is an important and useful concept and believe that it should be possible to determine a value that appropriately considers this factor so that it can be considered in the final restoration categorization.

5. Incorporate the "Phase 1 Water Quality Assessment" developed by the NHDES Watershed Management Bureau.

The NHDES Watershed Management Bureau (Ted Walsh and others) has developed a GIS-based method for assessing the water quality of wetlands pursuant to their mission under the Clean Water Act. The method considers a number of factors specific to each wetland and its watershed and results in a score (Ted's Score) that reflects likely water quality in the wetland.

We attempted to incorporate this methodology into the WRAM. Specifically, we attempted to incorporate a Python script containing that Phase 1 WQA into the larger Wetland Restoration Assessment Model, but were unsuccessful in completing this task because of difference in computer platforms and the amount of time translation of the script would have taken. The WRAM did incorporate data from the WQA, but it was based on a simple proximity analysis rather than taking full advantage of the WQA algorithm. A second attempt to incorporate the WQA into the WRAM should be attempted.

4.2 Recommendations to NH Communities

Some of the important findings and recommendations arising from this study are discussed below.

1. Wetland restoration should be a part of an overall strategy for environmental protection; abundant opportunities for wetland restoration exist within the Merrimack River Watershed.

As New Hampshire has grown in population, so has the pressure on our native landscapes. Past impacts to wetlands have reduced wildlife habitat, degraded water quality in some of our streams, and have increased the risks of floods, among other impacts.

There have been notable successes in our communities' efforts to protect the environment and retain community character. A great deal of information has been developed on identifying good sites for land protection, and communities and non-governmental organizations have applied many resources to conservation efforts and a series of important natural refuges have been created and expanded over the last few decades.

The NH Coastal Program has provided leadership on restoration of tidal wetlands along NH's coast, and has been successful in restoring many acres of salt marsh and tidal creek habitat.

But, until the creation of the ARM Fund, the potential for environmental improvements through the restoration of freshwater wetland habitats has received relatively little attention. Wetland restoration is important because it can create new habitat, new flood storage and new water quality improvements that can provide real benefit to our communities. This contrasts with land preservation which, while a critical part of an overall strategy for environmental protection, promises only to preserve the existing ecological function present in a conservation area.

2. Supportive landowners are a key element.

Many of the sites identified by the WRAM are located on private property. Because of the large scope of this project, it was simply not feasible to contact individual landowners to inquire about their potential support for a restoration project. Obviously, the first step in any restoration project is securing the support of the affected landowner(s).

In general, most Granite Staters are very supportive of environmental efforts, but the potential benefits and costs of a restoration project must be understood and clearly discussed with landowners. In many cases, a landowner is likely to benefit from a restoration project through the receipt of ARM Fund compensation for construction or permanent easements on their property.

3. Existing land uses must be integrated into a restoration plan in a balanced way.

Wetland restoration sites are, by definition, areas that have been or are currently impacted by human activity. This activity can be historical or on-going, and could include efforts to drain a wetland, could be fill placed to support a roadway or other structure, or could be use of the land such as timber harvesting or agriculture. When the restoration may affect an on-going activity or may affect public or private infrastructure, the restoration plan must be developed in a way that balances this use without undue effect.

An example of this issue is the potential use of agricultural land for wetland restoration. One of the most significant findings of this study is that there are numerous wetlands within the floodplain of the Merrimack River and its larger tributaries that have been and continue to be farmed.

For example, the broad, flat Merrimack River floodplain that dominates the western part of Litchfield is one of the last remaining important farming areas in southern New Hampshire. This area is home to several large farms that produce important local food supplies for the region. Much of this area was once floodplain wetland, which has since been converted to agricultural production.

The fact that farming generally does not change hydrological conditions significantly enough to completely eliminate a wetland means that many of these farmed wetlands could be restored. Often, the only significant impact to these areas is the periodic tilling associated with croplands or the disturbance from livestock grazing. In other cases, tiles or stream channelization has removed some of the hydrological inputs to a wetland.

In some cases, the agricultural use of the wetland has been discontinued due to a decline in the farming community or other factors. In these cases, the reversion (succession) of the wetland to its pre-disturbance community is apparent and can be expected to result in increased wetland function and value with time.

However, where the farming operation is on-going, wetland function and values are severely compromised. It is these cases where balancing restoration and active land use becomes far more difficult. Indeed, the restoration of an actively farmed wetland is likely to lose out to its continued use for agricultural production. However, these sites should not be written off until some contact with the affected landowner is made to judge their potential interest.

Note that a number of active agricultural sites are among the 30 examples discussed in Chapter 3 and presented in Appendix B. These sites are included because they represent some of the largest and best restoration opportunities in the watershed. Obviously, however, landowner support and a clear understanding of the value of the land as a functioning wetland vs. its ability to produce local food supplies is critical.

4. Proper design and construction is necessary to ensure project success.

Even for the example sites included in this study, additional ecological analyses, ground survey and engineering will be required to develop a final restoration plan. In some cases, geotechnical explorations or hydraulic modeling may need to be completed prior to or during final design. The design for any site can take time, and project planning should take this into account. While some of the best restoration plans are the simplest, other sites may be more complicated. Proper construction in accordance with final design and construction documents will maximize the likelihood of success and minimize potential unintended ecological consequences.

5. A post-construction monitoring and adaptive management plan should be an integral part of the project.

Proper design and installation will increase the likelihood for success. However, the first two to three years following construction are typically the most vulnerable years for restoration projects. Therefore, a short-term monitoring program, with provisions and funding for adaptive management if necessary should be included in the construction/implementation plan for all restoration plans.